Poster # 1

SIMPLIFYING THE MEASUREMENT OF PULMONARY CONTUSION TO PREDICT PATIENT OUTCOMES

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Introduction: Pulmonary contusion is the most frequent injury identified following blunt trauma. Complications occur in fifty percent of affected patients including positive pressure ventilation, ventilator dependent respiratory failure, acute lung injury, acute respiratory distress syndrome, and pneumonia. Previous reports have suggested that when pulmonary contusion involves greater than 20% of the pulmonary parenchyma, the incidence of complications is greater. To date, no easy method to quantify pulmonary contusion exists barring special software or formulas. The purpose of this study is to determine if a novel, simplified approach using standard lung volume measurements by CT imaging, will be predictive of complications.

Methods: A prospective study of all adult patients who sustained blunt trauma was included in this cohort. Exclusion criteria included coexisting traumatic brain injury, Glasgow Coma Score < 14, traumatic quadriplegia, tracheal or great vessel injury, severe facial and/or neck trauma, intubation prior to arrival or intubation for operative intervention. Demographic data and incidence of complications was collected. Meanwhile percentage of pulmonary contusion was measured on the admission CT using standard lung volumes in which the right upper lobe, right lower lobe, left upper lobe, and left lower lobe were designated as 20% of lung volume. The right middle lobe represented 10% with 10% variance. Incidence of complications was determined when the group was divided by percentage of lung injured (less than or greater than 20%). Confirmation that degree of lung injury was a contributor to pulmonary complications was analyzed with univariate logistic regression analysis.

Results: 125 patients met inclusion criteria and were included in this study. The mean volume of pulmonary contusion was 14%. Patients with pulmonary contusion involving greater than 20% of the pulmonary parenchyma had a statistically significant increase in the incidence of all pulmonary complications (Table). Data is incidence and * = $p < 0.05$ v < 20%.

Complication	<20% PC (n=88)	>20% PC (n=37)
Positive Pressure Ventilation	4 (4.5%)	11 (29.7%) *
Ventilator Dependent Respiratory Failure	3 (3.4%)	9 (24.3%) *
Acute Lung Injury	0 (0%)	4 (10.8%) *
Acute Respiratory Distress Syndrome	3 (3.4%)	5 (13.5%) *
Pneumonia	2 (2.2%)	6 (16.2%) *

Conclusion: Using standard lung volumes, pulmonary contusion can be easily calculated upon hospital admission and requires no additional software or formulas. In this prospective analysis, patients with more than 20% pulmonary contusion have an increased risk of complications. Simple calculation of pulmonary contusion allows rapid identification of patients at risk for complications and may improve triage of patients between hospitals to regional trauma centers and improve triage within hospitals to care areas with higher acuity care.

Poster # 2

CHARACTERISTICS OF PATIENTS WITH INHALATION INJURY WHO WERE SAFELY EXTUBATED LESS THAN FORTY-EIGHT HOURS FROM ARRIVAL AT A BURN CENTER

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Introduction: Because airway protection is paramount in transport of burn patients to a burn center, first responders and emergency physicians in referring institutions have been encouraged to take a liberal approach to endotracheal intubation in those suspected of smoke inhalation injury. Intubation in the Emergency Department setting, however, is sometimes complicated by hypoxemia during intubation, aspiration, inadvertent intubation of the esophagus, and increased cost. These complications might be safely avoided if we could more precisely determine what population of patients truly need endotracheal intubation. Working with the premise that patients extubated in less than 48 hours might safely have avoided intubation, we compared records of intubated incoming transfers who were extubated within 48 hours to those who required longer mechanical ventilation in an effort to identify clinical characteristics that might be considered in the decision to intubate emergently.

Methods: We retrospectively reviewed charts of patients who were intubated at an outside hospital and transferred to our Burn Center from 2006 to 2011. Patient age, TBSA burned, mechanism of burn, patient comorbidities, presence of associated trauma, presence of upper airway edema, soot in the naso- or oropharynx, singed facial hairs, presence of stridor, abnormal lung exam, and presence of respiratory distress were factors included for analysis. Two-tailed student's t-test or Fisher's exact test were used when appropriate for comparison of variables. Statistical significance was defined as $p<0.05$.

Results: 114 patients were identified. Time to extubation was not recorded in 2 charts. 45 out of 112 patients (40.2%; 95% CI 31.6 to 49.4%) were extubated within 48 hours of arrival (26 of these 45 were extubated in less than 24 hours). 67 of 112 patients either expired soon after transfer or required more than 48 hours of mechanical ventilation. As a group, the 45 patients who were extubated within 48 hours were younger, had smaller burn injuries, were less likely to be diabetic, and had fewer overall comorbidities. Presence of upper airway edema (p 0.68); soot in the naso/oropharynx (p 0.85); singed facial hairs (p 0.21); or stridor, abnormal lung exam, or respiratory distress (p 0.34) were not statistically different between the two groups.

Conclusions: Previously identified risk factors for mortality in burns, including age and TBSA burned, were correlated with a prolonged ventilator course. Interestingly, traditionally taught clinical stigmata of smoke inhalation injury did not correlate with amount of time spent on the ventilator. Further research needs to be done to evaluate significant risk factors for safe airway management so unnecessary intubations are reduced.

Poster # 3

RATIO DRIVEN RESUSCITATION LEADS TO INCREASED RATES OF FASCIAL CLOSURE

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Introduction: With the institution of the clinical practice guidelines, ratio driven resuscitation (RDR) in patients requiring massive transfusion (MT) has become common practice in combat casualties. Therefore, we sought to determine the effect RDR has on achieving early definitive abdominal fascial closure in combat casualties undergoing exploratory laparotomy.

Methods: Medical records of 1977 combat casualties admitted to a single US military hospital from Apr 2003 to Dec 2011 were reviewed. Patients receiving an MT and laparotomy in theater comprised the study cohort (n=172). The cohort was divided into RDR, defined as 0.8-1.2 u PRBC:1 u FFP, and no-RDR groups. Age, mechanism of injury, injury severity, blood products transfused, number of laparotomies, and days to fascial closure were collected. Assessed outcomes were early fascial closure ($\leq$ 2 days) and number of laparotomies to fascia closure. Significance and odds-ratios were determined utilizing Kruskal-Wallis Chi-Square and Backward Elimination Mutlivariable Logistic Regression

Results: The mean age of the study cohort was 24.0, mean ISS was 24.8 and IED blast was the most common mechanism of injury (74.4%).The cohort was divided in to RDR patients (N=73) and no-RDR (n=99). There was no significant difference in mean age, mean ISS, or rate of non-therapeutic ex laps between the groups. However, RDR patients had a significantly lower abdominal injury rate (34.2% v 72.7%, $p<0.01$), decreased number of laparotomies (2.7 v 4.3, $p=0.003$), and a achieved primary fascial closure faster (2.4d v 7.2d, $p=0.004$) . On multivariate analysis, RDR (OR 2.05, CI 1.03-4.07, $p=0.04$), and intra-abdominal injuries (OR 0.49, CI 0.22-0.86, $p=0.01$) were identified as independent predictors for early fascial closure.

Conclusion: Adherence to RDR guidelines resulted in significantly decreased number of abdominal operations and was identified as an independent predictor for early fascial closure. Further analysis is warranted to validate these findings.

Poster # 4

DOES TUBE THORACOSTOMY LOCATION MATTER? CURRENT TRAINING GUIDELINES MAY LEAD TO SUBOPTIMAL DRAINAGE AND THE NEED FOR SECONDARY INTERVENTIONS.

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Introduction: Current training for tube thoracostomy (TT) suggests the use of the nipple line as the most inferior landmark for placement, leading most tubes to be placed at the 5th intercostal space or higher. We hypothesized that TTs placed in this manner would be suboptimal for drainage compared to TTs placed through a more inferior inter-space and thus increase the duration of TT and the need for secondary interventions. **Methods:** A retrospective review of all patients undergoing TT at a level 1 trauma center from 1/1/2010 – 9/30/2012 was performed. Only patients who had a computed tomography scan following TT insertion were included so that rib inter-space placement and position of the tube within the thorax relative to the lung parenchyma could be recorded. The duration of TT drainage and the need for secondary interventions was determined and compared for tubes placed in different rib spaces and locations. TTs were additionally divided into a HIGH and LOW interspace group for comparison. Patients who died or had an early (< 24 hours from admission) thoracotomy were excluded. Other variables included in the analysis were patient age, injury severity score (ISS), ventilator days, trauma mechanism, and chest abbreviated injury scores (AIS). **Results:** 8186 trauma patients were screened over the study period and 862 patients received tube thoracostomy. After exclusions, 291 chest tubes were analyzed. 196 (67%) patients had a blunt trauma mechanism, 95 (33%) suffered penetrating trauma.

Rib Space	Number (%)		Location	Number (%)
3 (HIGH)	2 (0.6)		Anterior	42 (14.4)
4 (HIGH)	29 (10.0)		Fissure	98 (33.7)
5 (HIGH)	75 (25.8)		Inferior	4 (1.4)
6 (LOW)	106 (36.4)		Lateral	21 (7.2)
7 (LOW)	53 (18.2)		Posterior	113 (38.8)
8 (LOW)	26 (8.6)		Intra-parenchymal	10 (3.4)
9 (LOW)	1 (0.3)		Extra-thoracic	3 (1.0)

Table 1: Distribution of rib spaces and locations (relative to lung) of TTs

Average length of TT duration was 6.0 days. 66 (22.6%) patients required a secondary intervention after primary TT insertion. Among these patients, the most common intervention was an additional TT (58.5%), followed by video assisted thoracoscopic surgery (15.4%), thoracotomy (13.8%), and percutaneous drainage by interventional radiology (12.3%). TT duration increased with increasing vent days, ISS, and chest AIS. The need for secondary interventions was significantly increased among those in the HIGH placement group (29.2% vs. 18.9%, $p = 0.03$) **Conclusion:** There is significant variability in the level and location of TT placement after trauma, but this does not appear to affect TT duration. Tubes placed in higher interspaces are associated with an increased need for secondary interventions. Although current training guidelines exist to minimize extra-thoracic placement, they may promote suboptimal drainage.

Poster # 5

RECTAL CONTRAST IS NOT A RISK FACTOR FOR SURGICAL SITE INFECTION FOLLOWING TRAUMA

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Introduction : The use of rectal contrast to enhance detection of traumatic injury to the colon and intraperitoneal rectum during computed tomography (CT) scan of the abdomen and pelvis is controversial. Concern has been raised that the addition of contrast could lead to increased fecal spillage and subsequent morbidity. We performed this study to identify the impact of preoperative rectal contrast administration on outcomes in patients with colon or intraperitoneal rectal injuries.

Methods: A retrospective review of the trauma registry of a Level I Trauma Center was performed. All patients undergoing pre-operative abdominal CT subsequently identified as having colon or intraperitoneal rectal injuries at the time of laparotomy were included. Data related to demographics, injury mechanism and severity, operative findings and interventions, postoperative complications and mortality were collected. Patients receiving rectal contrast were compared to those who did not. Study outcomes were surgical site infection, organ dysfunction, any infectious complication, and mortality.

Results: Over a five-year period, 138 patients were identified as having a colon or intraperitoneal rectal injury at the time of laparotomy. Sixty-five (47.1%) patients without immediate indication for laparotomy underwent abdominal CT prior to surgery, and comprised the study sample. Of this cohort, 42 (64.6%) patients received rectal contrast. Baseline demographic analysis revealed no difference in age, ethnicity or injury severity between the groups. Likewise, there was no difference in associated injuries, transfusion requirement or need for fecal diversion. With regard to primary outcomes, no differences in surgical site infection, organ dysfunction or mortality were identified. Logistic regression revealed that procedures involving colon repair (versus resection) had a protective effect over the incidence of surgical site infections, and any infectious complication. The only independent risk factor for any infectious complication was the transfusion of more than 4 units of packed red blood cells in the operating room.

Conclusion: Pre-operative rectal contrast for the evaluation of trauma patients can be administered safely in the presence of intraperitoneal rectal or colon injuries, without concern for increased risk of surgical site infection, organ dysfunction, infectious complications, or mortality.

Variables Associated with Surgical Site Infection			
Variable	Odds Ratio	95% CI	p-value
Colon repair (vs. resection)	0.101	0.011-0.893	0.039
Rectal Contrast	2.269	0.392-13.140	0.361

Variables Associated with any Infectious Complication			
Variable	Odds Ratio	95% CI	p-value
Colon Repair (vs. resection)	0.160	0.040-0.649	0.01
> 4 units PRBC transfused	14.908	2.132-104.256	0.006
Rectal Contrast	1.390	0.379-5.090	0.619

Poster # 6

THE INCREASING ROLE OF ENDOVASCULAR TECHNIQUES IN ARTERIAL VASCULAR TRAUMA OF THE THORACIC OUTLET: REVIEW OF A CONTEMPORARY SERIES

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Introduction:Endovascular techniques (ET) have emerged in recent years as alternative treatments for traumatic vascular lesions especially in areas of difficult access such as the thoracic outlet (TO)

Methods: A retrospective review of patients with arterial trauma of the TO treated at a Level I Trauma Center from 2008 to 2012 was conducted. Clinical presentation, treatment, and results are shown.

Results: Twenty-three patients were treated; 22 were men. The median age was 37 (IQR 23–46).Injuries were caused by firearms in 18 patients, sharp objects in three, blunt trauma in one, and iatrogenic causes in one. Median ISS and RTS were 20 (IQR 16-29) and 7.55 (IQR 6.38-7.84), respectively. Twenty-five arterial segments were compromised, most frequently the subclavian in 13 (52.0%) and the axillary in eight (32.0%). Treatment was open in 13 patients (OPEN group), initially endovascular in eight (ENDO group), and initially open with endovascular treatment of complications (ENDOc group) in two. Ten patients in the OPEN group, three in the ENDO group, and two in the ENDOc group had hypotension or active bleeding at arrival. In the ENDO group, seven patients received definitive management with primary endovascular stenting, two of them with embolization. One received endovascular proximal control with an angioplasty balloon and was subsequently repaired open. The ENDOc group patients had been repaired by open surgery, developed postoperative ischemia, and were rescued by endovascular thrombectomy and stenting. Serious complications occurred in four patients in the OPEN group: death due to exanguination in one case, cerebral infarction with subsequent death in one case, infection of the repair with exanguinating bleeding in one case, and extensive ischemic damage of the extremity treated with amputation in one case. No major complications occurred in the ENDO and ENDOc groups; their repairs were found permeable at follow-up.

Conclusion: Endovascular treatment was used in the spectrum of complex TO arterial injuries in 43% cases, from vascular control before open repair in a hypotensive patient, to the definitive and complete treatment of injuires in stable patients and the rescue of occluded open repairs. ET options continue to increase for vascular injuries in this complex topography.

Poster # 7

IMMEDIATE VERSUS DELAYED REPAIR OF DESTRUCTIVE BOWEL INJURIES IN PATIENTS WITH AN OPEN ABDOMEN

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Introduction: Trauma surgeons frequently encounter destructive bowel injuries requiring surgery. Many management strategies have been described, including delayed abdominal closure. However, the timing in which repair of the bowel injury should be performed in patients with planned open abdomen management has not been specifically addressed. Our primary objective was to determine if there was a significant difference in the incidence of major complications between immediate and delayed repair among patients with traumatic bowel injuries and planned open abdomens; we hypothesized there would be no significant difference. **Methods**: This was a retrospective cohort study of adult patients with traumatic bowel injuries treated at an ACS verified Level I trauma center between 2001 and 2011 and who underwent laparotomy and were left with an open abdomen with a planned second operation. Pediatric patients (age less than 15 years) and patients who died in the first 24 hours were excluded. Patients were identified from the trauma registry. The primary exposure of interest was dichotomously defined as definitive repair of the bowel injury during the initial trauma operation (immediate) or definitive repair during a subsequent surgery (delayed). Multiple other covariates of interest were included. The primary outcome of interest was major complications (enterocutaneous fistula, dehiscence, and abscess). Other secondary outcomes crudely evaluated included length of hospital stay (LOS), ventilator days, intensive care unit (ICU) days and mortality. The difference in incidence of major complications between the two groups was evaluated using Poisson regression. **Results**: A total of 92 patients met study eligibility. Of these, 50 (54%) underwent immediate bowel repair. No significant differences were observed between the two groups in the distribution of body mass index, race, presenting vital signs, blood product utilization, injury severity score (ISS) and overall injury pattern (based on ISS body regions). However, patients in the delayed group had somewhat ($p<0.1$) greater age, incidence of penetrating injury, mean heart rate, packed red blood cell transfusion requirements, number of surgeries, and time to abdominal closure. Patients in the delayed group had a higher number of colon injuries compared to the immediate group (86% vs 60% respectively); these patients also sustained more injuries to multiple bowel sites ($p<0.05$). The delayed group also experienced more ventilator and ICU days ($p<0.05$). Univariate analysis suggested no significant differences in the proportion of major complications between the two groups. After adjusting for ISS, penetrating injury, initial base deficit, and presence of colon injury, there was no statistical difference in incidence of major complications [(RR)=1.35, 95% CI 0.8-2.3]. ISS, penetrating injury, and colon injury were significant independent predictors of major complications. No significant differences were observed in mean LOS and mortality. **Conclusion**: Patients undergoing immediate versus delayed repair of traumatic bowel injuries and who are left with an open abdomen have comparable outcomes in terms of major complications. In our population, delayed repair appears to have been chosen more frequently in patients with an increased injury burden and physiologic demands. The clinical decision to delay definitive repair should be considered in those patients with multiple or colonic injuries, and penetrating mechanism. Our study results suggest that both approaches (immediate or delayed) may be appropriate treatment options. Significant independent predictors of major complications in our study include ISS, presence of penetrating injury, and presence of colon injury.

Poster # 8

EXPLORATORY LAPAROTOMY FOR PROXIMAL VASCULAR CONTROL IS ASSOCIATED WITH SIGNIFICANT MORBIDITY IN COMBAT TRAUMA

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Introduction: Since 2009, blast injuries have caused an increase in high level lower extremity amputations. Pre-hospital hemorrhage control through application of combat action tourniquets has been life saving. However, some traumatic amputations are very proximal and are associated with such significant soft tissue injury, that control of the iliac vessels is necessary to perform adequate surgical debridement. We seek to report the safety profile of exploratory laparotomy (EXLAP) for proximal control (PC) of extremity hemorrhage in war-injured patients

Methods: Medical records of 845 combat casualties admitted to a single US military hospital from Apr 2009 – Dec 2011 were reviewed. Patients undergoing EXLAP in theater comprise the study cohort (n=135). The cohort was divided by EXLAP indication into PC and no-PC (nPC) groups. Variables collected included demographics, injury severity and mechanism, blood transfusion, and EXLAP findings. Outcome variables included number of EXLAP/days to fascial closure, abdominal complications, and need for re-operation after initial fascial closure. Kuskal-Wallis Chi-Square test was utilized to determine significance and odds ratios.

Results: The study cohort had a mean age of 24.0±4.5, a mean ISS of 22.9±9.0, and the most common mechanism of injury was IED blast (67.7%). 44 patients were identified as PC (n=44) and 91 were identified as nPC. When comparing PC to nPC, ISS was higher (25.8±8.2 v 21.4±9.1, p=0.008), more patients had at least one lower extremity amputation (93.1% v 28.6%, p=0.0001), more units of PRBC were transfused (38.0±30.9 U v 12.3±13.2 U, p=0.0001), more units of FFP were transfused (36.1±27.2 U v 11.7±14.0 U, p=0.0001), and there were fewer non-therapeutic EXLAP rates (0% v 35.2%, p=0.0001). There were no intra-abdominal injuries found at time of index operation for the PC group. Time to fascia closure (1.8±1.9 days v 1.7±2.8 days) and EXLAPs to closure (2.4±1.3 v 2.1±1.5) were similar, p>0.05. Intra-abdominal complications were higher for PC (43% v 24%, p=0.03, OR 0.45 (95% CI 0.21, 0.95). Likewise, re-operation rates were higher for PC (29.5% v 19.8%, p =0.03, OR 2.5 (95% CI 1.1, 6.0).

Conclusion: There is significant abdominal related morbidity associated with PC. Therefore, when the clinical situation allows, alternative approaches should be considered in achieving proximal vascular control (e.g. extraperitoneal or intravascular). Further studies are warranted to determine optimal methods of proximal control in these patients.

Poster # 9

SUCCESSFUL NONOPERATIVE MANAGEMENT (NOM) OF HIGH GRADE BLUNT SPLENIC INJURY IN PATIENTS WITH CONCOMITANT SEVERE TRAUMATIC BRAIN INJURY(TBI), A NTDB STUDY

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Introduction: It is well established that even high grade (grade 4 and 5) blunt splenic injury can be managed non operatively. It is less clear if this practice should be pursued in the patient with concomitant TBI where hypotension can cause secondary brain injury. The aim of this study is to look at outcomes of NOM of high grade splenic injury in the National Trauma Database (NTDB) in patients with TBI to see if this practice should be entertained.

Methods: The NTDB was queried to evaluate all patients from 2007 to 2010 (V8-11) with blunt splenic injury OIS≥4. Patients who required immediate operation (within 4 hours of admission) were compared to those with NOM. We enumerated the NOM patients who had angioembolization (AE). We compared admission age, gender, admission systolic blood pressure, heart rate, GCS, OIS for splenic injury and AIS for head injury. The following outcomes were evaluated: mortality, hospital LOS and ICU LOS. Patients who failed nonoperative management (f-NOM) were compared to those in which nonoperative management succeeded (s-NOM) looking at the same outcomes. A statistical analysis was performed, including an odds ratio for independent predictors of f-NOM. We performed subset analysis on patients who had NOM with AIS-Head ≥4. Significance was set at 0.05

Results: Of 9,248 patients presenting with spleen OIS≥4 , 2895 patients underwent immediate surgery and 6353 had NOM. 52% of grade 5 spleens required immediate operation. 26.2% of OIS 5 splenic injuries had s-NOM. Only 6% of s-NOM had AE. Hospital (10.6 ± 12.8 vs. 14.4 ± 17) and ICU length of stay (6.8 ± 9.6 vs. 9.5 ± 12.6) were significantly (p=0.001) shorter in the nonoperative group. Only 782(12.3%) of 6353 patients failed nonoperative management of their splenic injury. Those who failed were older than 55 (26.3% vs16.9% p=0.001), and had a higher percentage of grade 5 injury (40.9% vs. 24.1% p=0.001). There was no difference in the percentage of severe brain injury (AIS ≥ 4) in patients who failed nonoperative management (18.5% vs. 19.8% p=0.395). Independent predictors of failure of nonoperative management are age 55-81 (OR 1.75, 95% CI 1.48- 2.09) and OIS-Spleen grade 5 (OR 2.18, 95% CI 1.86 – 2.54).

In the subset analysis on 1570 patients with AIS-Head ≥4 and OIS≥4, 36.2% required immediate operation. Only 170(10.8%) f-NOM. Independent predictors of f-NOM included age 55-81 (OR 1.45, 95% CI 1.09-1.93) admission SBP <90 mmHg (OR 1.62, 95% CI 1.16-2.25) and OIS≥4 (OR 4.23, 95% CI 3.34-5.38). GCS<9 did not predict f-NOM

Conclusion: 89.2% of patients with severe Traumatic brain injury and severe splenic injury (OIS grade ≥4) were successfully managed nonoperatively. Older patients with grade 5 splenic injury were more likely to require splenectomy. Severity of brain injury did not negatively affect NOM and we should continue to attempt NOM in severe TBI.

Poster # 10

NON-OPERATIVE MANAGEMENT OF SOLID ORGAN INJURY: WHO'S DOING IT RIGHT?

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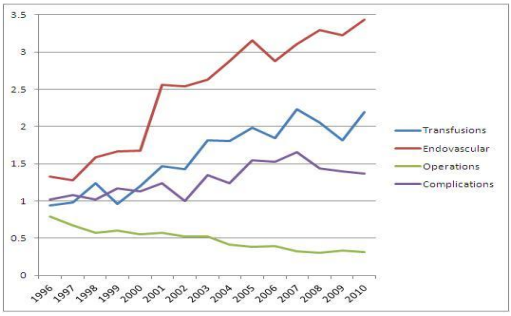
Introduction: Treatment of solid organ injury has undergone a paradigm shift from operative to non-operative management with the selective use of angiography. We hypothesized that the driving force for this change has come mainly from academic trauma centers and therefore shifts in management would lag behind in non-trauma and non-teaching hospitals. We also sought to evaluate any impact these changes may have had on transfusions, complications, and mortality.

Methods: The California Office of Statewide Health Planning and Development (OSHPD) hospital discharge database, including all non-federal hospitals in California was retrospectively reviewed. All patients admitted between 1995 and 2010 with liver, spleen, or kidney injuries were included. Bivariate and multivariate analyses were done for institutional and patient factors associated with interventions, transfusion, death and complications. Complications included surgical site infection, sepsis, urinary tract infection, pneumonia, venous thromboembolism, myocardial infarction and renal failure. Factors studied included; admission year, age, gender, injury type, race, insurance status, Survival Risk Ratio, Charlson co-morbidity index, teaching hospital and trauma center status.

Results: 93,401 patients met inclusion criteria, 28,191(30.18%) patients had an intervention; 25,691 (27.51%) operative, 3,368 (3.61%) endovascular, and 868 (0.9%) combined. Independent predictors of operation included; splenic injury, undesirable insurance, and Black or Hispanic race. Splenic injury, age 60-65, and admission to a teaching hospital or trauma center predicted endovascular intervention. Operations decreased while endovascular interventions significantly increased over time.



Independent predictors of transfusion included splenic injury, undesirable insurance, female, age>30, and Black race. Splenic injury, undesirable insurance, female gender, and age >35 were independent predictors of complications. Lack of insurance, age>35 or <5, and Hispanic race increased risk of death. Blood transfusion and complication rates increased, while the risk of death remained steady throughout the study period.

Trends in both interventions and outcomes were similar and concurrent among trauma and non-trauma centers, as well as teaching and non-teaching institutions.

Conclusion: The trend toward non-operative management was similar between teaching and non-teaching hospitals as well as trauma and non-trauma centers. Despite significant shifts in management strategy, mortality has remained steady. However, this has come at the cost of increased transfusion requirements and complication rates.

Poster # 11

BEYOND EMERGENCY SURGERY: THE PATIENTS, SKILL SET, TRAINING, AND RESOURCES THAT DEFINE ACUTE CARE SURGERY

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Introduction: The specialty of Acute Care Surgery (ACS) is still in its formative stages and considerable debate exists regarding definition, skill-set, and training requirements. While others have described the economic, case volume, and efficiency advantages of having an in-house surgeon for common emergency conditions, no clear data exists regarding the variation in patient pathology and physiology encompassed by this category. We hypothesized that a subset of patients with pathological and physiological criteria that require a level of care that exceeds the scope of general surgery practice could be defined and this unique patient population justifies the creation of this new surgical specialty.

Methods: We reviewed patient admissions over a 1-year period to the only general surgical service at a Level I trauma center. This service is staffed by trauma/critical care trained physicians who provide elective general surgery, trauma/critical care, and emergency general surgery services. Patient data was obtained from hospital billing, OR, trauma, and ICU databases. Patients were classified into four categories: Trauma, ACS, EGS or elective. We defined ACS patients as non-elective, non-trauma patients with significantly altered physiology requiring ICU admission and/or those with specific complex operative interventions. Differences in operative interventions, ICU & hospital LOS, mortality, and discharge disposition were analyzed using Chi-square, Fishers-exact and Kruskal-Wallis tests.

Results: Over 12 months, the in-patient service evaluated approximately 5500 patients, including 3300 trauma patients. 2152 were admitted: 37% trauma, 30% elective, 28% EGS, and 4% ACS. 67% of all patients required an operation. Excluding trauma, ACS patients accounted for 13% of emergent surgical admissions. ACS & Trauma patients were more likely to require multiple operations (ACS RR=11.5 (6-22.1) $p<0.0001$; Trauma RR=5.7 (3.2-10), $p<0.0001$), have longer hospital & ICU LOS, and higher mortality compared to the EGS group ($p<0.0001$) (Table). ACS & Trauma patients were significantly less likely to be discharged directly home, reflecting a need for a higher level of care (ACS RR=0.75 (0.65-0.85), $p<0.0001$; Trauma RR=0.67 (0.64-0.71) $p<0.0001$). EGS & elective patients were similar with respect to mortality and disposition at discharge.

	Total	Trauma	Acute	Emergent	Elective	p
Admitted patients	2152	805 (37.4%)	90 (4.2%)	613 (28.4%)	644 (30%)	-
Operation Gen Surg	1291	182 (22.6%)	77 (85.5%)	390 (63.8%)	642 (99.7%)	<0.0001
Operation any service	1451	339 (42.1%)	77 (85.5 %)	393 (64.1%)	642 (99.7%)	<0.0001
Multiple Operations	143	97 (12%)	22 (24.4%)	13 (2.1%)	11 (1.7%)	<0.0001
Hospital LOS (days)	2152	8.9	23.9	4.4	2.2	0.0001
ICU LOS (days)	424	6.8	7.9	0	4.1	0.25
D/C Home	1753	506 (63%)	63 (70%)	573 (94%)	611 (95%)	<0.0001
Death	68	59 (7.3%)	7 (7.8%)	1 (0.2%)	1 (0.2%)	<0.0001

Conclusion: Although ACS patients comprise a relatively small component of patients, they represent a distinctly different cohort than EGS patients. These differences are reflected in a significantly greater need for critical care, higher likelihood of multiple operations, and greater need for post-discharge rehabilitation services. In contrast, EGS patients were most similar to Elective surgery patients. The skills and expertise to adequately care for ACS patients, including the ability to rescue from complications and provide critical care interventions, differs from those required to manage EGS patients. This important distinction lends support to development of ACS training and certification beyond that required for basic emergency general surgery.

Poster # 12

OLD DOGS AND NEW TRICKS: LENGTH OF STAY FOR APPENDICITIS IMPROVES WITH AN ACUTE CARE SURGERY PROGRAM AND THE TRANSITION FROM PRIVATE SURGICAL PRACTICE TO MULTI-SPECIALTY GROUP PRACTICE

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Introduction: Acute care surgery (ACS) programs have emerged mainly at academic medical centers in response to the American Association for the Surgery of Trauma (AAST) leadership's endorsement of ACS as an emerging specialty. We hypothesized that the transition from private surgical group practice (PP) to a not-for-profit multi-specialty group practice with an ACS program would improve outcomes for patients with acute appendicitis.

Methods: A retrospective analysis of all patients with acute appendicitis presenting to a large tertiary care hospital was performed in two time periods: 18 months of PP and the following 12 months with ACS coverage. The severity of appendicitis was graded by the proposed classification of Garst and colleagues. Length of stay (LOS) was the primary outcome measure with secondary measures including morbidity, operative duration, and resource allocation.

Results: A total of 871 patients were studied (526 PP, 345 ACS). There were no significant differences in demographics, appendicitis grade, SIRS criteria, or symptom duration between the PP and ACS cohorts. The ACS group had higher ASA classifications ($p=0.01$), greater proportion of laparoscopic appendectomy ($p<0.01$), more transitions in care between the admitting/consulting and operative surgeon ($p<0.01$), and fewer surgeons performing appendectomy (12 vs. 22). There were no differences in operative duration, disposition, 30-day emergency department visits, hospital readmission, or morbidity between groups. LOS was shorter in the ACS group (median 1.6 vs. 1.9 days, $p=0.02$) and more cases were performed during the daytime shift (44.9% vs. 36.6%, $p=0.02$). Multivariate analysis identified that overall LOS was related to appendicitis grade ($p<0.01$), ASA class ($p<0.01$), symptom duration ($p<0.01$), and laparoscopic approach ($p<0.01$), while the ACS group was less likely to revisit the emergency department postoperatively (OR 0.47, 95% CI 0.25-0.88).

Conclusions: The initial transition from PP to ACS in patients with appendicitis resulted in decreased LOS. Revisit to the emergency department was higher in the PP era and there was no increased morbidity related to transitions of surgical care with ACS.

Poster # 13

SHOULD ADHESIVE SMALL BOWEL OBSTRUCTION BE MANAGED LAPAROSCOPICALLY? A NSQIP PROPENSITY SCORE ANALYSIS

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Introduction:Celiotomy is the most common approach for medically refractory small bowel obstruction (SBO). Small reviews suggest that a laparoscopic approach is associated with shorter length of stay (LOS) and less morbidity. Given the limitations of previous studies, we sought to evaluate outcomes of laparoscopic (L) compared to open (O) adhesiolysis for small bowel obstruction, utilizing the NSQIP dataset.
Methods:Patients from the ACS-NSQIP 2005-2009 database who underwent surgery for SBO were stratified based upon surgical approach. A propensity score (PS) to undergo L instead of O was calculated based upon demographics, comorbidities, physiology, and laboratory values. Outcomes between those who actually underwent L were compared to O patients who were PS matched.

Results:There were 6,762 patients who underwent surgery. The PS matching process created 222 matched patients in L and O groups. Laparoscopy was associated with significantlylower rates of any complication (OR 0.48; 95% CI: 0.30, 0.77), including superficial site infections (OR 0.17; 95% CI:0.05, 0.57), intra-operative transfusion (OR 0.15; 95% CI:0.03, 0.71), and shorter hospital length of stay (4 vs. 10 days; $p < 0.001$). There was no significant difference in operative time, rates of re-operation within 30 days or mortality.

Conclusion:Laparoscopic treatment of SBO is associated with lower rates of post-operative morbidity than laparotomy as well as shorter hospital length of stay. Laparoscopic treatment of surgical SBO is not associated with higher rates of early re-operation and appears to be associated with lower resource utilization

Poster # 14

THE OPEN ABDOMEN IN ACUTE CARE SURGERY: FACTORS ASSOCIATED WITH SUCCESS OF DEFINITIVE FASCIAL CLOSURE

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Introduction: Damage control surgery (DCS) has been widely used in trauma patients and its use in Acute Care Surgery (ACS) has been rapidly expanding; however, surgical strategies and factors associated with success of definitive fascial closure (DFC) are not as clearly defined as in the trauma literature. The objective of our study was to identify risk factors for failure of DFC in ACS in patients with severe secondary peritonitis (SSP).

Methods:A retrospective review (2004-2010) of a prospectively collected data on patients with SSP and DCS was performed at a level one trauma/ACS center. Demographics, presentation, and management variables were used to compare primary DFC and failure of fascial closure after the initial laparotomy.

Results:A total of 217 patients, (54% male) median age 55 (IQR 40-70) underwent DC for SSP. Post-operative adverse events (failure of anastomosis) were the cause of peritonitis in 141 (65.6%) and primary inflammatory (perforated viscus /abscess) caused peritonitis in 74 (34%). Median APACHE was 16 (11-21). DFC was achieved in 111/217 (51%). Failure of DFC occurred in 106 (49%) patients; of these, 72 were managed with skin only closure (SOC) 72/106 (68%), 6 underwent split thickness skin grafting (STSG), and 5 closed by wound granulation. DFC failure patients also presented greater incidence of persistent infections (56.3% vs. 23.4%, $p<0.001$) anastomotic leaks (21,2% vs. 6.3%, $p=0.001$), and longer length of stay in hospital and ICU (Median 30 days [IQR=17-47] vs. 21 days [IQR=14-32], $p=0.006$ and Median 13 days [IQR=7-24] vs. 9 days [IQR=5-16], $p=0.002$ respectively). The median number of laparotomies after the index (re-laparotomies) was two (IQR 1-3) in the DFC versus four (IQR= 2-7) laparotomies in the SOC group ($p<0.001$). Median DFC closure time was 5 days (IQR 3-10) compared to 12 days (IQR=8-18) in the SOC group ($p<0.001$). Overall mortality was 42 (19.5%), mortality in patients with DFC was 12/111 (10.8%) compared to 30/106 (28.3%) in failure of DFC ($p<0.001$).

Conclusion: The most significant factors associated with DFC are the total number of laparotomies and time required to obtain control of abdominal cavity contamination from the original insult. Our data show that the median of two re-laparotomies carried out preferable in the first 5 days from the initial surgery are conducive to DFC success. DFC failure is associated with increased intra-abdominal septic complications. Furthermore, SOC is successful in approximately 70% of DFC failure patients and it may take up to a week longer in order to achieve SOC.

Poster # 15

THE EFFECT OF AN ACCUTE CARE SURGERY (ACS) HYBRID MODEL ON HOSPITAL LENGTH OF STAY, HOSPITAL COSTS AND OR UTILIZATION

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Introduction: Prior to July, 2012 acute care services were provided by a combination of trauma surgeons and general surgeons, with the traditional paradigm of daily/nightly coverage added to a typical general surgeon elective workload. In July of 2012 we began a hybrid ACS service comprised of both general and trauma surgeons dedicated to the 24/7 care of urgent and emergent non-trauma general surgery patients. The ACS model had dedicated operating room (OR) time, an attending surgeon of the week, and a resident team seven days a week. The purpose of this review was to evaluate Pre- and Post-ACS data for the effects on hospital length of stay (LOS), OR utilization, and hospital costs. Our hypothesis was that the dedication of a hybrid ACS team would lead to improved outcomes in this patient population.

Methods: This retrospective data review compared Pre-ACS (7/1/2011- 6/30/2012) and Post-ACS (7/1/2012- 12/31/2012) at a 763 bed Level I Trauma Center and tertiary referral hospital. The three most common acute general surgery DRGs were analyzed: acute appendicitis, acute cholecystitis, and small bowel obstruction (SBO). Average hospital LOS and total hospital costs were evaluated. The time of day that the operations were done was also recorded.

Results: A total of 582 patients were included in the study. The Pre-ACS group, totaled 392 patients and the Post-ACS group consisted of 190 patients. For all three DRGs , the ED to OR arrival time was unchanged, but average LOS (aLOS) was shorter. For acute appendicitis aLOS decreased 30.3 hours per patient. For acute cholecystitis, aLOS decreased only 3.4 hours per patient. For SBO, aLOS decreased 33.9 hours per patient. The number of cases done past the regular operating day decreased. Pre-ACS 146 cases over the 12 months were done between the hours of 5 PM and 7 AM (41.2% of the total), compared to 54 cases in the Post-ACS group (29.8% of the total, p=.01 by Fisher's Exact Test). The overall savings on hospital costs for all three DRGs over the 6 month Post-ACS period was approximately $300,000.

Diagnosis	Total pts (n)		After hours cases (n)		Avg hospital LOS (hrs)	
	Pre-ACS	Post-ACS	Pre-ACS	Post-ACS	Pre-ACS	Post-ACS
Acute Appendicitis	198	96	93	37	71.5	41.3
Acute Cholecystitis	158	78	42	14	65.0	61.7
SBO	36	16	11	3	266.3	232.4
Totals	392	190	146	54	86.8	65.7

Conclusions: A hybrid model for the ACS service, including both general surgeons and trauma surgeons, with a dedicated weekly surgeon and reserved OR time demonstrates a decrease in hospital aLOS and hospital costs, with improved OR utilization.

Poster # 16

AN ACUTE CARE SURGERY FELLOWSHIP BENEFITS A GENERAL SURGICAL RESIDENCY

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Introduction: The ACS fellowship is a 2-year program that incorporates trauma, emergency general surgery and surgical critical care. One of the requirements in establishing the fellowship is that it does not negatively impact the existing general surgery residency. The purpose of this study was to prove that the fellowship did not adversely affect the residents' operative cases and to investigate the residents' attitudes toward the ACS fellowship.

Methods: The study was conducted at a university-affiliated residency with an accredited ACS fellowship. The ACGME operative case logs of graduating residents from consecutive academic years were reviewed; for the 3 years prior to the ACS fellowship (Pre), with 1 and then 2 ACS fellows (ACS 1R, ACS 2R). The ACS fellows' cases were tracked using the AAST case log (ACS 1F, ACS 2F). Surveys based on a Likert scale (1, strongly agree; 5, strongly disagree) were distributed to the general surgery residents to evaluate the residents' perspective on the fellows. Statistical analysis was performed with one-way ANOVA.

Results:

	Pre-ACS	ACS 1R	ACS 2R	*p* value	ACS 1F	ACS 2F
Total Residents	20	22	23	N/A	1	2
Mean graduating resident major cases	1361	1341	1301	.53	172	221
- Trauma	90	87	64	.20	45	55
- Thoracic	36	28	26	.20	3	3.5
- Vascular	131	176	195	.17	7	32
- Liver	16	11	11	.16	0	2.5

There was no significant decrease in the total number of resident cases, in spite of both the fellowship and the expansion of the residency. The number of trauma cases decreased but remained above the minimum ACGME requirement . 73% of the residents participated in the survey; the majority of responses to all survey questions were "strongly agree" or "somewhat agree," indicating a very positive attitude toward the ACS Fellowship.

Conclusion: An ACS Fellowship can be established and obtain adequate case volumes for the fellows without negative impact on a surgical residency. The surgery residents viewed the ACS fellows as an asset to their education.

Poster # 18

THE ROLE OF LPS STRUCTURE IN MONOCYTE ACTIVATION AND CYTOKINE SECRETION

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Background: Gram-negative sepsis is a leading cause of morbidity and mortality as a result of organ failure. Organ failure occurs through the activation and alteration of immune cell function following exposure to lipopolysaccharide (LPS) from gram-negative bacteria. Poorly regulated cytokine secretion is a factor in the development of organ failure. These cytokines are produced in response to LPS binding to toll-like receptor 4 (TLR4) complexes. This complex is composed of the TLR4 receptor, CD14, and several supporting proteins. Binding to the complex activates mitogen-activated protein (MAP) kinase cascades and downstream synthesis and secretion of cytokines. The LPS molecule has three components: a core hydrophobic lipid (Lipid A), a hydrophilic polysaccharide chain, and a hydrophilic O-antigen chain. Lipid A has historically been implicated as responsible for the development of sepsis. However, the role of the O-Antigen is less clear. The purpose of this study is to describe the effects of monocyte stimulation with structural variants of LPS molecules.

Methods: PBMCs were isolated and stimulated with LPS, LPS with attenuated O-antigen chain (RF5), or an LPS variant containing only Lipid A (DPL). Total cell protein was extracted and the concentration of phosphorylated and unphosphorylated p38, ERK, and JNK were assessed by Western blotting. PBMCs were stimulated with LPS, DPL, or RF5 and TNF-α and IL-10 levels in cell supernatants were measured using Luminex. In order to characterize the cell-surface components involved in cytokine generation, this was repeated in PBMCs that had been pre-treated with monoclonal antibody to CD14 or TLR4. TNF-α and IL-10 mRNA levels were measured by real-time PCR following cell stimulation.

Results: PBMC treatment with wild-type LPS activates p38, ERK, and JNK, increases de novo synthesis of both TNF-α and IL-10, and stimulates the release. This cytokine release appears to be CD14 dependent but largely TLR4 independent, as treatment with CD14 antibody results in nearly complete loss of cytokine release while treatment with TLR4 antibody only attenuated cytokine release. RF5 similarly activates all three MAP kinases in a CD14-dependent and TLR4-independent manner and stimulates synthesis and release of TNF-α and IL-10. However, these cellular responses are attenuated compared to cells treated with wild type LPS. DPL selectively activates p38 but not ERK or JNK, and no increase in TNF-α or IL-10 synthesis is observed.

Conclusions: Wild-type LPS has the greatest effect on monocytes by activating MAP kinase, increasing TNF-α and IL-10 synthesis, and stimulating largely TLR4-independent cytokine secretion. The presence of intact O-antigen appears important to this activation, as evidenced by the fact that the LPS variant with attenuated O-antigen activates the same cellular pathways as wild-type LPS, but to a much lesser degree. Isolated Lipid A selectively activates only p38 without activation of transcription of inflammatory cytokines. However, despite this attenuated transcription, isolated lipid A does result in secretion of pre-formed IL-10. This finding suggests that Lipid A has an alternate mechanism for stimulating cytokine release. Given the hydrophobic structure of Lipid A, activation by lipid A could be due to direct plasma membrane binding which is distinct from activation by the TRL4 dependent O-antigen activation.

Poster # 17

SLIDING CT SCANNER WITH INTERVENTIONAL RADIOLOGY FEATURES (IVR-CT) SYSTEM IMPROVE THE SURVIVAL IN THE PATIENTS WITH SEVERER BLUNT TRAUMA WHO REQUIRED EMERGENCY BLEEDING CONTROL

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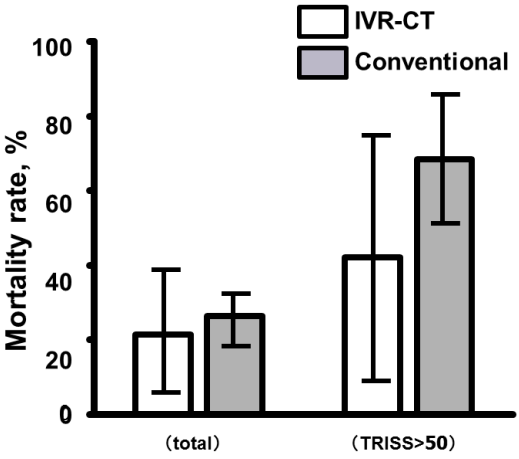
Introduction: We have advocated that CT performed before emergency bleeding control was associated with improved survival in severe trauma patients. In recent years, some major urban trauma centers have elected to install CT scanners inside emergency room. In August 2010 we installed a sliding CT scanner with interventional radiology features (IVR-CT) in our emergency room that allows emergency bleeding control without relocating the patients. The objective of this study was to assess whether IVR-CT has a beneficial impact on survival of patients with severe blunt trauma.

Methods: This historical control study was conducted from 2003 to 2012 in a level I trauma center. Inclusion criteria were patients with blunt trauma who admitted directly from the incident scene and required emergency bleeding control. We compared the time from patient arrival to CT initiation, to start emergency bleeding control procedures, and the mortality ratio in the patients of new workflow (IVR-CT group) with that of conventional workflow(C group).

Results: There were 152 patients in group C and 28 patients in group IVR-CT. CT initiation was faster in IVR-CT group. There was not significant difference of 28-days mortality ratio if compared all patients in both group. However, we found the lower mortality of IVR-CT group (42%) compared with group C (68%) in the severe patients who showed higher trauma and injury severity score (TRISS>50).
Conclusion: IVR-CT in the emergency room might create the beneficial effects on survival in severe trauma patients at high risk of death.



Poster # 19

DEFINING CRITERIA FOR THE RAPID SOURCE CONTROL LAPAROTOMY IN EMERGENCY GENERAL SURGICAL PATIENTS

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Introduction: The staged laparotomy in the operative management of emergency general surgery (EGS) patients is a natural by-product of trauma surgeons operating on the EGS patient-population. Indications for its application, however, are not well defined, and are currently based on the lethal triad used in trauma patients *in extremis*. This study sought to determine the acute physiologic indications for the staged, rapid source control laparotomy (RSCL) in EGS patients.

Methods: All EGS patients undergoing emergent RSCL and non-RSCL over 3 years were studied. Demographics, physiologic parameters, perioperative variables, outcomes, and survival were compared. Logistic regression models determined the influence of acute physiologic parameters on mortality and postoperative complications. EGS-based RSCL indications were defined.

Results: 215 EGS patients underwent emergent laparotomy during the study period, 53 (25%) were RSCL. With the application of the lethal triad to guide the use of RSCL, overall mortality in the RSCL group was significantly higher than in the non-RSCL population (45% vs 20%), as were complications (55% vs 28%). In EGS patients undergoing rapid source control laparotomy, hypothermia (temp<36F) and coagulopathy (requiring >3units blood) did not discriminate between survivors and non-survivors. However, compared to non-RSCL, survival was the same or significantly improved when RSCL was applied in the setting of preoperative sepsis (SIRS + infectious source), elevated lactate (≥3), acidosis (pH<7.2), high ASA score (=5), and increased age (≥70). Of the 162 non-RSCL emergent laparotomies, 27 (17%) required unplanned re-explorations; of these, 17 (63%) had sepsis preoperatively and 9 (33%) died.

Conclusion: The acute physiologic indicators which help guide operative decisions in trauma patients may not confer a similar survival advantage in EGS-RSCL patients. To replace the lethal triad, criteria for application of the rapid source control laparotomy in EGS need to be defined. Based on these results, the indications should include sepsis, lactate, acidosis, ASA score, and age. When correctly applied, the rapid source control laparotomy may help to improve survival in EGS patients *in extremis*.

Poster # 20

MALPRACTICE RISK IN ACUTE CARE SURGERY: WHAT IS THE BENCHMARK?

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Introduction: Trauma and emergency surgery care is perceived by many as a high malpractice risk specialty. Little data is available regarding malpractice risk in Acute Care Surgery. Malpractice claims history was examined over a 17-year time period in an academic Level I Trauma Center with transition to a Division of Acute Care Surgery.

Methods: The Divisions of Trauma/Burn and Surgical Critical Care were merged in 2005 to form the Division of Acute Care Surgery (ACS); including Trauma, Burn, Surgical Critical Care and Emergency Surgery. The ACS Division then expanded from 5 faculty in 2005 to 9 faculty in 2012. From 1996 to 2012, several system changes occurred. In 2002, an institutional policy of open disclosure was established in order to facilitate risk management and rapid settlement of appropriate cases outside of the court system. In 2005, an ACS faculty clinical mentorship program pairing new junior faculty members with senior faculty members was created to mitigate medicolegal liability. Internal review processes and house officer training oversight/regulation were also improved. An institutional risk management database, containing claims-related performance data, was queried to identify all ACS Division claims during the 17-year study period (Fiscal Year 1996 - FY 2012). Pre-ACS (FY 1996 - FY 2004) was compared with post-ACS (FY 2005 - FY 2012).

Results: The number of total annual claims over this time period did not change and ranged from 2 to 5 per year. With the creation of the ACS Division, the number of claims per 1000 Work Relative Value Units decreased significantly from 0.1 in FY 2002 to a nadir of 0.04 in FY 2012. The total incurred costs paid per FY decreased from a high of $3 million in FY 1996 to $0 in FY 2012. The pre-ACS period had 28 claims with $9.1 million incurred compared to the post-ACS period with 21 claims and $1.7 million incurred. A detailed analysis of claims made from FY 2002 to FY 2012 was performed. Of the 34 total cases within this time period, 14 (41%) were settled, 18 (53%) were closed, 1 (3%) resulted in plaintiff verdict, and 1 (3%) remains open. The majority of allegations were “failure to properly perform” (n=16, 47%). Of these, 12% were trauma-related, 25% ICU-related, and the remainder was related to emergency general surgery. Interestingly, “failure to monitor” (n= 6, 17%) comprised the majority of settlement dollars paid ($2.8 million vs. $1.0 million for “failure to properly perform”). Examination of settlement dollars allocated by service over the 10-year period documented that Acute Care Surgery only comprised 14.2% ($0.8 million).

Conclusion: In an academic Level I Trauma Center, malpractice risk significantly decreased over time with the development of an Acute Care Surgery model, faculty mentorship programs, open disclosure programs, improved internal review processes and house officer training. These data refute the perception that trauma and emergency surgery care is associated with high medicolegal risk.

Poster # 21

NATIONAL TRENDS IN HOSPITALIZATIONS, DEATHS, AND COSTS FROM ACUTE CARE SURGICAL EMERGENCIES, 2005-2010: BUILDING THE STAGE FOR COMPARATIVE FRAMEWORKS AND NATIONAL STANDARDS

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Introduction: The escalating crisis in access to emergency care, in addition to the growth and aging of the population, is contributing to the increasing demands for acute surgical care. This has raised questions about variations over time of mortality and costs associated with surgical emergencies. We aimed to evaluate trends of yearly estimates of hospitalizations, deaths, and costs (adjusted for inflation over time) associated with non-traumatic surgical emergencies (NTSE) in the United States (US).

Methods: From six years (2005-2010) of the Nationwide Impatient Sample (NIS) database, patients with discharge diagnoses of acute appendicitis, acute mesenteric ischemia, abdominal sepsis, non-traumatic aortic aneurysm and dissection, bowel obstruction, bowel perforation, and necrotizing fasciitis were analyzed. Yearly odds of hospitalizations and deaths and yearly averages of log-transformed costs were assessed using multilevel regressions controlled for demographics, the Charlson Comorbidity Index, and hospital characteristics. Analyses were repeated by US regions and hospital location (rural/urban).

Results: There were 1,973,604 hospital discharges with diagnoses of NTSE, accounting for 4.12% of total NIS discharges during 2005-2010. NTSE hospitalizations increased from 3.87% in 2005 to 4.37% in 2010 (adjusted odds ratio [aOR] =1.024, p-value<0.001). Overall mortality decreased from 5.32% in 2005 to 4.68% in 2010 (aOR=0.962, p-value<0.001). The greatest trend toward reduction in mortality was observed for acute appendicitis (aOR=0.889, p-value<0.001). Trends toward reduction in mortality for bowel perforation (aOR=0.996, p-value=0.746) and necrotizing fasciitis (aOR=0.976, p-value=0.213) did not reach statistical significance. Mortality increased significantly over time for bowel perforation in the South (aOR=1.031, p-value=0.041) and in rural hospitals (aOR=1.082, p-value=0.008). Median costs decreased from $12,693 in 2005 to $10,981 in 2010 (adjusted coefficient [aC] =-0.029, p-value<0.001), a trend that was consistent among all US regions. Cost did not vary significantly over time in rural hospitals (aC=0.000, p-value=0.759).

Conclusion: Despite the significant increase in NTSE related hospitalizations over time, mortality and costs are decreasing significantly, perhaps related to improvements in hospital management and increased penetration over time of acute care surgical models in the US. However, variations among US regions and hospital location were observed, these may be related to geographical differences in acute care surgical coverage for these conditions.

Poster # 22

Perineal Necrotizing Soft Tissue Infection (PNASTI) : An Observational Study of Multidisciplinary Care and Lower than Expected Mortality.

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Introduction: Fournier's gangrene, or perineal necrotizing soft tissue infection (PNASTI) is an aggressive time sensitive disease associated with high mortality and disability. Previous reviews report a mortality rate ranging from 20-30% and up to 80%. We reviewed the treatment and outcome of patients presenting to our center with PNASTI under the care of a multidisciplinary team. This includes immediate surgery performed by an in hospital trauma team after admission from a referring facility. The patient is then transferred to the Soft Tissue service within 12 hours of admission with a surgical team dedicated to the management of necrotizing soft tissue infection. Further surgical debridement, wound care, and fecal and urinary management are performed at the discretion of the team with return to the operating occurring on average every 48 to 72 hours until the wound is clean or closed. Consultations to hyperbaric oxygen therapy, infectious disease, nutrition, physical therapy are done for every patient as well as Endocrinology evaluation and admission to a closed surgical intensive care unit as indicated. Ongoing outpatient care occurs in a dedicated clinic.

Methods: We abstracted records of patients presenting with PNASTI to our center from 2006-2012 including demographics, comorbidities, surgical interventions, and outcome.

Results: Of 190 patients presenting with PNASTI average age was 54 and 26% of patients were female. Diabetes was the most prevalent comorbidity in 116 patients (61%). An average of 3.2 operations were performed over a 15.7 mean length of stay with 43% of patients undergoing surgery at a referring facility before transfer. Fifty-five (29%) of the patients had wounds too extensive to accomplish primary wound closure. Orchipexy was used to facilitate wound closure in 51% of male patients and 54 (28%) underwent surgical fecal diversion. Surgical urinary diversion was performed in 7.8% of patients. Primary wound closure was accomplished in 85 patients (45%) before discharge. Amongst 144 patients who survived and returned for follow up, 106 (74%) achieved complete wound healing observed over a mean period of 8.4 weeks after discharge. Mortality rate was 10.2%, including withdrawal of care for 12 (57%) of these patients:

Conclusion: In this observational study of PNASTI, the largest yet reported, a far lower than previously reported mortality rate was observed, with only 4.7% of deaths occuring in patients without the intention of withdrawal of care, and 10% mortality overall. While primary wound closure was acheived in less than one half of the patients, the majority of patients went on to wound healing with ongoing outpatient wound care and treatment. This model of care demonstrates a successful approach to this physiologically challenging and anatomically complex disease process.

Poster # 23

EARLY TRACHEOSTOMY IN POLYTRAUMA PATIENTS SAVES TIME AND MONEY

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Introduction: Patients suffering brain and thoracic injuries are often difficult to liberate from the ventilator and require tracheostomy. Best timing of tracheostomy remains ill-defined. While prior studies have addressed early versus late tracheostomy, they have generally suffered from the use of historical controls, which cannot account for variations in critical care management over time. Propensity scoring can be utilized to identify controls from the same patient population, minimizing the impact of confounding variables. The purpose of this study was to determine outcomes associated with early versus late tracheostomy by application of propensity scoring methodology.

Methods: Patients requiring intubation within 48 hours and ultimately receiving tracheostomy from January 2010 to June 2012 were identified from the trauma registry at a Level 1 trauma center. Early tracheostomy (ET) was defined as tracheostomy performed on or before the fifth hospital day. ET patients were matched to late tracheostomy patients (LT, tracheostomy after day 5 of admission) using variables including severity of chest and head injury, age and transfusion requirement. Outcomes included TICU length of stay (LOS), ventilator days and ventilator associated pneumonia (VAP) rates. Costs for these services were calculated using average daily billing rates for ICU care and ventilator management at our institution.

Results: There were 106 patients included in this analysis, 53 each in the ET (mean day of tracheostomy = 4) and the LT (mean day of tracheostomy = 10) cohorts. 71% of patients had an average age of 47 years and 94% suffered blunt injury, with an average NISS of 23.7 (Table). Patients in the ET group had a significantly shorter TICU LOS (21.4 days vs. 28.6 days, $p<0.0001$) and a significantly lower number of ventilator days (16.7 days vs. 21.9, $p<0.0001$) compared to the LT group. ET patients also had significantly less VAP compared to LT patients (34% vs. 64.2%, $p=0.0019$).

Table 1. Demographics of Early and Late Tracheostomy Groups

	ET (n=53)	LT (n=53)	p-values
Age (years)	48	46	0.6798
Blunt (%)	92.5%	94.3%	0.6957
Head AIS ($\geq$ 3)	37.7%	41.5%	0.6912
Chest AIS ($\geq$ 3)	66%	62.3%	0.6854
Admit SBP	110.2	118.9	0.1391
Admit BE	-4.88	-3.48	0.3285
PRBC/24hr	3.89	2.36	0.2077
ICU LOS	21.37	28.64	<0.0001
Ventilator Days	16.69	21.92	<0.0001
VAP	34%	64.2%	0.0019

Conclusion: In the current era of increased focus on resource utilization and health-care costs, early tracheostomy significantly decreased both pulmonary morbidity and critical care resource utilization. This translates to an appreciable cost savings, at minimum $52,173 per patient and a potential total savings of $2.8 million/year for the entire LT cohort. For trauma patients requiring prolonged ventilatory support, early tracheostomy should be performed.

Poster # 24

MIDDLE LATENCY AUDITORY EVOKED POTENTIAL INDEX MONITORING OF CEREBRAL FUNCTION TO PREDICT FUNCTIONAL OUTCOME AFTER EMERGENCY CRANIOTOMY IN PATIENTS WITH BRAIN DAMAGE

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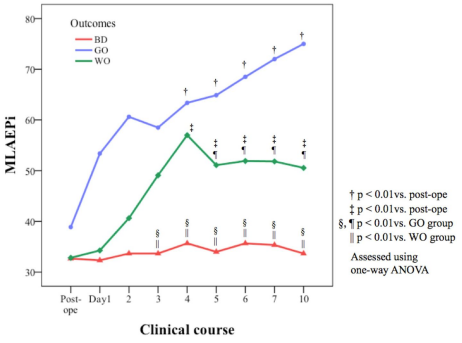
Introduction: Monitoring cerebral function is crucial in surgical critical care. However, until date, there is no satisfactory report on the monitoring of cerebral function to predict functional outcome after brain damage, i.e., traumatic brain injury (TBI) and stroke. The middle latency auditory evoked potential index (MLAEPi) monitor (aepEX plus®, Audiomex, Glasgow, UK) is a mobile MLAEP monitor measuring the degree of consciousness and representing it using numerical values. We considered that MLAEPi can predict neurological outcome after emergency craniotomy among patients with disturbance of consciousness (DOC) caused by brain damage.

Methods: After obtaining approval, the abovementioned patients who underwent emergency craniotomy within 12 hours of the damage, and who were subsequently monitored using MLAEPi were entered in this study. DOC was defined as an initial GCS score less than 8. MLAEPi was measured for 30 days after craniotomy. All patients were administered sedatives for 2 or 3 days after the onset of brain damage. Neurological outcome was evaluated before discharge using a cerebral performance category (CPC) score, and classified into 3 groups: good outcome (GO) for a CPC score of 1 or 2, worse outcome (WO) for a score of 3 or 4, and brain death (BD) for a score of 5.

Results: Twenty-six patients were included in this study (12 TBIs; 8 cerebral hemorrhage; 5 subarachnoid hemorrhage and 1 infarction). With regard to outcome, 9 patients had GO, 12 had WO, and 5 showed BD. MLAEPi was observed to be significantly higher on day 4 than at immediately after craniotomy in cases of GO or WO; significantly lower in BD than in GO or WO after day 4; and significantly higher in GO than in WO after day 5. (see Figure)

Conclusion: MLAEPi satisfactorily denotes cerebral function and predicts outcomes after emergency craniotomy in patients with DOC due to brain damage.



Poster # 25

CLINICAL RELEVANCE OF A ROUTINE DAILY CHEST X-RAY IN THE SURGICAL INTENSIVE CARE UNIT

Shelby Resnick MD, Kenji Inaba* MD, Efstathios Karamanos MD, Dimitra Skiada MD, James A. Dollahite BS, Obi Okoye MD, Peep Talving* MD,Ph.D., Demetrios Demetriades* MD,Ph.D., LAC+USC Medical Center

Introduction: A daily Chest X-ray (CXR) is routine in many surgical intensive care units (SICU). However, this practice has more recently come into question. The purpose of this study was to implement a selective CXR protocol in a high volume academic SICU and evaluate its impact on clinical outcomes.

Methods: A continuous series of patients admitted to the Los Angeles County + University of Southern California (LAC+USC) Medical Center SICU in February 2010 was compared with the patients admitted in February 2012. Between the two time periods a protocol was instituted in the SICU designed to eliminate the routine ordering of daily CXRs. All CXRs performed for each patient were reviewed and the indication for ordering documented. CXRs were divided into 2 groups, those without a documented indication; the automatic daily CXR (ADCXR) and those with documented indication; the physician-directed (PDCXR). All findings were reviewed by a board-certified radiologist. Patient demographics, comorbidities, ICU interventions, and admitting surgical service were documented. Outcome data collected included mortality, overall length of stay (LOS) and ICU LOS, mechanical ventilator free days, and complications.

Results: In 02/2010 and 02/2012, 107 and 90 patients were admitted to the SICU, respectively, for a total of 1,384 patient days. Overall the number of CXRs performed decreased from 363 (56.8% of patient-days) in 2010 to 291 (39.8% of patient days; $p<0.01$) in 2012. ADCXRs decreased in 2012 (123, 60.9% of patient days) from 2010 (211, 83.7% of patient days, $p<0.01$) with a concomitant increase in the number of PDCXR, from 16.3% to 39.1% of patient days ($p<0.001$). A greater proportion of PDCXRs had new findings (80.8%) compared to ADCXRs (23.5%, $p<0.001$). None of the findings on ADCXRs were considered of clinical significance. PDCXRs identified more new pneumonias (0, 0.0% vs 9, 9.3%; $p= 0.04$) and were used more often in management of tubes and lines (0, 0.0% vs 78, 80.4%; $p<0.001$). There was no difference between the two years in terms of overall LOS, ICU LOS, ventilator free days, morbidity or mortality.

Conclusion: Institution of a SICU protocol eliminating the automatic ordering of daily CXRs was successful in decreasing the number of CXRs performed, without affecting ICU LOS, overall LOS, need for mechanical ventilation, morbidity or mortality. Physician-directed ordering of CXRs increased the diagnostic value of the CXR and decreased the number of clinically irrelevant CXRs performed, resulting in decreased overall radiation exposure and hospital costs.

Poster # 26

PROPORTIONAL ASSIST VENTILATION VERSUS PRESSURE SUPPORT FOR SPONTANEOUS BREATHING TRIALS: A MECHANISTIC STUDY

John N. Melvan Ph.D., Terry L. Forrette MHS, RRT, Jeffrey Gruner MD, Rebecca Schroll MD, Jennifer Mooney MD, Lance E. Stuke MD, Alan B. Marr MD, John P. Hunt* MD,MPH, Patrick Greiffenstein MD, LSU Department of Surgery

Background: Proportional assist ventilation (PAV+) is an novel ventilator setting that adjusts the level of ventilator support based upon moment-to-moment changes in breathing mechanics. This study was designed to determine ventilatory response when PAV was used for spontaneous breathing trial (SBT). Pressure support (PS), a frequently used method for ventilator discontinuation, was selected for control.

Methods: All adult patients on mechanical ventilation for > 48hours in the Trauma Intensive Care Unit (TICU) were eligible. Patients determined to be ready for a SBT were placed on a PS setting of 5 cmH_20 and Positive End Expiratory Pressure (PEEP) of 5 cmH_20 (PS 5/5) for 10 min and average rapid shallow breathing index (RSBI) was calculated. This value was then used as our target RSBI to determine comparable PAV+ % support. Patients with average RSBI > 100 after 10min on PS were considered to have failed their SBT and were not included in this study. Eligible patients were initiated on PAV+ of 30% support for 10 min after which, if the RSBI was more than ± 10% target RSBI, the percent support was adjusted in ± 10% increments. Trials were performed in 2 min intervals and respiratory mechanics recorded until the target RSBI was achieved. SBTs lasted a total of 30 min. Qualified patients were extubated shortly therafter.

Results: A total of 53 patients underwent a total of 59 trials. The average RSBI, respiratory rate, tidal volume, and minute ventilation on PS are shown in the table. The differences between the two modalities were not statistically significant. There was a significant difference in the mean positive airway pressure (MPAP) as well as the Delta-P (calculated as the difference between Peak Inspiratory Pressure and the Peak End Expiratory Pressure or PEEP). The patients had a significantly lower Delta-P and MPAP on PAV+30 when compared to PS, as shown. There were no complications during the SBT's and all the patients studied appeared to tolerate both modalities equally well.

	Units	PS 5/5	PAV+ 30%	p Value
Resp Rate (f)	breaths/min	19.98 +/- 0.7	20.48 +/- 0.9	0.66
Tidal Volume (Vt)	mL	522 +/- 16	517 +/- 18	0.84
RSBI		41.6 +/- 14	41.6 +/- 15	0.53
Minute Ventilation (VE)	L/min	10.14 +/- 0.44	10.46 +/- 0.64	0.68
MPAP	cmH2O	7.2 +/- 0.06	6.9 +/- 0.09	0.02*
ΔP	cmH2O	4.8 +/- 0.25	5.6 +/- 0.07	0.003*

Conclusion: This study compared respiratory mechanics of patients on proportion assist ventilation to pressure support settings during an SBT. We found that when patients met criteria for SBT, PAV+ at 30% support was an equivalent mode of ventilation with regards to respiratory rate, RSBI, tidal volume, and minute ventilation as well as patient tolerance. Of note, when patients were placed on PAV+30% they had an average drop in their Delta-P and MPAP, possibly indicating improved patient-ventilator synchrony and patient comfort. Furthermore, we noted that PAV30+ may offer some clinical advantages over conventional ventilation, in that more information such as compliance, resistance, and work of breathing measurements can be obtained. These data provide evidence for the interchangeable use of PAV+ and PS in patients undergoing SBT and potential benefits of PAV+ over conventional ventilator settings.

Poster # 27

IT'S ALL ABOUT COMPLIANCE: PROPORTIONAL ASSIST VENTILATION HELPS PREDICT SUCCESSFUL LIBERATION FROM MECHANICAL VENTILATION IN TRAUMA ICU PATIENTS

Patrick Greiffenstein MD, John N. Melvan Ph.D., Terry Forrette MHS, RRT, Jeffrey Gruner MD, Rebecca Schroll MD, Jennifer Mooney MD, Alan B. Marr MD, Lance E. Stuke MD, John P. Hunt* MD,MPH, Juan C. Duchesne* MD, LSU Department of Surgery

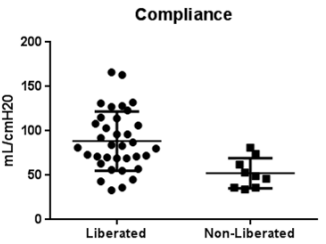
Background: One of the most accurate predictors of successful liberation from mechanical ventilation (MV) is the rapid shallow breathing index (RSBI). However, many patients predicted to successfully liberate from MV based on RSBI eventually fail. We hypothesized that other measurements obtained using Proportional Assist Ventilation (PAV+) during a Spontaneous Breathing Trial (SBT) can better predict liberation failures.

Methods: A retrospective review of our database examining MV liberation in our trauma/surgical ICU. Patients who met criteria for SBT per our protocol, having adequate neurologic, hemodynamic and respiratory parameters on Pressure Support 5 cmH2O, PEEP 5 cmH2O (PS 5/5) and RSBI <100, were placed on PAV+ 30% support for 30 min. We have found PAV+30% to be well-tolerated and equivalent to PS 5/5 as an SBT mode in our patients (unpublished data). Liberation was defined as greater than 24 hour ventilator-free breathing. Non-liberated patients required return to MV within 24hrs.

	Units	Lib	Non-Lib	p Value
# Trials		35	9	N/A
f on PS 5/5	breaths/min	18.4 +/- 0.9	23.7 +/- 2	0.01*
f on PAV 30%	breaths/min	18.4 +/- 0.9	25.1 +/- 3	0.006*
VE on PS 5/5	L/min	9.5 +/- 0.4	12.6 +/- 1.1	0.004*
VE on PAV 30%	L/min	9.0 +/- 0.4	14.3 +/- 2.4	0.0007*
MPAP on PS 5/5	cmH2O	7.1+/- 0.07	7.6 +/- 0.05	0.007*
MPAP on PAV-30%	cmH2O	6.8 +/- 0.07	7.5 +/- 0.3	0.003*
ΔP on PAV 30%	cmH2O	4.3 +/- 0.2	6.9 +/- 0.9	0.0003*
WOB on PAV 30%	Joules/L	0.7 +/- 0.05	1.2 +/- 0.1	0.001*
Compliance	mL/cmH2O	88.5 +/- 5.6	52.33 +/- 5.6	0.003*

Results: A total of 44 trials were conducted on 43 patients. There was no statistical difference in the average RSBI or tidal volumes (Vt) between the liberated (Lib) and the non-liberated (Non-Lib) groups. There were significant differences between Lib and Non-Lib in the respiratory rate (f) and minute ventilation (VE) as shown. The ΔP is the Peak Inspiratory Pressure minus PEEP, which also varied significantly when patients were on PAV+30%, reflecting the real respiratory support requirements. Lastly, Non-Lib patients exhibited a higher Work of Breathing (WOB) and lower compliance , as shown.

Conclusion: This study examined the respiratory mechanics of ventilated patients during the SBT. We found important differences in the respiratory demands between patients who were successfully liberated and those who were not. The ΔP was significantly higher in the latter, which on PAV+30% setting is patient-driven. This reflects a decreased compliance and a corresponding increased WOB, as these patients maintained their low RSBI by temporarily compensating with a higher f. We postulate that decreased compliance among Non-Lib patients increased respiratory demand and led to liberation failure.



Poster # 28

CONTINUOUS GLUCOSE MONITORING IN THE SURGICAL INTENSIVE CARE UNIT: FINDING THE SWEET SPOT

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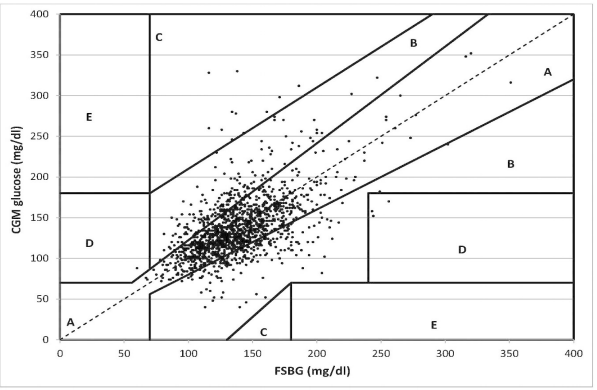
Introduction: Intensive glycemic control (IGC) in the surgical intensive care unit remains controversial partly because it entails a substantial risk of hypoglycemia. If demonstrated to be accurate, continuous glucose monitoring (CGM) using subcutaneous (SQ) sensors may mitigate this risk of IGC. **Methods:** In this blinded prospective study, patients admitted to the surgical intensive care unit (SICU) requiring insulin infusion were eligible. SQ CGM (Medtronic Guardian REAL-Time CGM, Northridge, CA) was placed in the abdomen or thigh and calibrated every 8-hrs, based on capillary (fingerstick) blood glucose readings (FSBG). Monitors were changed every 72 hrs (or if malfunction) until 144 hours or insulin infusion stopped. CGM data were compared with FSBG at least every 2 hours. Other data included demographics, diagnoses, fluid balance, doses of vasopressors and/or steroids, and any IV or enteral glucose source. FSBG and CGM readings were compared (mean and median absolute difference [MAD/MedAD], correlation coefficients, Bland-Altman plots, and Clarke error grids.) **Results:** Twenty four patients were enrolled (11 men; mean age 59±14.1 yrs; BMI 37.9±10.1 kg/m^2; fluid resuscitation in first 24 hrs, mean 6.1±3.5 L; APACHE II on day 1: 20.3±6.4; 17 requiring vasopressor therapy). Correlation coefficient between FSBG and CGM was 0.61 ($p<0.001$). The MAD between FSBG and CGM was 22.0 ± 21.9 mg/dl and the MedAD 16.0 IQR 24.0 mg/dl. The Bland-Altman plot did not identify any trends in accuracy related to FSBG level. Time from calibration did not correlate with MAD , coefficient of 0.008 ($p=0.771$). The Clarke error grid (figure) analysis demonstrated that 98.9% of data points were in zones A (71.3%), indicating agreement with FSBG ±20%, or zone B (divergent, but discrepancy would likely not lead to patient harm) Just 0.81% of data points were in zone C (potentially dangerous overcorrection likely) and only 0.27% were in zones D or E (potentially dangerous failure to detect hypoglycemia or hyperglycemia). **Conclusions:** In this preliminary investigation, CGM appears reasonably accurate in the SICU, despite widespread use of pressors and large volume resuscitation. Further investigation into the accuracy of these devices to assist clinicians in achieving IGC is warranted.



Poster # 29

EXPRESSION OF CELL SPECIFIC SURFACE ANTIGENS ON ENDOTHELIAL MICROPARTICLES IN PATIENTS WITH SYSTEMIC INFLAMMATORY RESPONSE SYNDROME

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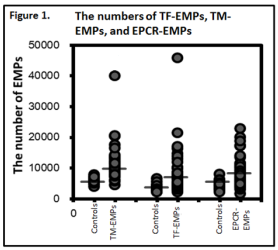
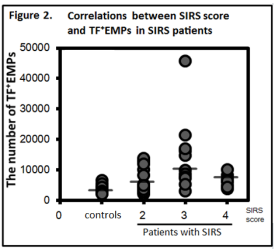
Introduction: The role of endothelial microparticles (EMPs) has not been thoroughly clarified in the pathogenesis of critical illness. EMPs present several cell specific surface antigens and these subpopulations are heterogeneous with different antigenic profiles and function. The objective of this study was to investigate the role of EMPs in patients with systemic inflammatory response syndrome (SIRS) by evaluating surface antigen expression on EMPs.

Methods: This prospective observational study was conducted from November 2012 to February 2013. Criteria for inclusion were adult patients with SIRS. Blood samples were collected from each patient on the day met the SIRS criteria and from the healthy volunteers. The number of tissue factor-positive EMPs (TF-EMPs), thrombomodulin-positive EMPs (TM-EMPs), and endothelial protein C receptor-positive EMPs (EPCR-EMPs) were measured by flow cytometry immediately after blood sampling. EMPs was defined as events detected by annexin V+/CD146+ with the diameter of <2.0um. To determine surface antigen expression of EMPs, anti-CD142, anti-CD141 and anti-CD201 antibodies were used for TF, TM and EPCR, respectively. The relation was evaluated between each expression and severity of illness assessed by SIRS score, APACHE II score, and SOFA score.

Results: This study was composed of 35 patients who met the inclusion criteria and 12 healthy controls. Causes of SIRS were trauma in 11 patients, post-cardiac arrest syndrome in 8, sepsis in 5, encephalitis in 5, others in 6. The numbers of TF-EMPs, TM-EMPs, and EPCR-EMPs were significantly increased in patients with SIRS versus those in controls ($p<0.05$) (Figure1). As shown in Figure 2, the number of TF-EMPs was significantly increased with the increases of SIRS score in patients with mild to moderate SIRS (score 2 or 3), whereas that was decreased in patients with severe SIRS patients (score 4) ($p<0.05$). Similar trend was observed in other disease severity scores such as APACHE II or SOFA scores.





Conclusion: In SIRS patients with highest degree of disease severity, the enhanced expression of surface antigens on EMPs declined, suggesting that EMPs may reflect the severity of endothelial damage in the pathophysiology of SIRS.

Poster # 30

ELEVATED SERUM CREATINE PHOSPHOKINASE IS ASSOCIATED WITH MORTALITY AND INOTROPIC REQUIREMENT IN CRITICALLY INJURED ADULTS

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Vanderbilt University Medical Center

Introduction: Hemeproteins such as myoglobin induce lipid peroxidation and cause oxidative injury when released as a result of cell damage. Creatine phosphokinase (CPK) elevation is a marker for free myoglobin, which can undergo autoxidation and catalyze lipid peroxidation, increasing oxidative stress. Myoglobin-induced oxidative stress is associated with renal failure in patients with rhabdomyolysis. Since oxidative injury is a key mechanism of injury-related organ dysfunction, we hypothesized that serum CPK levels correlate with mortality and duration of inotropic support, i.e. shock, among critically injured patients.

Methods: We conducted a retrospective review of 16,695 patients admitted to the Trauma Intensive Care Unit over nine years. 2,793 patients with serum CPK levels were included in the analysis. Mortality and inotrope requirement were collected continuously into an electronic ICU repository. Univariate analysis was accomplished using Spearman correlation and the Mann Whitney U test. A propensity score for elevated CPK was determined using a linear regression model that included 13 covariates. Adjustments for propensity score, age, gender, race, and University Healthsystem Consortium expected mortality were utilized in regression models: logistic regression to assess the independent effect of CPK level on mortality and need for inotropic support, and Poisson regression to assess the independent effect of CPK level on duration of inotropic support.

Results: Median CPK was significantly higher in patients who died (895 [IQR 331, 2366] vs. 719 [257, 1954], $p= 0.008$) and in those who required any inotropic medications (945 [357, 2436] vs. 464 [183, 1217], $p< 0.001$). A propensity score adjustment model controlling for potential confounders was utilized to determine that the adjusted odds of mortality increased by 1.15 (95% CI 1.04- 1.28) per natural log unit increase in CPK ($p= 0.009$) and the adjusted odds of requiring inotropic medication increased by 1.31 (95% CI 1.22-1.41) per natural log unit increase in CPK ($p< 0.001$). There was a significant association between CPK level and duration of inotropic support (Spearman's rho .234, $p< 0.001$) that remained significant after propensity score adjustment and controlling for potential confounders.

Conclusion: In critically injured patients, elevated serum CPK level is independently associated with mortality, need for inotropic support, and duration of inotropic support. If this association is verified prospectively, there may be a role for treatment with hemeprotein reductants, e.g. acetaminophen, to mitigate the effects of shock and end-organ dysfunction in critically injured patients with elevated CPK.

Poster # 31

PRE-OPERATIVE PROLONGED FASTING: IS IT REALLY NECESSARY?

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Introduction Western surgical standards for pre-operative management for adult surgical patients include having patients fast for eight hours before an elective, scheduled surgical time. This has been proven to cause patient discomfort, increased insulin levels, decreased glucose levels, and other complications currently under investigation. In Europe, common practice is not to have patients fast for eight hours, but rather they have adopted practices of *nil per os* (NPO, fast) of solids for six hours and liquids for two hours. We hypothesize the amount of gastric contents does not affect lung complications in trauma patients who require urgent operative intervention.

Methods: This is a 5-year retrospective descriptive review from January 2008-December 2012 at a Level 1 Trauma Center. Inclusion criteria: Trauma patients who went to the operating room within 3 hours of arrival to the Emergency Department (ED) and who had a Computerized Topography (CT) of the abdomen and pelvis prior to operative intervention. The CTs of the patients included were used to calculate the size and amount of approximate gastric contents prior to operative intervention. The maximal axial diameter of the stomach was recorded. Post-operative complications were analyzed. Patients were excluded if they were intubated prior to arrival to the Operating Room (OR). Multiple logistic regression was used determine, if any, risks for developing pneumonia.

Results: Of the 561 patients with trauma admissions requiring operative intervention, 86 patients met the inclusion criteria. Mean age of patients included was 36.2 years old. Mean Heart Rate (HR) was 95.4 bpm, mean Systolic Blood Pressure (SBP) 122.7 mmHg, mean time to the OR from ED arrival was 1hour and 28 minutes. Of the patients included, 6% developed pneumonia. Mean maximal diameter of patients who developed pneumonia was 9.2 cm (SD 5.02), and of the 94% that did not develop pneumonia, mean was 10.97 cm (SD 3.88); p = 0.33. On a multiple logistic regression analysis, maximal axial diameter of stomach on pre-operative CT of the abdomen and pelvis was not a significant risk factor for development of pneumonia (Table I).

Table I. Logistic Regression for Developing Post-Operative Pneumonia

	OR	CI (95%)	p
Injury Severity Score (ISS)	1.01	0.80 - 1.26	0.96
Ventilator Days	4.81	1.28 - 18.02	*0.02
Crystalloid Volume, Intra-Operative (ml)	1.00	0.99 - 1.84	0.24
PRBC, Intra-Operative (units)	0.01	0.00 - 1.842	0.08
CT Abd/Pelvis Maximal Diameter (cm)	0.67	0.38 - 1.19	0.67

Significance p < 0.05; OR = Odds Ratio; CI = Confidence Interval; PRBC = Packed Red Blood Cell

Conclusion: The results in this study provide further evidence showing no correlation between gastric contents and developement of post-operative pneumonia. In elective surgery, keeping patients NPO for prolonged periods of time pre-operatively could add undue negative consequences that can be avoided. Ventilator days were the only significant predictor with an increased odds ratio of developing pneumonia. Findings of this study in urgent and emergent trauma patients with full stomach contents, could be potentially applied to elective surgical practice. Perhaps further randomized trials could be designed to explore different elective, pre-operative regimens to investigate the effects on post-operative outcomes.

Poster # 32

TIMING AND IMPLICATIONS OF POST-TRAUMATIC EARLY ACUTE KIDNEY INJURY

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Introduction: Severely injured patients are often in positive fluid balance in the first few days post-injury. We questioned whether early mild acute kidney injury (eAKI) predicts positive fluid balance and whether excessive fluid administration might worsen outcomes in patients with eAKI.

Methods: We reviewed records of trauma patients with a heart rate > 90 admitted to the ICU, with no known history of renal dysfunction, for fluid balance and changes in serum creatinine in the first 48 hours after admission. We defined eAKI by RIFLE criteria within 48 hours. We evaluated the impact of baseline characteristics, injury severity, and fluid balance at 8 and 24 hours on eAKI and the impact of creatinine changes on ICU length of stay with multivariate analysis.

Results: Of 148 patients, 26 (18%) had eAKI (Risk=18, Injury=6, Failure=2) either upon presentation (n=25) or within 48 hours (n=1). Patients with eAKI had a higher ISS (22 vs 15, p=.04) and were more likely to receive blood (58 vs 26%, p=.001) but did not have a lower admission blood pressure than those without eAKI. Early AKI patients had a higher fluid balance at 8 hrs (3.8 vs 1.4 L, p<.001) and 24 hrs (6.5 vs 2.4 L, p<.001) despite similar 8 hr (1.2 vs 1.2 L, p=.85) and 24 hr (2.4 vs 2.6 L, p=.43) urine output. 24 hr positive fluid balance was associated with AKI (OR 1.16 [CI 1.03-1.29]) independent of ISS, diabetes, blood transfusion, age, or admission SBP or HR. Patients with eAKI had a median ICU length of stay 1 day longer than those without (3 days [IQR 2,11] vs 2 days [IQR 1,7], p=.02). Increased ICU stay was associated with 24 hr change in creatinine (p=.003), ISS (p=.08) and 24 hr fluid balance (p=.03) but not with age (p=.45) or transfusion (p=.11). Among the 26 patients with eAKI, there was a trend towards 24 hour fluid balance predicting an ICU stay longer than the median (OR 1.3, CI .98-1.7, p=.07).

Conclusions: Early AKI manifests at presentation and should be recognized to avoid unnecessary volume administration. Although early AKI might be interpreted as an indication for vigorous fluid administration, the injured kidney shows signs of inability to tolerate excess fluid as early as 8 hours. Even mild renal dysfunction may lead to a prolonged stay in the ICU.

Poster # 33

ULTRASOUND-GUIDED THORACOSTOMY TUBE PLACEMENT IN SURGICAL INTENSIVE CARE PATIENTS

KAVEH NAJAFI DO, STEVEN MAXIMUS MD, JACQUELINE K. PHAM BS, MICHAEL E. LEKAWA* MD, MATTHEW O. DOLICH* MD, ALLEN P. KONG MD, NICOLE P. BERNAL MD, LAURA K. FINDEISS MD, CRISTOBAL BARRIOS Jr., MD, University of California, Irvine - Orange County

Introduction:
Pleural effusions are common in the critically ill, occurring in over 60% of patients. Pleural effusions in critically ill patients have been associated with a longer duration of mechanical ventilation, ICU stay, and increased mortality. Drainage of large pleural effusions by thoracentesis produces improvement in lung mechanics and oxygenation and significantly relieves dyspnea in most cases. Transportation logistics and complications related to pleural drainage remain a concern in mechanically ventilated patients. Given the issues that arise, we aimed to document our early experience with ultrasound guided thoracostomy tube placement of critically ill patients in the SICU. We hypothesized that patients undergoing US guided tube thoracostomy placement in the SICU achieve equivalent outcomes compared to patients undergoing similar procedures with Interventional Radiology (IR).

Methods:
This is a retrospective review comparing patients with radiographically evident pleural effusions or pneumothorax treated with percutaneous placement of thoracostomy tubes using thoracic ultrasound compared to patients undergoing tube thoracostomy placement or thoracentesis done by IR. Duration of tube placement, volume of fluid removed at insertion, total volume removed, time in IR suite, and complications were noted.

Results:
A total of seventy three patients were analyzed, with twenty patients (27.4%) undergoing ultrasound guided chest tube placement in the SICU via surgical intensivists compared to fifty three patients (72.6%) undergoing thoracentesis or chest tube placement with IR. All SICU patients (100%) had chest tubes inserted, compared to 21 IR patients (39.6%). Compared to IR patients, SICU patients had similar volume removed at insertion (948.2 ml vs. 838.4; p= 0.54), and total volume removed (1736.4 vs. 1637.7; p=0.82). The average duration of tube placement for SICU patients was 3.86 days, compared to 6 days for IR patients (p=0.01). The remaining thirty one IR patients underwent thoracentesis (60%), with the average volume removed 778.2 ml. The average time in the IR suite was 131.8 minutes. No complications were noted for either group.

Conclusion:
Ultrasound enhances the practitioner's ability to evaluate, diagnose and treat critical ill patients. US is easily available, portable, non-invasive, and virtually painless, making it an increasingly popular and valuable tool in the ICU. Our case series provides early evidence that US guided chest tube placement by intensivists can produce similar results to IR procedures without the issues of transportation, resource expenditure, and time off unit, making it safe and efficient for critically ill patients.

Poster # 34

TISSUE PERFUSION MEASUREMENTS AND MORTALITY IN THE CRITICALLY-ILL

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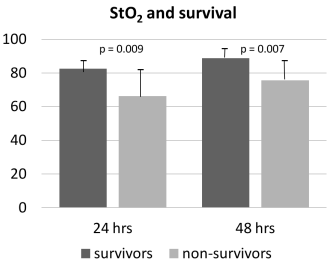
Introduction: Measurement of tissue perfusion may facilitate the detection of early shock and guide its subsequent treatment. Several promising noninvasive methods provide quantitative measurement of tissue perfusion in normal and in shock states. Transcutaneous PO_2 ($PtcO_2$) changes with PaO_2 and FiO_2 in non-shock states, but during shock, $PtcO_2$ approximates cardiac output with minimum response to increasing FiO_2 and PaO_2 due to vasoconstriction of the skin (1). This response is called the Oxygen Challenge Test (OCT), and has been shown to predict organ failure, mortality, and used as an endpoint of resuscitation. OCT value of ≥25 mmHg implies adequate perfusion, and <25 mmHg implies shock (1). Near-infrared spectroscopy measurements of tissue hemoglobin oxygen saturation (StO_2, Hutchinson Technologies, Hutchinson MN) and a pulse oximetry-based perfusion index (PI, Masimo, Irvine CA) are two additional non-invasive methods of tissue perfusion. Both StO_2 and PI have been shown to correlate with hypoperfusion and tissue ischemia in critically-ill subjects (2,3). However, its utility in resuscitation and its use as endpoints have yet to be defined.

Methods:Simultaneous measurements of OCT, StO_2, and PI were done in 52 critically-ill subjects with pulmonary artery catheters during resuscitation and throughout the ICU stay. Fisher's exact test was used to compare OCT at 24 and 48 hours to survival. The t-test was used to compare StO_2 measurements in survivors versus non-survivors. The same was done with PI measurements.

Results: Tissue perfusion measurements were performed in 52 patients over the first 24 and 48 hours. Demographics of the 52 patients were: 66±16 yrs of age, 32 males: 20 females, APACHE II 26.9±8.6, 35 septic shock/severe sepsis, 15 hemorrhagic shock, 16 cardiac failure, 44 respiratory failure patients. Thirty-three of the 52 subjects survived to discharge or transfer to other acute care facilities. There was no association between survival and OCT measured at either 24 hours or 48 hours. Likewise, PI values were not different between survivors and non-survivors. In contrast, StO_2 in survivors was significantly higher when compared to StO_2 in non-survivors. This difference was observed with measurements obtained at 24 hours and 48 hours after ICU admission.



Conclusion: Measurements of tissue perfusion can provide valuable information in the detection and treatment of shock. While the OCT has previously shown an association to survival, this was not the case in this investigation. Higher values of StO_2 are associated with survival in this investigation. Further investigation is needed to determine the utility of these perfusion measurements as resuscitation endpoints.

1) Yu M et al, Shock 2007;27:615. 2) Crookes BA et al, J Trauma 2005;58:806. 3) Felice C et al, Eur J Pediatr 2002;161:561.

Poster # 35

INTERLEUKIN-6 PREDICTS MULTI-ORGAN SYSTEM FAILURE IN ADULTS WITH SEVERE BLUNT TRAUMA: AN ANALYSIS OF THE GLUE GRANT

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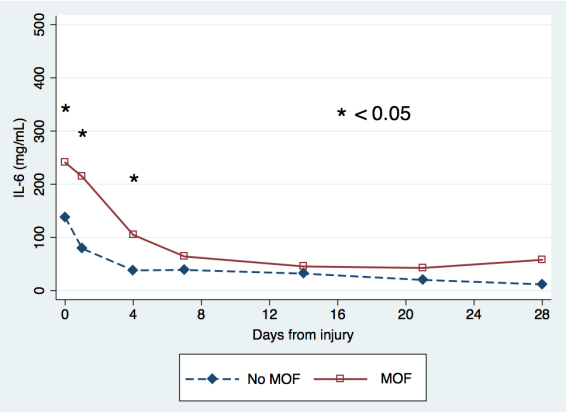
Introduction: Despite advances is surgical critical care, multi-organ system failure (MOF) remains the leading cause of late mortality after trauma, accounting for up to 80% of all injury-related deaths in the Surgical Intensive Care Unit. With this project we attempt to identify a reliable predictor for development of MOF in adults with severe blunt trauma.

Methods: Data were extracted for secondary analysis from the prospectively collected multicenter cohort of severely injured blunt trauma patients with hemorrhagic shock, the Glue Grant. A subset of patients consented to have serial measurements of pro-inflammatory mediators, including IL-6. Diagnosis of MOF required a Marshall Multiple Organ Dysfunction Score ≥5. The Mann-Whitney test was used to compare the serial IL-6 levels between MOF and non-MOF patients, and Receiver Operating Characteristic (ROC) Curves were plotted for the early (≤day 4) IL-6 measurements.

Results: From the overall cohort, 73 subjects had early serial measurements of their IL-6 levels and comprised our sample. The mean Injury Severity Score was high at 30.4±13.5 and 31.5% of our patients developed MOF on day 3.5±2.6 on average. The distribution of IL-6 levels across MOF & non-MOF subjects is summarized in the figure below. The C-statistic of IL-6 measured on post-injury day 4 was 0.77, indicating good predictive capability for MOF, while the sensitivity, specificity and accuracy were 86.4%, 67.4% and 73.9% respectively.

Conclusion: IL-6 reliably predicts development of MOF among blunt trauma patients with hemorrhagic shock.



Poster # 36

HYPERGLYCEMIA IS ASSOCIATED WITH VENOUS THROMBOEMBOLISM IN CRITICALLY ILL TRAUMA PATIENTS

Ramita Rahimian Cristobal Barrios Jr., MD, Tamana Kaderi BS, Roya Moheimani BS, Jacqueline Pham BS, Bryan Imayanagita BS, Michael E. Lekawa* MD, Matthew O. Dolich* MD, Nicole P. Bernal MD, Allen P. Kong MD, University of California, Irvine - Orange County

Introduction: Hyperglycemia has many physiologic consequences and is associated with diabetes, critical illness, and trauma. Blood viscosity increases with hyperglycemia, which may potentially result in formation of venous thromboembolism (VTE). In the intensive care unit, VTE is one of the most common complications, and standard prophylactic measures exist to prevent its development. We hypothesize that critically ill post-trauma patients with elevated average blood glucose levels have an increased rate of VTE.

Methods: Data were collected on trauma patients 18 to 50 years of age admitted from 2009 to 2011 at an urban Level-1 trauma center. Demographics, injury severity scores, ICU length of stay, ventilator days, and glucose levels (maximum, minimum, and average) were obtained. Hyperglycemia was defined as maximum or average glucose >140 mg/dL or a minimum glucose >110 mg/dL. Univariate and multivariate analyses were performed to identify independent predictors.

Results: 120 patients were included in the study. Development of VTE was associated with ICU length of stay (18 vs. 9, $p<0.01$) and hyperglycemia based on average (57.6% vs. 20.7%, $p<0.01$), maximum (84.8% vs. 42.5%, $p<0.01$), and minimum (66.7% vs, 31.0%, $p<0.01$) glucose levels. Independent predictors of VTE included maximum glucose level >140mg/dL (OR 5.79, $p=0.01$).

Conclusion: Critically ill hyperglycemic patients are associated with VTE formation. This may reinvigorate the debate on tight glucose control. Also, given that many hospital protocols do not consider hyperglycemia as a criterion for VTE prophylaxis, its inclusion in such protocols may be needed. Further studies are warranted to confirm these results.

Poster # 37

MODULATION OF THE NICOTINIC ANTI-CHOLINERGIC PATHWAY PROTECTS AGAINST INTESTINAL BARRIER DYSFUNCTION AND RELEASE OF DAMPS IN VITRO

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Introduction: Damage associated molecular patterns (DAMPs) are endogenous molecules released after shock conditions and activate innate immunity which may lead to systemic inflammation and organ injury. Preinjury vagal nerve stimulation and nonspecific (nicotine) and alpha-7 specific nicotinic agonists (AR-R17779) protect against gut barrier failure and lung injury in conditions associated with intestinal hypoperfusion. Intestinal epithelial cells (IEC) selectively express the alpha7-nicotinic acetylcholine reseptor (nAChR). We compared pre vs. post-insult administration of nicotinic agonists on intestinal barrier function and DAMPs release in an *in vitro* intestinal epithelial model.

Methods: IEC-6 intestinal epithelial cell monolayers were subjected to hypoxia (90 min)/reoxygenation challenge. Cells were treated before or after hypoxic challenge with nicotine (5μM) or AR-R17779 (4μM). IEC-6 cell apoptosis, actin cytoskeletal integrity (phalloidin staining) and permeability to FITC-dextran (FD4) were determined. DAMPs production was indexed by HMGB-1 (Western blot) and mitochondrial DNA (coxIII using RT-PCR) release.

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

	% apoptosis	Perm. (nmol/cm^2/hr)	HMGB-1(relative density)	Cox III(mRNA levels)
IEC-6 control	4.8±0.3	0.34±0.01	0.47±0.2	1.0
IEC+HR	12.2±1.6*	0.48±0.03*	1.89±0.4*	3.2
IEC+nico pre-HR	11.5±2.0*	0.43±0.04*	1.56±0.3*	2.8
IEC+nico post-HR	5.3±0.5#$	0.36±0.02#$	0.41±0.2#$	0.4
IEC+ARR pre-HR	11.9±1.7*	0.44±0.03*	1.66±0.3*	2.1
IEC+ARR post-HR	6.1±1.0#$	0.32±0.01#$	0.46±0.1#$	0.3

*p<0.001 vs. IEC-6 control, #p<0.001 vs. IEC +HR, $p<0.001 vs. same group pre-HR

IEC cytoskeletal integrity was preserved by either agonist when administered post-hypoxic insult only.

Conclusion: Nonspecific and specific nicotinic agonists protected against intestinal epithelial barrier derangement and DAMPs release when administered post-hypoxia only. The disparate effects noted likely reflect increased agonist sensitivity due to activation of intracellular signalling pathways related to the hypoxic insult. This has clinical relevance especially with the nonspecific agonist nicotine, where toxicity from dose and duration of administration has limited further trials. Our data suggest that there is a therapeutic window following injury where these agents may be effective in limiting intestinal barrier derangement and resultant inflammatory injury and remote organ failure.

Poster # 38

A TWO MINUTE TEST DURING ROUNDS CAN REPLACE A SPONTANEOUS BREATHING TRIAL

Matthew Bloom MD, Jonathan Lu MD, Tri Tran BS, James Mirocha MS, Marko Bukur MD, Rex Chung MD, Eric Ley MD, Nicolas Melo MD, Ali Salim* MD, Daniel Margulies* MD, Cedars-Sinai Medical Center

Introduction: The Spontaneous Breathing Trial (SBT) is commonly used to assess for extubation readiness, but takes 30-60 minutes to administer. A two-minute test affords rapid evaluation during rounds. We hypothesized that a two-minute pre-extubation test (2MIN) could replace the SBT. The primary endpoint was ability to predict successful extubation. The secondary endpoint was missed opportunities to extubate.

Methods: Data were prospectively collected on all patients endotracheally intubated for >48 hours nearing extubation in a tertiary center's mixed trauma/surgical ICU from August 2012 to January 2013. The SBT was performed for at least 30 minutes at 40% FiO2, PEEP 5, PS 8. This was followed by a 2MIN trial, in which patients were disconnected from the ventilator and directly observed. Patients who failed the SBT were allowed to recover for several hours before performing the 2MIN trial. A successful 2MIN was defined as maintaining all of the following: heart rate ≤ 120, systolic blood pressure 90-180, respiratory rate ≤ 35, SpO2 ≥ 90%, and no signs of patient agitation. The decision to extubate was made at the attending's discretion. Successful extubation was defined as not requiring reintubation within 48 hours.

Results: Seventy sets of evaluations were performed, resulting in 51 extubations. 47(92.2%) of these were successful. The 2MIN test correctly predicted success (*PPV*) in 42/45(93.3%) extubations vs. 46/50(92.0%) via SBT. 5/47(10.6 %) successful extubations were missed (*1-sensitivity*) by the 2MIN test vs. 1/47 (2.1%) with an SBT. No adverse effects were attributed to the 2MIN test. Oxygen saturation <90% was present in all 18 (of 70) 2MIN failures, tachypnea in 4, hypertension in 1, and tachycardia in 1.

	Successful extubation	Required reintubation
Passed SBT	46	4
Failed SBT	1	0
Passed 2MIN	42	3
Failed 2MIN	5	1

Conclusion: This preliminary study demonstrates that the 2MIN test predicts extubation success with rates similar to that of the longer SBT. However, the 2MIN test missed more opportunities for extubation. The most efficient extubation regimen may consist of a 2MIN test and immediate extubation for those who pass, followed by an SBT for the others. Additional studies may further improve the overall predictive accuracy of the 2MIN.

Poster # 39

FC-GAMMA-RIIA POLYMORPHISM IS ASSOCIATED WITH INCREASED RISK OF SEPSIS IN TRAUMA PATIENTS

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Introduction: Infections cause the majority of morbidity and mortality in trauma patients who have survived the initial trauma and subsequent resuscitation. A dysregulated immune response leading to multiple organ dysfunction is the most frequent cause of late post-traumatic deaths. We have found a novel anti-inflammatory pathway that is initiated by the acute phase protein, C-reactive protein (CRP), interacting with FcγR on macrophages. This pathway is protective in animal models of endotoxin shock, immune complex inflammation and autoimmune disease. However, it also may contribute to trauma-induced immunodeficiency. We hypothesized that genetic polymorphisms in the receptor for CRP might contribute to individual differences in cytokine responses and susceptibility to infectious complications after severe trauma.

Methods: We conducted a case-control study on a prospectively identified cohort of adult patients admitted after severe trauma (as defined by an Injury Severity Score > 16 or ICU admission). The Human Research Review Committee approved all protocols prior to sample collection. We enrolled 50 patients and collected blood samples at enrollment and again at 48 and 72 hrs. Patients were followed through their hospital stay and any septic events before 30 days were recorded, as defined by the presence of SIRS and a documented infection as defined by the CDC guidelines. CRP levels and a panel of inflammatory cytokines were determined in the plasma from all three blood draws. Additionally, DNA was extracted from blood and analyzed for the 131 H/R FcγRIIa polymorphism, that strongly affects the binding of IgG and CRP to this receptor.

Results: We identified a 3.5 times increased odds of sepsis in patients with CRP levels greater than the median on day 2 and in individuals with the polymorphism of the FcγRIIa receptor that binds CRP poorly. In multivariate analysis, we found that high ISS and elevated CRP and IL-6 levels on day 2 increased the probability of developing sepsis in our patients.

Conclusions: The FcγRIIa polymorphism has been described as a heritable risk factor for autoimmune and certain infectious diseases. Our findings suggest that a common genetic variation in the FcγRIIa receptor may contribute to infectious susceptibility in trauma patients.

Poster # 40

IMPACT OF POSITIVE FLUID BALANCE ON CRITICALLY ILL SURGICAL PATIENTS: A PROSPECTIVE OBSERVATIONAL STUDY

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Introduction: Post-operative fluid therapy has been a mainstay in the care of the critically ill surgical patient. Recently several retrospective studies have shown deleterious outcomes in patients receiving liberal fluid administration. The purpose of the current prospective investigation was to determine the effect of post-operative fluid-balance on subsequent outcomes in Acute Care Surgical (ACS) patients admitted to the surgical intensive care unit (SICU).

Methods: This study was conducted in a 24-bed dedicated SICU at a Level 1 trauma center with a dedicated ACS service. ACS patients admitted to the SICU from 06/2012 to 01/2013 were followed prospectively. Demographics, clinical characteristics, as well as daily recorded fluid intake and output were collected. Patients were stratified by fluid balance (FB) into FB positive (FB +) and FB negative (FB -) group by SICU day 5 or day of discharge from the SICU. A Cox-Regression was used with fluid balance as time-dependent variable to derive factors independently associated with mortality and in-hospital complications.

Results: A total of 144 ACS patients met inclusion criteria. The mean age of the cohort was 55.8±24.3 (y), with 68.8% of patients admitted for traumatic injuries. Mean APACHE IV score, admission lactate, co-morbidity burden, and vasopressor requirements were similar between FB + and FB – groups. Duration of mechanical ventilation was shorter for the (FB –) group (5.4±5.6 vs 8.6±9.2 days, p=0.059). Although there was no statistically significant difference in mortality (11% (FB -) vs 15.5% (FB+), p=0.422), after adjusting for confounding factors, (FB –) status was independently associated with significantly lower complications, both overall and infectious (AOR [95% CI]: 0.65 [0.54, 0.79] and 0.65 [0.53, 0.78] respectively).

Conclusion: In a cohort of critically-ill ACS patients achieving (FB –) status early during the SICU admission was associated with a nearly 40% reduction in the risk for post-operative complications. Further large prospective investigation should be undertaken to characterize this discrepancy and derive the optimal practices of fluid resuscitation in the ACS patient.

Poster # 41

SHOULD the INTRA-CRANIAL PRESSURE MONITOR go the way of the PULMONARY ARTERY CATHETER?

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Introduction: Brain Trauma Foundation (BTF) guidelines recommend intracranial pressure (ICP) monitoring for traumatic brain injury (TBI) patients with a Glasgow Coma Scale (GCS) score of 8 or less, with an abnormal head CT, or a normal head CT scan with systolic blood pressure $\leq$ 90mmHg or abnormal motor posturing in patients of age >40. The benefits of these guidelines on outcome remain unproven. We hypothesized that adherence to BTF guidelines does not improve outcome after TBI.

Methods: All TBI patients with an admission GCS $\leq$8 admitted to our Level I trauma center over a 3 year period were identified. Adherence to the individual components of our institutional TBI Bundle (ICP Monitoring, SpO2>95%, PaCO2 30-39, SBP>90, CPP>60, ICP <25, Temp 36-37^{O}C) was assessed, and comparisons in mortality and discharge functional status were made between the different bundle elements. High discharge functional status was defined as discharge to home.

Results: We identified 2,618 TBI patients, 261 of whom met the BTF criteria for ICP monitoring. After excluding those with non-survivable injuries (n=67), 194 patients were available for analysis (71 received an ICP monitor and 123 did not). There were no significance differences in demographics, admission GCS (4±1.7 vs. 3.9 ± 1.7; *p*-0.7), Injury Severity Score (25.7±9.9 vs. 26±10; *p*-0.1), and head Abbreviated Injury Scale (4±0.8 vs. 4.2±0.8; *p*-0.1), between the two groups. Survival was higher in patients without an ICP monitor (98% vs. 76%, p<0.004). Non-monitored patients were discharged with higher levels of function per discharge location (28% home vs. 4% home; *p*<0.001). No other components of the bundle were statistically different between groups, but overall compliance was poor - median 3 components out of 6 (IQR 2-4).

Compliance with Brain Trauma Foundation Goals

	ICP + (n=71)	ICP- (n=123)	*p*
SaO_2 = 95%, (%)	93%	91%	0.3
SBP > 90 mm Hg, (%)	91%	92%	0.5
Temperature 36-37°C, (%)	18%	21%	0.4
PCO_2 30-39 mm Hg, (%)	26%	29%	0.3
CPP =60, (%)	67%	Nil	-
ICP <25 mm Hg, (%)	64%	Nil	-

SBP – Systolic Blood Pressure, CPP –Cerebral Perfusion Pressure, ICP – Intra-cranial Pressure

Conclusion: Our data suggest that there is a subset of patients meeting BTF criteria for ICP monitoring that do well without ICP pressure monitoring. This finding should provoke re-evaluation of the indication and utility of ICP monitoring in TBI patients.

Poster # 42

LEVELS OF ADRENOMEDULLIN IN SCREENING BRONCHOALVEOLAR LAVAGE FLUID PREDICT THE PRESENCE OF PATHOGENIC MICROORGANISMS IN THE LUNGS OF INTUBATED TRAUMA AND SURGICAL PATIENTS, A PROSPECTIVE STUDY

Rafael F. Diaz-Flores MD,MPH, Colleen Stoeppel MD, Fernando A. Rivera-Chavez MD, Ming-Mei Lui MS, Kenneth Hawkins RRT, Joseph Minei* MBA,MD, Christian T. Minshall* MD,Ph.D., University of Texas Southwestern Medical Center at Dallas

Introduction: Pneumonia is a significant problem, particularly in the ventilated and critically ill patient. Recent evidence suggests that trauma and surgical patients' deep airways are frequently colonized with bacteria on admission. Furthermore, a positive screening CDBAL is a predictor of a subsequent pneumonia with the same microorganism, which suggests that the pneumonia may be an extension of a complication present at the time of admission. ADM is an endothelial-derived protein with multiple actions in the cardiovascular system, including affecting cardiac and vascular contractility in response to disease, injury, and shock states. It has previously been shown to predict morbidity and mortality in septic patients, as well as rates of pneumonia in ventilated patients with a high clinical pulmonary infection score.

Methods: CDBAL samples were prospectively collected for all subjects admitted to the Surgical Intensive Care Unit at Parkland Memorial Hospital who were intubated for longer than 48 hours between April of 2011 and June of 2012, as per our protocol previously approved by our hospital-acquired infection control committee. Patients who later in their hospital course had an elevated CPIS had a second diagnostic CDBAL performed, as per our institution's VAP protocol. Any time a CDBAL was performed, 10 ml were sent to the laboratory for the intended purpose and all remaining fluid was frozen and stored in a designated study freezer. ADM levels were measured by ELISA (ng/ml).

Results: During the study period 154 screening CDBAL samples were collected, ADM levels were measured in 79 samples and the rest were inadequate due to insufficient quantity to perform the test. There was a statistically significant difference between the ADM levels of patients that had a positive culture and those that did not ($p=0.03$) with a sensitivity of 92.31% and specificity of 80.56%. There was also a statistically significant difference between patients that eventually developed a pneumonia and those who did not, regardless of whether or not their screening CDBAL was positive ($p<0.0001$), with a sensitivity of 93.18% and a specificity of 84.85%. There was no difference between ADM levels in patients with a positive screening CDBAL and pneumonia and those with a positive screening CDBAL and no pneumonia. Most of the diagnostic CDBALs performed on patients with an elevated CPIS were positive for the same microorganism that was noted on the initial screening CDBAL.

Conclusion: ADM is a vasoactive peptide with an increasingly wide diagnostic and prognostic profile. It has been noted to predict morbidity and mortality in a wide variety of disease states, and is thought to be useful in the diagnosis of VAP. Levels in CDBAL samples of patients with a high CPIS have been shown to be predictive of pneumonia, something that can be a useful tool in reducing the use of unnecessary antibiotics while waiting for culture results. In this study, we attempted to evaluate ADM levels on screening CDBALs performed in trauma and surgical ICU patients that had been intubated for over 48 hours. We found that the ADM levels in CDBAL fluid predict the presence of a microorganism in the airway, regardless of whether or not the patient does eventually develop pneumonia. This holds true even for patients that develop pneumonia several days after their screening CDBAL.

Poster # 43

LOOKING BEYOND DISCHARGE: CLINICAL VARIABLES AT TRAUMA ADMISSION PREDICT LONG TERM SURVIVAL IN THE OLDER SEVERELY INJURED PATIENT

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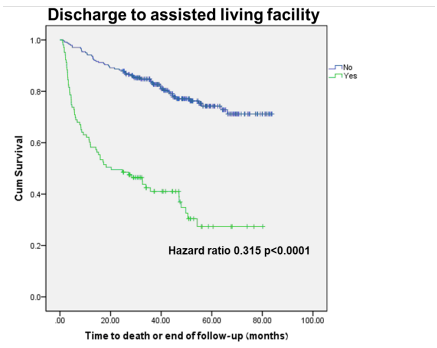
Introduction: Increasing age and co-morbidity are established risk factors for mortality following trauma. Furthermore, although long term follow up is difficult to obtain in most trauma settings, these data are particularly essential for assessing outcomes in the older (≥60) patient. We hypothesized that clinical data obtained during initial hospital stay could accurately predict long term survival.

Methods: Using our trauma registry and hospital database, we reviewed all trauma admissions (age ≥60, ISS>15) to our Level 1 center over the most recent 7 years. Mechanism of injury, co-morbidities, ICU admission, and ultimate disposition were assessed for 2-7 years post-discharge. Primary outcome was defined as long term survival to the end of the last year of the study. Multivariate analysis identified independent predictors of long term survival.

Results: Of 342 patients discharged following initial admission, mean age was 76.2 ± 9.7, and ISS 21.5 ± 6.9. 119 patients (34.8%) died (mean follow up 18.8 months; range 1.1 -66.2). For 233 survivors, mean follow-up was 50.2 months (range 24.8 -83.8). Univariate analysis disclosed post discharge mortality was associated with age(80.1 ± 9.64 vs 74.2 ± 9.07), mean number of co-morbidities(1.6 ± 1.1 vs 1.0 ± 1.2), fall as a mechanism, lower GCS upon arrival (11.85 ± 4.21 vs 13.73 ± 2.89), intubation at the scene and discharge to an assisted living facility (all= p<0.001). Cox regression analysis hazard ratio (HR) showed that independent predictors of mortality on long term follow-up included: older age (HR=1.044; Fig. 1), fall as mechanism (HR= 1.9), lower GCS at admission (HR = 0.883) and discharge to assisted living facility (HR = 0.315; Fig. 2) (all= p<0.0001).

Figure 1

Figure 2



Conclusion: Nearly two-thirds of patients ≥60 who were severely injured survived >4 years following discharge; furthermore, admission data, including younger age, injury mechanism other than falls, higher GCS and home discharge predicted a favorable long term outcome. These findings suggest that common clinical data at initial admission can predict long term survival in the older trauma patient.

Poster # 44

PREDICTORS OF RECURRENT VIOLENT INJURY

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Introduction: A significant number of patients who present after intentional violent injury will endure multiple traumas resulting from violence, resulting in potentially avoidable utilization of healthcare and municipal resources. This study aims to identify those most at risk for recurrent violent injury.

Methods: A retrospective cohort study was conducted including all victims of initial intentional violent injury presenting to an urban trauma center from 2004-2009. Patients were followed for recurrence through 2012. Chi-squared and logistic regression analysis were used to identify factors associated with increased risk for recurrent violent injury.

Results: During the study period, a total of 2748 patients survived initial violent injury and were included the analysis. Of these, 314 (11%) returned with recurrent violent injury. Five characteristics of the initial injury presentation were found which together predicted a nearly tenfold increased risk for recurrence in logistic regression analysis: age < 25 years (adjusted-OR 1.8, CI 1.4-2.3), having medical insurance (adjusted-OR 2.4, CI 1.8-3.1), residence in a >85% black neighborhood (adjusted-OR 1.7, CI 1.1-2.6), assault as mechanism (adjusted-OR 1.5, CI 1.2-2.1), and discharge home from emergency department (adjusted-OR 2.3, CI 1.8-3.0). All five predictors were significant at the $P<0.01$ level. Gender, race, and injury severity score were not statistically significant predictors in our analysis.

Conclusion: Five criteria of patients who present with initial violent injury can be used to predict those who are most likely to return with recurrent violent injury: age, insurance, neighborhood, mechanism, and disposition. We hope that using these criteria for enrollment in our community-based violence prevention program will direct resources toward patients most likely to benefit from intervention.

Poster # 45

CHANGES IN TRAUMA SERVICE CODING PRACTICES FOLLOWING ELECTRONIC HEALTH RECORD IMPLEMENTATION

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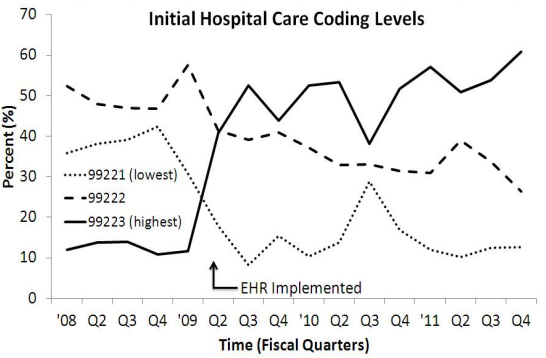
Introduction: Implementing an electronic health record (EHR) system is an expensive and large-scale project. Few studies have examined the impact of inpatient EHR's on documentation coding levels and professional fee reimbursement. Trauma and Emergency Surgery services are ideal for the study of this question given their high percentage of inpatient evaluation and management (E & M) work. The purpose of this study is to elucidate the effect of an EHR on coding practices for the inpatient Trauma and Emergency Surgery Service at an academic level I Trauma Center. Our hypothesis is that EHR implementation leads to higher coding levels and increased professional fee revenue.

Methods: De-identified data was extracted from the University Health System Consortium and Association of American Medical Colleges Faculty Practice Solution Center database (FPSC). Our medical center transitioned from written physician notes to the EHR in May 2009. The database was queried for notes written by the trauma and emergency surgery service in calendar years 2008 and 2011 to compare years before and after EHR implementation. The CPT codes of interest were for E & M Initial Hospital Care (99221, -2, and -3) and Subsequent Hospital Care (99231, -2, and -3). Coding levels were linked to standard Medicare Relative Value Units (RVU's). Professional coders were used throughout and coding guidelines were unchanged over the study period.

Results: The figure shows the distribution of Initial Hospital Care codes for 2008 to 2011. The arrow indicates the transition to EHR. Coding levels for Initial Hospital Care (admission) notes increased immediately and markedly. Revenue from these codes went up by 28.1%. Subsequent Hospital Care (progress notes) codes went up less dramatically by 1.7%.



Conclusions: The increase in higher E & M coding levels activity as a result of EHR implementation was financially significant, immediate and durable. The increase in total Initial Hospital Care notes resulted from improved coder note recognition and higher note quality. Revenue increased measurably.

Poster # 46

BREAKING DOWN THE BARRIERS! FACTORS CONTRIBUTING TO BARRIER DAYS IN A MATURE TRAUMA CENTER

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Introduction: As we enter the brave new world of the Patient Protection and Affordable Care Act of 2010, it is imperative that trauma centers provide not only excellent trauma care but cost-effective trauma care. To that end, we sought to determine those factors, which contribute significantly to barrier days (BD), which is when a patient is medically cleared for discharge (D/C) but unable to leave the hospital. We hypothesized that there would be significant demographic and payor factors associated with barrier days

Methods: In a Pennsylvania-verified Level II trauma center, since 1986, all trauma admissions who were discharged alive from 2010-2012 were queried from the trauma registry. Barrier days were identified by physicians at daily sign-out and recorded by the trauma registrars. Patients with a hospital length of stay (LOS) ≤ 24hours or transferred to another hospital were excluded. Univariate logistic regression was used to analyze which factors were significant for barrier days. Significant variables were then included into a multivariate logistic regression model. A p-value≤0.05 was considered significant

Results: A total of 3056 patients, after exclusion criteria, were included in the study. There were 105 (3.44%) patients with at least one barrier day.

Variables	Unadj. Rates for Hospital BD n(%)	Adjusted OR (95%CI)	P-Value
Vent Days >=1	20 (8.3)	2.40 (1.37-4.20)	0.002
ISS >=15	79 (4.3)	1.69 (1.05-2.73)	0.030
Medicaid	21 (5.4)	2.05 (1.22-3.46)	0.007
D/C Dest. (Rehab)	30 (4.5)	2.79 (1.55-5.03)	0.001
D/C Dest. (Nursing Home)	52 (7.3)	6.39 (3.71-11.00)	<0.001
Co-Morbidities >=1	92 (6.0)	1.96 (1.04-3.69)	0.036

Conclusion: Patients awaiting nursing home placement and rehab placement were at 6.39 and 2.79 times higher odds of having significant barriers to discharge, respectively. More severe injuries and ventilator assistance also constituted significant barriers to discharge. Understanding what type of patient is prone to develop barriers to discharge will allow case managers and social workers to intervene with discharge planning early on in that patient's hospital course and possibly reduce healthcare costs.

Poster # 47

BOOZE AND BULLETS: GEOGRAPHIC ASSOCIATION OF LIQUOR LICENSES AND GUNSHOT WOUNDS IN CHICAGO

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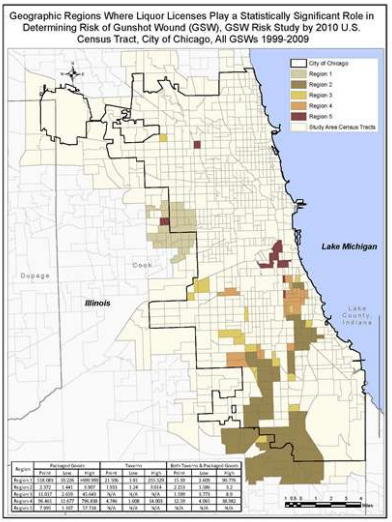
Introduction: The association between alcohol and interpersonal violence is well established. Up to 80% of homicide perpetrators and victims are known to have used alcohol before the incident. As reaction to the high rate of gunshot wound (GSW) deaths in South Central Los Angeles, a community coalition sought to close liquor stores, which they identified as being foci of violence. However, many store owners felt they were being unfairly targeted, as little data has supported these claims. We hypothesized that proximity to a liquor-selling establishment would be associated with GSWs in Chicago.
Methods: Scene address data from the Illinois State Trauma Registry from 1999-2009 was utilized to geocode all GSWs that presented to trauma centers in Chicago during the study period. We compared this with publicly available U.S. Census demographic data and City of Chicago Liquor Board data. A combination of Ordinary Least Squares (OLS) and geographically weighted regression (GWR) was performed, using ArcGIS 10.0, to identify homogenous 'risk regions' throughout the study area. Liquor licenses (LL) per census tract, as well as their position relative to gunshot wound assaults, were combined with U.S. Census demographic and American Community Survey 5 year estimated socio-economic data to identify these regions. The results were then used to develop a Weighted Spatial Morbidity Rate (WSMR) estimate of per person risk throughout the city. Logistic regression analysis was then performed, using SAS statistical software, to obtain the independent effect of access to liquor on hospitalizations for GSWs.



Results: A total of 11,744 GSWs were geocoded. We did not find an association of LL with GSWs for the city overall (OR 0.97, 95%CI 0.96-0.99). However, using OLS and GWR regression, we included areas where there was an association with LL in a map of overall per person risk (WSMR) for the entire city. Figure 1. In the area of highest LL association, which is also an area with a high incidence of GSWs, the effect was very strong (OR 42.88, 95%CI 2.42-759.84).
Conclusion: We found that liquor licenses were a strong independent predictor of GSW incidence in many areas of Chicago. However, this association was not demonstrable for the entire city, and, in fact, marked regional variation was apparent. This regional variation may explain heterogeneity in previously reported work.

These data may contribute to our understanding of the interplay between alcohol and violent injury disparities.

Poster # 48

MINOR TRAUMATIC INJURY IN GERIATRIC POPULATION - NOT SO MINOR AFTER ALL

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Introduction: Geriatric trauma is an expanding demographic that continues to grow as the population ages. Many geriatric traumas present with a relatively minor injury severity score (ISS) complicated by multiple co-morbidities and decreased physiologic reserve. We hypothesize that the geriatric trauma patient has a poorer outcome as compared to their younger counterparts when controlling for injury severity and sought to quantify this difference.

Methods: Trauma patients admitted to a single Level I trauma center from 2006 until 2011 were retrospectively analyzed using the hospital trauma registry database. The in-hospital mortality of this population was reviewed for co-morbidities, age, and ISS using hierarchical logistic regression. Age was subdivided into young (18-39 years old), middle-aged (40-64 years old), and geriatric (65 and older). ISS was categorized into mild (<15), moderate (15-29), and severe (>30) injury.

Results: 16562 patients were admitted during the study period, and 5257 were 65 years or older. Co-morbidities of coronary artery disease (CAD), congestive heart failure (CHF) and dementia were significantly associated with mortality with respective odds ratios (OR) of 2.58, 2.29, and 1.89 ($p<0.01$). Geriatric age was associated with mortality when compared to young and middle-aged cohorts (OR 4.18 and 3.34 respectively; $p<0.01$). Geriatric trauma patients had higher associated mortality across all injury levels compared to young patients, and in instances of minor injury severity, showed eleven-fold higher odds of mortality ($p<0.01$; see Table).

Odds Ratios of Risk of Mortality Age Specific to Injury Severity

	ISS Score (injury severity)		
	Mild	**Moderate**	**Severe**
Geriatric *vs.* Young*	**11.16**	**4.76**	**1.44**
Geriatric *vs.* Middle-Aged*	**10.56**	**3.49**	**1.35**
***p < 0.05**			

Conclusion: Minor injury (ISS<15) in the geriatric population is associated with an eleven-fold higher mortality as compared to similarly injured younger patients. This discord between minor injury severity and higher mortality is likely secondary to limited reserve and co-morbidities.These patients are a vulnerable trauma population who, with even minor injuries, are strongly associated with an adverse outcome and require vigilance to minimize untoward events and a multidisciplinary approach for goals of care and end of life discussions.

Poster # 49

ADDING INSULT TO INJURY: DISCONTINUATION OF INSURANCE FOLLOWING SPINAL TRAUMA

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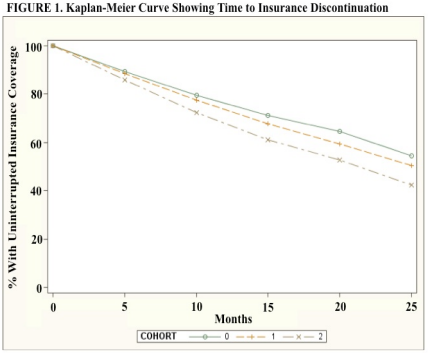
Introduction: Per-person 30-year medical payments following traumatic injury are estimated to be in excess of $345,000. Those with medical insurance are not necessarily protected from this economic risk, as they depend on continuation of insurance to prevent catastrophic financial ruin. We hypothesized that severely injured patients with spinal cord injuries (SCI) undergoing surgery are at increased risk for loss of insurance relative to more moderately injured individuals and non-trauma patients.

Methods: We used 2006-2010 data from MarketScan® to identify elective spine surgery patients (n = 155,832), spine trauma patients undergoing surgery without SCI (n = 3,433), and spine trauma patients undergoing surgery with SCI (n = 419). The main outcome measure was duration of insurance coverage. Descriptive insurance coverage analysis was performed using Kaplan-Meier methodology. Multivariate analysis was performed by Cox regression.

Results: In the 12 months following index admission, elective and trauma patients without SCI had lower rates of insurance discontinuation than trauma patients with SCI (24.2% vs. 26.2% vs. 32.5%, $p < 0.001$). This trend persisted at 24 months (39.1% vs. 43.3% vs. 50.4%, $p < 0.001$). Kaplan-Meier analysis revealed an increased rate of insurance discontinuation for the patients with SCI in the 24 months following surgery (Figure 1). The unadjusted hazards ratios (HR) for insurance discontinuation in the Trauma with SCI cohort were 1.41 (95% CI, 1.19-1.67) and 1.44 (95% CI, 1.26-1.65) at 12 and 24 months, respectively, but became nonsignificant after adjustment. However at 5 years even the adjusted HR was significant for this group (1.18, 95% CI 1.04-1.35). Significant covariates included age, length of stay, and discharge status.

Conclusions: In this large, high integrity longitudinal database, almost a third of trauma patients undergoing spine surgery for SCI had discontinuation of their insurance. While a number of factors contribute to this, including loss of employment-based medical coverage, future medical costs typically fall on patients, their families, and publicly funded organizations. This study highlights an area for future policy development if the United States hopes to move toward a more efficient, equitable health care environment.

FIGURE 1. Kaplan-Meier Curve Showing Time to Insurance Discontinuation



Cohorts: 0 - Elective; 1 - Trauma without SCI; 2 - Trauma with SCI
Log-Rank Chi-Square = 54.0; $p < 0.001$

Poster # 50

OBESITY PREDISPOSES TRAUMA PATIENTS TO WORST OUTCOMES: A NATIONAL TRAUMA DATA BANK ANALYSIS

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Introduction: One-third of U.S. adults are obese. The impact of obesity on outcomes after blunt traumatic injury have been studied with disparate results. The aim of our study was to evaluate outcomes in obese trauma patients after blunt trauma. We hypothesized that obese patients have adverse outcomes as compared to non-obese patients after blunt traumatic injury.

Methods: We performed a retrospective analysis of all patients (≥18y.o.) sustaining blunt injury using the National Trauma Data Bank (NTDB) for years 2007-2010. Patients with recorded comorbidity of obesity (BMI ≥ 40) were identified. Patients transferred, dead on arrival, and with isolated traumatic brain injury were excluded. Propensity score matching was utilized to match obese patients to non-obese patients in a 1:1 ratio based on age, gender, injury severity score (ISS), Glasgow coma scale (GCS), and systolic blood pressure on presentation. The primary outcome was mortality and the secondary outcome was in-hospital complication.

Results: A total of 32,780 (Obese: 16,390, Non-obese: 16,390) patients were included in the study. Obese patients were more likely to have in hospital complications (OR: 1.8, 95%CI: 1.6-1.9), longer hospital length of stay (OR: 1.2, 95%CI: 1.1-1.3), and longer intensive care unit length of stay (OR: 1.15, 95%CI: 1.09-1.2).

In-Hospital Complications

	Obese (n=16,390)	Non-Obese (n=16,390)	P
Pneumonia	1.7% (283)	1.3% (204)	0.02
ARDS	2.1% (336)	1% (167)	0.001
Surgical Site Infection	0.4% (73)	0.2% (31)	0.01
Sepsis	0.3% (48)	0.1% (23)	0.03
DVT	1.2% (194)	0.6% (100)	0.001
PE	0.4% (64)	0.3% (43)	0.04
Decubitus Ulcer	0.8% (136)	0.4% (64)	0.01

The overall mortality rate was 2.8% (n=851). Mortality was higher in obese patients compared to non-obese patients (3.0%vs.2.2%, OR: 1.4, 95% CI: 1.1-1.5).

Conclusion: Obesity is independent predictor of mortality and in hospital complications after blunt traumatic injury. Obesity is a systemic problem affecting multiple organ systems response to trauma. The results of our study call for attention through focused injury prevention efforts. Future studies are needed to help define the consequences of obesity that influence outcomes.

Poster # 51

DIFFERENCES IN INJURY PATTERNS BETWEEN MALE AND FEMALE DOMESTIC VIOLENCE PATIENTS: A CALL FOR EXPANDED HOSPITAL-BASED VIOLENCE SCREENING AND INTERNTION

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Introduction: Domestic violence (DV) resulting from an intimate partner or family member represents a significant public health concern. Hospital initiated screening and intervention have focused predominately on female victims. Few studies have focused on the prevalence of males as victims, and fewer characterized injuries in male victims. We sought to characterize injury patterns of male compared to female DV victims and hypothesized that male victims would have different injury pattern, therefore necessitating targeted screening measures.

Methods: Retrospective review of trauma patients at a Level 1 trauma center from 2010-2012 was performed to identify male and female victims of DV with injuries severe enough to warrant hospital admission. Data analyzed included sex, race, age, co-morbidities, mechanism, injuries, hospital LOS, ISS, associated substance abuse and co-morbidities. Injuries were evaluated according to region of body injured. Child abuse and sexual assault victims were excluded. Data for male and female victims were compared using SAS software. Statistics consisted of Fisher's extract test and Chi-Square analysis.

Results: Of the 11, 193 trauma admissions, 129 victims (70 males, 59 females) of DV were recorded in the registry. Men and women were well matched in terms of demographics, hospital LOS, ISS, and medical co-morbidities. Men were more often victims of stab wounds (M: 31.07% vs. F: 13.59%) and women were more likely victims of assault (F: 23.3% vs. M: 13.59%; p-value =0.011). Women had a higher incidence of injuries to the neck (10.85% vs. 3.88%, p=0.0081) and face (19.38% vs. 13.95% p=0.045), while men experienced 2x the number of abdominal injuries as women (19.38% vs. 10.08%, p=NS). There were no differences in drug use at time of injury, however males were more likely to have a history of alcohol and substance abuse than females (13.88% vs. 1.55%, p=0.0008; 5.43% vs. 0.78%, p<0.0001). Twice as many males tested positive for alcohol at the time of injury compared with females although not significant (30% vs. 14%).

Conclusion: Injury patterns among male victims of DV are different. This study suggests that tailored screening of male victims and substance abuse evaluation should be conducted in a hospital setting.

Poster # 52

RISK FACTORS FOR SYMPTOMATIC VENOUS THROMBOEMBOLISM AFTER TRAUMA: A POPULATION-BASED CASE-COHORT STUDY

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Introduction: Failure to provide appropriate prophylaxis for venous thromboembolism (VTE) to hospitalized, at-risk patients is considered a medical error by the Institute of Medicine. Hence, it is important to understand which risk factors, available during the first 24 hours of admission, help predict which hospitalized patients go onto develop symptomatic VTE. Within a population-based study, we tested pre-hospital and in-hospital risk factors which may be associated with incident VTE after trauma up to 92 days after injury.

Methods: We utilized the Rochester Epidemiology Project to identify all Olmsted County, MN residents from 1988-2005 who met criteria for a first lifetime (objectively documented, symptomatic) VTE event after trauma. Random cohort sample of trauma patients stratified on sex, year of trauma and likelihood of surgery (ICD-9 injury codes) were also chosen. Complete medical histories in the community were reviewed and collected for 92 days prior to and after trauma date. Sample weights were used for univariable and multivariable survival analysis. Data are presented as median interquartile range (IQR) and hazard ratio (HR) with 95% confidence interval (95% CI) with $p < 0.05$ considered as significant.

Results: Two hundred incident VTE cases and 370 random cohort members were identified. The overall estimated incidence of VTE in patients who are hospitalized for their trauma is 1.09% (0.94, 1.25; 95% CI). The time (days) from trauma to diagnosis of VTE was 18 (6, 41). Univariable survival analysis revealed several pre-hospital and injury - related risk factors predictive of VTE. In a multivariable model, several risk factors for VTE were identified (Table).

Variable	HR (95% CI)	P - value
Leg Paresis after Trauma	3.77 (1.79, 7.94)	0.0005
Chronic Renal Disease	3.12 (1.72 , 5.67)	0.0002
Superficial Thrombosis	2.10 (1.21, 3.64)	0.0081
Non-hospital Related Immobility History	1.91 (1.26, 2.91)	0.0025
Age at Trauma / 10	1.34 (1.22, 1.47)	0.0001
Weight (kg) / 10	1.24 (1.13, 1.35)	0.0001

Conclusions: This is a first report of a population-based case-cohort study evaluating the incidence of VTE after trauma up to 92 days after injury. The risk factors identified in this study will be validated in a prospective case-cohort study, which is currently open to enrollment.

Poster # 53

ACE'S ADVENTURE AND RICHIE'S NEIGHBORHOOD: A PROSPECTIVE RANDOMIZED TRIAL OF A VIDEOGAME AS AN EDUCATIONAL TOOL FOR PEDIATRIC INJURY PREVENTION

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Introduction: Injury is the number one cause of death and disability in children in the United States and an increasingly important public health problem globally. While prevention of injuries is an important goal, prevention efforts are currently fragmented, poorly funded and their effectiveness is rarely studied. Among school-aged children, pedestrian crashes are a major mechanism of injury. We hypothesized that we could develop a game-based educational tool that would be effective in teaching early elementary school children the principles of pedestrian safety.

Methods: We designed a unique interactive video game (Ace's Adventure Game) featuring a child walking to school. Within the game are several "mini-games" each focusing on a different pedestrian safety message. The game is available in both English and Spanish. We also built a life-size simulated street (Richie's Neighborhood) modeled after the game that can be rolled out in a parking lot or school gymnasium for education and testing purposes. After obtaining consent from schools and parents, 2 nd and 3rd grade students were randomly assigned to play the pedestrian safety videogame or to attend a 20 minute didactic teaching session where the same pedestrian safety topics that were included in the game were discussed. Both groups were then "tested" on the simulated street where trained observers recorded whether the students demonstrated correct pedestrian behaviors at 8 testing constructs covered by both the videogame and the didactic session. A perfect score on the simulated street was 8.

Results: A total of 299 students were enrolled in the study which included 14 schools; 161 in the game arm and 138 in the didactic. 46% were 2nd graders and for many children Spanish was their primary language. The mean score for those who were in the didactic arm was 5.3 (SD+1.1) and 5.4 (SD=1.1) for those in the videogame arm (p-value=0.9968).

Conclusions: Students who played the educational videogame focused on pedestrian safety performed similarly to those who attended a more traditional and labor-intensive didactic learning session. Innovative educational methods, such as game-playing, could significantly change our approach to injury prevention and have the potential to decrease the burden of injury among children world-wide.

Poster # 54

PRE-INJURY BETA-BLOCKADE IS PROTECTIVE IN ISOLATED SEVERE TRAUMATIC BRAIN INJURY

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Introduction: The purpose of this study was to investigate the effect of pre-injury beta-blockade in patients suffering isolated severe traumatic brain injury (TBI). We hypothesized that beta-blockade prior to TBI is associated with improved survival.

Methods: The trauma registry of an urban academic trauma center was queried to identify patients with an isolated severe TBI between 1/2007 and 12/2011. Isolated severe TBI was defined as an intracranial injury with an abbreviated injury scale of (AIS) ≥3 excluding all extracranial injuries AIS ≥3. Patient demographics, clinical characteristics on admission, injury profile, Injury Severity Score, AIS, in-hospital morbidity, and beta-blocker exposure were abstracted for analysis. The primary outcome evaluated was in-hospital mortality stratified by pre-injury beta-blockade exposure.

Results: Overall, a total of 662 patients met study criteria. Of these 25% (n=159) were exposed to beta-blockade prior to their traumatic insult. When comparing the demographics and injury characteristics between the groups, the sole difference was age with the beta-blocked group being older (69 ± 12 yrs vs. 63 ± 13 yrs,p <0.001). Beta-blocked patients had a higher rate of infectious complications (30% vs. 19%, p = 0.04), with no difference in cardiac or pulmonary complications between the cohorts. Patients exposed to beta-blockade vs. no beta-blockade experienced 13% and 22% mortality, respectively (p = 0.01). Stepwise logistic regression predicted the absence of beta-blockade exposure as a risk factor for mortality (OR 1.9, 95% CI 2.3-9.8, p= 0.01). After adjustment for significant differences between the groups, patients not exposed to beta-blockade experienced 2-fold increased risk of mortality (AOR 2.2, 95% CI 1.3-3.7, p = 0.004).

Conclusion: Pre-injury beta-blockade improves survival following isolated severe traumatic brain injury. The role of prophylactic beta-blockade and the timing of initiation of such therapy after traumatic brain injury warrant further investigations.

Poster # 55

A PROPHYLACTIC WARFARIN REVERSAL POLICY UTILIZING FROZEN PLASMA IS INEFFECTIVE IN PREVENTING DELAYED INTRACRANIAL HEMORRHAGE AFTER TRAUMA

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Introduction: Trauma centers are seeing an increasing number of elderly patients using anticoagulants who are often injured after low energy mechanisms. The most common anticoagulant used is warfarin. Intracranial hemorrhage (ICH) after trauma in these patients can occur either acutely or in a delayed fashion and can lead to devastating consequences. We hypothesized that a policy of prophylactically reversing anticoagulation in all patients on warfarin with frozen plasma would decrease the delayed development of ICH.

Methods: After institutional review board approval, we retrospectively reviewed all trauma patients from January 2010 until November 2012 admitted to our trauma center with ground level fall as a mechanism of injury, on warfarin with an INR within 4 hours of triage time of > 1.5 and a negative initial head CT who were observed for delayed hemorrhage. Patients admitted had either suffered a loss of consciousness or had external signs of head trauma. Based on our reversal policy, they were then transfused with fresh frozen plasma (FFP) on arrival with a goal to reduce the INR to < 1.5. Patients were classified as reversed if their INR reached < 1.5 between 4 and 24 hours of hospital arrival (REV) or unreversed if lowest INR was > 1.5 during the same time frame (NREV). Patients were assessed clinically for change in neurologic exam and CT scanning was performed selectively based on neurologic changes.

Results: Of 392 patients who fell on anticoagulants during the study period, 194 met our inclusion criteria. Forty-three (22%) patients were able to be reversed using an aggressive pre-emptive FFP transfusion strategy, while 151 (78%) remained unreversed. Demographics and clinical characteristics of both groups are summarized in Table 1. NREV patients were predominantly male and younger compared to the REV group ($p<0.05$). Mean FFP units received in both groups were the same (1.6 units, $p=0.968$). NREV patients had a higher INR value of 3 (± 1.7) on arrival in comparison with REV patients with INR of 2.5(± 1), $p<0.0.5$. There was only one patient during the study period that developed an ICH in a delayed fashion; this patient belonged to the REV group and was identified by neurologic changes.

Conclusion: The incidence of delayed hemorrhage in this study was 0.5 % which is similar to previous reports. An aggressive prophylactic strategy of FFP transfusion for anticoagulation resulted in a low proportion of patients who were effectively reversed and did not have an impact on the rate of delayed hemorrhage. We recommend a period of observation only for patients on anticoagulation with suspected head trauma and a negative initial CT.

	Anti-coagulation Not Reversed (n=151)	Anti-coagulation Reversed (n=43)	p-value
Age	82.2 (10)	85.8 (5.9)	<0.05
Number of Males	74 (49)	11 (25.6)	<0.05
Fresh Frozen Plasma (units)	1.6 (0.8)	1.6 (0.7)	0.968
Length of Stay	2.7 (1.8)	2.7 (1.4)	0.9856
Injury Severity Score	3.8 (3.2)	4.7 (4.6)	0.25
INR- Arrival	3 (1.7)	2.5 (1)	0.018
INR- Follow Up	1.8 90.4)	1.4 (0.1)	<0.05

Poster # 56

DYSPHAGIA PREDICTS ONE-YEAR MORTALITY IN ELDERLY PATIENTS WITH CERVICAL SPINE FRACTURES

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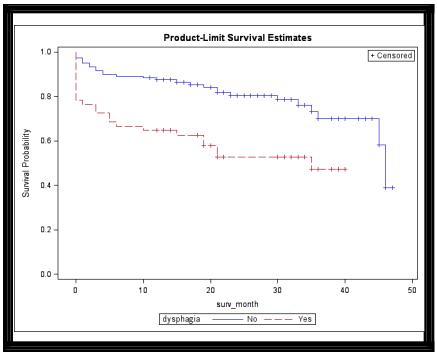
Introduction:

Dysphagia increases mortality in hospitalized elders. We sought to identify predictors of dysphagia in patients ≥ 65 with cervical spine fractures, and to determine the impact of dysphagia on mortality.

Methods:

All trauma patients ≥ 65 with cervical spine fractures, without spinal cord injury (SCI), from 2009- 2011 were identified from our level one trauma registry. Data about demographics, injury characteristics, co-morbidities, in hospital complications and mortality was collected. The Social Security Index was used to identify death up to one year after injury. Chi-square test and Wilcoxon rank-sum test were used for comparisons between groups, and multivariate logistic regression to identify predictors of dysphagia, p <0.05.

Results:



Of 171 patients, 51 (29.8%) patients had dysphagia. Patients with dysphagia were older (85.7 ± 7.7vs. 79.7 ± 8.2years, P <0.001), were more likely to have sustained a fall (90% vs. 76%, p=0.031), had lower initial GCS (12.3 ± 7.4 vs. 14.1 ± 8.8, p<0.001), had higher age adjusted Charlson Co morbidity Score (4.5± 3.3 vs. 5.8 ± 3.0, P 0.02), and were more likely to have multiple cervical spine fractures (37% vs. 21%, p=0.025). During hospitalization, dysphagia was associated with higher rates of delirium (20% vs. 6%, P 0.006), pneumonia (14% vs. 1%, P <0.001), mechanical ventilation ≥ 2 days (P < 0.001). Patients with dysphagia were more likely to get tracheostomy and feeding tubes (14% vs. 7%, p=0.001, and 43% vs. 2%, p < 0.001, respectively). Comparatively few patients with dysphagia were discharged home (6% vs. 28% p = <0,001). Logistic Regression showed that increasing age (OR 1.12 4, 95% CI (1.058-1.193)) and cause of injury (OR 4.12 95%CI (1.664-10.202)), were both significant predictors for dysphagia. Patient with dysphagia were more likely to have mechanical ventilation ≥ 2 days in duration (OR 38.4, 95% CI (8.574-172.21)). Log Rank Survival analysis showed that patients with dysphagia have significantly lower survival (p=0.0003) at all points throughout the course of the study.

Conclusion:

Dysphagia is associated with several adverse outcomes, including lower probability of survival in geriatric patients after cervical spine fracture. Dysphagia after cervical spine fractures is an important finding, and should be considered when communicating prognosis with patients and their families.

Poster # 57

OUTCOMES IN TRAUMATIC BRAIN INJURY FOR PATIENTS PRESENTING ON ANTIPLATELET THERAPY

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Introduction: As the population ages, a growing number of patients are presenting to trauma units with head injuries while on anti-platelet therapy (APT). The influence of APT on these patients is poorly defined. This study examines the outcomes of patients on APT presenting to the hospital with blunt head trauma (BHT).

Methods: The registries of two level I trauma centers were reviewed for patients over 40 years of age presenting from January 2008 to December 2011 with BHT. Patients on APT were compared to patients presenting with BHT not on APT. The primary outcome measures were in-hospital mortality, intracranial hemorrhage (ICH) and need for neurosurgical intervention. Hospital length of stay (LOS) was reviewed as a secondary outcome measure. Both crude and multivariate-adjusted logistic regression models were fit to estimate odds ratios and 95% confidence intervals. Adjusted models included antiplatelet status as well as age, injury severity score (ISS) and Glasgow coma score (GCS).

Results: All patients meeting inclusion criteria and having complete data (n=1547) were included in the analytic cohort ; 422 (27%) of these patients were taking APT [aspirin, n=330; clopidogrel, n = 36; aspirin and clopidogrel, n = 56]. Overall rates of ICH, neurosurgical intervention and in-hospital mortality of patients with BHT in our study were 45.4%, 3.1% and 5.8%, respectively. Controlling for age, ISS and GCS, there was no significant difference in ICH (OR=0.84, 95% CI: 0.61-1.16), neurosurgical intervention (OR=1.26, 95% CI: 0.60-2.67), or mortality (OR=1.79 95% CI: 0.89-3.59) associated with APT. Subgroup analysis revealed that among more severely injured patients (ISS $\geq$ 20), those on APT had elevated odds of in-hospital mortality (OR=2.34, 95% CI: 1.03-5.31) compared with non-users. Prolonged hospitalization (LOS>14 days) was more likely in the APT group than those in the non APT group (OR=1.85, 1.09-3.12).

Conclusion: This is the largest study examining the effects of APT on outcomes in BHT. While the effects of anti-platelet therapy in BHT patients aged 40 years and older showed no significant difference in ICH, neurosurgical intervention and in-hospital mortality, older and more severely injured patients on APT may carry an increased risk of poor outcome when compared with non-APT patients. Larger studies are needed to appropriately assess the effects of antiplatelet therapy on BHT outcomes in these populations.

Poster # 58

DOES EVERY TBI WITH POSITIVE HEAD CT NEED A NEUROSURGEON? SCREENING CRITERIA FOR TRANSFER TO LEVEL 1 AND 2 TRAUMA CENTERS

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Introduction:Traumatic brain injury (TBI) is common but only 5% of patients with TBI require surgical intervention. Recent studies have suggested that there might be criteria by which patients can be safely monitored at lower tiered trauma centers (Level 3 or 4). The purpose of this study was to investigate potential criteria for safe observation of mild TBI patients without transfer to Level 1 or 2 trauma centers.

Methods:Retrospective review of the trauma registry for patients with mild TBI from 6/ 2006- 9/2011, with a positive finding on head CT was performed . The investigational criteria for 'observation' included patients with GCS > 13, blunt injuries with small SAH, IPH, EDH or SDH, non-displaced calvarial fractures. The criteria for 'transfer' included GCS<13, penetrating injury, moderate to large SAH, IPH > 10 mm, SDH or EDH > 5 mm, midline shift > 3 mm, anticoagulation, and depressed or basilar skull fractures. All neurosurgical diagnostic and therapeutic interventions (ICP monitor, external ventricular drain (EVD), craniotomy) were compared for both groups. Statistical analysis was performed using Chi Square and Fisher's Exact Test.

Results: 1504 patients met inclusion criteria.

	N	Mortality	Repeat CT scan	ICP	EVD	Crani
Observe	676	4 (0.5%)	155 (23%)	0	0	0
Transfer	828	21(3%)	445 (54%)	10 (1%)	6 (0.7%)	112 (14%)
P value	---	.006	<.001	.003	.04	<.001

No patient that met observation criteria required an ICP monitor, EVD or craniotomy. None of the deaths in the Observe group were secondary to head injury. .

Conclusion:Select patients with mild TBI meeting criteria could be safely observed at Level 3 and 4 trauma centers, decreasing trauma system expenses, and transfer risks while preserving Level 1 and 2 trauma center resources.

Poster # 59

THE MODIFIED BERNE-NORWOOD CRITERIA PREDICT TWO TIERS OF RISK FOR TBI PROGRESSION

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Introduction: As a basis for venous thromboembolism (VTE) prophylaxis after traumatic brain injury (TBI), we have previously described an algorithm based on hemorrhage patterns first described by Berne and Norwood and modified by our group. Based on these injury criteria and their behavior over time, we classify patients as Low-, Moderate-, or High-risk for spontaneous progression of hemorrhage with specific VTE prophylaxis regimens tailored to each tier of risk. Here we sought to internally validate the modified Berne-Norwood criteria as a tool for stratifying TBI patients by risk for spontaneous progression.

Methods: In our algorithm, patients with any or all of the following modified Berne-Norwood criteria are classified "Low-risk" for spontaneous progression: subdural hemorrhage (SDH) <9 mm thick, epidural hemorrhage (EDH) <9 mm thick, contusion <20 mm in diameter, a single contusion per lobe, any amount of subarachnoid hemorrhage (SAH), or any amount of intraventricular hemorrhage (IVH). Patients with any injury exceeding these criteria are labeled "Moderate-risk" for progression, and any patient undergoing a monitor or craniotomy is classified "High-risk." From 2/2010 to 11/2012, patients presenting with intracranial hemorrhage were prospectively entered into a dedicated database tracking their injury types and sizes, risk category at presentation, and any progression on subsequent CTs. Exclusions were receipt of only 1 CT or preinjury warfarin.

Results: The cohort of 414 subjects were classified as Low-risk (n=201), Moderate-risk (n=74), or High-risk (n=139) after their first CT. After repeat CT scan, radiographic progression was noted in 27% of Low-risk subjects, 51% of Moderate-risk, and 58% of High-risk. Omnibus testing for differences in progression rates between the three risk strata was significant overall ($p<0.0001$). ANOVA showed the Low-risk progression rate to be significantly lower than both the Moderate- and the High-risk arms, while no significant difference was seen between the Moderate- and the High-risk arms themselves.

Conclusions: The modified Berne-Norwood criteria are a valid tool for classifying TBI patients into two categories of risk for spontaneous progression of their intracranial hemorrhage patterns. This in turn supports the creation of tailored VTE prophylaxis regimens for each arm which reflect these different levels of risk.

Poster # 60

ROUTINE TRANSFER TO TRAUMA CENTER FOR MILD TRAUMATIC BRAIN INJURY (mTBI) IS UNNECESSARY

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Introduction: Patients with mTBI are frequently transferred to trauma centers for neurosurgical (NSG) consultation. Previous studies suggest that these patients may be managed safely without NSG consultation even with abnormal computed tomographic (CT) findings. The purpose of our study was to assess the outcomes of patients transferred to our Level I trauma center with mTBI compared with direct admission with mTBI.

Methods:Retrospective review was performed of trauma admissions from 2007-2012. Inclusion criteria were TBI with initial Glasgow Coma Scale (GCS) 14-15 (mTBI). Demographics, initial and follow up CT findings, NSG consultation, neurosurgical intervention, and outcomes were reviewed. Continuous variables between the two groups were compared using Student's t-test; Comparisons between the two groups on unranked categorical variables were performed by Chi-square. Significance was set at $p<0.05$.

Results: 1,324 patients identified; 531 patients were transferred from outlying hospitals and 793 were direct admits. Median time prior to transfer was 3 hours. Of all patients, 44% received NSG consultation (70.0% transferred vs. 26%, $p<.01$). Twenty six patients (1.9%) required NSG intervention (2.5% transferred vs. 1.6%). Neurosurgical interventions consisted of elevation of depressed skull fractures, removal of foreign bodies and repair of injury associated aneurysms. Transferred patients were older, and more frequently required NSG consultation.

Table: Patient characteristics and outcomes

Group	Transfer	Direct Admit	p
n	531	793	
Age (years)	45.3 ± 28.8	33.4 ± 21.9	<0.01
ICU LOS	0.5 ± 1.4	0.2 ± 1.3	<0.01
Hospital LOS	2.9 ± 3.6	2.0 ± 3.0	<0.01
ISS	6.9 ± 2.5	5.0 ± 2.7	<0.01
RTS	12.0 ± 0.3	11.9 ± 0.4	0.04
NSG Consult	70%	26%	<0.01

Conclusion: The incidence of NSG consultation resulting in intervention, beyond observation, was low. Our data suggest that most patients may be safely managed at their originating hospital; particularly if the initial head CT scan demonstrates no significant pathology. The need for neurosurgical intervention was always clinically or radiographically apparent. To improve resource utilization, reduce healthcare costs and streamline the process of care, we have enacted guidelines across our healthcare system for appropriate indications to transfer patients with mild TBI.

Poster # 61

HEAD INJURY SEVERITY IS ASSOCIATED WITH VENOUS THROMBOEMBOLISM IN PATIENTS WITH ISOLATED TRAUMATIC BRAIN INJURY

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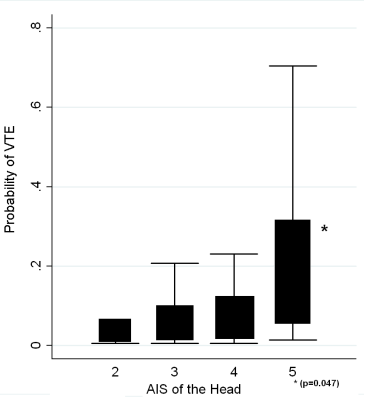
Introduction: Traumatic brain injury is thought to be an independent risk factor for venous thromboembolism (VTE). Previous investigations have been limited by inclusion of patients with multiple injuries, and many lack results of surveillance ultrasound. We hypothesized that increased brain injury severity in patients with *isolated* traumatic brain injury (IsoTBI) is associated with VTE.

Methods: The records of patients admitted to our Level I trauma center from 6/2006-12/2011 were reviewed for injury data, VTE risk factors, results of surveillance ultrasound, and severity of IsoTBI (Head-AIS). Patients were identified by ICD-9 codes for traumatic brain injury, and those who had no additional major injuries (non-head AIS ≤1) were included in the study. The association of Head-AIS and VTE was analyzed using a case-control design. Among the IsoTBI patients, those diagnosed with lower extremity deep vein thrombosis or symptomatic pulmonary embolus (cases) were matched for age, gender, and admission year to those without VTE (controls).

Results: 345 IsoTBI patients were identified. There were 41 cases (11.9%). The number of controls matched to each case ranged from 1 to 16. Cases had a higher mean Head-AIS (4.36 vs. 3.89, p=0.001) and overall injury severity score (20.4 vs. 16.8, p=0.001). Although cases were more likely to have received pharmacologic prophylaxis (53.7% vs. 11.9%, p<0.001), the mean time to initiation of prophylaxis was 11 days. Following adjustment for all factors found to be associated with VTE (Glascow Coma Scale score, ventriculostomy placement, ventilator days, history of previous VTE, chronic obstructive pulmonary disease, and placement of a central or femoral line) cases were significantly more likely to have a greater severity of head injury (Head AIS of 5, OR = 2.57, 95%CI 1.01-6.53, p = 0.047).



Conclusion: The prevalence of VTE in IsoTBI patients is significantly associated with the severity of traumatic brain injury. VTE surveillance protocols are warranted in these high risk patients. Because of the difficulties associated with early initiation of pharmacologic prophylaxis in the most severely injured IsoTBI patients, placement of a prophylactic inferior vena cava filter may be considered.

Poster # 62

A GOAL-DIRECTED MULTIMODALITY MONITORING AND THERAPEUTIC PROTOCOL DECREASES MORTALITY IN PATIENTS WITH SEVERE TRAUMATIC BRAIN INJURY (sTBI)

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Introduction: Patients with sTBI (Glasgow Coma Scale-GCS ≤ 8) are conventionally monitored and treated using the Brain Trauma Foundation guidelines; however, recent studies question the utility of intracranial pressure (ICP) monitoring. This study examined whether a goal-directed multimodality monitoring and therapeutic protocol (GD-MM&TP) can decrease 14-day mortality compared to that predicted by the CrasH model.

Methods: from 7/2011 to 9/2012, 33 patients with sTBI (mean age 46 ± 21, GCS 5 ± 2) were monitored and treated with a 5-day protocol that included maintenance of normothermia with dry water immersion, brain O_2 (PbO_2) ≥ 20 mm Hg, ICP ≤ 20 mm Hg, cerebral perfusion pressure (CPP) ≥ 60 mm Hg to keep tissue oxygen saturation (bi-frontal Near-Infrared Spectroscopy) ≥ 60%, burst suppression as needed, nutritional support targeted to a Respiratory Quotient (RQ) of 0.83 by day 3, osmotherapy (OsmRx) and decompressive craniectomy (DC) when indicated.

Results: 2/33 patients failed OsmRx requiring DC. The predictive mortality (PM) was 55% (18/33). Actual mortality (AM) was 33.3% (11/33), yielding a 39% reduction in mortality. The decrease in mortality ranged from 11.6% to 69.7%.

PM	N	Mean %ile	AM	Decrease
0-20	7	12.9 ± 4.5	0/7	na
21-50	8	40.4 ± 9.2	1/8 (12.5%)	69.7%
51-79	9	62.8 ± 6.7	5/9 (55.5%)	11.6%
80-100	9	92.2 ± 6.0	5/9 (55.5%)	39.8%

Conclusion: A GD-MM&TP can decrease predicted mortality in patients with sTBI.

Poster # 63

PLATELET TRANSFUSION IMPROVES ASPIRIN INDUCED PLATELET DYSFUNCTION IN PATIENTS WITH TRAUMATIC BRAIN INJURY>

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Introduction: Platelets are critical for initial hemostasis after trauma. Management of patients with intracranial hemorrhage (ICH) taking antiplatelet agents (aspirin or clopidogrel) often includes platelet transfusion however there is little evidence to support this. We investigated platelet function before and after platelet transfusion in patients taking antiplatelet agents with traumatic ICH.

Methods: Blood samples were collected from patients with traumatic ICH. Patients known or suspected to be taking antiplatelet medications were transfused one bag of pooled platelets (6 units). Platelet function was assessed using a Multiplate multiple electrode aggregrometer (Verum Diagnostica GmbH, Munich Germany) within 3 hours of sample collection. Platelet activation was induced by adenosine diphosphate (ADP), Collagen, and arachodonic acid (AA).

Results: 14 patients with ICH were enrolled in the pilot study. 10 patients were taking aspirin at the time of injury and 2 of those were also taking clopidogrel. 11 patients received platelet transfusion (all 10 patients taking aspirin +/- clopidogrel and 1 patient not known to take antiplatelet agents). Median admission platelet function for the 3 patients not taking aspirin that did not receive platelet transfusion was ADP 51 (range 39 to 86), Collagen 34 (range 27 to 53) and AA 26 (range 11 to 53). Median admission platelet function for the patients that received platelet transfusion (10 patients taking aspirin +/- clopidogrel and one patient taking no antiplatelet agents) is shown below.

	Reference Range	**Admission value median (Q1, Q3)**	**4-12 hours post tx median (Q1, Q3)**	**12-36 hours post tx median (Q1, Q3)**
ADP, U	43-92	29.0 (26.0,59.0)	27.0 (23.0,51.0) p=0.331*	46.0 (33.0,49.0) p=0.437**
Collagen, U	43-90	24.0 (22.0,31.0)	24.0 (18.0,29.0) p=0.196*	34.0 (31.0,41.0) p=0.437**
AA, U	40-91	19.0 (17.0,24.0)	26.0 (23.5,36.5) p=0.015*	37.0 (34.0,52.0) p=0.031**
Platelets x $10^3/\mu L$	150-450	213 (192,234)	220 (186,254) p=0.492*	

Tx=platelet transfusion, ADP-adenosine diphosphate, AA-arachadonic acid * Admission value compared to 4-12 hours post platelet transfusion ** Admission value compared to 12-36 hours post platelet transfusion

Conclusion: In this pilot study we demonstrate platelet dysfunction in patients with isolated ICH. The greatest degree of dysfunction is in the response to platelet activation by arachadonic acid in patients taking aspirin which inhibits arachadonic acid metabolism by interfering with the cyclo-oxygenase pathway. This aspirin induced platelet dysfunction is improved with platelet transfusion and that improvement continues beyond 12 hours, which supports the practice of platelet transfusion for patients with traumatic ICH taking aspirin or clopidogrel.

Poster # 64

ENHANCED IDENTIFICATION OF CHILDREN WITH NON ACCIDENTAL TRAUMA IN THE EMERGENCY ROOM

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INTRODUCTION: Non-accidental trauma (NAT) is extremely difficult to identify in pediatric emergency rooms. Victim and parental cooperation is uncommon as the guardians are often the perpetrators and the child victim is afraid of additional retribution. We hypothesized that an analysis of injury patterns and presently available injury assessment tools in this cohort would elucidate criteria that assist in the identification of NAT.

METHODS: All cases of NAT seen at a level 1 tertiary pediatric trauma center over a 3 ½ year period were reviewed. Children were retrospectively identified by court affidavit, Child Protection Team notes or other records in the chart confirming NAT. Prospective data collected included, presenting complaint, HPI, physical examination, vital signs, injury severity score (ISS), and hospital disposition. Pediatric trauma score (PTS) was calculated from this data set. Patients were subdivided by age: G1 = 0-1 yr old, G2 = 1-2 yrs old, G3 = 2-3 yrs old. Comparison was made to age-matched accidental trauma patients from the same time period.

RESULTS: Of 125 children discharged from our hospital with a diagnosis of NAT, 107 (85.6%) were under 3 years of age (68.2% G1, 19.6% G2, 12.1% G3). These children represented 14.4% of all trauma victims aged 0-3 at our institution (23.3% G1, 9.4% G2, 6.2% G3). Most arrived by private car (67%) and most had a trauma-related complaint (68%); however, the majority of presenting complaints inaccurately described the etiology of the injury (80%). Common presenting findings were mental status change (54%), bruising (49%), favoring/tenderness of a limb (27%), change in PO tolerance (17%). Mean PTS for NAT vs. accidental trauma patients was 6.9 vs. 8.6 (G1), 8.1 vs. 9.5 (G2), and 8.7 vs. 9.8 (G3). No NAT patient had a PTS > 10, whereas 45% of accidental trauma patients had a PTS > 10. Linear regression showed the correlation between declining PTS and increasing rate of NAT to be significant (ANOVA: $F(1,708)= 88.611$, $p < .001$, R squared = .111). Mean ISS for NAT vs. accidental trauma patients was 11.93 vs. 9.17 (G1), 12.05 vs. 7.37 (G2), and 8.92 vs. 6.59 (G3).

CONCLUSION: PTS < 10 was significantly associated with NAT in this population. When age (<1 yr), any mental status change in the child, and arrival by private vehicle are combined with PTS <10 the likelihood if NAT is almost assured. We feel these data indicate that PTS should be obtained as a screening tool on any child presenting to an emergency room with injuries, not involved in the presenting complaint, or when they appear out of proportion to a described injury. PTS <10 appropriately indicates a NAT work up if these criteria are applied.

Poster # 65

LIBERAL UTILIZATION OF REPEAT CT IMAGING IN MILD BLUNT HEAD INJURY: DOES ANTI-PLATELET THERAPY INFLUENCE INJURY PROGRESSION

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Introduction: Traumatic brain injury (TBI) accounts for significant morbidity and mortality. There are increasing numbers of patients currently receiving anti-platelet therapy (APA). The objectives of this study are to evaluate injury progression on repeat CT imaging in patients admitted with mild TBI (GCS 13- 15) and to assess the effect of pre-injury anti-platelet therapy.

Methods: Retrospective review of prospectively collected institutional data of all patients admitted with mild TBI. Inclusion criteria: 1) patients with mild TBI on admission, 2) patients requiring serial brain imaging (2 or more). Exclusion criteria: 1) patients with moderate and severe TBI (GCS 3- 12), 2) patients receiving pre injury anticoagulation. Data collected included demographics, injury severity score (ISS), admission GCS, mechanism of injury, length of stay, APA therapy, platelet function/ ASA assay, therapeutic platelet transfusions, surgical intervention and initial and subsequent brain imaging. Changes in CT imaging defined as any progression in hemorrhagic volume as determined by an attending neuro-radiologist on serial imaging. Data was analyzed, and the mean of the continuous variables were compared using student's T- test and Anova. The relative frequency of the categorical variables were compared using Pearson chi square test or the Fisher exact test with statistical significance set at a $p< 0.05$.

Results: 105 patients with mild TBI were included during the 13 month study period. Patients were divided into two groups; Group I: APA Group (anti-platelet agent) and Group II: non-APA Group (no anti-platelet agent). Group I consisted of 58% male, 42% female, mean age of 74.7 years, hospital length of stay 13.7 days, average ISS 17.5 and Group II 67% male, 33% female, mean age 46.3 length of stay 8.1 days and average ISS 15.7. Mechanism of injury in Group I; 83% fall, 14% MVC, 2% bicycle crash and in Group II; 47% fall, 19% MVC, 9% bicycle crash, 11% pedestrian struck, 2% ATV crash and 12% assault. Hemorrhagic progression on serial CT imaging was evaluated among the two groups. No statistically significant difference in the hemorrhagic volumetric progression on CT imaging between Group I and Group II was noted, 12.3% vs. 14.3% ($p= 0.9$). Mean ASA assay Group I at the time of admission was 482.8 and 569.4 in Group II ($p<0.0001$). Surgical interventions were higher in Group I, 8% vs. 3% in Group II ($p<0.05$). Among the patients in Group I, 83% received aspirin (ASA), 4% were on Clopidogrel and 13% received both. 56.2% patients in Group I received therapeutic platelet transfusion and the mean ASA assay of the patients pre and post platelet transfusion was 452 vs. 573 ($p<0.0001$). Intra-group analysis of Group I revealed the patients that received platelet transfusion had higher progression in the hemorrhagic volume on serial CT imaging than those that did not receive platelet transfusion, 25% vs. 2% ($p=0.002$). The initial ASA assay in the patients receiving platelets was significantly lower with mean assay of 459 vs. 516 ($p=0.01$) although there was no significant difference in the ASA assay post transfusion.

Conclusion: Potential for significant hemorrhagic progression noted on serial CT imaging requiring surgical intervention in mild TBI patients is small with no additional risk of progression in the cohort of patients receiving pre-injury anti-platelet therapy. Although transfusion of platelets corrected the measured ASA assay, it offered no advantage in limiting volumetric progression among the APA patients.

Poster # 66

DIFFUSE AXONAL INJURY IN CHILDREN: INSIGHT INTO DIAGNOSTIC AND PROGNOSTIC INDICATORS

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Introduction: Diffuse axonal injury (DAI) is associated with significant morbidity and mortality. Pediatric DAI remains a diagnostic and prognostic challenge. We present the largest reported series of pediatric DAI patients, highlighting clinical presentation, diagnostic methods and factors associated with increased risk for mortality.

Methods: A retrospective review of 2,989 children (age < 18 years) with moderate to severe traumatic brain injury (TBI), defined as head abbreviated injury score (AIS)$\geq$ 3,who presented to a level 1 pediatric trauma center over a 15 year period (1997-2011) was carried out. Diagnosis of DAI was made based on predefined radiographic criteria. Patient demographics, clinical, laboratory and radiographic findings, rate of survival to discharge and factors influencing survival were recorded. Data is presented as mean $\pm$ SEM. A $p<0.05$ was considered statistically significant.

Results: Patients were divided into two groups: DAI (n=103, mean age 6.8 $\pm$ 0.5) and non-DAI (n=2,886, mean age 4.9 $\pm$ 0.1)). DAI was suggested on initial head computed tomography scan in 17% of patients. In contrast, magnetic resonance imaging was diagnostic in 91% patients at 6.45 ± 1.02 days, while continuous electroencephalography (cEEG) provided high diagnostic yield in 83% at 2.6 ± 0.53 days.

After adjusting for injury severity and head AIS scores, initial GCS scores were significantly lower in patients with DAI (7.7 vs 12.1, p <0.001). ICP monitoring was higher in DAI patients (48.5% vs 7.7%). Children with DAI had lower initial pH (7.25 vs 7.28, p=0.036), higher base deficit (-6.8 vs -5.8, p<0.001) and increased mortality (18.5% vs 6.9%, χ^2_1 10.635, p=0.001) than those in the non-DAI group.

Among survivors, DAI patients had longer ICU stays (Z score 14.01, p<0.001), higher number of ventilator days (Z score 9.63, p<0.001), longer overall length of stay (Z score 12.39, p<0.001) and increased need for rehabilitation (χ^2_1 254.44, p<0.001).

Multivariate analysis was performed to determine independent predictors of mortality among DAI patients. These included lower initial GCS (χ^2_1 9.25, p=0.002, OR 0.34), hyperglycemia at admission (χ^2_1 4.97, p=0.025, OR 1.02), pupillary dilation (χ^2_1 17.43, p<0.001, OR 21.08), anisocoria (χ^2_1 3.98, p=0.046, OR 5.43) and pressor requirement (χ^2_1 3.88, p=0.048, OR 6.89).

Conclusion: Utilization of bedside cEEG plays an important role in early suspicion for DAI, thus reducing the need for urgent MRI and facilitating targeted therapeutic interventions . Insight into prognostic factors can be an important asset in patient management, promoting early consideration for rehabilitation and parent counseling.

Poster # 67

IMPACT OF PRE-INJURY WARFARIN USE AMONG MEDICARE BENEFICIARIES WITH HEAD TRAUMA

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Introduction: The effect of warfarin on outcomes of head injured patients remains controversial. Yet more than 2 million Americans, many of them elderly, are started on warfarin annually resulting in more than 30 million prescriptions per year. Meanwhile, with the aging US population, elderly Americans are becoming an increasingly large proportion of head injured patients. We studied a national cohort of Medicare beneficiaries with head injuries to determine the effects of pre-injury warfarin on outcomes.

Methods: A retrospective review of a 5% random sample of Medicare claims data (2009-2010) was performed for enrollees with at least 1 year of Medicare eligibility and Part D prescription drug claims available. Head injury cases were identified using ICD-9 codes for intracranial hemorrhage with or without accompanying skull fractures. Patients with isolated skull fractures or concussions without mention of hemorrhage were excluded. Using Part D prescription drug claims, warfarin exposure was defined as two or more warfarin prescriptions filled within 60 days prior to injury. Characteristics (age, sex, race, co-morbidities) and outcomes (mortality, length of stay (LOS), ICU LOS) between warfarin patients and patients not on warfarin (non-users) were compared using univariate tests of association. Multivariable models adjusting for patient characteristics, concomitant torso injuries and long-bone fractures, and need for ICU care were conducted to measure the independent effect of warfarin on in-hospital mortality.

Results: Of 773,389 eligible Medicare beneficiaries, we identified 3,420 head injured patients (0.4%), 6.6% of whom were treated with warfarin. While warfarin users and non-users were similar in race and co-morbidities, warfarin users were more likely to be female (74.2% vs. 65.6%, $p<0.01$), and older (median age 83, IQR 78-88 vs. 82, IQR 75-87, $p=0.04$) than non-users. Warfarin users had higher in- hospital mortality compared to non-users (16.9 vs. 10.2%, $p < 0.01$). In multivariable analyses, only torso trauma and ICU stay were found to be significant independent predictors of mortality. Warfarin users had 1.9 times the odds (95% CI 1.3-2.7) of dying in the hospital compared to non-users when adjusting for confounders. Eighty-nine percent of patients (N=3,055) survived hospitalization, but warfarin use did not predict ICU admission, ICU LOS, or overall LOS among these survivors.

Conclusion: Anticoagulation with warfarin increases risk of mortality after head injury nearly two fold in Medicare beneficiaries even after adjusting for other risk factors. As new, more difficult to reverse, agents are introduced for chronic anticoagulation this problem may be exacerbated. Physicians should exercise caution when initiating chronic anticoagulation in patients over the age of 65.

Poster # 68

SEVERELY INJURED CHILDREN HAVE HIGHER LIFETIME RISK OF CANCER

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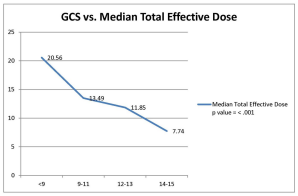
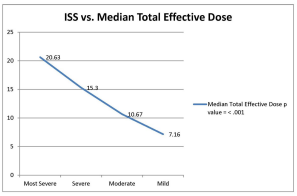
Introduction: The number of imaging studies performed in the United States has increased exponentially since the 1980s. Radiation exposure in pediatric trauma patients has come under much scrutiny. Multiple studies have shown that for an entire population of pediatric trauma patients, the average radiation dose and associated lifetime attributable risk(LAR) is acceptably low. However, no study to date has stratified patients according to Injury Severity Score(ISS) or Glasgow Coma Scale(GCS). Our hypothesis is that pediatric trauma patients with higher ISS or lower GCS have significantly more radiation exposure and associated LAR than that of the pediatric trauma population as a whole or those children who are less severely injured.

Methods: A retrospective review of medical records was completed for children who presented to an urban ACS Verified Level I Trauma Center during 2008-2009. Demographic, injury, and radiographic data were recorded for each patient based on the actual radiation delivered for each radiographic study through hospital discharge. The effective dose was recorded and the LAR was calculated using models from the BEIR VII Report for each patient.

Results: A total of 1252 children were evaluated during the study period. A total of 959 were included in this analysis representing all children discharged alive from the Trauma Center with complete radiation dose reports from imaging studies. Mean age was 7.25(+4.74) years. Overall mean effective dose (EffD) was 12.91 (+15.80) mSy with a range of 0- 146.77 mSy. Radiation dose varied by ISS and GCS. When ISS categories were evaluated, mean EffD ranged from 7.79 (median 7.16) for mild injuries to 28.76 (median 20.63) for the most severely injured (p-value < 0.001). EffD based on GCS ranged from a mean of 12.16 (median 7.74) for those with a GCS of 14-15 to 27.35 (median 20.56) for GCS <9 (p-value < 0.001). The mean lifetime attributable risk of cancer for these children was 2.62 (+3.23), range 0 to 32.13.





Conclusion: Though the overall mean effective dose of radiation children were exposed to was similar to previously published studies, when patients were stratified according to ISS or GCS, the amount of radiation severely injured children were exposed to was higher than has previously been reported in the literature. Moreover, severely injured children were exposed to a significantly higher dose of radiation and will have a significantly higher risk of cancer than less severely injured children. This should be disclosed to parents during their children's hospitalization.

Poster # 69

SURVIVAL OF PEDIATRIC BLUNT TRAUMA PATIENTS PRESENTING WITH NO SIGNS OF LIFE IN THE FIELD

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Introduction: Pre-hospital traumatic cardiopulmonary arrest is associated with a dismal prognosis, and these patients rarely survive to hospital discharge. Although there are clear guidelines for resuscitation efforts in adult blunt trauma patients who are found with no signs of life in the field, these guidelines do not apply to the pediatric population, mostly due to the paucity of data. The objective of our study is to gather data from a large patient database and determine the survival rate of pediatric patients presenting in the field with no signs of life after blunt trauma, as well as describe the impact that resuscitation efforts, including Emergency Department (ED) thoracotomy have on outcomes.
Methods: After Institutional Review Board (IRB) approval, we conducted a retrospective review of the American College of Surgeons National Trauma Data Bank research data set (2002-2010). All patients 18 years and under who experienced blunt traumatic injuries were identified (ICD-9 800-869). For each patient, we determined age, gender, race, and injury severity score (ISS). “No signs of life” (SOL) was defined as: pulse=0, respiratory rate=0, systolic blood pressure=0 and Glasgow Coma Scale (GCS)=3. These same four criteria were then re-assessed on arrival at the ED. Subjects were then re-assessed upon arrival to the ED and separated into "responders" (at least 1 sign on life) and "non-responders" (no SOL) of field resuscitation. We compared survival to hospital discharge between children who responded to field resuscitation and those who did not, and patients who underwent ED thoracotomy and those who did not.
Results: Among patients 18 and younger, there were a total of 3,115,597 patients who were found in the field by EMS after suffering blunt trauma. Of those patients, 0.26% (N=8058) had no SOL when they were found in the field. 70% were male. 10% were less than 1 year old, 20.4% were 1-4, 11.1% were 5-9, 12.7% were 9-14, and 45.8% were 15-18 years old. 38% were white, 34.4% were black, and 17.5% were Hispanic. 81% of these children had major trauma (ISS>15). Survival to hospital discharge of all patients presenting with no SOL was 4.4% (N=354). 25% of patients found in the field with no SOL were successfully resuscitated by EMS in the field and had regained SOL by the time they arrived to the ED (N=1993). Of those patients who regained SOL, 13.3% (N=265) survived. 75% of patients still did not have SOL by the time they arrived to the ED. Only 1.5% (N=89) of those patients survived. Overall, for patients found in the field with no SOL, survival was significantly higher in patients who did not receive a resuscitative thoracotomy than for those who did, even when they had regained signs of life in the ED.

	Thoracotomy		No Thoracotomy		P-value
	Survived N (%)	Died N (%)	Survived N (%)	Died N (%)	
No SOL in field – total (N=8058)	7 (1.4)	504 (98.4)	347 (4.6)	7152 (94.8)	P=0.0011
No SOL in field or in ED (N=6065)	3 (0.73)	405 (99.0)	86 (1.5)	5534 (97.8)	P=0.2692
No SOL in field but SOL in ED (N=1993)	4 (3.9)	99 (96.1)	261 (13.8)	1618 (85.6)	P=0.0106

Conclusion: Survival of pediatric blunt trauma patients who are found in the field with no signs of life is dismal. Resuscitation by EMS prior to arrival in the ED improves survival, however resuscitative thoracotomy in these patients cannot be justified as it exposes personnel to blood-borne pathogens and does not improve patient survival.

Poster # 70

THROMBOELASTOGRAPHY PARAMETERS VERSUS CLASSICAL COAGULATION PROFILE IN TBI AND NON-TBI TRAUMA PATIENTS

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Introduction: Thrombelastography (TEG^{TM}, Hemoscope,Niles,IL) is increasingly utilized to detect coagulopathy. As TEG depicts overall coagulation it may be more comprehensive and capable to detect any coagulation abnormalities in comparison to classical coagulation tests (CCT: PT,PTT,INR,plt). Traumatic brain injury (TBI) is thought to contribute to coagulopathy. The primary aim was to compare TEG parameters of TBI vs Non-TBI patients. The secondary aim was to identify TEG vs CCT parameters associated with outcome (mortality, need for transfusion, length of stay (LOS)).

Methods: This was a cross sectional, retrospective, observational study of 142 patients (full trauma team activations only) admitted to a university based, Level 1 trauma center. TEG and CCT (PT,PTT,INR, plt) were collected on admission. Citrated Kaolin samples were utilized. Data was analyzed by a biostatistician using JMP V10.

Results: Data was collected from 142 patients (pts), 44 (31%) women and 98 (69%) men. 48 pts had TBI and 94 pts were NTBI. Overall mortality was 20.4% (45.8% TBI vs 7.4% NTBI). There were no significant associations between any TEG or CCT parameters and ISS, scene vs transfer, hospital LOS, or ventilator days. There was no difference between the TBI and NTBI groups in terms of TEG or CCT parameters. Variables found to be associated with mortality were ↓K *($p = 0.0118$)* and age *($p = 0.0057$)*. MA was the only parameter (TEG or CCT) associated with need for transfusion of pRBC (*$p= 0.0377$*). PRBC transfusion was given in 94% of 16 patients with an MA < 57.4 (1-4 units in 44% and > 4 units in 50%). Platelet transfusion was given in 89% of 9 patients who have MA < 58.1. FFP transfusion was given in 80% of 15 patients who have R ≥ 5.8. Decreased MA *($p=0.0003$),* ↓K *($p=0.0154$),* ↑PT *($p= 0.0015$),* and ↑INR *($p=0.0014$)* were significantly associated with FFP transfusion. **K** value was significantly associated with mortality *($p = 0.0118$*) and hypotension *($p=0.0172$)*.

Conclusion: TEG parameters are potentially useful as an initial tool to rapidly diagnose coagulopathy and predict transfusion in trauma patients. Presence of TBI is not independently associated with a detectable coagulopathy. MA is the best single indicator for pRBC and/or FFP transfusion in trauma patients. TEG analysis is more efficient than the classical parameters in detecting patients who will need pRBC and/or FFP transfusion.

Poster # 71

PATIENTS WITH BLUNT HEAD TRAUMA ON ANTICOAGULANTS OR ANTIPLATELETS: CAN BE SAFELY DISCHARGED AFTER A NORMAL CRANIAL CT?

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Introduction:Trauma centers are more frequently evaluating patients with blunt head trauma who are receiving anticoagulant or prescription antiplatelet (ACAP) therapy. Because of reports of delayed intracranial hemorrhage (ICH) after blunt trauma in this patient group, many trauma centers are performing repeat head CTs on all patients taking ACAP therapy. We evaluated patients on ACAP following blunt head trauma for the occurrence of delayed ICH and the necessity of repeat head CTs

Methods:We retrospectively reviewed adult blunt head trauma patients admitted to our urban Level I trauma center from January 2008 to December 2010 who were receiving preinjury ACAP therapy. All had cranial CT scans. We reviewed medications, mechanism of injury, head CT results, and outcomes. Demographic data, international normalized ratio (INR), and results of neurologic examinations were recorded. We determined the incidence of delayed ICH on the second CT scan (CT2) for patients with a negative initial CT scan (CT1).

Results:Two hundred and sixty patients qualified for the study. Sixty-one patients (23%) with a mean age of 77 years were found to have ICH on cranial CT examination. Thirty-two (52%) were men and 29 (48%) were women. Coumadin was taken by 10 (16%) of 61 patients, 22 (36%) took plavix, and 47 (77%) took aspirin. Twelve (20%) patients took plavix and aspirin. Four (7%) took coumadin and aspirin together. The average INR for patients on coumadin was 2.3. Two patients with positive findings on CT1 and on coumadin had sub-therapeutic INR levels (1.5, 1.6) but were also taking aspirin. Falls (75%) were the most common mechanism of injury found in patients.Two patients (3%) had a negative CT1 but were found to have evidence of an intracranial hemorrhage on CT2 (one patient was taking coumadin (INR =2.6) and the other patient was taking plavix and aspirin). These two patients did not require surgical intervention.

Conclusion:Only 23% of patients on ACAP suffering blunt trauma were found to have findings of ICH on CT1. The incidence of delayed ICH in our study was 3%. However, none of the delayed findings were clinically significant or required surgical intervention. Our findings suggest that, among patients on ACAP therapy with a negative CT1 and a normal or unchanged neurologic examination, a routine CT2 is unnecessary. It is possible that a period of observation may be sufficient to recognize those patients with symptoms that could be due to delayed ICH. Intracranial hemorrhage following trauma in patients on ACAP therapy will present on CT1 in the majority of patients. Therefore, patients could be safely discharged if CT1 is normal with appropiate instructions.

Poster # 72

EARLY DIFFUSE SLOWING ON ELECTROENCEPHALOGRAM IN PEDIATRIC TRAUMATIC BRAIN INJURY: IMPACT ON MANAGEMENT AND PROGNOSIS

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Introduction: Traumatic brain injury (TBI) in children continues to be a major public health problem resulting in long term disability. Bedside early electroencephalogram (EEG) is frequently utilized in moderate and severe TBI for early recognition of subclinical seizure activity and to direct patient management. However, the significance of diffuse slowing (DS) on EEG monitoring remains unclear. The aim of our study is to explore the frequency of DS on EEG in pediatric TBI patients, and determine its association with patient outcomes.

Methods: We performed a retrospective review at a level I pediatric trauma center of all children with moderate and severe TBI (Glasgow Coma Scale (GCS) <10) over a 3 year period from January 2010 to December 2012. EEG monitoring results, patient demographics, clinical characteristics, length of stay and post injury outcomes were recorded. Data are presented as mean$\pm$ SEM, $p<0.05$ was considered statistically significant.

Results: 219 children, ages 0-18 years, were identified with GCS <10. 81 of these patients who had bedside EEG performed within 48 hours of admission were included in the study. Patients were divided into 2 groups based on the presence (Group A, n=50, mean age 5.7$\pm$ 0.7 years) or absence (Group B, n=31, mean age 4.2 $\pm$ 0.9 years) of diffuse slowing pattern on EEG. After adjusting for injury severity score and head abbreviated injury scale, initial GCS scores were significantly lower in group A patients compared with group B (4.9 vs 8.1, $p<0.001$). Among survivors, group A patients had significantly higher number of ventilator days (8.6 vs 4.7 days, $p<0.05$) and longer ICU stay (11.1 vs 6.2 days, $p<0.05$) compared with group B. Although mortality rate was similar in both groups (14% vs 19.3%), the need for in-hospital rehabilitation was found to be significantly higher in patients with diffuse slowing (74% vs 19.3%, $p<0.05$). Group A patients also had increased rehabilitation length of stay (21.8 vs 4.1 days, $p<0.05$) and worse Glasgow outcome scores at the time of discharge from rehabilitation unit (6 vs 8).

Conclusion: The presence of diffuse slowing on EEG within 48 hours of injury in children with TBI is associated with prolonged patient recovery and poor functional outcomes. DS on early EEG monitoring should prompt early consideration for rehabilitation and the need for intensive directed therapy.

Poster # 73

THE IMPACT OF LEVEL IV TRAUMA CENTER DESIGNATION IN A STATE TRAUMA SYSTEM: SURVIVAL, LENGTH OF STAY AND CHARGES

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Introduction: While Level I Trauma Centers (L1TCs) have been shown to improve outcome for trauma patients, the degree to which the addition of Level IV Trauma Centers (L4TCs) in rural settings to a statewide Trauma System influences outcomes is unknown. We sought to evaluate the impact of relatively recent designation of L4TCs within a statewide Trauma System. We hypothesized that trauma patients treated at one of 15 Arizona State designated L4TCs and transferred to L1TCs post designation will have improved survival, reduced length of stay (LOS) and charges compared to those treated pre-designation.

Methods: Arizona State Trauma Registry data were analyzed for the years 2005-11. Between 2008-11, Arizona designated 15 L4TCs in rural areas of the State. Pre (P-1) and Post (P-2) designation groups were classified based on the designation date of each L4TC. Confounding effects were controlled by removing 3 months of data before and after designation.

Variables included LOS at the transferring facility, LOS at L1TCs, hospital charges (L1TCs), injury severity score (ISS), and mortality. SAS (version 9.3) was used for data analysis and manipulation. The Kruskal-Wallis test for multiple comparisons was used to identify potential differences among groups. A sub-cohort of severely injured patients (ISS >15) was further analyzed under the premise that this population may benefit the most by L4TCs designation.

Results :2,504 Patients met inclusion criteria, 1,367 P-1 and 1,137 P-2. In general, P-2 compared to P-1 had a significantly lower median total LOS at the L1TC (2 vs. 3 days, p <0.005) but no significant difference in other outcome variables (Table). The SUB-COHORT group did not show any significant difference between P-1 and P-2 with respect to the outcome variables.

Conclusion: In Arizona, early data from the state trauma registry post implementation of a system of rural Level-IV Trauma Centers demonstrates significant reduction in median LOS at the receiving Level I Trauma Centers, but no difference in survival, LOS at referral hospital or charges. Further analysis is needed to define the role and confirm statistically the benefit of Level IV Trauma Centers in a Trauma System.

Outcome Variables	(P-1)	(P-2)	P value
LOS (Hours) at Transferring Facility	3	3	0.0981
LOS (Days) - L1TCs	3	2	0.006 *
Hospital Charges at L1TCs	$27,128	$30,303	0.058
ISS at Level I			0.87
0-8	40.1%	40.3%	
9-15	32.3%	32.5%	
16-25	17.8%	18.3%	
>25	9.1%	7.1%	
Final Outcome at Level I			
Mortality	2.56%	2.46%	0.40
			* Significant =P < 0.05

Poster # 74

THE OUTCOME OF PATIENTS WITH "DO NOT RESUSCITATE" ORDERS: IS THERE ANY DIFFERENCE BETWEEN LEVEL 1 VERSUS LEVEL 2 TRAUMA CENTERS?

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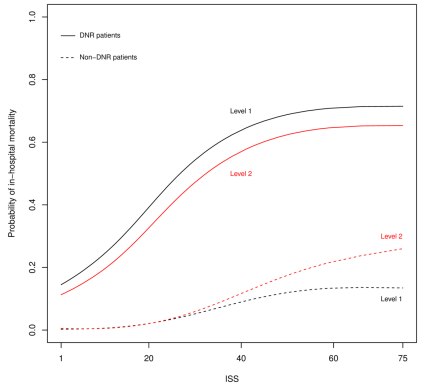
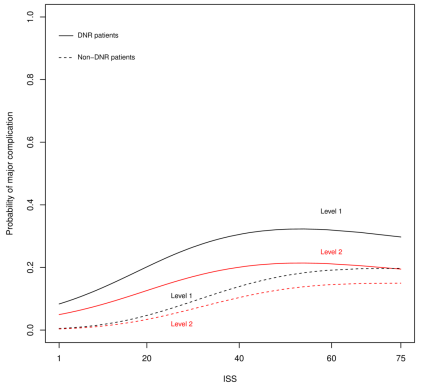
Introduction: Institutional variation in outcome of patients with "do-not-resucitate (DNR)" orders has not been well described in the setting of trauma. The purpose of this study was to assess the impact of trauma center designation on outcome of patients with DNR orders.

Methods: A statewide trauma database (PTOS: Pennsylvania Trauma Outcome Study) was used for the analysis. Characteristics of patients with DNR orders were compared between state-desginated Level 1 and 2 trauma centers. In-hospital mortality and major complication rates were compared using hierarchical logistic regression models that included a random effect for trauma centers. We adjusted for a number of potential confounders and allowed for non-linearity in injury severity score (ISS) and age in these models.

Results: A total of 106,291 patients (14 Level 1 and 11 Level 2 trauma centers) were identified in the PTOS database between 2007 and 2011. We included 5,953 patients with DNR orders (5.6%). Although more severely injured patients with comorbid disease were made DNR in Level 1 trauma centers, trauma center desgnation level was not a significant factor for in-hospital mortality of patients with DNR orders (OR:1.33, 95% CI: 0.81-2.18, p=0.26). Level 1 trauma centers were significantly associated with higher rate of major complication (OR: 1.75, 95% CI:1.11-2.75, p=0.016). For patients without DNR orders, Level 1 trauma centers were significantly associated with lower in-hospital mortality rate in patients with very high ISS (>40) and higher major complication rate (OR: 0.75, p=0.05 and OR: 1.39, p=0.04, respectively).

Conclusion: In-hospital mortality of patients with DNR orders is not significantly influenced by trauma designation level after adjusting for case mix. More aggressive treatment or other unknown factors may have resulted in significantly higher complication rate in Level 1 trauma centers.





Poster # 75

MEASURING PATIENT SATISFACTION: FACTORS THAT DRIVE HCAHPS SURVEY RESPONSES IN A TRAUMA AND ACUTE CARE SURGERY POPULATION

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Introduction: Hospital quality metrics new reflect patient satisfaction and are measured by the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Survey scores. Understanding these metrics and their drivers will be integral in providing quality care as this process evolves. This study identifies factors associated with patient satisfaction as determined by HCAHPS survey responses in trauma and acute care surgery patients.

Methods: HCAHPS survey responses from acute care surgery and trauma patients at a single institution between 3/11-10/12 were analyzed. Logistic regression determined which patient characteristics and responses to individual HCAHPS care questions predicted highest hospital score (a rating of 9-10/10 or a *"definitely yes"* hospital recommendation). Demographic and clinical variables (age, gender, education, ethnicity, insurance provider, length of stay, complications, ISS and whether surgery was performed) were also analyzed as predictors of satisfaction. Subgroup analysis for trauma patients was also performed.

Results: The highest hospital ranking was noted in 70.3% of 182 total survey responses, and 78.6% gave a "definitely yes" recommendation. With the exception of new medication explanations, all responses to questions about care and environment were associated with satisfaction measured by either numeric score or recommendation to family and friends. The strongest predictors of highest hospital ranking were respect shown by doctors (OR 24.5, CI 5.44-110.4), doctors listening to the patient (OR 9.33, CI 3.7-23.5), nurses listening to the patient (OR 8.65, CI 3.62-20.64), doctor's explanations (OR 8.21, CI 3.5-19.2), and doing everything possible to control pain (OR 7.71, CI 3.22-18.46). Clinical factors and outcomes such as complications, hospital length of stay, ICU length of stay, mechanism of injury, and need for an operation were not significant predictors of satisfaction. In trauma patients alone, an increase in ISS was inversely related to numeric hospital score (OR=0.93, CI=0.87-0.98). Demographic predictors included insurance status and educational level. Enhanced Medicare plans were negatively associated with highest hospital ranking (OR 0.17, CI 0.06-0.51) compared to Medicare/Medicaid/commercial insurance. "At least some college education" was also inversely associated with highest hospital ranking (OR 0.36, CI 0.18-0.74). Disposition to either a nursing or rehabilitation facility was associated with higher hospital ranking (OR 29.74, CI 1.20-735) compared to discharge home without outpatient services. Discharge home with home health nursing (OR 0.168, CI 0.05-0.6) were associated with an even lower numeric hospital score. Age, gender, and ethnicity were not significant predictors. Predictors of a "definitely yes" recommendation were similar to score. The only major difference was that discharge to inpatient rehab was associated with a lower recommendation compared to discharge home without services (OR 0.052, CI 0.007-0.393).

Conclusion: This study reinforces the relationship between provider interpersonal skills and patient satisfaction. A patient's perception of how well the clinical team (doctors and nurses) interacted and communicated with them was the strongest predictor of satisfaction reflected in HCAHPS survey answers. With the exception of injury severity score, clinical factors and outcomes such as complications, length of stay, and mechanism of injury were not associated with patient satisfaction. Insurance status and disposition after hospital stay were also potential predictors of numeric hospital rating. Listening to patients, treating them with respect, and fully explaining the plan of care were identified as interactions most strongly tied to patient satisfaction, as measured by the HCAHPS.

Poster # 76

THE IMPACT OF DEVICE-ASSOCIATED INFECTION ON TRAUMA PATIENT OUTCOMES AT A MAJOR TRAUMA CENTER

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Introduction: Catheter-associated urinary tract infection (CAUTI) and ventilator-associated pneumonia (VAP) are infections that are considered performance measures. We sought to analyze the incidence, prevalence and risk of CAUTIs, and VAP, in trauma patients, the demographic and injury factors related to CAUTI and VAP and their relative risk of negative outcomes [prolonged length of stay (LOS), sepsis and death].

Methods: Trauma registry data were analyzed (age >18, LOS > 24 hours) from 1/1/07 to 12/31/11, excluding burns. Demographics, injury location, severity, and blunt vs. penetrating were analyzed relative to outcomes along with device-associated infection as defined by the CDC (CAUTI or VAP). Outcomes analyzed included ICU and hospital LOS, sepsis and in-hospital death. We set the significant threshold at $p<0.005$ to allow for multiple comparisons. Multivariable logistic regression was then used to determine contributing factors to sepsis, including device-associated infections.

Results: The included population (n=10,755), were 66.6% male, had a mean age of 45.1 years, 91.8% blunt trauma, a median injury severity score (ISS) of 10 and a mean albumin of 2.80 g/dL. Patients developing CAUTI (n= 324, 3.0%, $p<0.005$) were more likely female (59.4%), had higher median ISS (20.5), and were older (56.7 years). Patients with VAP (n=161, 1.5%, $p<0.005$) had higher median ISS (27) and decreased admission albumin (2.51g/dL). Septic patients (n=149, 1.4%, $p<0.005$) had a higher median ISS (24.0), were older (52.3 years), and had a lower admission albumin (2.41g/dL). Sepsis was associated with increased death and prolonged LOS as expected ($p < .005$). In multivariable analysis, independent predictors for sepsis included: CAUTI (odds ratios [OR] 16.15, $p<0.001$), VAP (OR. 6.95 $p<0.001$), ISS (OR 1.05 per unit, $p<0.001$), age (OR 1.02 per year, $p<0.001$) and penetrating, abdominal, pelvic and/or chest injury.

Conclusion: Development of CAUTI and VAP significantly increase the risk of sepsis in trauma patients after adjustment for injury type, location, severity, and age. This study suggests the importance of device-associated infections as vectors for sepsis in trauma and highlights the importance of prevention initiatives.

Poster # 77

IMPACT OF PREINJURY ANTICOAGULANTS AND PRESCRIPTION ANTIPLATELET AGENTS ON OUTCOMES IN OLDER PATIENTS WITH TRAUMATIC BRAIN INJURY

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Introduction: Many older patients with traumatic brain injury (TBI) are on pre-injury anticoagulants or prescription antiplatelet agents (ACAP). We sought to determine if ACAP use adversely affected patient outcomes and survival.

Methods: Retrospective analysis of patients age ≥55 years with blunt-force TBI (head Abbreviated Injury Score >1) was performed. Patients were categorized as ACAP (warfarin, clopidogrel, dipyridamole/ASA, enoxaparin, subcutaneous heparin or multiple agents) or non-ACAP. ACAP patients were further stratified by class of agent (anticoagulant vs. antiplatelet). Primary outcome was in-hospital mortality. Secondary outcomes were progression of initial TBI, development of a new hemorrhagic focus (remote from initial injury) and need for increased level of care at discharge (relative to pre-admission living status).

Results: A total of 362 patients admitted to our Level I trauma center from 7/2006-12/2011 were analyzed: 277 (77.2%) non-ACAP and 82 (22.8%) ACAP. ACAP status was significantly related to decreased survival. After adjustment for age, comorbidities, Injury Severity Score and Glasgow Coma Scale score, ACAP patients were almost 3 times more likely to die than non-ACAP (Table). ACAP use predicted development of new hemorrhage, but was not associated with either progression of initial TBI or an increase in level of care at discharge. Compared to non-ACAP, the increased mortality risk was greater for antiplatelet use than for anticoagulants. Antiplatelet use was also associated with need for skilled nursing facility or rehabilitation placement.

Hazard Ratios for Mortality			
	HR	95% CI	p-value
ACAP	2.81	1.20-6.57	0.017
Age, years	1.06	1.02-1.10	0.007
Charlson Index	1.58	0.92-2.72	0.100
ISS	1.11	1.04-1.18	0.001
GCS	0.76	0.70-0.83	< 0.001

Conclusion: Older TBI patients on ACAP at the time of injury are more likely to develop a new focus of hemorrhage and are significantly more likely to die than non-ACAP patients. Additional study of the independent relationship between ACAP and TBI mortality and of the impact of prescription antiplatelet agents on outcomes is warranted.

Poster # 78

Sarcopenia and Frailty in Elderly Trauma Patients

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Introduction: Sarcopenia describes a loss of muscle mass and resultant decrease in strength, mobility and function that can be quantified by CT. We hypothesized that sarcopenia and related frailty characteristics are related to discharge disposition after blunt traumatic injury in the elderly.

Methods: We reviewed the charts of 252 patients, 65 years of age and older, who sustained blunt trauma without traumatic brain injury and subsequently underwent abdominal CT as part of their initial evaluation prior to admission to a Level 1 trauma center. Data for 7 frailty risk factors were abstracted. Sarcopenia was measured by obtaining the skeletal muscle cross sectional area (CSA) from each patient's psoas major muscle at the level of the L4-L5 intervertebral disc space, using Slice-O-Matic® software. Discharge destinations were defined as death, skilled-nursing facility, nursing home, rehabilitation, home and home-health. The latter 3 were grouped as independent outcomes. Chi-square, Fisher's exact, and logistic regression were used to determine factors associated with discharge dependence.

Results: Mean age was 76 years, 49% were male, and the mean ISS was 13.3. Discharge destination was independent in 61.5%, dependent in 29%, and 9.5% of patients died. Lower psoas major muscle CSA in elderly trauma patients was related to discharge destination. Controlling for age and other significant factors in a final model, revealed that each 1 cm^2 increase in psoas muscle CSA was associated with a 20% decrease in the odds of dependent living ($p<0.001$). Other variables significantly associated with the disposition outcome were gender, weakness, hospital complication, and cognitive impairment. The effect of ISS was not found to be significant ($p=0.475$).

	Odds Ratio	p value
Sex (male)	4.7 (1.8-12.5)	0.002
Age (64-74)	Reference	
75-84	3.32 (1.35-8.16)	0.009
>84	2.96 (1.03-8.51)	0.044
Psoas major CSA	0.80 (0.73-0.88)	<0.001
Weakness	3.38 (1.46-8.76)	0.005
Complications	4.48 (1.08-18.52)	0.038
Cognitive Imapairment	3.81 (1.37-10.62)	0.010

Conclusion: Lower psoas major muscle CSA is related to discharge destination in elderly trauma patients and can be obtained from the admission CT. Lower CSA is related to loss of independence upon discharge in the elderly. The early availability of this variable during the hospitalization of elderly trauma patients may aid in discharge planning and the transition to dependent living.

Poster # 79

WHO SHOULD ADMIT GERIATRIC GROUND LEVEL FALLS?

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Introduction: There is significant known morbidity and mortality associated with geriatric ground level falls. Given that the injury severity is often under appreciated, there is growing sentiment that this patient population may be better served with admittance to a surgical service. We hypothesize that geriatric patients sustaining a ground level fall can be selectively managed on either medical and surgical services with equivalent outcomes.

Methods: We performed a retrospective cohort study of all geriatric patients (>/= 65 years old) after sustaining a ground level fall that were admitted to our ACS-verified level 1 trauma center from January 2006 – April 2012. Patients admitted to a surgical service were compared to those admitted to a medical service for demographics, admission physiology, as well as injury pattern and severity. The primary outcome was mortality while secondary outcomes included hospital and ICU length of stay.

Results: There were 1,188 patients identified, 801 (67%) of which were medical admissions (MA) and 387 (33%) surgical admissions (SA). The SA group was younger (77 vs. 79 years old, $p = .0002$) but did not differ by male gender (38% vs. 34%, $p = 0.24$) or Caucasian race (80% vs. 76%, $p = 0.17$). There were no differences in admission pulse (82 vs. 82, $p = 0.66$), systolic blood pressure (149 vs. 150, $p = 0.42$), or GCS (14 vs. 14, $p = 0.13$) but the ISS was slightly higher in the SA group (12 vs. 11, $p = 0.006$). The SA group more often had severe injuries (AIS >/= 3) to the face (4% vs. 1%, $p = 0.007$), chest (12% vs. 2%, $p < 0.0001$), and abdomen (3% vs. 1%, $p = 0.02$), while the MA group more often had severe injury to the extremities (33% vs. 26%, $p = 0.02$). There was no difference in severe head injury between groups (42% vs. 41%, $p = 0.89$). There was no difference in mortality for surgical admissions (9%) vs. medical admissions (6%), $p = 0.09$. Among survivors, the SA group spent more days in the ICU (1 vs. 0.7, $p = 0.01$) but there was no difference in hospital length of stay (5 days vs. 5 days, $p = 0.10$).

Conclusion: After ground level falls, elderly patients admitted to a surgical service are more severely injured and more often sustain severe injuries to the face, chest, and abdomen, while those admitted to a medical service more often sustain severe extremity injury. Regardless of admitting service there is no difference in mortality or hospital length of stay. Elderly patients who sustain ground level falls can be selectively managed on medical or surgical services with equivalent outcomes.

Poster # 80

OUTCOMES OF TRANSPLANT PATIENTS AFTER BLUNT TRAUMA

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Introduction: Recipients of solid organ transplantation are altered hosts. The impact of post-transplant status on trauma outcomes is not known. We hypothesized that transplant patients (TXP) with blunt trauma have higher complication rates and mortality compared to nontransplant patients (non-TXP).

Methods: We performed retrospective case-control study at our hospital, a Level I trauma center and solid organ transplant center. The trauma registry was queried for blunt trauma patients admitted 1999 to 2011 with history of solid organ transplant. TXP (cases) were matched by age, ISS, and physiology (initial SBP <90) to non-TXP (controls) at ratio of 1:3. We compared ICU and hospital length of stay (LOS), complication rate, hospital mortality and discharge disposition, using Fisher's exact test, chi-square or Mann-Whitney U test where appropriate, with significance defined as 2-tailed $p < 0.05$.

Results: Fifty-three TXP were identified and matched to 159 non-TXP. TXP did not have significantly different ICU length of stay, complication rate or mortality compared to non-TXP. However, TXP had longer hospital LOS, were less likely to be discharged to home, and were more likely to be discharged to rehabilitation.

Conclusion: Transplant patients who sustain blunt trauma have comparable morbidity and mortality to matched nontransplant patients but are more likely to require acute rehabilitation. Modifiable factors of the acute care phase remain to be identified.

1. Transplant patients	**N =53**
Age (mean ± SD)	55 ± 14 yrs
Male:female	70:30
ISS (mean ± SD)	9.6 ± 6.4
Organ transplant	
Kidney	21
Liver	15
Lung	7
Kidney+pancreas	4
Heart	3
Kidney+liver	1
Heart+kidney	1
Heart+lung	1

2. Outcome	**TXP N = 53**	**Non-TXP N = 159**	**p**
ICU LOS (mean ± SD)	2.9 ± 8.4	1.3 ± 6.4	NS
Hospital LOS (mean ± SD)	8.7 ± 11.6	5.1 ± 7.6	<0.05
Overall complication rate	11.3%	10.7%	NS
Hospital mortality	5.7%	3.2%	NS
Discharge disposition			
Home	61%	78%	<0.05
Rehabilitation	21%	8%	<0.05
Skilled nursing	16%	8%	NS

Poster # 81

ARE THE ELDERLY MORE LIKELY TO FAIL NON-OPERATIVE MANAGEMENT OF BLUNT SPLENIC INJURIES?

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Introduction: There is conflicting data on whether non-operative management (NOM) of blunt splenic injuries (BSI) carries a greater risk of failure in elderly patients compared to younger patients. This has important implications as the elderly are more likely to have acquired bleeding disorders, and may be less tolerant of acute blood loss.

Methods: We used the 2011 National Trauma Data Bank dataset to extract information from level 1 and 2 trauma centers. Patients 13 years and older sustaining BSI were divided into three age groups—13-54 years, 55-74 years, and ≥75 years. Splenic injury severity, determined from AIS 98 predot codes, the presence of congenital or acquired bleeding disorder, gender, the presence of associated intra-abdominal injuries with an AIS>=3, the presence of pelvic or acetabular fractures were noted. We assumed that in patients who underwent splenic procedures within 1 hour of arrival, NOM was not attempted. These patients, as well as those who died or were discharged <1 hour of arrival were excluded from analysis. Univariate analyses were done using Kaplan-Meier survival curves for time to splenectomy. Significant variables ($p<0.10$) were entered into a Cox proportional hazards regression model.

Results: After exclusions, 15450 patients remained. Of these, 380 patients had grade 1 injuries and none in this subgroup had any splenic procedures. After exclusion of these patients, of the remainder, 2286 had splenic procedures, thus giving a NOM failure rate of 15%. Unadjusted incidences of NOM failure were 14.2%, 19.2 % and 16.6% respectively in the three age groups in ascending order based on age. Cox regression analysis found increasing splenic injury severity, bleeding disorder, associated abdominal injuries with AIS>=3, associated pelvic and/or acetabular fractures, age groups 55-74 and ≥75 years to be independent predictors of failure of NOM (table).

Conclusions: Elderly patients with BSI have an increased risk of failure of NOM after adjusting for splenic injury severity, presence of associated abdominal injuries, pelvic fracture and bleeding disorder. Future studies could target interventions that might decrease NOM failure rates without increasing morbidity or mortality. The indications and effectiveness of splenic angioembolization in the elderly could be evaluated.

parameter	hazard ratio (95% confidence intervals)
bleeding disorder	1.29 (1.02 to 1.63)
splenic grade 3*	3.40 (3.01-3.83)
splenic grade 4*	7.24 (6.45-8.13)
splenic grade5*	16.0 (14.1-18.1)
55-74 age group**	1.54 (1.38-1.71)
≥75 age group**	1.53 (1.28-1.82)
associated abdominal injuries, AIS≥ 3	1.56 (1.39-1.74)
associated pelvic/acetabular fracture	1.41 (1.28-1.56)

*referrant is grade 2 **referant is the 13-54 age group

Poster # 82

ASSOCIATION BETWEEN QUALITY INDICATORS AND FUNCTIONAL OUTCOMES IN GERIATRIC TRAUMA PATIENTS

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Introduction: Quality indicators (QI) for geriatric trauma patients developed using the RAND/UCLA Appropriateness Methodology are ideally linked to meaningful outcomes. The association between adherence to inpatient QI and long-term functional outcomes for geriatric patients with traumatic injury is unknown. We hypothesize that increasing adherence to QI results in significantly improved long term functional outcomes in geriatric trauma patients.

Methods: Prospective cohort study of consecutive patients $\geq$65 years admitted to an urban Level I trauma center (2007-2010). Patient care data and adherence to QI were retrospectively abstracted. Functional data [5 activities of daily living (ADL), Vulnerable Elderly Survey-13 (VES-13)] were obtained for pre-injury, 3 months, 6 months, and 12 months after discharge. A mixed-effects multi-level linear regression model estimated the effect of adherence using composite quality score (QI met/QI triggered for each patient) on functional outcome (change in ADL performance) with risk adjustment.

Results: Seventy-seven geriatric trauma patients with mean age 77.4$\pm$8.1 and mean Charlson Comorbidity Index (CCI) 4.7$\pm$2.5 were evaluated. 80% suffered motor vehicle or pedestrian versus vehicle accidents, or fall. Mean Injury Severity Score (ISS) was 13.2$\pm$9, VES-13 1.2$\pm$2.1, median length of stay 6 days (interquartile range 3-14), and 26% experienced inpatient morbidity. Mean composite quality score was 62.9$\pm$0.1%. They experienced a significant and persistent decline in ADL score after injury [pre-injury ADL score 4.7 (95% confidence interval (CI) 4.5, 4.9); 3-month ADL score 3.5 (95% CI 3.2, 3.7); 12-month ADL score 3.9 (95% CI 3.6, 4.1)]. Change in composite quality score from 40% to 90% resulted in a 1-point improvement towards pre-injury ADL score over 12 months [β coefficient 2.03, 95% confidence interval (0.19, 3.87), p=0.03].

Conclusion: There is significant deterioration in functional outcomes for geriatric patients after traumatic injury that persists for up to a year after hospitalization. Better adherence to geriatric trauma QI is associated with significant mitigation of functional decline.

Poster # 83

RACIAL DISPARITIES IN POST-HOSPITALIZATION REHABILITATION AFTER TRAUMATIC BRAIN INJURY

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Introduction: Traumatic Brain Injury (TBI) is a major source of morbidity across the United States, with an annual incidence of 1.7 million, resulting in 275,00 hospitalizations. This results in ~$76.5 billion of direct and indirect costs. Many of these indirect costs are due to loss of functionality after injury. Patients who suffer moderate to severe TBI benefit, in the form of improved function and independence, from intensive rehabilitation after their initial hospitalization. However, there are significant barriers to obtaining intensive rehabilitation. Racial disparities in access to post-hospitalization care have been demonstrated in stroke and hip fracture populations, as well as the general trauma population. It has been unclear the role race and ethnicity play in disparities associated with discharge destination after TBI. We sought to examine predictors for receiving a higher post-injury level of rehabilitation, and identify potential racial disparities in discharge destination among TBI patients. We hypothesize that Hispanic and African-American patients are less likely to receive intensive rehabilitative services following discharge.

Methods: This is a retrospective study using National Trauma Data Bank (NTDB) data from 2007-2010. The study population included TBI incidents, age $\geq$18, who sustained a moderate to severe TBI, as defined by Abbreviated Injury Score (AIS) 2 through 5, and survived to discharge. Discharge destination was defined ordinally by increasing intensity of rehabilitative services (home, home with home health, skilled nursing facility and acute inpatient rehabilitation). Variables included age, gender, race (non-Hispanic white, African American, Hispanic), AIS, Injury Severity Score, mechanism of injury, Glasgow Coma Scale–Motor score on arrival, insurance status and verified trauma center level. In-hospital characteristics included length of stay, ICU days, and ventilator days. Propensity-score weighting was used to balance observable covariates between race categories. Subsequent ordinal logistic regression was used to adjust for in-hospital characteristics and explore racial disparities within discharge destination.

Results: The study cohort included 696,558 TBI incidents, of which 369,477 were included in our propensity weighted analysis. 298,540 (77%) of incidents were classified as non-Hispanic white, 38,533 (9%) were Hispanic, and 48,622 (13%) were African-American. Propensity weighting resulted in covariate balance among our racial groups. After ordinal logistic regression, Hispanic (adjusted OR=0.68 CI=0.66-0.71) and African-American (adjusted OR=0.89 CI=0.86-0.92) populations were less likely to be discharged to a higher level of rehabilitation as compared with non-Hispanic whites.

Conclusion: Hispanic and African-American TBI patients are significantly less likely to receive discharge to intensive rehabilitation than their white counterparts. Members of these communities are less likely to receive intensive rehabilitation, which will affect return to functionality. It is important to identify factors leading to this disparity, and address them to ensure equal access to post-acute care services. It is possible this disparity is rooted in socio-cultural norms and real or perceived expectations on the part of clinician, patient and family. Our growing healthcare system needs to adapt to address these disparities in order to fully serve the patients and communities they treat. Intensive rehabilitation services, as well as education regarding what they engender must be offered to TBI patients meeting functional criteria.

Poster # 84

MEDICATION RISK FACTORS FOR ACUTE RESPIRATORY DISTRESS SYNDROME FOLLOWING TRAUMA

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Introduction: Acute respiratory distress syndrome (ARDS) is a significant cause of morbidity and mortality in trauma patients. Efforts aimed at the prevention of ARDS depend on early identification of at-risk patients. There is limited data on the correlation between individual patient comorbidities present at the time of injury and subsequent ARDS risk. We used detailed information from a statewide collaborative quality initiative (CQI) focused on trauma to assess existing patient medications as a clinical predictor of risk for development of ARDS following injury.

Methods: Our trauma CQI program collected information on trauma patients using the existing trauma registry infrastructure in 23 hospitals from 2008 to 2011. In addition to National Trauma Data Bank data elements, information was collected on patient medications at the time of injury (aspirin, steroids, statins, and beta blockers). Inclusion criteria were age >17, ISS>4, admission to the trauma service, and LOS >0 days. Patients who met no signs of life criteria at presentation to the hospital were excluded. We used bivariate analysis to identify potential predictors of ARDS ($p<0.2$). Stepwise logistic regression was used to create the final model. Co-variates forced into the model included: age, injury severity score, race and gender. We then investigated the contribution of pre-existing medications towards the development of ARDS using our risk-adjustment model. Observed to expected ratios and 95% confidence intervals were calculated for each exposure variable.

Results: 25,113 trauma patients were admitted and 205 were diagnosed with ARDS. Co-variates in the final model were: age, ISS, motor GCS, systolic blood pressure, race, gender, AIS chest>2, AIS abdomen>2, diabetes, chronic alcohol abuse, and blood administration in the first 24 hours. Routine steroid use was associated with an increased risk of ARDS (table). Patient use of aspirin, beta blockers, and statins had neither a negative nor positive effect on risk for subsequent development of ARDS in trauma patients. The area under the ROC for the model was 0.84.

Conclusion: In addition to common risk factors for ARDS following trauma, the presence of routine steroid use on admission substantially increased the odds of developing ARDS. Routine use of common medications such as aspirin, beta blocker, or statin drugs had no association with subsequent development of ARDS in trauma patients. Patient comorbidities identified at the time of admission, as well as injury-related risk factors, should be considered during the management of trauma patients at risk for developing ARDS.

Medication	Observed		Expected		O/E Ratio	95% confidence interval	
	N	%	N	%		Lower	Upper
Aspirin	17	8.3	12.6	6.1	1.35	0.79	2.16
Routine Steroid Use	4	2.0	1.0	0.5	3.96	1.08	10.14
Beta blocker	10	4.9	10.6	5.2	0.94	0.45	1.73
Statin	14	6.8	12.7	6.2	1.10	0.60	1.84

Poster # 85

USE OF PRE-TRAUMA FUNCTIONAL INDEPENDENCE MEASURE (FIM) SCORE TO ASSESS PREDICTION OF SURVIVAL IN GERIATRIC TRAUMA PATIENTS

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Introduction: The geriatric patient represents an increasingly important cohort in the trauma arena, and is challenging because of their multiple co morbidities, unique physiology, and impaired physiologic reserve. It has been suggested a measure that is more specific to geriatric patients is needed for survival prediction since standard scoring models are not reliable in this population. The Functional Independence Measure (FIM) is a measure of disability that combines motor and cognitive parameters to access the level of assistance a patient needs to perform activities of daily living. Widely used in rehabilitative medicine, FIM has been shown to predict discharge outcomes as well as identify patients at high risk for falls. We hypothesized that pre-trauma FIM scores could be used to predict survival in the geriatric trauma population.

Methods: Retrospective analysis of the trauma registry patients age 65 and older admitted to a Level I Trauma Center from July 1, 2006 to July 1, 2012. A total of 1315 patients were identified for model development and regression analysis. Age, ISS, RTS, BMI, and Pre- trauma FIM scores (12 point scale) were studied. The primary outcome variable was survival. Observations with missing data points were excluded from analysis. A total of 941 patients underwent stepwise regression to identify those factors predicting survival. Statistical significance was reached with p-value < 0.05. Multiple logistic regression analysis was then performed. Variables that were significant predictors of survival are reported as adjusted odds ratios with confidence intervals.

Results: The mean age of patients was 78(SD±8.2) and 52% were female. The mean ISS was 13(SD±8.7) and a mean BMI of 26. Overall mortality was 11%, and 58% of patients who died were male. The odds ratio of survival was 3.532 (2.191-5.718, Cl 95%) times greater for every 1 point increase in the pre-admission FIM **expression** score. Although a similar increase in survival was observed with increasing pre-admission FIM **motor** score (OR 1.481, 0.986-2.165, Cl 95%) ($p<0.0001$) this significance was lost when controlling for age, sex, and race ($p=0.0581$). Additionally, the odds of surviving increase 80.5% and 6.8% for every 1 point increase in the RTS and BMI respectively.

Conclusions: Pre-trauma FIM scores, specifically the expression component, were predictive of survival in geriatric trauma victims in this study. The pre-trauma FIM may be useful as a geriatric specific parameter for mortality prediction. Further study of predictive models is needed to determine in geriatric patients the FIM scores impact on standard trauma scoring models.

Poster # 86

THE IMPACT OF ACUTE SOLID ORGAN INJURY ON THE US HEALTH CARE SYSTEM

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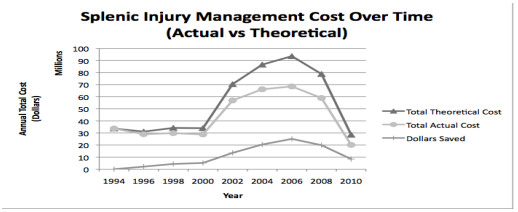
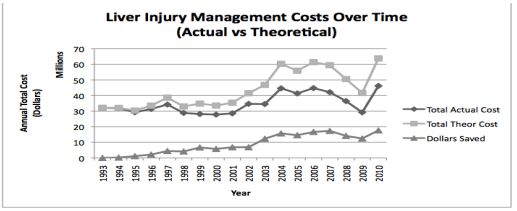
INTRODUCTION: Since the 1980's, there has been a paradigm shift towards non-operative management of stable patients with acute solid organ injury. Historically, evidence of hemoperitoneum or a penetrating injury to the abdomen warranted immediate exploration. These injuries are increasingly being managed nonoperatively. The impact of this practice change on national health care expenditure has not been well characterized.

METHODS: Retrospective trend analysis using data collected from the HCUP Nationwide Inpatient Sample (NIS) spanning 1993-2010 was studied using patients with a primary diagnosis of splenic and liver injury. Cost analysis was performed using cost-to-charge ratios, where actual costs of hospitalization with current management practices were compared to theoretical costs projecting 1994 practice patterns forward.

RESULTS: 29,409 adult patients admitted with primary splenic injury and 84,254 for primary liver injury were analyzed from 1993 to 2010. The proportion of patients undergoing operative management for splenic injury decreased from 60.5% to 32%, and 42% to 19% for liver. Average cost of patient care for splenic injury dropped by $8,421 per patient, a net reduction in total costs per admission of 29.5% ($p<0.0001$), resulting in an average estimated $12 million/year reduction in cost of care. For liver injury, cost has been reduced by $8,822/pt, a 27.7% reduction, with a net $17 million/year savings. Length of stay has been reduced by a mean of 1.7 days per patient for splenic injury ($p=0.0001$) and 2.2 days for liver injury ($p=0.0001$).

CONCLUSION: The trend towards non-operative management of solid organ injury has resulted in a substantial decrease in health care expenditure and length of stay. Advancements in trauma care can have significant impact on the cost of health care in the US.





Poster # 87

A ROBUST PERFORMANCE IMPROVEMENT PROCESS AND THE IMPACT ON VENOUS THROMBOEMBOLISM IN TRAUMA PATIENTS

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Introduction: Venous thromboembolism (VTE) and pulmonary embolism (PE) are well-known complications after trauma and result in significant morbidity and mortality. Many risk factors and prophylactic measures have been identified, however screening and treatment practices vary widely among trauma centers. In 01/2009, we implemented a robust performance improvement (PI) process aimed at evaluating and improving our current prophylaxis measures. This included eight sequential interventions, such as auditing missed doses and patients not on appropriate prophylaxis, adding a "DVT prophylaxis" section to daily progress notes, developing formal chemoprophylaxis guidelines and TEG-based recommendations for placing prophylactic IVC filters in high risk patients.

Methods: We conducted a retrospective review of 25,354 adult patients from a university-based Level-1 trauma center over a six year period (2006-2011). Patients admitted in 2006-2008 (PRE) were compared to those admitted in 2009-2011 (POST) after implementation of our internal PI process. We evaluated both unadjusted and adjusted PE and VTE rates using chi square, t test, and multiple logistic regression.

Results: Of 25,354 adult trauma patients during the study period, 11,690 (46%) were in the PRE group and 13,664 (54%) were in the POST group. Both groups had clinically similar risk factors. The overall PE rate for the study period was 1.09% and VTE rate was 1.99%. In the PRE vs POST group, the unadjusted PE rate was 1.19% vs 1.01% (p=0.17) and unadjusted VTE rate was 2.13% vs 1.87% (p=0.15). After controlling for age, race, trauma mechanism, operative intervention, and injury severity score, no significant change in event rates was detected between groups for either PE (OR 0.91; 95% CI 0.72-1.15) or VTE (OR 0.94; 95%CI 0.79-1.13). Overall mortality decreased from 6.3% to 5.5% (p=0.007).

Conclusion: After implementing several targeted interventions, we did not observe a decrease in PE or overall VTE rates at our institution. While this does not exclude the possibility of a small, undetected change in rates, it is unlikely that any clinically significant change would have occurred. In addition, any potential decrease in rates may be masked by a higher detection rate of clinically insignificant VTE as a result of a lower threshold for screening. Our current PI efforts have focused on identifying ways to improve adherence to current guidelines and increase the intensity of prophylaxis. These findings suggest that future efforts should focus on evaluating the efficacy of the current recommendations themselves and developing evidenced based interventions proven to decrease VTE.

Poster # 88

DAMAGE CONTROL RESUSCITATION INCREASES SUCCESSFUL NON-OPERATIVE MANAGEMENT RATES AND SURVIVAL AFTER SEVERE BLUNT LIVER INJURY

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Introduction: Non-operative multidisciplinary management for severe (AAST Grades IV and V) liver injury has been utilized for two decades. We have previously shown that Damage Control Resuscitation (DCR) employing low-volume, balanced resuscitation improves survival of severely injured trauma patients, however little attention has been paid to organ specific outcomes. We wanted to determine if implementation of DCR has improved survival and successful non-operative management after severe blunt liver injury.

Methods: A retrospective study was performed on all adult trauma patients with severe blunt liver injury who were admitted from 2005 to 2011. Patients were divided into pre-DCR (2005-2008) and DCR (2009-2011) groups. Patients who died before leaving the emergency department (ED) were excluded. Outcomes (resuscitation products used and survival) were then compared by univariate and multivariate analysis.

Results: Between 2005-2011 there were 29,801 trauma admissions, and 1412 (4.7%) patients sustained blunt liver injury. 244 (17%) injuries were AAST grade IV or V, of which 206 patients survived to leave the ED. The pre-DCR group (2005-2008) was comprised of 108 patients whereas the DCR group (2009-2011) had 98 patients. The groups were not different in demographics, prehospital and ED vital signs or ISS. The DCR cohort had an increase in successful non-operative management (54 to 74%, $p<0.01$) as well as a reduction in initial 24-hour PRBC (mean, 12 to 5 units, $p<0.01$), plasma (mean, 12 to 6 units, $p<0.02$) and crystalloids (mean, 7161 to 4565 ml, $p<0.01$) administration. DCR also resulted in improved survival (73% to 94%, $p<0.01$).

Conclusion: In patients with severe blunt liver injury, DCR was associated with less blood product use, a higher successful non-operative management rate and improved survival.

Poster # 89

POSTTRAUMATIC STRESS DISORDER (PTSD) FOLLOWING TRAUMATIC INJURY AT SIX MONTHS: ASSOCIATIONS WITH ALCOHOL USE AND DEPRESSION

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Introduction: Posttraumatic stress disorder (PTSD) is becoming progressively recognized as a psychological morbidity in significant numbers of injured patients. We sought to investigate psychological and behavioral outcomes associated with PTSD following trauma. Participants in a longitudinal outcome study were identified as either PTSD positive or PTSD negative at six months following injury. Risky alcohol use, depression, demographic and injury related variables were explored in each group.

Methods: This prospective cohort study included patients $\geq$ 18 years, admitted to our Level I trauma hospital and voluntarily enrolled in an IRB approved longitudinal outcome study. Baseline measures were obtained using structured interviews with the participants during the initial admission. Follow up data was collected by phone at six months. PTSD was measured using the PTSD Checklist- Civilian Version (PCL-C), risky alcohol use was measured using the Alcohol Use Disorders Identification Test (AUDIT-C), and depression was measured using the Patient Health Questionnaire (PHQ-8). Demographic and injury related variables were also collected.

Results: 118 participants completed measures at baseline and six months were analyzed. 25.4% (n = 30) screened positive for PTSD at six months. There were no significant differences in risky alcohol use between the PTSD positive and PTSD negative groups at six months. However the entire sample showed a significant decline in risky alcohol use at six months (p=.0043). Differences were found in depression among the PTSD positive and PTSD negative group. All PTSD positive participants at six months were also positive for depression (p<.0001). Although there was a 10% increase in the sample from baseline to six months (p = .03), for those participants who were PTSD positive there was a 53% increase in depression from baseline (p = .0002). Statistically significant differences were found between PTSD positive and PTSD negative participants regarding age (40.1 ± 15.9 vs. 50.9±18.2, p = .0047), male (77% vs. 23%, p = .0109), penetrating injury (30% vs. 70%, p <.0001), history of PTSD (83% vs. 17%, p = .0246) or other psychiatric condition (63% vs. 37%, p = <.001).

Conclusion: PTSD was not associated with risky alcohol use at six months. Surprisingly, risky alcohol use declined in both groups. Incidence of PTSD (25.4%, n = 30) and risky alcohol use (25%, n = 29) were equal at six months. All patients with PTSD at six months also scored positive for depression. This research suggests a potential value in screening for PTSD and depression in the trauma population. Further research should explore what factors account for the decrease in risky alcohol use at six months. While the American College of Surgeons-Committee on Trauma requires brief screening and intervention for risky alcohol use due to the societal impact, reinjury rates and cost effectiveness, given the frequency and co-occurrence of risky alcohol use our study suggests that screening for psychological conditions may be equally important.

Poster # 90

UNIVERSITY HEALTHSYSTEM CONSORTIUM EXPECTED MORTALITY OUTPERFORMS TRISS IN THE GERIATRIC TRAUMA POPULATION

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Introduction: The geriatric population, aged 65 and older, is the most rapidly growing segment of the U.S. population, projected to double in the next 20 years. Although this group comprises only 1/10 th of the total population, it accounts for 1/3rd of trauma expenditures and an increasing percentage of trauma admissions. While mortality prediction models have been developed to evaluate trauma care delivery, they have generally not been validated in the geriatric population. One common system, the Trauma and Injury Severity Score (TRISS), utilizes anatomic injury (Injury Severity Score – ISS), physiologic injury (Revised Trauma Score – RTS), and age to estimate risk. This system assigns an age-independent risk to both alterations in GCS and systolic BP below 90 mmHg and does not adjust for comorbidities. A second system, the University Health System Consortium Expected Mortality (UHC-EM), predicts mortality using a proprietary regression model relying heavily on baseline comorbidities and adjusted annually; UHC-EM has never been validated in trauma. We hypothesize that: 1) TRISS would perform less accurately in the geriatric population and 2) UHC-EM would be superior to TRISS in predicting trauma mortality, particularly in geriatric trauma patients.

Methods: We conducted a single-center retrospective analysis of all adult trauma admissions from January 2005 to June 2012 utilizing data collected in real time from our electronic data repository. Geriatric patients were defined as age 65 and older. We selected patients with both TRISS and UHC-EM scores in the data repository for analysis (n = 14,089, geriatric = 1,743, non-geriatric = 12,346). We collected demographic and outcome data and utilized Receiver Operator Curve (ROC) analysis to calculate the area under the curve (AUC) for UHC-EM and TRISS in determining in-hospital mortality for geriatric and non-geriatric trauma patients.

Results: Our trauma observed to expected mortality indices were 0.35 (TRISS) and 0.90 (UHC-EM). Geriatric patients had higher mortality than non-geriatric patients [18.1% (316/1,743) vs. 6.0% (740/12,346), $p < 0.001$ by Fisher's exact test], more ICU days (2.7 [IQR 1.2, 5.4] vs. 1.9 [IQR 0.9, 4.5], $p < 0.001$ by Mann-Whitney U test), and more mechanical ventilation days (3.0 [IQR 2.0, 6.0] vs. 2.0 [IQR 1.0, 5.0], $p < 0.001$). TRISS was less accurate in the geriatric population (ROC-AUC of 0.81 vs. 0.90, $p < 0.05$). UHC-EM out-performed TRISS in both populations (ROC-AUC 0.89 [geriatric] vs. 0.93 [non-geriatric], $p < 0.05$) in predicting mortality, but the difference was higher in geriatric patients (ΔAUC of 0.08 [geriatric] vs. 0.03 [non-geriatric]).

AUC	NON-GERIATRIC	GERIATRIC	ΔAUC
UHC	0.93 [0.92, 0.94]	0.89 [0.87, 0.91]	0.04*
TRISS	0.90 [0.89, 0.91]	0.81 [0.78, 0.84]	0.09*
ΔAUC	0.03*	0.08*	*p < 0.05

Conclusions: UHC-EM is superior to TRISS in predicting mortality in both geriatric and non-geriatric trauma patients, but the difference between UHC-EM and TRISS is accentuated in the elderly. UHC-EM may achieve superiority in geriatric trauma patients by incorporating medical comorbidities that impair the already-diminished physiologic reserve in the geriatric population.

Poster # 91

CAN NON-TRAUMA CENTERS SAFELY PERFORM THE INITIAL MANAGEMENT OF ELDERLY PATIENTS SUSTAINING A GROUND LEVEL FALL?

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Introduction: As the United States population ages trauma centers are more frequently tasked with caring for elderly individuals who have sustained an injury. Ground level falls in the elderly may be associated with severe injuries and have the potential for significant morbidity and even mortality. For this reason, some authors have advocated taking elderly ground level falls directly from the scene to regional trauma centers. We hypothesize that elderly ground level falls can be safely evaluated and initially managed at non-trauma centers and only those patients sustaining injury need to be transferred to trauma centers for definitive care.

Methods: We performed a retrospective study of all elderly (>/= 70 years old) patients who sustained a ground level fall and were admitted to our trauma center from 2005 – 2012. Patients who were transferred from a non-trauma center to our ACS-verified level 1 trauma center were compared to patients who were admitted directly to our trauma center. Transfer patients were compared to non-transfer patients for demographics, admission physiology, as well as injury pattern and severity. The primary outcome was mortality while secondary outcomes included length of stay in the hospital and ICU.

Results: There were 1,066 elderly patients who sustained a ground level fall admitted to our trauma center, 397 (37%) were transferred from a non-trauma center while 660 (63%) were admitted directly to our trauma center. While there was no difference in age (80 years old vs. 80 years old, $p = 0.77$) the transfer patients were more often male (37% vs. 32%, $p = 0.01$) and Caucasian (88% vs. 75%, $p < 0.001$). There was no difference between groups with regards to emergency department physiology including heart rate (81 vs. 83, $p = 0.09$), hypotension (2% vs. 2%, $p = 0.87$), or initial GCS (14 vs. 14, $p = 0.26$). Patients transferred from a non-trauma center had a higher injury severity score (13 vs. 11, $p < 0.001$) and had a higher AIS for the head (2 vs. 1, $p < 0.001$) but lower AIS for extremities (0.7 vs. 1.5, $p < 0.001$) and less often required an orthopedic procedure (13% vs. 33%, $p < 0.001$). Despite a higher injury severity score patients who were transferred from a non-trauma center had a lower mortality (4% vs. 9%, $p = 0.004$) and there was no difference in ICU (1 day) or hospital (5 days) length of stay.

Conclusion: Non-trauma centers can safely perform the evaluation and initial management of elderly ground level falls and subsequently transfer patients with identified injuries to regional trauma centers. Non-trauma centers in the community should be utilized for the initial evaluation, treatment, and stabilization of elderly ground level falls, decompressing trauma centers to care for more severely injured patients.

Poster # 92

THE ASSOCIATION BETWEEN DO NOT RESUSCITATE (DNR) ORDERS AND OUTCOMES IN A PROPENSITY MATCHED TRAUMA POPULATION

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Introduction: The use of Do Not Resuscitate (DNR) orders and outcomes associated with DNR in the trauma setting are not well characterized. The purpose of this study is to compare outcomes related to the presence and timing of a DNR order. We hypothesized that DNR would be associated with worse outcomes, and that patients made DNR in the hospital will have worse outcomes than those with pre-existing DNR status.

Methods: We examined all trauma patients admitted to a level I trauma center between 1/2007 – 9/2012. Propensity score techniques with a caliper distance of 0.0001 were used to match two cohorts: 1) patients with and without a DNR; 2) pre-existing vs. in-house DNR. We matched based on significant differences in the following: age, gender, Charlson Comorbidity Index (CCI), admission service, transfer status, activation status, cause of injury, Injury Severity Score (ISS), ED Glasgow Coma Score (GCS) and ED vital signs [systolic blood pressure, pulse, and respiratory rate]). The following outcomes were examined in the matched populations: death, a major complication, admission to the ICU, and hospital LOS. We examined death, major complications and ICU admission using conditional logistic regression, while LOS was examined using a Wilcoxon signed rank sum test.

Results: There were 10209 patients, of which 1354 (13.3%) had a DNR order; 536 (5.3%) had a pre-existing DNR and 818 (8.5%) had a DNR established in-house. In the overall study population, outcomes were significantly worse for the DNR population compared to those without a DNR, as were outcomes for patients with an in-house DNR compared to those with a pre-existing DNR ($p < 0.05$ for all comparisons). There were significant differences between the DNR and non DNR population, and thus were matched on age, gender, CCI, transfer and activation status, trauma service admission, GCS, and fall injury. The resulting DNR cohort included 2150 well matched patients (1075 DNR patients, or 79.4% of the DNR population). DNR patients had significantly increased odds of mortality, developing a major complication, and admission to the ICU, table 1; there was no difference in hospital LOS with a DNR. There were significant differences between the pre-existing and in-house DNR population, and thus were matched on age, gender, activation status, trauma service admission, GCS, fall injury, and all ED vital signs. The resulting pre-existing vs. in-house cohort included 1058 well matched patients (529 pre-existing DNR patients, or 98.7% of the pre-existing DNR population). A DNR established in-house was significantly associated with increased mortality, developing a major complication, admission to the ICU, as well as increased hospital LOS, table 1.

Table 1. Outcomes by DNR status

Outcome, Odds ratio (95% CI)	DNR vs. no DNR (n=2,150)	*p* value	In-house vs. pre-existing DNR (n=1,058)	*p* value
In-hospital mortality	21.33 (9.4 - 48.4)	< .001	1.67 (1.03 - 2.7)	0.04
Major complication	2.18 (1.5 - 3.2)	< .001	3.15 (1.7 - 5.9)	< .001
ICU admission	1.68 (1.3 - 2.2)	< .001	4.93 (2.8 - 8.8)	< .001
LOS difference, median (IQR)	0.0 (5) days	< .001	1.0 (4) days	< .001

Conclusions: A DNR was highly prevalent in our general trauma population, and was associated with greater mortality, complications, and ICU admission than a matched non DNR population. A DNR established after traumatic injury, compared to a pre-existing DNR, was also associated with worse outcomes. Further research is needed to determine if these findings are related to an in-house DNR being a marker of poor outcome, or if patients with a DNR are treated less aggressively, leading to more complications and higher mortality.

Poster # 93

FULL COMPLIANCE WITH THE BRAIN TRAUMA FOUNDATION TBI GUIDELINES IS NOT NECESSARY FOR MORTALITY IMPROVEMENT

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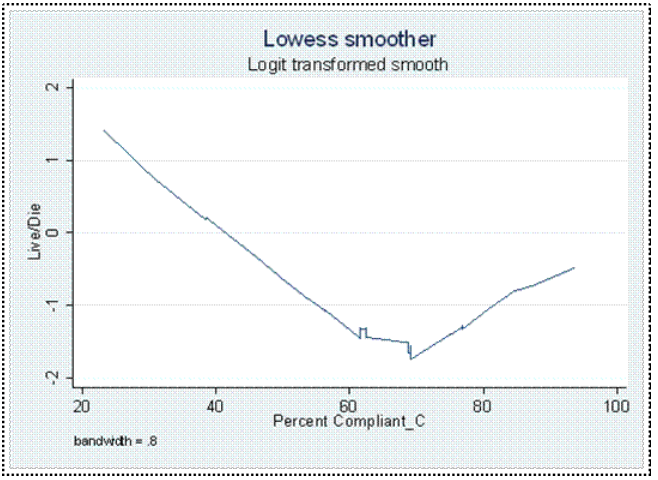
Introduction: Clear, evidence-based guidelines for the care of the severe traumatic brain injury have been available from the Brain Trauma Foundation since 1995. To date, there are 15 recommendations that make up the guideline. Although individually validated, there has been no examination of the effect of strict adherence to the *entire* guideline. We examined the rate of compliance and their impact on mortality.

Methods: In a Pennsylvania-verified mature Level II trauma center, patients with an admission Glasgow Coma Scale (GCS)≤8 from 2007-2012 were queried from the trauma registry. Exclusion criteria included: patients who died in ≤24hours, transferred to a pediatric trauma center, and/or no abnormal findings on head CT scan. Strict adherence to the Brain Trauma Foundation's guidelines (BTFG) was determined in a binary fashion (Yes/No). We then calculated each patient's percent compliance with total number of guidelines. Univariate logistic regression was used to find significant predictors of mortality, including percent compliance with BTFG. Significant factors were added to a multivariate logistic regression model. We looked at the mortality rates across the spectrum of percent compliance. We defined significance as $p \leq 0.05$.

Results:We had a total of 185 patients that met our inclusion criteria. The percent compliance ranged from 23.1% to 93.8%, with a mean of 66.03%. Following adjustment for age and Injury Severity Score (ISS), patients with a compliance rate of ≤60% suffered a 2.81 higher odds of mortality (OR 2.81; 95% CI 1.25-6.33; p=0.013). When the rate of mortality was compared across the spectrum of compliance, the odds of mortality decreased as compliance increased until around 70%.



Conclusion: Full compliance with all 15 TBI guidelines can be difficult to achieve. We have demonstrated a linear relationship between increased compliance and decreased mortality. However, the survival benefit reverses once 70% adherence is reached, suggesting that certain subset of TBI patients will die despite best available trauma care.

Poster # 94

RISKS FACTORS FOR COMPLICATIONS AFTER ESOPHAGEAL REPAIR IN PATIENTS WITH PENETRATING CERVICAL TRAUMA

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Introduction: Penetrating esophageal trauma (PET) is associated with a high incidence of complications and death. Complications after esophageal repair may result in severely compromised quality of life and prolonged hospital course with increased medical costs. We aimed to identify predisposing risk factors for complications of esophageal repair associated with penetrating neck trauma.

Methods: We performed a retrospective review of cervical PET patients treated in a Level I Trauma Center from 1999 to 2012. Subjects who died during the first 24 hours were excluded. A model to identify potential risk factors of esophageal repair complications was developed by univariate and multivariate logistic regression analysis. Additional models were constructed to further analyze the identified risk factors.

Results: One hundred and three PET patients were surgically treated; five died during the first 24 hours. Of the remaining 98, 83.7% were male, and 54.1% suffered stab wounds. Median age was 25 years old (IQR 20-28). Median RTS was 7.11 (IQR 7.08-7.84) and median ISS was 16 (IQR 16-36). Esophageal repair complications occurred in 33.7% of the patients. Infectious complications occurred in 29.6%, fistula in 16.3%, and stenosis in 2%. Overall mortality was 12.2%. Multivariate logistic regression analysis found a preoperative interval of $\leq$ 6 hours (OR 5.29, $p<0.01$), saliva present in the traumatic wound (OR 4.10, $p=0.05$), concomitant tracheal injury (OR 3.56, $p=0.04$), and need to perform an esophagostomy (OR 4.99. $p=0.03$) as independent risk factors for esophageal repair complications. A second model was constructed to explain the $\leq$6 hour preoperative interval identified hypotension (OR 4.11, $p=0.02$), dyspnea (OR 6.4, $p=0.14$), and saliva in the traumatic wound (OR 3.0, $p=0.14$) as associated variables.

Conclusion: In our patient population, early surgical intervention is dictated by the presence of hypotension, dyspnea, and saliva in the wound on initial presentation. Primary esophageal repair performed within six hours or less, dyspnea, presence of saliva in the traumatic wound, concomitant tracheal lesion, and need for esophagostomy were all risk factors associated with a high incidence of complications after esophageal repair.

Poster # 95

A MODIFIED KAMPALA TRAUMA SCORE (KTS) OUTPERFORMS THE INJURY SEVERITY SCORE (ISS) IN TRAUMA MORTALITY PREDICTION IN A DEVELOPED SETTING

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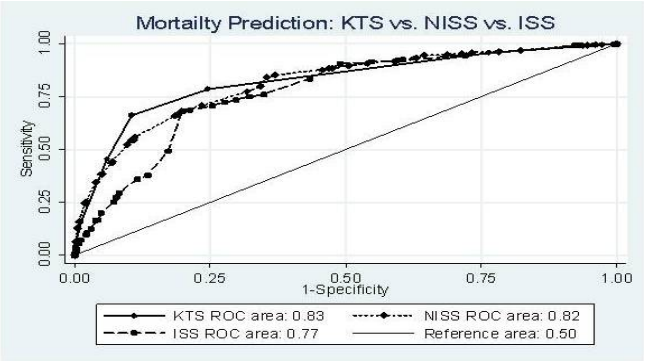
Introduction: Historically, mortality prediction in large trauma studies has relied upon anatomy-based injury severity scoring tools. This study sought to examine whether a simple injury severity scoring system developed for use in low-income settings, which includes the use of physiologic data, performs as well as anatomic injury scores in mortality prediction in a developed setting.

Methods: Using patient-level data collected at 18 Level I trauma centers and 51 non-trauma center hospitals in the US, the anatomy-based Injury Severity Score (ISS) and New Injury Severity Score (NISS) were calculated, as were scores based on a modified version of the physiology-based Kampala Trauma Score (KTS). The dataset did not have consistently reliable data on presenting respiratory rate, therefore, a modified KTS, which excluded respiratory rate, was calculated. Receiver Operating Characteristic (ROC) curves examined predictive ability of the modified KTS compared with the ISS and NISS.

Results: A total of 5,043 injured individuals were included in the study. In this sample, the modified KTS outperformed the ISS (AUC=0.83, 95% CI 0.81-0.84 vs. 0.77, 95% CI 0.76-0.79, respectively) and demonstrated similar predictive ability compared with the NISS (AUC=0.83, 95% CI 0.81-0.84 vs. 0.82, 95% CI 0.80-0.83, respectively).

Conclusion: The modified KTS, which is calculated using data readily available at patient presentation, may represent a useful tool for clinicians assessing trauma mortality risk in real-time, as well as for researchers examining administrative data, when physiologic measures are available. Further examination of the KTS in developed settings is warranted.



Poster # 96

Hospital Outcomes of Patients Receiving Pre-Hospital Cardiopulmonary Resuscitation for Pulseless Electrical Activity After Trauma

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Introduction: While the American College of Surgeons Committee on Trauma does not currently consider injured patients who require pre-hospital cardiopulmonary resuscitation (CPR) for pulseless electrical activity (PEA) to be “dead-on-arrival" to the emergency department, the outcomes of such patients has not been extensively described.

Methods: Retrospective analysis of all patients from a Level I trauma center registry from 2002-2011 who received pre-hospital CPR. Composite hospital survival/organ donation rates stratified by injury mechanism and presence/absence of pre-hospital PEA were assessed. Pediatric patients, inter-hospital transfers, patients suffering burns or drowning, and patients suffering medical arrest prior to injury were excluded from analysis.

Results: 113 patients were admitted to the emergency department after undergoing CPR. The pre-hospital rhythm was reported for 100 of these patients (62 with PEA, 38 without PEA). Basic characteristics and composite hospital survival/organ donation rates for these patients are shown in the Table:

	Blunt Mechanism		Penetrating Mechanism	
	No PEA	PEA	No PEA	PEA
Number of Patients	20	27	18	35
Age (Mean ± SD)	39 ±17 years	47 ± 19 years	32 ± 15 years	34 ± 15 years
Male Gender	5 (25%)	5 (19%)	2 (11%)	4 (11%)
Duration Pre-Hospital CPR (Median, IQR)	16.5 (5-25)	17 (10-30)	12.5 (10-20)	13 (5-20)
ED Thoracotomy	0 (0%)	1 (4%)	5 (28%)	12 (34%)
Survival or Organ Donation	0 (0%)	2 (7%)	0 (0%)	3 (9%)

Conclusions: Combined hospital survival/organ donation rates are not negligible in patients who require pre-hospital CPR for PEA after injury. These findings provide support for the current practice of classifying such patients as alive on Emergency Department admission after blunt or penetrating trauma.

Poster # 97

OUTCOMES FOLLOWING CENTRAL CORD SYNDROME: WHO WALKS?

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Introduction:
Acute traumatic central cord syndrome (ATCSS) is the most common form of incomplete spinal cord injury. The purpose of this study was to identify factors that may affect functional outcomes following ATCCS. The research question was: What clinical characteristics predict disposition after ATCSS?

Methods:
The trauma registry identified all patients admitted for blunt spinal cord injury at our 800 bed, level 1 urban hospital from January 2001 to December 2012. A retrospective review of the medical records of patients who were treated for spinal cord injury was performed and patients having ATCSS were identified from this group. Data collected included age, gender, injury severity score (ISS), admission systolic blood pressure (SBP), admission heart rate (HR), and mechanism of injury (MOI). Information on initial hematocrit, type of treatment; operative or non-operative, location of injury, hospital length of stay (HLOS), disposition, and independence at discharge were also recorded. Logistic regression analysis was conducted to identify probability of disposition. Variables in the equation included age, ISS and admission SBP. A P value of 0.05 was considered significant.

Results:
There were 328 patients with traumatic spinal cord injury of which 57 had ACTSS. Most of the patients were male (78.9%) with a mean age of 57±14 and an average ISS of 19±6. The most common MOI was fall 62%, followed by motor vehicle related 31%, and other 5%. The average GCS on admission was 15±2, average initial hematocrit was 39±4 and mean HLOS was 15±16 days. Overall hospital mortality was 4% (2). Of the 96% (55) of patients surviving to discharge, the majority (59%) was discharged to a rehabilitation facility and 26% were discharged to home. Initial SBP was significantly higher (P = 0.01) (143.4±28) in patients who were independent at discharge as compared to patients who were dependent (121.9±31.1). Patients discharged to home and who were independent for feeding and locomotion had ISS that was significantly lower (P=0.04), (OR: 1.3 95% CI 1, 2). Age and mechanism of injury were not significant predictors of outcome.

Conclusion:
ACTSS is a life altering injury that can be devastating for families and patients. Maintaining an elevated SBP in the peri-injury period has been common practice in maximizing outcome. Admission SBP appears to be an important factor and a predictor of functional independence and patient's ability to return to home. Further studies are indicated to explore this critical issue.

Poster # 98

PREHOSPITAL BLIND INSERTION AIRWAY DEVICE FOR AIRWAY MANAGEMENT OF BLUNT TRAUMA PATIENTS WITH SEVERE TRAUMATIC BRAIN INJURY: NOT AS GOOD AS WE MIGHT THINK

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Introduction: There is evidence that prehospital endotracheal intubation is associated with increased mortality for blunt trauma patients with severe traumatic brain injury (TBI). Subsequently, most patients with severe TBI are now managed prehospital with noninvasive airway maneuvers. For a variety of reasons, some blunt severe TBI patients still require more advanced airway interventions in the prehospital setting prior to arrival at a trauma center. Endotracheal intubation remains the standard for definitive airway management in trauma patients. However, some prehospital agencies have transitioned to using a blind insertion airway device (BIAD) as an alternative to endotracheal intubation. We hypothesize that prehospital BIAD is not acceptable as an alternative to prehospital endotracheal intubation for blunt trauma patients with severe TBI. The purpose of this study was to analyze blunt trauma patients with severe TBI and compare outcomes in those managed with prehospital BIAD vs. prehospital endotracheal intubation (ET).

Methods: We performed a retrospective review (2006 – 2011) of all blunt trauma patients with a prehospital GCS $\leq$ 8 who were admitted to our urban, level 1 trauma center. Patients were divided into two groups based on prehospital airway management: ET vs. BIAD (all patients with prehospital BIAD subsequently underwent ET upon arrival to our emergency department). The primary outcome was mortality.

Results: There were 710 blunt trauma patients with a prehospital GCS $\leq$ 8 admitted to our trauma center (40 years old, 60% Caucasian, 74% male gender, prehospital GCS = 4, ISS = 31). A total of 334 (47%) patients were managed prehospital by noninvasive airway maneuvers and were excluded, while 275 (39%) underwent ET and 101 (14%) underwent BIAD. When comparing the ET and BIAD groups there was no difference in admission demographics but the BIAD group had a slightly higher ISS (35 vs. 32, $p = 0.04$). Mortality was higher for patients managed with BIAD (63%) vs. ET (45%), $p = 0.002$. When controlling for all other variables using logistic regression, prehospital BIAD was an independent risk factor for mortality (Odds Ratio = 2.2, $p = 0.02$) while ET was not (Odds Ratio = 1.4, $p = 0.29$).

Conclusion: When compared with endotracheal intubation, the use of prehospital BIAD in blunt trauma patients with severe TBI is associated with increased mortality and prehospital BIAD is an independent risk factor for mortality. BIAD may not be an acceptable alternative to endotracheal intubation for this patient population. Further studies are needed to identify the ideal method of prehospital airway management for blunt trauma patients with severe TBI who cannot be managed by noninvasive airway maneuvers.

Poster # 99

AERODIGESTIVE DYSFUNCTION IN HIGH CERVICAL SPINE FRACTURES IS ACCENTUATED BY THE NEED FOR SURGICAL INTERVENTION

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Introduction: Cervical spine fractures are a common injury in the elderly, ground-level-fall population. These injuries are treated with cervical immobilization with or without surgical fusion. Despite an intact spinal cord, these injuries are frequently associated aspiration pneumonia. Herein, we attempt to discern the etiology of this complication as related to dysphagia and its association with operative intervention

Methods: A retrospective review of all isolated C1 & C2 vertebral column fractures without spinal cord injury during a five year period, at an urban level 1 trauma center and regional model spinal cord injury center was performed. Patient demographics along with operative procedures, speech evaluations, and the incidence of pneumonia and need for tracheostomy were reviewed

Results: 277 patients met inclusion criteria with 44% being male and a mean age of 73.9 years. There were no differences in age, mean ISS, Charlson Comorbidity Score, or mortality between those patients treated with and without surgical intervention. Patients managed operatively had significantly higher rates of dysphagia requiring an altered diet (36.2% vs. 24.4%, $p<0.04$), need for mechanical ventilation and tracheostomy (17.1% vs. 2.9%, $p<0.0001$), pneumonia (6.7% vs. 1.7%, $p<0.04$), length of stay in days (15.0 vs. 6.3, $p<0.0001$), and discharge to a location other than home (76.2% vs. 47.1%, $p<0.0001$) when compared to patients managed without operative intervention.

Conclusion: Isolated cervical spine fractures at C1 and C2 without neurologic spinal cord injury are associated with significant morbidity. The application of operative intervention significantly increases morbidity despite similar demographics and preinjury comorbidity. Further study is needed to determine whether the increased mobidity is related to more severe cervical injuries or to the surgical manipulation itself.

Poster # 100

EARLY TRACHESOTOMY FOLLOWING ANTERIOR CERVICAL FIXATION

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Introduction: Patients with cervical spine injuries often require prolonged ventilator support with tracheostomy, especially when associated with spinal cord injury. Traditionally tracheostomy has been delayed after anterior cervical fusion (ACF) for concerns regarding surgical site infection (SSI). With the advent of percutaneous tracheostomy (PDT) many centers have begun earlier tracheostomy folowing ACF. We compared the effect of timing of PDT on in hospital outcomes in the largest population reported to date.

Methods: We performed retrospective review of all patients with anterior cervical fixation receiving a PDT during a ten year period. The study site is a Level I trauma center with a regional model spinal cord injury center. Outcome variables included the infectious complications, ICU length of stay (LOS) and hospital LOS. Patients were dicotomized into early versus late PDT based on a cut off of 6 days from the time of ACF to PDT.

Results:Two Hundred and seventy nine patients underwent ACF, of which 65 had a PDT. We excluded 7 patients who had a PDT before ACF and 4 who had missing data elements, resulting in a study population of 54 patients. Thirty-one patients had early PDT while 23 had late PDT. Patients were well matched for age, gender, GCS on admission, injury severity score, level of cervical vertebral fracture and Charlson comorbidity index. Patients with late PDT higher rates of atelectasis (26% vs 3.2%, p=0.03) and trends of highr rates of pnemonia (61% vs 39%, p=0.16) and sepsis (56% vs 26%, p=0.08) . Hospital LOS as well as ICU LOS was shorter with early PDT (26.3 vs 33.3 days, p=0.04 and 17.2 vs 23 days, p=0.02, respectively). No patient had a cervical SSI in either group.

Conclusion: In the largest population reported to date, early PDT within 6 days of ACF is associated with reduced hospital and ICU LOS as well as morbidity without an increased risk of SSI. A larger prospective study would aid in establishing the optimal timing for PDT in patients following ACF.

Poster # 101

Expanding Current Guidelines for CT Angiography for Detection of Blunt Cerebrovascular Injury

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Introduction:Early detection and treatment of blunt cerebrovascular injuries (BCVIs) has reduced the number of injury-related neurologic sequelae. Broadening of the screening criteria has recently been advocated; however this may subject patients to unnecessary tests and treatment. We adopted a broad CT angiogram-based BCVI screening algorithm in 2007 based on multiple published indications. The goal of this study was to evaluate current guidelines with recently published national guidelines to identify which criteria result in the highest detection of BCVI.

Methods:From January 1, 2007 to December 31, 2010, we prospectively evaluated patients utilizing a screening algorithm for BCVI based on multiple literature recommendations. CTAs were helically acquired at 1.25mm slice thickness on 64-detector row CT scanners. Results were analyzed using a fisher test to determine correlations between clinical presentations and imaging results. IRB approval was obtained for this study. Our findings were then compared to existing published guidelines.

Results:There were 422 patients that met criteria to receive CTA to assess for BCVI. 48 patients were found to have +CTA for BCVI (Grade 1 = 24, Grade 2 = 16, Grade 3 = 6, Grade 4 = 10, Grade 5 = 2) resulting in an incidence of 11.3%. Cervical spine fracture was present in 35/48 (73%), basilar skull fracture was present in 10/48 (21%), and neurological deficit was present in 11/48 (23%). Cervical spine fracture and basilar skull fracture was statistically correlated with BCVI ($p=0.04$). Neurological deficit was also correlated with BCVI ($p<0.001$). We had 7/35 (20%) patients with cervical spine fractures and BCVI that met our screening criteria but would have been missed utilizing other national published guidelines. None of the 48 patients who presented with BCVI had related infarct seen on head CT or seat belt abrasions of the neck.

Conclusion: The 11.3% incidence of BCVI found utilizing our broad screening protocol is much higher than previously reported. Additionally, we found 7/35 (20%) patients with cervical spine fractures and BCVI that would have been missed with the new recommendations. Our data supports increased risk stratification and shows that blunt cerebrovascular injury is correlated with cervical spinal fracture, basilar skull fracture and neurological deficit. We recommend CTA be performed on patients with any cervical spine fracture, in addition to the current recommendations.

Poster # 102

RISK FACTORS UPPER EXTREMITY VENOUS THROMBOSIS

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Introduction: Numerous studies on lower extremity deep venous thrombosis (LEDVT) have shown significant morbidity and mortality mandating routine preventive measures and prophylaxis. Recommendations on prophylaxis or treatment of upper extremity deep venous thrombosis (UEDVT) are difficult to make because of the limited data on trauma patients. The purpose of this study was to identify risk factors for development of UEDVT and make recommendations on surveillance, prophylaxis and treatment in trauma patients.

Methods: Records of trauma patients admitted to a Level 1 Trauma Center over a three-year period were reviewed. Patients with an upper extremity ultrasound (UEUS) positive for thrombosis were identified from the trauma registry. Only patients with thrombosis in the brachial, axillary or subclavian veins were included. UEUS is done selectively on our trauma service. Patient demographics, prophylactic anticoagulation, Injury Severity Score (ISS), type of central access and incidence of pulmonary embolism were abstracted.

Results: There were 6,605 trauma admissions during the study period. Of these trauma admissions, 384 patients received an upper extremity ultrasound. 56 of the 384 patients (14.6%) were positive for an UEDVT. Of the patients with UEDVT, 39 (69.6%) were men and 17 (30.4%) were female; not significantly different from the general trauma population. The mean age for patients with a DVT was 60±21.1. The mean age for patients with a negative DVT exam was 56.47±21.0 years (p = .29). Twenty-seven patients with a UEDVT were symptomatic (including edema, erythema, and/or pain). Of the 56 patients with a DVT, 42 (75%) patient did not receive prophylactic anticoagulation due to a documented contraindication. Patients with a DVT had an average ISS score of 22.54±8.9. In comparison, trauma patients without a DVT had an average ISS score of 18.88±10.1 (p = 0.012). Fifty patients with a DVT had a peripherally inserted central catheter (PICC), 2 had subclavian or jugular central line, two had neither and two patients had both. On average, an UEDVT was found 7.8 days after a PICC line was placed. Pulmonary embolism was identified in two patients with an UEDVT.

Conclusion: High ISS and presence of a PICC line were found to be risk factors for an UEDVT. Age did not appear to have a strong impact. Pharmacologic prophylaxis decreases the risk of UEDVT and should be given in the absence of a contraindication. Upper extremity duplex ultrasounds should be considered for screening trauma ICU patients due to the frequent absence of symptoms in UEDVT. If central access is required, central lines should be used in place of PICC lines due to their propensity to cause UEDVTs.

Poster # 103

NOVEL PREHOSPITAL MONITOR WITH INJURY ACUITY ALGORITHM TO IDENTIFY PATIENTS WHO REQUIRE LIFE SAVING INTERVENTION

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Introduction: The greatest opportunity for reducing military trauma mortality involves detection and treatment of life-threatening conditions in austere prehospital conditions. A miniature wireless vital signs monitor (MWVSM) has been designed according to the logistic requirements of the United States Special Operations Command. It incorporates a proprietary injury acuity algorithm termed the Murphy Factor (MF), which is a summary alarm based on vital signs and time trends. We test the hypothesis that the MF can identify trauma patients who require a life saving intervention (LSI).

Methods: From December 2011 to date, a prospective trial is being conducted in collaboration with prehospital providers. The MWVSM (mini-Medic, www.athenagtx.com) detects skin temperature, pulse oximetry (SpO_2), heart rate (HR), pulse wave transit time (PWTT), and MF. LSIs included: intubation, tube thoracostomy, central line insertion, blood product transfusion, and operative intervention. Prehospital data and MF from a MWVSM were compared to vital signs (SpO_2, systolic blood pressure (SBP), and HR) from a conventional monitor. Sensitivity (Se), specificity (Sp), negative predictive value (NPV), positive predictive value (PPV), and area under the receiver operating characteristic curve (AUC) were calculated.

Results: 86 patients suffered predominantly blunt trauma (n=72, 84%), were mostly male (n=72, 84%), age 47±19 yrs, and ISS 10(12). Those who received a LSI (n=40) had similar demographics, but higher ISS (15 vs 5) and mortality (21% vs 0%) (all $p<0.05$). MF > 3 during transport was superior to vital signs alone or in combination for identifying need for LSI.

	Se	Sp	NPV	PPV	AUC	p=
HR>100	31	79	74	55	0.549	0.536
SBP<90	12	98	59	80	0.546	0.558
SpO_2<95	14	98	57	83	0.526	0.747
HR>100 or SBP<90 or SpO_2<95	49	76	64	63	0.616	0.142
MF>3	41	88	62	75	0.665	0.038

Conclusion: An injury acuity algorithm has the potential to identify prehospital trauma patients who need a LSI, and is superior to conventional vital signs. New technology combined with algorithms that include trends over time may have the ability to improve prehospital care for both civilian and military populations.

Poster # 104

1:1:1 -A MATTER OF LIFE AND DEATH

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Introduction: The appropriate ratio of blood (pRBCs), fresh frozen plasma (FFP) and platelets (Plts) that optimizes resuscitation of critically injured patients who require a massive transfusion protocol (MTP) remains to be determined. Evidence from the military conflicts in Iraq and Afghanistan indicates that a ratio of 1:1:1 offers the greatest chance of survival in combat casualties but application of this approach to civilian trauma management is only now evolving. We hypothesize that deviation from a 1:1:1 ratio of blood products negatively impacts survival.

Methods: A retrospective cohort study of all trauma patients treated at our urban Level I Trauma Center between late 2008 and 2012 who required an MTP ($\geq$ 10 units pRBC/24 hrs) was conducted. Data on amount of blood products given, mechanism of injury, injury severity score (ISS), patient outcomes and demographic data were collected. We defined a new variable, the average normalized ratio (ANR), that incorporates the relative number of transfused units of pRBCs, FFP, and Plts normalized for Plts transfused. ANR was calculated as follows: [((6*6pack platelets)/pRBC) + ((6*6pack platelets)/FFP) +(6*6pack platelets)/ (6*6pack platelets)]/3. A precise 1:1:1 transfusion ratio resulted in an ANR equal to 1. An ANR was determined for each MTP recipient. Very few patients received an exact 1:1:1 ratio (ANR=1) so the reference group was expanded to include an ANR >0.9 and <1.1. The ANR was then categorized into 0.2 deviations higher or lower than the reference ANR. Logistic regression was used to determine the odds of death associated with incremental ANR deviation from the reference group.

Results: One hundred thirty-seven patients received massive transfusions during the study period and 42.3% survived (n=58). One patient received no Plts or FFP transfusions and was excluded. Patients who died received a significantly greater percentage of pRBCs (units packed red cells/total units received) than patients who survived (51.3% vs 41.0%; p<0.00001). Death was also associated with a significantly lower percentage of FFP units (28.5% vs 32.2%; p= 0.004) and Plts (20.1% v 26.8%; p = 0.001) in relation to total units of blood products received. Logistic regression demonstrated increased odds of death with increasing deviation from the reference ANR range, after adjusting for ISS.

Odds of death associated with ANR, among massive transfusion patients, 2008-2012 (adjusted for ISS)

Deviation <0.1 from ANR=1	(n)	OR	95% CI
None (reference)	22	1.0	
0.1 - < 0.3 deviation	63	2.6	0.9, 7.8
0.3 - < 0.5 deviation	38	5.9	1.8, 19.4
>0.5 deviation	13	27.0	2.8, 258.7

Conclusion: ANR represents an easily calculated parameter that quantitates the mix of blood products transfused. Data from this study suggest that a <0.1 deviation from the reference ANR did not alter patient survival but subsequent deviations were associated with a significant increased risk of death after adjusting for ISS. Our results are consistent with recent military experience and support the use of blood product replacement that best approximates a 1:1:1 ratio. Use of ANR and its predictive characteristics will require additional studies for validation.

Poster # 105

HOW HIGH CAN YOU GET? THE IMPACT OF INVERSE RATIO RESUSCITATION IN DAMAGE CONTROL LAPAROTOMY

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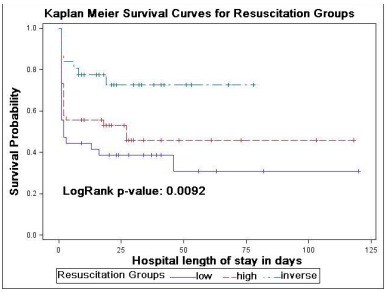
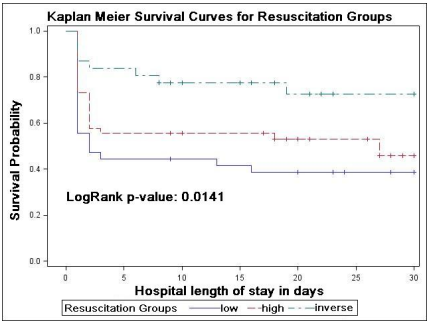
Introduction: In patients with severe hemorrhage, high (1:1-1:2) FFP:PRBC ratio has been widely accepted. Although evidence exists that lower ratios convey similar survival advantages to high ratio resuscitation, no single study has compared them to an inverse ratio FFP:PRBC >1:1. We hypothesize that an inverse ratio (>1:1) when compared to high and low ratios will convey a survival benefit.

Methods: This is a 53-month retrospective analysis of all intra-abdominal injuries requiring damage control laparotomy (DCL). Resuscitation groups by FFP:PRBC ratios: inverse (>1:1), high (1:1-1:2), and low (<1:2). Patients with ≥10 units PRBC were evaluated in each resuscitation group. Survivability Kaplan-Meier (KM) curves were generated.

Results: 113 patients had injuries requiring DCL (low, n=36; high, n=45; inverse, n=32). No difference was noted in patient demographics between groups. As seen in overall and 30-day KM curves, inverse ratio resuscitation conveyed a survival benefit. A dose-dependent survival benefit was noted when controlling for inverse ratios at the 6-hr interval, OR (CI 95%): low 5.0 (1.4-17.3), high 2.3 (0.7-7.9); and at the 24-hr interval: low 5.6 (1.6-19.3), high 2.5 (0.7-8.8).

Conclusion: To our knowledge this is the first study that specifically looks at survival outcomes in DCL patients with severe hemorrhage using inverse FFP:PRBC ratios. Inverse ratio resuscitation showed improved overall and dose-dependent survival when compared to high and low ratio resuscitation.





Poster # 106

DO ALL TRAUMA PATIENTS BENEFIT FROM TRANEXAMIC ACID? THE EXPERIENCE OF AN URBAN LEVEL 1 TRAUMA CENTER

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Introduction: There is strong evidence that Tranexamic Acid (TXA) reduces mortality in hemorrhaging civilian and military trauma patients. However, there are wide variations in transport time, availability of fluids and blood products between battlefield and urban settings and between developed and developing countries. We test the hypothesis that TXA reduces mortality in patients requiring emergency operative intervention (OR) after trauma at a level 1 urban center.

Methods: From 7/09 to 1/13, 778 consecutive patients who required emergent OR after trauma were entered into a registry and retrospectively reviewed. 104 of the sickest patients received TXA, which was administered within 3 hrs (1 g bolus then 1 g over 8 hrs). These patients were matched to controls using propensity scores based on age, shock class, and revised trauma score. Statistical analysis was then performed with parametric or non-parametric tests, as appropriate.

Results: 208 total patients were analyzed. Median age was 37, 81% male, 62% penetrating, 77% laparotomy, 23% thoracotomy, 86% received PRBC transfusions, 15% TBI and 27% mortality. Age, ISS, mechanism and admission vital signs and lab values were similar between groups. Data were similar in the OR and at 24hr.

OR data median or mean	ISS	ER time min	IVF ml	EBL ml	pRBC ml	FFP ml	LOS days	mortality %
NoTxA(n=104)	29±17	26	3443	800	750	0	12	25
TxA (n=104)	27±16	23	4450	1500	2125	1250	12	28
p=	0.566	0.275	0.016	0.020	<0.001	<0.001	0.529	0.667

Conclusion: In trauma patients requiring emergency OR in an urban level 1 trauma center, TXA did not reduce mortality, bleeding, or transfusion requirements. Prospective studies are needed to identify subsets such as these who may not benefit from TXA.

Poster # 107

OXIDATIVE AND INFLAMMATORY RESPONSES IN TISSUES FROM PIGS SUBJECTED TO HEMORRHAGE AND AORTIC BALLOON OCCLUSION

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Introduction: Uncontrolled intracavitary bleeding remains a leading cause of potentially survivable deaths in both military and civilian trauma. Recent evidence and improved surgical techniques suggest that resuscitative endovascular balloon occlusion of the aorta (REBOA) may be a viable means to manage the hemorrhage and improve survival in these patients. The present study further characterized the responses to 30 or 90 min REBOA in a swine hemorrhage model.

Methods: Swine (n=6/gp) were subjected to ~ 24 ml/kg hemorrhage for 30 or 90 min of shock (no treatment) or with REBOA. Animals were then resuscitated with shed blood and additional fluids or vasopressors as needed to maintain MAP to 60 mmHg. After 48 hr, pigs were euthanized and lung, heart, kidney and brain were frozen and stored at -80^{o}C for analysis of indices of oxidative stress (thiobarbituric acid reactive substances (TBARS), antioxidant status (total antioxidants, glutathione (GSH), antioxidant enzymes) and cytokines (IL-1β, IL-6, IL-10).

Results: Hemorrhage reduced central aortic pressure (CAP) to < 40 mmHg and REBOA improved CAP in both groups and cerebral oxygenation in the 90 min group. No significant differences were observed between groups in any of the indices of oxidant stress, antioxidants or cytokines after 30 min shock/REBOA. In lung and kidney from the 90 min groups, TBARS were about 20% lower in REBOA than shock group and GSH levels were better preserved in the lung REBOA group. No significant differences were observed in xanthine oxidase, catalase, NADH or total antioxidants in any tissue from both 90 min groups. Of the cytokines, only IL-1β and IL-6 were significantly lower in the 90 min REBOA group than the 90 min shock group.

Conclusion: These data suggest that REBOA for 90 min followed by resuscitation did not appear to induce any persistent inflammatory responses after 48 hr in this swine hemorrhage model, indicating that the procedure is relatively safe. Additional studies are required to establish the safety limits of this procedure and determine whether it can improve outcomes in severely injured trauma patients.

Poster # 108

COLLOID AND A HIGH FFP/RBC RESUSCITATION DO NOT REDUCE POSTOPERATIVE FLUID NEEDS

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Introduction: Recent data (AAST 2012) suggest that the combination of colloid and a high FFP/RBC resuscitation will reduce postoperative fluid uptake. This was assessed by comparing a high (>0.35) versus a low (<0.35) FFP/RBC resuscitation in both arms of a prospective randomized study of albumin (A) versus no albumin (NA) resuscitation for shock requiring massive transfusion.

Methods: A retrospective review of a prospective randomized data base of 96 patients requiring an average of 13.8 RBC, 8.9 L balanced electrolyte solution (BES), 784 ml FFP during OR; 46 patients, by random selection, received 31 gm A. Admission BP (78 torr), pulse (130), and shock time with BP below 80 (32 min), were similar for A and NA. Measurements during the postop fluid uptake phase included serum albumin (SA), plasma volume (PV), BES infusion (L), inulin space (ECF), interstitial space (ECF-PV), and weight gain (kg).

Results: A was associated with a higher SA, IFS, and weight gain (Table). The higher FFP/RBC in A patients was associated with increased IFS and weight gain versus low FFP/RBC in NA patients (Table).

FFP/RBC (ml/u)	26 N/A 24		20 A 26	
	<0.35	>0.35	<0.35	>0.35
SA (gm/dL)	2.9*±0.01	2.9*±0.7	4.2±0.17	4.4±0.2
PV (ml)	1581±238	1496±266	1504±393	1554±111
BES (ml)	8954±567	8364±1422	10350±1493	9264±140
IFS (ml)	11979**±1306	12304±1583	13014±189	13379±101
Wt Gain (kg)	6.5**±0.7	7.0±0.4	7.8±1.3	8.0±1.1

*P<0.05 vs A groups; **P<0.05 vs >0.35/A group

Conclusion: The combination of A plus a high FFP/RBC resuscitation does not prevent post-shock fluid uptake which is a function of the severity of the shock insult. These findings confirm prior work that all colloid enters the IFS increasing IFS expansion and delaying IFS mobilization.

Poster # 109

NOT AS GOOD AS WE THINK WE ARE: TRAUMA ATTENDING GESTALT IS AN UNRELIABLE PREDICTOR OF MASSIVE TRANSFUSION

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Introduction: Early identification and treatment of trauma patients requiring massive transfusion (MT) is associated with reduced mortality. While numerous risk factors have been demonstrated and many predictive scores proposed, there are no universally accepted systems or algorithms to identify these patients. We hypothesized that even among experienced trauma surgeons, the clinical gestalt of identifying patients who will require MT is unreliable.

Methods: The PRospective Observational Multi-center Major Trauma Transfusion (PROMMTT) study was a prospective cohort study evaluating acute resuscitation patterns at ten US level-1 trauma centers from July 2009–October 2010. MT was defined as $\geq$ 10 units within 24 hours of admission. Clinical gestalt assessments were performed during the acute resuscitation. The primary question ("Is this patient likely to receive a MT?") was asked at ten minutes after arrival. Patients were included in the current analysis if a response to this gestalt question was recorded.

Results: Of 1245 patients, 966 met inclusion criteria and 221 (23%) received MT. 415 (43%) were predicted by faculty physicians to receive a MT. Those predicted by gestalt to receive MT were younger, more likely injured from penetrating mechanism, had higher heart rates, and lower systolic blood pressure (all $p < 0.05$). Those predicted to receive MT also had higher ($p<0.001$) 24-hour (17% vs. 6%) and in-hospital mortality (28% vs. 16%). The sensitivity for clinical gestalt was 65% and specificity was 64%. Positive and negative predictive values were 35% and 86%, respectively, with an AUROC of 0.64. There were no significant differences in AUROC between centers ($p=0.711$).

Conclusion: Data from this large, multicenter trial demonstrates that employing clinical gestalt to predict MT is unreliable. Because of the increased mortality associated with delayed therapy, more reliable systems or algorithms are needed to definitively identify and treat these severely injured patients early.

Poster # 110

GENE EXPRESSION OF SELECTED MEMBERS OF THE TOLL-LIKE RECEPTOR (TLR) PATHWAYS AND SUPPRESSOR OF CYTOKINE SIGNALING 3 (SOCS3) CORRELATE WITH MICRORNAs 146a AND 155 IN TRAUMA PATIENTS WITH HEMORRHAGIC SHOCK

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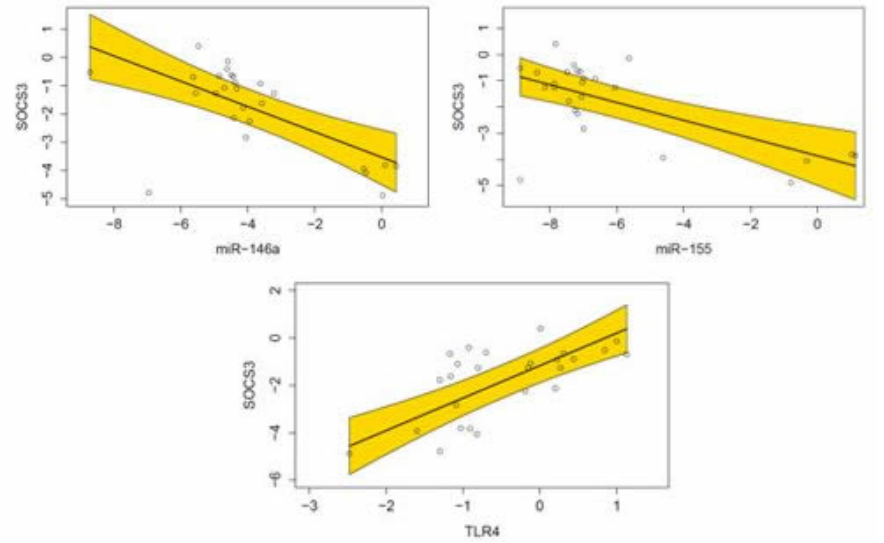
Introduction: Toll-like receptors (TLRs) recognize specific molecular patterns associated with endogenous molecules released from stressed or damaged cells. TLR signaling also requires stringent regulation by suppressor of cytokine signaling 3 (SOCS3) and microRNAs (miRNA) to avoid major detrimental effects to the host. We hypothesized that expression of selected genes and regulators in both the TLR3 and TLR4 pathways following injury and hemorrhagic shock would correlate with clinical parameters.

Methods: Twelve trauma patients in hemorrhagic shock were prospectively enrolled in this IRB-approved study. Peripheral whole blood samples were collected at 0, 12, 24, and 48 hours. Age, ISS, GCS and serial vital signs, pH, BD, crystalloid, blood products, and injury patterns were recorded. Gene expression of SOCS3, STAT3, TLR3, TLR4, MyD88, TRAF6, TICAM1, TRAM1 were measured using custom PCR arrays. miRNA expression was measured by qRT-PCR. Statistical analysis was performed for each possible pair of markers (gene, miRNA, and clinical parameters) using linear mixed models.

Results: Sixteen statistically significant correlations between genes and miRNAs were found changing over time in all patients. SOCS3 gene expression levels correlated directly with TLR4 ($p<0.001$), and indirectly with miRNAs 146a ($p<0.001$) and 155 ($p<0.001$). There were no statistically significant correlations between gene expression levels and any of the clinical parameters. All patients survived to discharge.



Conclusions: The direct correlations between gene expression levels of SOCS3 and TLR4, the indirect correlations between miRNAS 146a and 155 and SOCS3, as well as the correlations between selected members of the TLR pathways are unique findings in trauma patients with hemorrhagic shock. These findings may suggest regulation by miRNAS 146a and 155. Additional studies are needed to elucidate the role of miRNA expression and their potential association with outcome following severe injury.

Poster # 111

MASSIVE TRANSFUSION TRIGGERS AS END POINTS OF RESUSCITATION IN THE MODERN ERA: LEARNING WHEN TO TURN THE MASSIVE TRANSFUSION PROTOCOL OFF

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Introduction: Although progress has been made in ability to identify those most likely to receive a massive transfusion [MT], little work has been done to identify patients who require continued resuscitation at later time points. Prior work has validated individual massive transfusion [MT] triggers obtainable at the time of presentation for prediction of likelihood of MT resulting in a recently proposed MT score [MTS]. We hypothesized that our MTS score would be superior in both prediction of the need for total resuscitation and the need for continued resuscitation at 6 & 12 hours.

Methods: We prospectively enrolled all patients in whom the massive transfusion protocol (MTP) was initiated. Hemodynamic, laboratory, and intervention parameters were determined at defined intervals up to 96 hrs. For each patient, the need for on-going transfusion during a given time interval was defined based upon either an inappropriately low response to transfusion or a hemoglobin decrease of > 1gm/dL if no transfusion was received. Timing and cause of death were utilized to account for survivor bias by grouping early hemorrhagic deaths as needing MT if they died prior to receiving >=10 units of PRBCs within 6 hours or 24 hours, respectfully. Multivariate logistic regression controlling for interaction between variables was utilized to determine independent predictors of outcomes and Receiver Operator Curves were calculated.

Results: A cohort of 228 consecutive MTP activations including 190 trauma and 38 medical/OB patients. 28 day mortality was 37%. Calculated from triggers at initial presentation, a Revised MTS (SBP<90mmHg, BD>=-6, Temp<35.5 C, INR>1.5, Hgb <11g/dL) was superior to the original MTS (including HR>=120bpm, FAST status, mechanism) or the ABC score for determination of MT in trauma patients (TABLE). For those still alive at hour 6 (n=188, 82%), the Revised MTS was highly predictive for future PRBC need (AUC 0.87) in hour 7 to 12 and hours 12 to 24. At hour 6, the model was highly predictive of subsequent 24 hr (AUC 0.97) and 28 day mortality (AUC 0.82). If patients remained with a base deficit >=-6 at hour 6, the RR of death by 24 hours was 7.9 (2.7-23, p=0.0002).

Conclusion: A Revised MTS calculated at time zero is a valid predictor of need for MT. Early end points of resuscitation adopted from the components of the Revised MTS are highly predictive of on-going transfusion needs following hour 6. Failure to normalize these trigger components by hour 6 in the era of 1:1 resuscitation portend a particularly poor prognosis.

Strategy	MT within 6 hrs (AUC)	MT within 24 hrs (AUC)	Independent Predictors of blood product needs at hr 7-12	Adjusted		
				OR	95% CI	p-value
Revised MTS	0.69	0.74	**INR** (for each increase of 0.5 units)	1.5	0.4-5.3	0.50
			SBP (for each 10 mm Hg decrease)	**1.4**	**1.1-1.8**	**0.008**
Original MTS	0.68	0.67	**Hgb** (for each 1g/dL decrease)	**1.8**	**1.3-2.5**	**<0.001**
			Base Deficit (for each 2 unit increase)	**1.3**	**1.0-1.6**	**0.04**
ABC Score	0.58	0.51	**Temperature** (for each 0.5 C decrease)	1.2	1.0-1.6	0.13

Poster # 112

LEAVE NO ONE BEHIND: ANALYSIS OF SEVERELY INJURED PATIENTS WHO RECEIVED DEFINITIVE CARE IN LEVEL 3 AND 4 TRAUMA CENTERS

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Introduction: There has been significant focus on the fate of the patient transferred from a lower level trauma center (LLTC - level 3 or 4) to a higher level of care. However, we know little about severely injured patients who are not transferred. To better understand this population and to inform the development of evidence-based inter-facility transfer criteria, we set out to explore the profile and outcome of this population.

Methods: Retrospective cohort study of adult severely injured (ISS>15) patients cared for in LLTC participating in NTDB (2010-11). Demographic and injury profiles were compared between patients who were transferred to Level 1 or 2 centers and those who received definitive care at LLTC.

Results: We identified 8,356 patients across 151 Level 3 and 305 patients across 40 Level 4 TCs. 8,239 severely injured patients received definitive care at LLTC, with few admissions per center (median 18, IQR 4-59). Elderly patients with falls represented over a third of patients cared for at LLTC (Table). Mortality was 9%, with marked variability across institutions.

	Transferred to Level 1/2	Level 3 (n=151)	Level 4 (n=40)
N (median, IQR)	N/A	26 (6 - 70)	1 (2 - 5)
Age ≥ 65	38%	40%	43%
MVC	38%	41%	36%
Fall	48%	47%	53%
GSW/stab	4%	4%	3%
Other	10%	8%	8%
ISS (median, IQR)	20 (17 – 25)	18 (17 - 25)	17 (16 - 21)
Head AIS ≥ 3	68%	61%	59%
Chest AIS ≥ 3	29%	34%	34%
Abdomen AIS ≥ 3	8%	7%	6%
Lower extremity AIS ≥ 3	11%	10%	11%
Mortality	10%	9%	9%
Time to death (days/median, IQR)	3 (1 – 7)	2.5 (1 - 7)	1 (1 - 3)

Conclusions: LLTC provide definitive care for a significant number of severely injured patients with a unique case-mix. Deaths occur with considerable frequency. These data suggest a potential opportunity to better identify who requires transfer to higher levels of care to reduce potentially preventable deaths.

Poster # 113

THE AGING OF AMERICA: A COMPREHENSIVE LOOK AT OVER 25,000 GERIATRIC TRAUMA ADMISSIONS TO U.S. HOSPITALS

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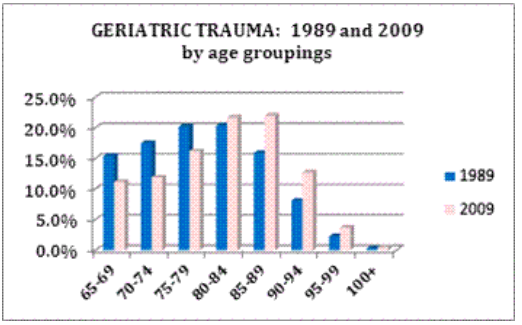
Introduction: A comprehensive report on geriatric trauma by trauma center (TC) status, based on 1989 Medicare data, was last published in 2001. The purpose of this study was to compare 1989 findings with 2009, and to examine recent differences in patient characteristics and outcomes by TC status.

Methods: From 2009 Healthcare Cost and Utilization Project Nationwide Inpatient Sample (HCUP NIS) data, we examined a geographically representative sample (N=25,512) of injured older adults (>/= age 65) admitted to 127 hospitals (Level I [9 hospitals, n=4126], Level II [16, n=6572], Level III/IV [29, n=3849], non-TCs [73, n=10,965]) in 24 states. We examined differences: 1) in age, gender, and mortality between 1989 and 2009; and 2) in 10 patient characteristics and 4 outcomes by TC status.

Results: Higher percentages of patients were in older age groups in 2009 than in 1989, however, mortality declined overall (4.8% vs. 3.4%, $p < .001$), and for all age groups ($p < .001$). Consistent incremental patterns of differences were observed among TC levels ($p < .001$) for all patient characteristics and outcomes. Level I TCs admitted highest percentages of: lower age groups, males, non-white race, motor-vehicle related trauma, intracranial injuries, internal injuries, patients with more than a single injury and highest APR-DRGs. Non-TCs admitted 43% of the sample, and highest percentages of oldest age groups, comorbidities, falls, femur neck fractures, and patients requiring a major OR procedure. Although Level I TCs had higher lengths of stay and total charges, a higher percentage of patients were discharged home as compared to other TC levels and non-TCs.



Conclusion: Despite a growing number of patients in oldest age groups (> 80 years), inpatient mortality declined over 2 decades. Level I TCs are managing patients at highest risk for decompensation and mortality; however, a significant percentage of patients are going to non-TCs. These findings urge the trauma community to organize all-inclusive systems with appropriate resources to support the growing older population.

Poster # 114

EMERGENCY DEPARTMENT TRAUMA SURGERY IMPROVES OUTCOME OF PATIENTS WITH TORSO INJURY AND UNSTABLE VITAL SIGNS

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Introduction: Although patients with severe torso injury should receive surgical intervention in a fully equipped operation room (OR), almost all hospitals in Japan are required to transport patients to the OR via a long corridor. This factor can result in delays in hemorrhage control and potentially increase excess mortality. Therefore, our center has implemented a policy for urgent surgery in the emergency department (ED) when patients with severe torso trauma present with unstable vital sign (UVS).

Methods: This is a retrospective study of patients in which urgent surgical intervention was carried out between January 2007 and December 2012. Patients with cardiac arrest on ED admission were excluded. Demographics, Revised Trauma Score (RTS), Injury Severity Score (ISS), and probability of survival (Ps) were assessed. Surgical intervention was defined as thoracotomy, celiotomy, or retroperitoneal packing, and UVS was defined as RTS <7.84.

Results: Of 194 cases for which urgent surgical intervention for torso trauma was performed, 129 cases had UVS on ED admission. These cases were divided into two groups on the basis of undergoing surgery in the ED (ED group, n=59) or the OR (OR group, n=70). Seventeen cases involved penetration wounds, 76% of patients underwent celiotomy, and 10% received retroperitoneal packing for severe pelvic fracture. Resuscitative thoracotomy was carried out in 37 cases, and damage control surgery was conducted in 40 cases. RTS in the ED group (4.5 ± 2.0) was significantly lower than in the OR group (6.5 ± 1.2) ($p<0.0001$), and ISS was 37.0 ± 15.8 in the ED group vs. 25.1 ± 13.6 in OR group ($p<0.0001$). Nine cases in the ED group (15.3%) had unexpected survival despite Ps score of <0.5.

Conclusion: The present findings suggest that emergency department trauma surgery (EDTS), which can be carried out in less than 10 min, for patients with severe torso trauma, UVS, and ISS >25, might be effective. Although in recent years hospitals have adopted a hybrid ED space with a fully prepared OR, or a trauma resuscitation protocol in the OR that bypasses the ED, hospitals should still consider special layout and facility design. In contrast, the EDTS strategy at our hospital is not dependent on these limitations.

Poster # 115

PREHOSPITAL ABC SCORE ACCURATELY TRIAGES PATEINTS WHO WILL REQUIRE IMMEDIATE RESOURCE UTILIZATION

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Introduction: The Assessment of Blood Consumption (ABC) score has been utilized to identify patients at risk for massive transfusion (MT) immediately after hospital arrival. We recently added FAST capability to our helicopters, allowing for the calculation of a prehospital ABC (pABC) score on all flights. The purpose of this study was to determine if pABC could identify patients that would receive MT or undergo emergent laparotomy.

Methods: Prospective observational study of all trauma patients arriving to our level 1 trauma center by our helicopter and who underwent in-flight FAST exam over a six month period. pABC score was (+) if two or more of the following were present in flight: penetrating trauma, HR >120, SBP <90, or (+) FAST exam. Emergent laparotomy: directly from ED to OR within 2 hours. MT: ≥6 units of RBC in first 6 hours.

Results: 291 trauma patients were reviewed. 28 (9.6%) patients underwent emergent laparotomy and 16 (5.5%) patients received MT. pABC predicted emergent laparotomy with a PPV 43% and NPV of 93% (Sens. 36%, Spec. 95%, AUROC 0.78). pABC predicted receipt of MT with a PPV 35% and NPV of 97% (Sens. 42%, Spec. 94%, AUROC 0.82). Use of pABC of ≥2 to activate the operating room would result in a 57% over-triage and 7% under-triage. Likewise, pABC of ≥2 would result in over-triage of MT protocol activation of 65% with an under-triage of 3%.

Conclusion: Prehospital ABC is an effective early tool for predicting immediate resource utilization of patients after trauma center arrival. Its use in the prehospital setting provides an acceptable over-triage rate and outstanding under-triage rate. In light of these findings, our MT protocol is now activated by pABC ≥2 and we are currently developing a process to mobilize operating room staff and resources based on pABC.

Poster # 116

OUTCOMES AND POTENTIAL IMPACT OF A NEW NETWORK OF TRAUMA CENTERS

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Introduction: Population growth outside of urban areas may leave gaps in the provision of trauma care. We studied the effect of adding new trauma centers in a State with the 3rd fastest growth rate in the US. One existing trauma center and four provisional level 2 trauma centers (TC) were combined to create a large scale trauma network (TN). The new trauma centers were placed in those areas with the lowest ratios of TC to residents based on State data. The aims of this study were to determine the impact of the TN to the trauma patients as well as the overall outcomes of the TN compared to other TC.

Methods: The State Agency for Health Care Administration (AHCA) database from 2005 to 2012 Q1-Q2 was used to compare mortality, length of stay (LOS), and complication rates. To measure the potential effect of the TN on injured patients admitted to hospitals the frequencies of outcomes were measured before and after the initiation of the TN. The TN was then compared to the rest of the TC's in the State. Multivariate logistic regression was used to match and adjust for age, injury status (penetrating versus non-penetrating), gender, race, and injury severity (ICISS). Adult trauma patients were defined as >=16 years with ICD9 800-959.9 excluding: 840-848.9, 905-909.9, 910-924.9, 930-939.9, 820-821.9 who are >64 years.

Results: State trauma volumes demonstrated a consistent and steady growth over the past 5 years from 59,927 patients in 2007 to 67,241 patients in 2012 with greater than 60% of cases discharged from non-trauma centers in all years. After the introduction of the TN, mortality for adult trauma patients who were admitted to any State hospital, (the trauma population as a whole) decreased, aOR 0.84 (95% CI 0.82, 0.87). The TN was also compared to all other TC's. There was no significant difference in mortality between the groups (p-value 0.37). LOS was significantly less (p-value 0.0001) in the TN, and the TN had significantly lower complication rates (24.6% vs. 26.1%, p-value 0.02).

Conclusion: This analysis shows that there was a decrease in inpatient trauma mortality which was temporally associated with the advent of the TN. The TN performed equally to other TC's in terms of mortality but had significantly lower complication rates and lower LOS. The positive impact of the TN is likely due to improved access in areas of very low TC to resident ratio and by capturing trauma patients previously treated in non-trauma centers.

Poster # 117

TQIP RATING USING IN-HOSPITAL VS. 30-DAY MORTALITY

Justin Sobrino MD, Baylor Institute for Health Care Research and Improvement

Introduction:The Centers for Medicare and Medicaid Services, the National Surgical Quality Improvement Program (NSQIP), and other benchmarking programs use 30-day mortality to report quality of care. In contrast, the Trauma Quality Improvement Program (TQIP) uses in-hospital deaths only, and may miss post-discharge deaths occurring within 30 days. We hypothesized that TQIP ratings of trauma center quality would significantly change if 30-day mortality were used.

Methods:Patients treated at an urban level I trauma center (2006-08) were linked with the National Death Index (NDI), a database of death certificates maintained by the Centers for Disease Control and Prevention, to determine their outcome after discharge. All adult patients (age ≥ 16 years) were included in the study. Exclusion criteria were consistent with TQIP and included the following: those reported dead on arrival, gunshot wounds to the head, time from injury to ED arrival ≥ 1 day, and primary injury mechanisms of burns, poisoning, drowning, hanging, submersion or asphyxiation. These criteria identified 3,409 patients who were tracked in the NDI to identify patients who died after discharge. Center's Observed to Expected mortality ratio (O-E) was calculated using in-hospital vs. 30-day mortality.

Results:A total of 199 patients died before discharge. An additional six patients died after discharge but within 30-days. O-E ratio using in-hospital deaths only showed higher than expected mortality indicating a worse than expected performance at this trauma center (O-E ratio 1.11, 95% 1.01 to 1.34). Addition of deaths up to 30 days captured a few more deaths worsening the O-E ratio (O-E ratio 1.22, 95% CI 1.12 to 1.46). However, the difference between the two ratios was statistically not significant.

Conclusion:TQIP rating of trauma center quality would not change significantly if 30-day mortality were used. Hence, trauma centers should not be required to report 30-day mortality.

Poster # 118

DEFINING THE OPTIMAL TIME TO THE OPERATING ROOM MAY SALVAGE EARLY TRAUMA DEATHS

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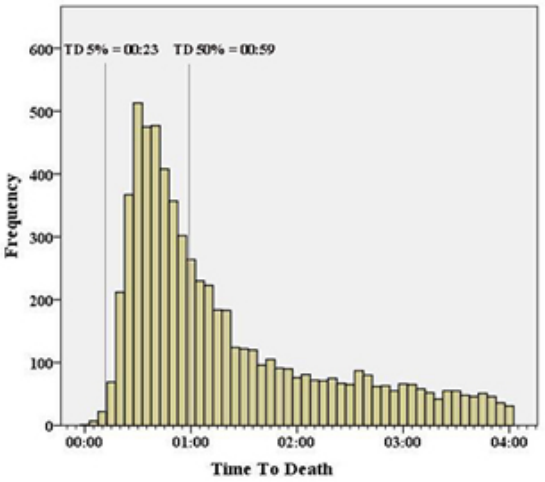
Introduction: Early deaths upon arrival to trauma centers have the potential for salvage if surgery is immediately available. The optimal time from injury to the operating room (OR) is not known. We studied the time from injury to death for this subset of patients to quantify the time to the OR that gives the potential to save the greatest number of these patients.

Methods: The Pennsylvania Trauma Outcomes Study (PTOS) is a comprehensive trauma registry including all Pennsylvania trauma centers. PTOS was queried for all adult trauma patients between 1999 and 2010. Our patient population included all patients with time of injury and death data who died within four hours of injury. The distribution of Time to Death (TD) was examined for the overall group and for subgroups of penetrating versus blunt injury, the presence of hypotension (defined as SBP≤90), death in Emergency Department (ED), and operative groups. The times representing the 5th percentile and the 50th percentile of TD (TD5 and TD50, respectively) were calculated from the distributions. The median times (TD50s) were compared using the Mann-Whitney U Test. We assigned TD5 as a benchmark that identifies the time when 95% of patients are still alive with the potential to be saved by operative intervention.



Results: The PTOS database contained 412,768 patients for the 11 year time interval and 27,479 (6.7%) that died. Death within four hours of injury was our final analysis group of 6,547 (1.6%). The overall population TD5 and TD50 was 0:23(H:MM) and 0:59, respectively. Median penetrating injury times were significantly shorter than blunt injury times (TD5/TD50 = 0:29/1:10 versus 0:19/0:43). Median time was significantly shorter in the overall group for hypotensive versus normotensive patients (TD5/50 = 0:22/0:52 versus 0:43/2:18). TD5/50 for patients who died in the ED was 0:22/0:47. The group of patients reaching the OR had TD5/50 = 0:59/2:22. Operative subgroups had different TD5/TD50: abdominal surgery (n=607) = 1:09/2:26, thoracic surgery (n=756) = 0:47/2:00, and cranial surgery (n=18) = 2:45/3:14.

Conclusion: This study describes a novel approach to quantify benchmark times from injury to the OR that yield the greatest opportunity for survival for early in-hospital trauma deaths. We found significant differences in these times suggesting different time standards be applied based on patient mechanism and physiology. This information should be used to develop optimal time standards to operative intervention in trauma patients.

Poster # 119

AN ANALYSIS OF PRE-HOSPITAL DEATHS: WHO CAN WE SAVE?

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Introduction: Since their inception in the late 1970s, trauma networks have saved thousands of lives in the pre-hospital setting. However, little recent work has been done to evaluate the patients who die in the field prior to transport. Understanding the epidemiology of these deaths is crucial for trauma system performance evaluation and improvement. We hypothesized that specific patterns of injury could be identified and targeted for intervention.

Methods: Medical Examiner reports in a large, urban county were reviewed including all trauma deaths during 2011 that were not transported to a hospital (ie. died at the scene). Age, sex, date of death, mechanism, and list of injuries were recorded. An expert panel reviewed each case to determine primary cause of death, and if the patient's death was potentially preventable, or unpreventable.

Results: A total of 455 patients were included. Patients were 81% males, died mostly from penetrating (46%) and blunt (38%) causes, and included 23% documented suicide. The leading cause of death was neurotrauma (36%), followed by hemorrhage (30%), asphyxia (18%), and combined neuro/hemorrhage (17%). The anatomic regions most frequently injured were neck (61%), chest (51%), and extremities (34%), followed by abdomen (33%). 22% of patient deaths were classified as potentially survivable given current treatment options.

Table. Cause of death and anatomic region injured for all potentially salvageable patients

	Potentially Salvageable Patients (n=100)
Cause of Death	
Hemorrhage	46 (46%)
Neurotrauma	34 (34%)
Hemorrhage + Neurotrauma	13 (13%)
Asphyxia	6 (6%)
Asphyxia + neurotrauma	1 (1%)
Anatomic Region Injured	
Neck	61 (61%)
Chest	58 (58%)
Brain	52 (52%)
Extremities	43 (43%)
Abdomen	36 (36%)
Pelvis	20 (20%)

Conclusion: More than 1 of every 5 trauma deaths in our study area is potentially survivable. In this group, neck injuries and death via hemorrhage were predominant and suggest targets for future pre-hospital interventions. Future research and implementation of pre-hospital interventions should specifically target this subgroup. In addition, efforts targeting suicide prevention are still of great importance.

Poster # 120

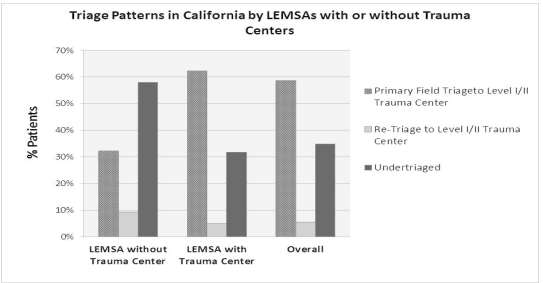
VARIABILITY IN TRIAGE PATTERNS: A POPULATION-BASED LONGITUDINAL STUDY OF SEVERELY-INJURED PATIENTS FROM 2005-2009

Kristan L. Staudenmayer* MD, MS, Feng Lin MS, Robert Mackersie* MD, David Spain* MD, Renee Hsia MD, MSc. Stanford University

Introduction Severely-injured trauma patients have improved mortality when triaged to Level I or II trauma centers. Appropriate triage requires proper identification and routing of patients from the field, as well as re-triage from non-trauma hospitals. We sought to determine variability in triage patterns by creating a longitudinal database of all injured patients for a geographic region. We hypothesized that there would be variability in triage patterns and associated mortality.

Methods Data for all hospital discharges and Emergency Department (ED) visits in the State of California were obtained from the California's Office of Statewide Health Planning and Development Database (OSHPD) from January 1, 2005, through December 31, 2009. Hospital and ED visits associated with injury were identified and linked to create a longitudinal database. Vital statistics data were used to determine long-term mortality. We included all hospitalized patients ≥18 years and excluded patients who died in the ED. Major trauma was defined as having an injury severity score (ISS) > 15. Primary triage was defined as field triage to a Level I/II trauma center, whereas re-triage was defined as field triage to a non-Level I/II center followed by transfer to a Level I/II. Primary outcomes were triage patterns and mortality. Data were analyzed for the entire state and by region (organized into 32 "Local Emergency Medical Services Agencies" or LEMSAs). Univariate and multivariate analyses were performed.

Results: A total of 550,683 adults were admitted during the study period—60,182 (11%) had sustained major trauma. The under-triage rate was 35% (N=20,988) and varied by LEMSA (12% to 87%). Rates of re-triage were low (overall 6%) and varied by LEMSA (1% to 38%). Primary field triage ranged from 7% to 77%. In adjusted analysis, several factors were significantly associated with lower odds of primary triage: age≥55 (OR 0.78, p=0.001), female gender (OR 0.88, p=0.014), greater number of comorbidities (OR 0.92, p=0.000), and fall mechanism vs. motor vehicle collision (OR 0.54, p=0.000). Unadjusted one-year mortality was 25% for under-triage vs. 16% and 18% for primary and re-triage, respectively (p=0.000).



Conclusion: This is the first study to longitudinally link all hospital and ED visits for injury for the most populous state in the United States. Over this 5-year time period, we found highly variable rates of primary and re-triage which were associated with disparities in age and gender. There is opportunity to increase triage to trauma centers by improving re-triage policies and by addressing existing disparities.

Poster # 121

FIREARM-RELATED INJURIES IN PATIENTS ≤18 YEARS OF AGE: U.S. NATIONAL ESTIMATES AND CHARACTERISTICS FROM 2007-2009

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Introduction: The characteristics of gunshot wound (GSW) violence in the U.S. pediatric population has not been well described. We sought to determine the incidence and associated patterns of firearm-related injuries for patients presenting to U.S. Emergency Departments (EDs) over a 3-year time period.

Methods: Data from the Healthcare Cost and Utilization Project's Nationwide Emergency Department Sample (NEDS) from years 2007 to 2009 were used. NEDS is a nationally representative sample of all ED visits in the United States. GSWs were determined by matching E-codes to injury and intent using the matrix of E-code groupings for injuries from the Centers for Disease Control. Patients were included if they had sustained a GSW and were ≤18 years of age. Population-based estimates were derived using weights provided by NEDS. All data presented represent weighted numbers.

Results: The number of pediatric GSWs over the 3 year time period was 36,749, representing 18% of all GSWs. Pediatric GSW patients were predominantly male (88%), more often victims of assault vs. unintentional violence (53% vs. 36%), more often in the lowest quartile for income (53%), and were more often located in central metropolitan locations (47%). GSWs increased exponentially with age. (Figure) Overall mortality for the population was 6%, but was higher for children<7 (from 8-16%). There were regional differences noted with the highest rates of GSW violence in the South and lowest in the Northeast (41% vs. 13% of all GSW). However, the South had the lowest rates of assault as the manner of intent, while the Northeast had the highest (47% vs. 62%).

Conclusion: GSW in pediatric patients comprised almost 20% of all firearm injuries treated in EDs in the USA from 2007-2009. Pediatric GSW violence is mostly a disease of poor, urban, teenage boys; however, there is variability. Younger ages were more often associated with unintentional violence, female gender, and higher mortality rates, while regional differences in manner of intent were present. This suggests different prevention and treatment priorities, such as a focus on inner-city GSW violence in the Northeast and on gun safety efforts in the South.