Session X

Poster # SII-1

TEMPORARY CLOSURE OF THE OPEN ABDOMEN; A SYSTEMATIC REVIEW ON DELAYED PRIMARY FASCIAL CLOSURE IN PATIENTS WITH AN OPEN ABDOMEN.

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Background: In some cases of abdominal trauma or infection, edema or packing precludes fascial closures after laparotomy. This "open abdomen" must then be temporarily closed.

Objective: To systematically review the literature on temporary abdominal closure (TAC) to assess which TAC technique is associated with the highest fascial closure rates.

Search strategy: The Cochrane Register of Controlled Trials, and the MEDLINE and EMBASE databases were searched until December 2007. References of relevant articles were checked for additional studies.

Selection criteria: Search criteria included (synonyms of) "open abdomen", "fascial closure", "vacuum", "re-approximation" and "ventral hernia". The definition of "open abdomen" had to include "the inability to close the abdominal fascia after laparotomy".

Data collection: Two reviewers independently extracted data from original articles using a checklist with predefined criteria. Authors were conntacted for additional information.

Main results: The search identified 154 abstracts of which 96 were considered relevant. No comparative studies were identified. After reading them, 51 articles, including 57 case series were included. Eight series used the VAC, 15 series used the Vacuum pack, four series used the Artificial burr, and 16 series applied Mesh or sheet. Seven series used the Zipper technique, three series used a Silo, two series used Skin closure, and Dynamic Retention Sutures and Loose packing were used in one series each. The highest fascial closure rates were seeen in the Artificial burr (90%), DRS (85%), and VAC (60%). The lowest fascial closure rates were seen with Skin closure (11%) and Mesh/sheet (23%). The lowest mortality rate was seen in the Artificial burr (17%), VAC (18%), and DRS (23%).

Authors conclusions: The results of this review suggest that, in patients with an open abdomen, the TAC techniques that keep permanent traction on the fascial edges (e.g. VAC, DRS, and Artificial burr) show the highest percentages of fascial closure. Furthermore, these techniques also show the lowest martality rates.

Session X

Poster # SII-2

OBSERVATION FOR NON-OPERATIVE MANAGEMENT OF BLUNT LIVER INJURIES: HOW LONG IS LONG ENOUGH?

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Introduction: Non-operative management of blunt liver injuries has become the standard of care in hemodynamically stable patients. However, there is no evidence based guideline regarding optimal length of inpatient observation.

Purpose: Our hypothesis is that blunt liver injuries, regardless of grade, should be observed based on physiologic findings only, not a pre-determined length of observation.

Methods: A retrospective review of the trauma registry and charts was completed. Data collected included grade of injury, length of stay (LOS), serial hemoglobin (Hgb), and failure of non-operative management. The length of observation guideline was serial Hgb every 6 hours for 24 hours, then every 12 hours until stable. With a normal clinical exam and stable Hgb on at least 2 consecutive measures, the patients were discharged.

Results: From 8/02 through 10/07, there were 9107 blunt trauma admissions; 706 patients had blunt liver injury. 192 patients were excluded; 127 went for laparotomy/angiography, 32 were transferred/repatriated after stabilization but prior to discharge, and 33 patients died of injuries not related to the liver. The remaining 514 patients were reviewed:

Grade (n)	Non-op Success	Inpatient Failures	Outpatient Failures	Isolated Liver (n)	Isolated Success	Isolated LOS
I-II (408)	96%	16	0	38	100%	1.5±0.8
III (78)	88%	9	0	11	100%	2.9±1.4
IV (26)	85%	3	1	5	80%	5.6±3.6
V (2)	50%	1	0	1	0%	13

The single outpatient failure returned 2 weeks after discharge with a bile leak. The two failures in the isolated liver injury group were due to bile peritonitis and these increased LOS in grades IV/V. No isolated blunt liver injuries failed non-operative management for ongoing hemorrhage. Compliance with these guidelines for discharge was 89%.

Conclusions: Observation period for blunt liver injuries based on the guideline of a normal clinical exam and stable Hgb is safe, effective and limits LOS.

Session X

Poster # SII-3

VACUUM ASSITED CLOSURE:EFFECTIVENESS IN THE MANAGEMENT OF THE TRAUMATIC OPEN ABDOMEN

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Objective: To evaluate the use of Vacuum Assisted Closure (VAC) therapy as an effective temporary abdominal closure (TAC) modality in the management of trauma patients with open abdomens.

Methods: A retrospective study of trauma patients at a level I trauma center that required TAC for the management of traumatic open abdomens. VAC therapy was compared to Vacuum Pack Therapy (VPT). Trauma patients included had open abdomens for: damage control surgery, treatment of an abdominal compartment syndrome, coagulopathy, intra-abdominal sepsis, hypotension, packing, severe acidosis, and hypothermia. Cohorts were compared for similarity of the groups as well as: time to primary closure, closure rates, mean intra-abdominal pressures, and complications: fistulas, ARDS, sepsis.

Results: Of the 354 trauma laparotomies performed between January 2002 to December 2007 67 patients (18.9%) required temporary abdominal closure (TAC). Fifty-one patients had VAC therapy; 16 with VPT. In the VAC group a primary closure rate of 92.7% was achieved with a mean closure rate of 5.3 days (range 1-20) days. There was a secondary closure rate of 7.9% with a mean of 33 days (range 20-57 days). This compared to 16 patients in the VAC pack cohort with a mean primary closure of 12.5% and a mean time to closure of 24 days. There no fistulas in the VAC group; 4 patients (25%0 developed fistulas in the VPT group. Mean intra-abdominal pressure in the VAC group was 16 mmHg as compared to the VPT group which was 29mmHg ($p>0.05$). ARDS was 50% VPT vs. 5% VAC; 50% VPT group developed tertiary abdominal compartment syndrome vs. 0% in the VAC group; 50% systemic sepsis rate with VPT vs. 5% with VAC therapy.

Conclusion: VAC therapy is an effective modality with superior mean closure times and overall faster closure rates. VAC therapy has a lower intra-abdominal pressure which may contribute to a lower overall complication rate and improved outcomes in this patient population.

Session X

Poster # SII-4

IS THE TRAUMA SURGEON OBSOLETE IN THE ERA OF NON-OPERATIVE MANAGEMENT OF PEDIATRIC ABDOMINAL TRAUMA?

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Background: The success of non-operative management of children sustaining abdominal trauma has prompted the evolving concept of pediatricians providing initial care of these young patients. We hypothesized pediatric patients often sustain significant abdominal injuries which mandate laparotomy and prompt trauma surgeon evaluation and care.

Methods: Pediatric patients (? 18 years old) undergoing laparotomy for acute injury at two level I trauma centers from 1/1/98 to 10/1/06 were identified from the trauma registries. Demographic data, operative indications, and outcome were recorded. * = $p < 0.05$.

Results: 165 pediatric patients underwent postinjury laparotomy. 90% of the operations were therapeutic and 14% required damage control surgery. Abdominal injuries were evenly divided in penetrating trauma patients (15 solid organ, 19 hollow visceral, 17 combined, 10 with no injuries). There was a predominance of hollow viscus injuries in bluntly injured children (19 solid organ, 55 visceral, 6 combined, 4 with no injury). Fifteen (9%) patients died (3 penetrating, 12 blunt) with 7 due to abdominal sources.

	Age	SBP	HR	Op Indication	Damage Contr
Penetrating (61)	15.5±0.4	116±4	100±3	Exam (48) Diag Adjuncts (13)	11
Blunt (104)	8.7±0.5*	104±2*	124±3*	Exam (21) Diag Adjuncts (83)	12

Conclusions: Trauma laparotomy in the injured child is not an obsolete concept. Almost two-thirds of pediatric patients requiring operative intervention sustained their abdominal injury from a blunt mechanism. The decision to operate was based on physical exam in 79% of patients with penetrating trauma, but 80% of children with blunt abdominal injury underwent additional diagnostic adjuncts (ultrasound, CT scan, DPL) to help determine the need for laparotomy. With often only nominal hemodynamic perturbations, involvement of an experienced surgeon is essential in the initial evaluation and care of injured children.

Session X

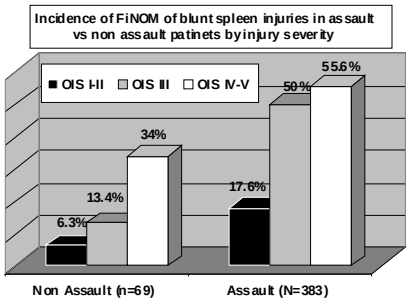
Poster # SII-5

BLUNT ASSAULT IS ASSOCIATED WITH FAILURE OF NON-OPERATIVE MANAGEMENT OF SPLENIC INJURIES DESPITE A DECREASED OVERALL INJURY SEVERITY

David Plurad, MD, DJ Green, MD, Kenji Inaba*, MD, Rodd Benfield, Joseph DuBose, MD, Tony Shiflett, DO, Demetrios Demetriades*, MD PhD. LAC + USC Division of Trauma/ Surgical Critial Care.

Objective: Non-operative management (NOM) of blunt spleen injuries has become standard of care for its high success rate. We observe many blunt assault (BA) patients fail NOM despite lower overall injury severity. We performed this study to determine if BA is independently associated with failed initial non-operative management (FiNOM) of spleen injuries.

Methods: Utilizing the Trauma Registry at our Level I center, we reviewed data of all patients with blunt spleen injuries, who did not undergo immediate splenectomy, admitted from Jan, 1, 1992 to Dec, 31, 2007. FiNOM was defined as any patient who underwent splenectomy greater than 12 hours after admission. Logistic regression was performed to determine if BA was independently associated with FiNOM.



Results: FiNOM occurred in 57 of the 419 (13.6%) patients initially managed non-operatively. FiNOM decreased significantly from 15.8% (1992-1999) to 6.2% (2005-2007) (p=0.05) over time. This was not true for BA patients (33.3% vs. 30%).FiNOM for BA patients was 36.1% (13/36) vs 11.5% (44/383) for all other mechanisms. FiNOM was increased across all Organ Injury Scale (OIS) scores for the spleen in BA patients. BA was independently associated with FiNOM.

Conclusion: BA is associated with FiNOM independent of severity of spleen injury. Despite an increasingly successful policy of NOM in all blunt spleen injuries, this does not apply for blunt assault. BA patinets with spleen injury can be appropriate for NOM but need more close monitoring when this option is selected.

Variables independently associated with FiNOM		
Variable	**p-value**	**OR (95% CI)**
Pediatric	0.04	0.12 (0.02-0.92)
GCS ≤ 8	0.03	0.31 (0.11-0.87)
OIS spleen IV-V	<0.01	5.51 (2.66-11.39)
Blunt assault	<0.01	3.57 (1.51-8.45)
Year of admit	<0.01	1.12 (1.03-1.21)

Session X

Poster # SII-6

THREE DECADES OF NONOPERATIVE MANAGEMENT OF BLUNT SPLENIC TRAUMA AT A SINGLE INSTITUTION: WHAT HAVE WE LEARNED? HOW FAR HAVE WE COME?

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Introduction: Recent literature suggests that novel applications of nonoperative management (NOM) of blunt splenic trauma have resulted in steadily increasing rates of nonoperative splenic salvage. It has also demonstrated an increase in mortality attributable to delayed intervention. We propose that a mature NOM protocol can lead to steady rates of NOM usage and NOM success with no attributable mortalities

Methods: A retrospective chart review was performed of all adult patients identified in the trauma registry with a diagnosis of splenic injury for the period between January 2001 to December 2006. All patients were treated by immediate splenectomy or by our NOM protocol. Data recorded included patient demographics, ISS, AAST splenic injury grade, transfusion requirements, and indications for failure of NOM. This data was then compared to our previously published experience with NOM of splenic injuries beginning in 1978.

Results: Over this six-year period, 160 patients were diagnosed with blunt splenic injuries. Forty patients (25%) underwent immediate splenectomy secondary to persistent hemodynamic instability. These patients had significantly elevated ISS, splenic injury grades, and transfusion requirements. Mortality was 38% in this group. Of the remaining 120 patients, 107 patients (89%) successfully completed NOM. 13 patients (11%) failed initial NOM and underwent delayed splenectomy. These patients had elevated ISS, splenic injury grades, and transfusion requirements. Since our original report of 36% in 1984, rates of NOM usage have remained consistent through time, 67% (1990), 65% (1996), and 69% (2002) to our current rate of 75%. NOM success rates have also remained stable at 89%, 97%, 85%, 88% and 89% respectively. Since 1984, our cumulative rate of nonoperative splenic salvage has been 63% with no attributable mortality in our protocol.

Conclusion: These data demonstrates consistent rates of NOM enrollment, NOM success, and overall nonoperative splenic salvage can be achieved while maintaining no attributable mortality by following a mature NOM protocol.

Session X

Poster # SII-7

THE ACCURACY OF RECTAL CONTRAST CT IN PATIENTS WITH PENETRATING PERICOLONIC INJURY

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Background: While evidence supports the use of Computed Tomography (CT) in the management of penetrating abdominal trauma, there is little data on the accuracy of specific CT findings in diagnosing colon injury.

Methods: The computerized laboratory record was used to identify all trauma patients in a 4-year period undergoing early (<24h) abdomen/pelvis CT for evaluation of pericolonic penetrating injury. A blinded attending radiologist prospectively read patients' initial CT scans, documenting adequacy of scan, rectal contrast extravasation (EXTRAV), free intraperitoneal air (FREE AIR), free peritoneal fluid (FREE FLUID), tissue injury adjacent to bowel (ADJ INJURY), and a trajectory either unidentifiable or passing within 5cm of bowel (TRAJECTORY). Additionally, a global assessment (GLOBAL) was made as to whether colon or rectal injury was present. Each sign's sensitivity and specificity were calculated.

Results: 56 patients were enrolled. 22(39%) underwent exploration, and 34 were treated nonoperatively. There were no delayed diagnoses. At surgery 3/56 (5%), 3/56(5%), and 5/56(9%) were found to have colon, rectum, and small bowel perforation respectively. One patient with no worrisome CT signs underwent colostomy for presumed low rectal injury.

	EXTRAV	FREE AIR	FREE FLUID	ADJ INJURY	TRAJECTORY	GLOBAL
Sens-colon	3/3(100%)	3/3(100%)	2/3(67%)	3/3(100%)	3/3(100%)	3/3(100%
Spec-colon	48/53(90%)	44/53(83%)	40/53(75%)	35/53(66%)	31/53(58%)	40/53(75%)
Sens-rectum	2/3(67%)	1/3(33%)	1/3(33%)	3/3(100%)	3/3(100%)	2/3(67%)
Spec-rectum	47/53(89%)	42/53(78%)	39/53(74%)	35/53(66%)	31/53(58%)	39/53(74%)

Conclusion: CT was effectively used to rule out injury. Extravasation of rectal contrast is a sensitive and specific sign of penetrating colon perforation. Without contrast extravasation or free air, tissue damage or wound trajectory adjacent to the colon are not indications for surgery.

Session X

Poster # SII-8

THE EFFICACY OF TRANSARTERIAL EMBOLIZATION (TAE) FOR SEVERE LIVER INJURY AMONG BLUNT MULTIPLE ORGAN TRAUMA CASES

Hiroyuki Otsuka, MD, Seiji Morita, MD, Shinichi Iizuka, MD, Takeshi Yamagiwa, MD, Yoshihide Nakagawa, MD, Isotoshi Yamamoto, MD, and Sadaki Inokuchi, MD. Tokai University Hospital.

Purpose: Emergency laparotomy is generally performed for severe liver injury, but treatment outcomes for severe liver injury in multiple organ injuries have been poor. Recently, TAE has been applied to liver injury, but its efficacy among multiple injuries has not yet been established. We performed a retrospective comparison study. **Subjects:** Among 510 patients with blunt liver injury admitted at our emergency center during the past 10 years, either emergency TAE or laparotomy was performed on 69 cases. Among them, we selected 29 cases having liver injury of AAST Class Grade ? or higher and also having injuries of AIS 3 or higher, other than in the abdominal region, as our study subjects (ages: 39.9±17.1, males : females=22 : 7). ISS: 33±5.7, RTS: 5.8±2.1, TRISS: 34.4±31.0, the mortality: 8/29 (27.6%). **Methods:** One group of 16 cases who received laparotomy (surgery group) and another group of 13 cases who received TAE (TAE group) were compared with respect to the following parameters: age, gender, causes of accident, RTS and TRISS and hematological tests at the time of admission, ISS, liver injury grade, total amount of blood transfusion, incidents rate of other abdominal organ injuries, hours from time of injury to time of hemastasis, number of days of hospitalization, incidents of complications, and mortality. **Results:** The significant differences ($p<0.05$) between the surgery group and the TAE group were found to the following parameters: RTS: 5.0±2.3 vs 6.8±1.5, TRISS: 46.8±32.3 vs. 19.2±22.2, incidents rate of other abdominal organ injuries 10/16 vs. 4/13, total amount of blood transfusion 76.3±29.5 vs. 28.9±27.7 units, and mortality 7/16 vs. 1/13. The TAE group showed higher RTS, lower TRISS, and less multiple abdominal organ injuries and demonstrated less total blood transfusion and lower mortality compared with the surgery group. In contrast to TRISS: 19.2±22.2, actual mortality was low 1/13 (7.7%). **Conclusion:** Among the cases of severe liver injury with blunt multiple organ injuries, TAE may be found to be effective for subjects showing higher RTS at the time of admission with no associated abdominal injuries.

Session X

Poster # SII-9

TITANIUM IV IONS INDUCED HUMAN OSTEOCLAST DIFFERENTIATION AND ENHANCED BONE RESORPTION IN VITRO

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Introduction: There is increasing evidence that titanium ions are released from prosthetic and osteosynthetic metal implants resulting in 1µM concentration in surrounding tissues and blood, and playing a role in aseptic loosening. Our aim was to investigate, whether Ti(IV) ions induce differentiation of monocytes (MC) into osteo-resorptive multinucleated cells and influence the activation and function of *in vitro* generated osteoclasts (OC).

Methods: Human MC and *in vitro* generated OC were exposed to 1µM Ti(IV) ions for ten days. Thereafter, transcription of specific OC genes, including tartrate-resistant acid phosphatase (TRAP) and cathepsin K (CATK) was measured. The effects of Ti(IV) on the osteoclastic activity and differentiation were also evaluated by measuring the enzymatic activity of TRAP using ELF97 as a fluorescent substrate. Additionally, functional evidence of osteoclastic bone resorptive activity was determined by a lacunar resorption assay system using cell cultures on dentin slides.

Results: In total, cells derived from 22 healthy individuals were studied. After Ti(IV) treatment MC from five donors (22.7%) showed a "responsive" pattern characterized by increased gene expression of OC markers, TRAP activity and bone resorptive ability. The "responsive" cohort showed an increased expression of TRAP and to a lesser extent CATK mRNA. Detection and quantification of intracellular TRAP activity revealed a significant increase of TRAP-positive cells in treated MC of the "responsive" cohort. Ti(IV) treated MC of the same cohort became functional bone resorbing cells, increasing significantly their osteo-resorptive activity to similar levels of OC *in vitro*.

Conclusion: This study provides strong support that Ti(IV) ions induce differentiation of MC towards mature, functional OC in approximately 20% of individuals. These OC may well be responsible for enhanced periprosthetic bone resorption. These findings may help to explain the pathomechanism of aseptic loosening, and contribute to understanding and preventing failure of metal implants used in trauma and orthopedic surgery.

Session X

Poster # SII-10

THE EPIDEMIOLOGY OF TRAUMATIC LIMB AMPUTATION: AN NTDB ANALYSIS

Galinos Barmparas, MD, Kenji Inaba*, MD MS, Pedro G R Teixeira, MD, Michele Criscuoli, BS, David Plurad, MD, Donald J Green, MD, Joseph DuBose, MD, Demetrios Demetriades*, MD PhD. University of Southern California.

Introduction: The purpose of this study was to examine the epidemiology and outcomes after traumatic upper (UEA) and lower extremity amputations (LEA).

Methods: The National Trauma Data Bank v. 5 was utilized to identify all traumatic amputations. Demographics, mechanism of injury, clinical characteristics, associated injuries, and outcomes were abstracted.

Results: From 2000 to 2004 there were 8910 amputated patients, accounting for 1% of all trauma patients. Of these, 6855 (76.9%) had digit and 2055 (23.1%) had limb amputation. For limb amputations, 76.7% were males, average age 36.1±17.7 years, ISS 16.8±12.5, and GCS 12.6±4.5. Multiple limbs were amputated in 7.3% (151/2055), 54.6% had LEA and 38% had UEA. 83% were blunt; the most common mechanism was MVC (51%), followed by machinery accidents (19.4%). MVC occupants had more UEA (54.5%, $p<0.001$), whereas motorcyclists (86.2%, $p<0.001$) and pedestrians had more LEA (91.9%, $p<0.001$). After adjusting for confounders, there was no difference in mortality between UEA and LEA. However, patients with LEA had longer hospital and ICU length of stay (LOS) [adjusted mean difference (AMD)=4.65, 95% CI: 2.98 to 6.33, $p<0.001$] and [AMD=1.83, 95% CI, 0.25 to 3.41, $p=0.02$] respectively. Patients with LEA were more likely to be discharged to a skilled nursing facility ($p<0.001$); patients with UEA were more likely to be discharged home ($p<0.001$). Multiple limb amputations were an independent risk factor for mortality. Patients with delayed (>12 hours) amputation had a longer hospital and ICU LOS [AMD=-4.43, 95% CI:-6.76 to - 2.10, $p<0.001$] and [AMD=-2.79, 95% CI: -4.90 to -0.67, $p=0.01$] respectively, and more often required extension of their primary amputation [adjusted OR=2.48, 95% CI:1.49 to 4.15, $p<0.001$].

Conclusion: Limb amputations remain a prevalent sequelae after severe extremity injury in the civilian trauma population. Further investigation into optimal limb salvage techniques is warranted.

Session X

Poster # SII-11

HEMORRHAGE DISTURBS INTER-ALVEOLAR PERFUSION DISTRIBUTION IN BOTH NORMAL AND LEUKOCYTE-DEPLETED RATS

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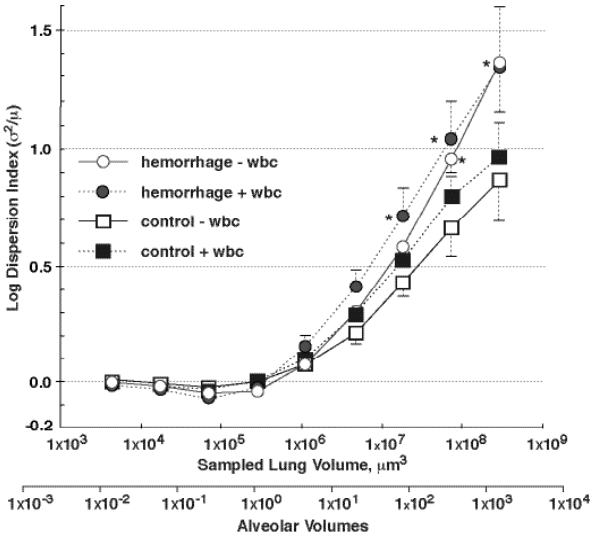
Background: We have shown previously that hemorrhage results in perfusion mal-distribution among alveoli in the lungs of rats (*J. Trauma* 60:158-160, 2006). To determine if this might be caused by leukocyte sequestration within lung capillaries, we measured trapping patterns of 4 μm diameter fluorescent latex particles infused into the pulmonary circulation of normal and leukocyte depleted rats following hemorrhage.

Methods: Rats (482±35 g) were leukocyte depleted using cyclophosphamide (100 mg/kg), which caused their circulating leukocyte counts to fall from 7,957±2,015 to 926±425 after 5 days. The rats were anesthetized and 30% of their blood volume was removed. One hour later, $2x10^8$ 4 μm diam. fluorescent latex particles were infused into a peripheral vein, and the lungs were then removed and air-dried. Particle distributions among alveoli were measured in confocal lung images using dispersion index (DI) analysis (J. Appl. Physiol. 94: 420-8, 2003). A logDI value of zero corresponds to a statistically random particle distribution. The more logDI exceeds zero, the more the distribution is clustered or non-random.



Results: LogDI data, shown in the figure, revealed that perfusion distribution was significantly more mal-distributed in hemorrhaged rats whether or not they were leukocyte depleted.

Conclusions Hemorrhage causes mal-distribution of inter-alveolar perfusion independent of the presence or absence of leukocytes. We hypothesize that this mal-distribution may be due to the formation of microthrombi within lung capillaries following hemorrhage.

Session X

Poster # SII-12

EFFECTS OF ALTITUDE ON VENTILATOR PERFORMANCE

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Objective USAF Critical Care Air Transport Teams (CCATT) provide care at cabin altitudes of 4,000 to 8,000feet. We evaluated the effects of altitude on tidal volume (V_T) delivery by two ventilators (Impact 754 and LTV-1000).

Methods Ventilators were evaluated in an altitude chamber at sea level, 4,000, 8,000, and 15,000 ft. V_T's of 250 ml, 500 ml, and 1000 ml were set. At each V_T, PEEP was set at 0, 10, and 20 cm H_2O and inspired oxygen concentration (FIO_2) was 0.21 and 1.0. Each ventilator was connected to a test lung and a Fleisch pneumotachograph was used to monitor airway pressures and V_T (RSS-100, Hans-Rudolph). At each altitude and FIO_2, the system was recalibrated using a super syringe.Data expressed as mean ± SD for 10 breaths.

Results With each increase in altitude delivered V_T increased. The LTV V_T was >10% of set V_T at 8,000 feet and 37% greater at 15,000 feet. At FIO_2 of 0.21 the Impact 754 accurately corrected V_T for altitude up to 15,000 feet. The table demonstrates differences (Δ) in set and delivered V_T's at a V_T of 500 mL, FIO_2 of 0.21, and PEEP of 10 cm H_2O at altitudes of 4,000, 8,000, and 15,000 feet. Statistical analysis was done using ANOVA comparing set and actual V_T. * $p < 0.01$

Altitude	**4,000 feet**		**8,000 feet**		**15,000 feet**	
V_T 500 ml	Actual V_T	% Δ	Actual V_T	% Δ	Actual V_T	% Δ
Impact 754	439±31*	-12	451±35*	-10	505±47	+1
LTV-1000	510±2	+2	550±2*	+11	687±6*	+37

Conclusions Increasing altitude effects accuracy of flow measurement devices used by ventilators to control V_T. The LTV-1000 has no mechanism for altitude compensation. The 754 altitude compensation features were most effective at FIO_2 of 0.21. Higher FIO_2 resulted in greater V_T Δ's at all altitudes. With evidence that lower V_T's promote safety, controlling V_T accurately at any altitude is important. Further testing of devices prior to deployment is warranted.

Session X

Poster # SII-13

RESCUE THERAPY FOR POST-TRAUMATIC RESPIRATORY FAILURE: INITIAL EXPERIENCE WITH A PORTABLE LUNG ASSIST DEVICE

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Background: The Novalung interventional lung assist (iLA) is a pumpless extracorporeal membrane system developed to aid in carbon dioxide elimination in patients with respiratory failure, but its role in poly-trauma patients has yet to be defined. We hypothesized that the use of the Novalung system in multiply injured patients with severe respiratory failure would provide rescue therapy and facilitate lung protective ventilatory strategies.

Methods: This report describes our initial experience with the use of the Novalung iLA device in patients with major trauma complicated by severe respiratory failure unresponsive to conventional mechanical ventilation. Outcome variables of interest included lung salvage rates, survival, treatment time, changes in ventilatory parameters, arterial oxygen and carbon dioxide values after initiation of treatment, and complications.

Results: Novalung therapy was utilized in 8 patients with severe traumatic injuries from March 2005 to December 2007. One death resulted from fulminant pulmonary edema and cardiac arrest at the time of catheter placement. Lung salvage was accomplished in all 7 remaining patients (100%). There was one late death unrelated to the Novalung treatment for an overall survival rate of 75%. One patient developed cerebral edema with elevated intracranial pressure after decannulation with rise in pCO2 to 73. No other device related complications were noted. Air evacuation was possible while on therapy. The average PaO_2/FiO_2 ratio at the initiation of therapy was 88 and the mean time required on the assist device was 9 days. Rapid improvement in gas exchange allowed prompt re-initiation of lung protective strategies. All patients were successfully extubated between 1-7 days after weaning from the Novalung iLA system.

Conclusions: The Novalung iLA is a straightforward, highly portable lung assist device that allows return to lung protective ventilatory strategies after initiation. Its use is associated with a high rate of lung salvage and survival in severely injured patients who have failed other modes of respiratory therapy.

Session X

Poster # SII-14

ADRENOCORTICOTROPIC HORMONE (ACTH) AND CORTISOL RESPONSE TO CORTICOTROPIN RELEASING HORMONE IN THE CRITICALLY ILL: A NOVEL ASSESSMENT OF THE HYPOTHALAMIC-PITUITARY-ADRENAL AXIS

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Introduction: Adrenal insufficiency occurs in the critically ill. The underlying pathophysiology is not understood, including whether the adrenal insufficiency is primary, secondary or tertiary.

Methods: We enrolled 25 patients at risk for adrenal insufficiency (>55yo, in the SICU > 1 week, baseline cortisol <20). Baseline levels of cortisol and ACTH were measured. We used a novel method of assessing hypothalamic function. Corticotropin releasing hormone (CRH) was administered, levels of ACTH and cortisol were measured over 90 minutes. Area under the curve (AUC) was calculated for cortisol and ACTH. Adrenal insufficiency was diagnosed and treated by standard methods. Chi-square and t-test, were used, $p<0.05$ was significant.

Results: Six of the 25 had adrenal insufficiency. Five of these 6 died compared with 3 of 19 with a normal adrenal function ($p<0.01$). ACTH levels were increased in non-survivors and ACTH peak for non-survivors was increased compared with survivors regardless of adrenal function measured by standard methods (cosyntropin stimulation) (tables). This was not true for cortisol AUC after CRH administration.

All patients	n	Mean ACTH peak	Mean ACTH AUC	Mean AUC cortisol
Alive	17	28.51	1958.81	2647.48
Dead	8	59.21	4147.89	2459.19
p		0.05	0.069	0.787

Normal adrenal function	n	Mean ACTH peak	Mean ACTH AUC	Mean AUC cortisol
Alive	16	28.91	1992.70	2708.24
Dead	3	57.78	4127.56	4277.87
p		0.073	0.097	0.129

Conclusions: ACTH peak response and AUC to the novel CRH stimulation test was increased in non-survivors regardless of the response to cosyntropin or the cortisol response after CRH administration. Excessive ACTH response to CRH may be an independent marker for mortality regardless of adrenal function.

Session X

Poster # SII-15

CT BASED BEDSIDE VENA CAVA FILTER INSERTION: A NEW TECHNIQUE

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Introduction: Vena cava filter placement frequently involves transporting ventilated, difficult patients to radiation facilities. We developed a technique for bedside insertion of vena cava filters based on the measurements of vena cava size taken from the patient's abdominal CT scan. Insertion was done without additional imaging.

Methods: Patients with indications for vena cava filter insertion were selected. Exclusion criteria were: 1) morbid obesity (BMI>40); 2) clot in the right femoral vein; 3) vena cava anatomical abnormalities. The technique requires: 1) review of the abdominal CT scan for cava size, location of the vertebra where the renal vein/cava junction is located (usually T-12 or L-1), location of the bifurcation (usually L-5 or S-1), or other anomalies; 2) measure the distance from the right superior endplate of L-3 to the junction of the right femoral neck and femoral head (about 26 cm); 3) duplex scan of the groin to exclude DVT if the patient has been hospitalized for >5 days; 4) cardiac monitoring during the procedure; 5) after local anesthesia, insertion of a TrapEaze vena cava filter delivery catheter into the femoral vein to the desired distance (usually about 26 cm); 6) measure the venous pressure to prevent arterial deployment; 7) deploy the filter; and, 8) check a followup abdominal film to ascertain proper filter deployment location.

Results: The technique was piloted under fluoroscopy with two surgeons, one of whom was blinded. We determined that morbid obesity would have resulted in iliac vein deployment in some patients. A total of 29 patients were then done at the bedside using the described technique. Age range was 14 to 77 years, and 10 were women. All filters were deployed in the target area. One patient developed vena cava thrombosis a week after the filter placement.

Conclusions: Bedside vena cava insertion based on abdominal CT scan measurements is quick, easy, safe, and effective. The technique reduces patient transport, cost, and radiation exposure.

Session X

Poster # SII-16

INHIBITORY EFFECTS OF ANTI-HYPERLIPIDEMIC DRUG FOR ENDOTHELIUM INJURY UNDER HIGH GLUCOSE LEVELS

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Objective: Currently, strict glycemic control with intensive insulin therapy (IIT) is emerging as a standard of care in ICU. However, IIT has resulted in hypoglycemia, and it is associated with an increase risk of mortality. Recent studies pay attention to the concept that peroxisome proliferator-activated receptor (PPAR) agonist, fenofibrate has beneficial effects under hyperglycemic conditions. So, we examined whether fenofibrate ameliorated endothelial dysfunction caused by acute oxidative stress with high glucose level in vitro.

Methods: Endothelial cell were grown as monolayer on permeable supports, and adjusted the concentration of D-glucose in medium as 150 mg/dl. Xanthine oxidase and xanthine (XO+X group) or saline (control) were administered into the apical chambers. The permeability was assessed by quantifying the trans-endothelial passage of a fluorescent agent. Another set of chambers was treated with XO+X and fenofibrate (XO+X+F). The ability of fenofibrate to scavenge the radicals was also analyzed using electron spin resonance method.

Results: In the basal chambers, the concentration of fluorescence in the XO+X group was significantly higher than that of the control after oxidative stress (5.3 ± 0.4 vs. 4.2 ± 0.9 µg/dl, $p < 0.01$). The permeability increase caused by the oxidative stress ameliorated by the fenofibrate administration.

Conclusion: The endothelial monolayer dysfunction caused by XO+X was significantly attenuated with fenofibrate. The PPAR agonist may have a potential effect against endothelial derangement under hyperglycemic patients without the risk for hypoglycemia.

Session X

Poster # SII-17

HUMERAL HEAD INTRAOSSEUS INSERTION : THE PREFERRED EMERGENCY VENOUS ACCESS?

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Objective: To compare the speed of humeral head intraosseus (IO) catheter placement with conventional methods for venous access (peripheral IV (PIV) and central venous access (CVC) catheter) during emergent resuscitation in the emergency department.

Methods: The study was completed in two phases. In Phase I, conventional methods for venous access (PIV and CVC) were evaluated for all trauma and medical resuscitation patients presenting to the emergency department. Time required to establish IV access with good flow (CVC or first PIV), complications of catheter placement, perceived Visual Analog Scale (VAS) pain scores, patient comorbidities, and other relevant patient data were collected. In Phase II, all trauma and medical resuscitations requiring central venous access or complicated by failed PIV access attempts underwent IO catheter placement at the humeral head using the Vidacare® EZ-IO AD catheter. Time to IO access with good flow, complications, and patient data were collected in a manner similar to Phase I. IO catheter placement was performed by both RN and MD health care providers.

Results: Mean time to IO access was 1.0 min (SD = 0.5), substantially less than that required for PIV access (3.95 min, SD = 3.7) or CVC access (15.25 min, SD = 6.7). No major complications were identified in either Phase I or Phase II. Minor complications for PIV access included IV infiltration, poor flow, and catheter dislodgement. Minor complications for CVC catheter placement included inability to thread guidewire. No minor complications were encountered with IO catheter placement. VAS pain scores associated with IO insertion were similar to those associated with PIV and CVC catheter placement, although patients did experience a slight increase in pain with IO infusion.

Conclusions: Humeral head IO catheter placement is significantly faster than PIV or CVC catheter placement, with a similar complication profile and perceived pain from insertion. Consequently, humeral head IO catheter placement may be the preferred method for obtaining venous access during the emergent resuscitation of critically ill patients.

Session X

Poster # SII-18

NON-OPERATIVE MANAGEMENT OF BLUNT AORTIC INJURY : A 10 YEAR EXPERIENCE FROM A LEVEL I TRAUMA CENTER

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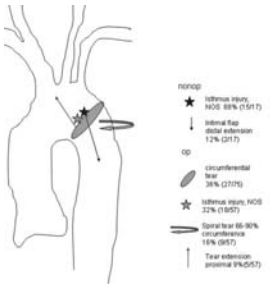
Introduction : Blunt aortic injury is highly morbid and has experienced a changing trend in evaluation and treatment patterns. With improved non-invasive imaging modalities, CT scan has replaced aortography as the preferred technique. There has also been increased interest in non-operative therapy (NONOP) for these injuries as the natural history is further elucidated. An apparent rise in diagnosis of blunt aortic injuries is presumably from the high utilization of CT scan trauma evaluation. We sought to understand these trends from a contemporary series of blunt aortic injuries.

Methods : A retrospective review of all trauma admissions over a 10 year period was performed (1996-2006). Data was analyzed for outcome markers, surgical management, non-operative therapy and follow-up. Significance was defined as p ? 0.05.

Results : Reasons given for NONOP include severity of injuries, age, and comorbidities (24/30). A minority had NONOP due to evaluation of aortic injury as intimal only (6/30). On long-term follow-up, 53 operative patients (OP) were alive at 34 months (range 1-139) and 15 NONOP alive at 19 months (range 1-73). Review of available follow-up CT scan or chest x-ray showed all 15 OP patients with stable exam and resolution of injury in a NON. Overall mortality was similar in both groups (32.9% vs. 43.4%, p=0.45). Baseline characteristics, triage time, and length of stay were similar. The NONOP was significantly older (59.7 y vs. 37.8 y, p?0.05) and less tachycardic at presentation (97 vs. 109, p=0.02). In the NONOP, the type of aortic injury was more focal and only intimal (see Fig). An average of 2.4 antihypertensive medications were prescribed at discharge for the NONOP group. More utilization of NONOP was noted in recent years (p=0.01).



Conclusion : Increasing utilization of NONOP for blunt aortic injury is feasible and in appropriately selected candidates results in equivalent short-term outcomes.

Session X

Poster # SII-19

A SYSTEMATIC METHOD OF FOLLOW-UP IMPROVES RETRIEVAL RATES FOR REMOVABLE IVC FILTERS IN A TRAUMA PATIENT POPULATION

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Introduction: Temporary inferior vena cava filters (tIVCF) reduce the risk of pulmonary embolism without the long-term morbidity of permanent filters. However, most tIVCFs are not removed leaving patients at risk for thromboembolic complications as well as the unknown risks of long-term, temporary filter use.

Hypothesis: We hypothesize that a comprehensive system for tIVCF follow up results in a high rate of filter removal.

Methods: We reviewed the medical records of patients who underwent treatment with a tIVCF at a level one, community-based trauma center between January 1, 2003 and June 30, 2007. The center utilizes radiology nurses to perform daily evaluations of all tIVCF patients to determine the potential for filter removal.

Results: tIVCFs were placed in 84 patients, 24 (29%) had known venous thrombosis. Two patients died before tIVCF could be considered for extraction and were excluded leaving 82 patients for evaluation. Filters were removed in 52 patients (63%). 17/52 (33%) had their tIVCFs repositioned an average of 1.5 times before removal at a mean of 30 days. In contrast, 35/52 (67%) patients did not undergo IVCF repositioning and had their IVCFs removed after an average of 10.7 days. Among the 30 patients in whom filters were not extracted 8 were transferred elsewhere. Of the 22 remaining patients, 3 were lost to follow up, attempted removal failed in 4 and 15 had indications for filter retention: contraindication to anticoagulation (N=6); thrombus in the tIVCF (N=6); and venous thrombosis while anticoagulated (N=3). Thus of the 72 living patients cared for by our system, tIVCFs were removed in 72%. Of the 22 patients in our system in whom filters were not removed, removal was contraindicated in 15 (68%).

Conclusions: A dedicated system for monitoring patients with temporary IVCFs markedly improves retrieval rates for temporary IVC filters.

Session X

Poster # SII-20

BLUNT ILIAC ARTERY INJURIES: A NATIONAL TRAUMA DATA BASE ANALYSIS OF ASSOCIATED INJURIES AND OUTCOMES

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Objective: Due to its protected retroperitoneal location, blunt iliac artery injury (BIAI) is seldom diagnosed but can be associated with serious complications. Iliac vessels can become injured by direct compression from severe pelvic fractures but an association with seat belt syndrome is also theorized. We performed this study to characterize this rare injury with respect to patient demographics, injury patterns, and outcomes in patients with moderate to severe pelvic fractures.

Methods: Utilizing the NTDB v 5.0 and 7.0, we extracted incident codes associated with any pelvic fracture having an abbreviated injury score (AIS) of 3 or 4 related to blunt mechanism. We compared individual records associated with vs. without BIAI. We defined independent associations with BIAI with logistic regression.

Results: There were 6377 entries eligible where 221 (3.1%) had an associated BIAI. The incidence of BIAI increased with pelvic fracture severity [44/652 (6.7%) for AIS 4 vs. 177/5725 (3.1%) for AIS 3]. Severe pelvic fractures (AIS = 4) [1.58 (1.11-2.25), 0.011], emergency department hypotension (systolic blood pressure < 90 mmHg) [1.81(1.35-2.43), <0.001], and concurrent bowel injury [2.21 (1.59-3.08), <0.001] were independently associated with BIAI. Seat belt use [16/819 (2.0%) with vs. 205/5558 (3.7%) without] was not associated with an increased incidence in this group. Mortality [(adjusted OR, 96% CI; 2.45(1.82-3.29)] and overall complications [(adjusted OR, 95% CI; 1.43(1.06-1.93)] were significantly increased with BIAI.

Conclusions: BIAI is a rare diagnosis but when present, is associated with a higher rate of overall complications and mortality. Vigilance is warranted in the diagnosis and subsequent management of patients with this infrequent injury. In the presence of moderate to severe pelvic fracture, seat belt use does not increase the incidence of BIAI.

Session X

Poster # SII-21

AN ASSOCIATION BETWEEN ABDOMINAL ABSCESS AND DELAYED VASCULAR HEMORRHAGE IN PATIENTS WITH COMBINED ILIAC VESSEL AND HOLLOW VISCERAL INJURIES

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Introduction: Iliac vessel gunshot wounds (IVGW) are often associated with hollow visceral injuries (HVI). The effect of HVI on post-operative outcome is not well described in these patients. We hypothesized that HVI leads to increased morbidity in patients with IVGW.

Methods: Patients with IVGW aged 18 to 65 that survived greater than 24 hours, were retrospectively reviewed over 6 years. Demographics, injury severity scores (ISS), hemodynamics, resuscitation fluid, antibiotic usage, operative core temperatures, method of vascular repair, and types of HVI were gathered. Univariate logistic regression was used to measure significance and odds ratios estimates of these variables in relation to outcomes.

Results: Twenty-nine males and 1 female were included, with ISS = 19.6 ± 9.6, and mean age = 27.7 ± 8.2 years. The IVGW were arterial (n=3, 10%), venous (n=18, 60%), and combined (n=9, 30%). HVI were: colon (n=5, 16.7%), small bowel (n=9, 30%), and combined (n=9, 30%). Ten (33%) developed post-operative abdominal abscesses (AA) and 6 (20%) delayed iliac vessel hemorrhage. Predictors of AA and hemorrhage are displayed in Tables 1 and 2.

Table 1 Predictors of Post-Operative Abdominal Abscess

Variable	p value	Odds Ratio	C.I.
First Systolic Pressure < 90	0.711	1.33	0.29-6.12
Transfused Red Blood Cells	0.157	1.03	0.99-1.07
Estimated Blood Loss	0.223	1.00	1.00-1.00
Antibiotics	0.755	1.33	0.22-8.10
Operative Temperature	0.810	1.09	0.55-2.17
Small Bowel Injury	0.081	4.72	0.83-27.07
Colon Injury	0.035	5.67	1.13-28.45
Colon and Small Bowel Injury	0.523	2.60	0.14-453.70
Damage Control	0.101	4.40	0.75-25.84

Table 2 Predictors of Iliac Vessel Hemorrhage

Variable	p value	Odds Ratio	C.I.
Artery and Vein Injury	0.403	2.30	0.33-16.22
Method of Arterial Repair	0.669	0.67	0.10-4.26
Method of Vein Repair	0.960	>999	0.001-999.9
Damage Control	0.942	>999	0.001-999.9
Post-Op Anticoagulation	0.945	0.92	0.09-9.69
Abdominal Abscess	0.009	23.00	2.18-242.30

Conclusion: Colon injury predicted AA in patients with IVGW. In turn, patients with AA were 23 times more likely to develop delayed iliac vessel hemorrhage. These results suggest a need to better define the roles of enteric diversion and tissue interposition between iliac vessel and hollow visceral repairs.

Session X

Poster # SII-22

A CASE OF SUCCESSFUL SURGICAL TREATMENT FOR A PATIENT WITH NECK VESSELS, HEART AND LUNG INJURIES

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The injury of carotid artery and jugular vein, heart or lung, each one of these will be fatal trauma. Therefore the combination of all of those will provoke a further tragedy. We experienced a case of successful surgical treatment for a patient with neck vessels, heart and lung injuries. This rare case is reported.

A 35-year-old man, under the condition of stabbing to his chest with a knife, was transported to our hospital. On arrival, his vital signs were critical, consciousness of loss and blood pressure of low. Also he had 4 wounds on the neck and pulsatile bleeding was seen from one of those. Immediately he was transferred to our operation room and underwent an emergent surgery. His left carotid artery had been divided completely and both jugular veins lacerated. The artery was repaired using a 5-0 polypropylene, and the veins using 6-0 polypropylenes. On the other hand, his stab wound of chest had reached into the right ventricle cavity through the left lung. The heart injury was repaired by 4 U-sutures using 3-0 polypropylenes with felt strips, and lung injury using a 3-0 Teflon coated polyester, while a cardiac massage was performed for 10 minutes during heart suturing. His postoperative course was good except for the necessity of neurological rehabilitation, and he discharged walking by himself.

It is reported that the mortality rate is 20 % of neck injury and 30 to 57 % of cardiac injury and much higher in a case of shock on arrival respectively. On the occasion of a combination of neck, heart and lung injuries, the mortality is unknown.

A successful procedure of serious trauma is reviewed.

Session X

Poster # SII-23

SURGICAL AUDIT OF NON TRAUMATIC EMERGENCY DEATHS. A DATA TO BE USED FOR APPRAISAL.

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Background : The goal of this report is to break the cycle of inaction. Little attention has been given to non trauma surgical admissions and deaths. The objective of this study was to describe the review process of the Committee for Audit of Surgical Emergency Mortality and to identify preventability and errors on management.

Methods : This study was a prospective audit review of all cases of patients who died while under the care the Emergency Surgical Service at our teaching hospital between March and September 2007. Non trauma deaths were evaluated followed a combined death committee (anesthesiologist, general surgeons, critical care). Data included Apache II , Manheim peritonitis index- MPI (if applied), autopsy review and chart review.

Results : Twenty four patient charts were reviewed. Mean age was 65.0 ± 15.7 and 62,5% were female. On admission 62,5% were diagnosed as acute abdomen (submitted to laparotomy) and 37,5% as gastrointestinal bleeding. Mean Apache II was 21.0 ± 5.3; mean MPI was 31.0± 7.5. Mean time from admission to death was 3.6 ± 16.7 days.. Mean time from admission to operating room was 18.0 ± 18.5 hs. The most common location of deaths occurred was the ICU (45%), followed by the ER (15%). The main cause of death were considered MOF (80%) and hemorrhagic shock (20%). 50 % of deaths were judged to be potentially preventable.. In the non preventable group, errors were identified in 75% . Errors were related to delay in treatment, (29%), technical error (12%) and missed diagnosis (8%).

Conclusion : This study highlights the importance of clinical judgment in the provision of emergency care. Although the process of assigning preventability to a non traumatic death is specially subjective because most patients who died were elderly and had complex comorbidities, surgical audit can discriminate those deaths that are *potentially* preventable and can identify inappropriate care in order to institute best evidence guidelines focused on patient safety.

Session X

Poster # SII-24

ACUTE APPENDICITIS AND THE TRAUMA SURGEON AS EMERGENCY GENERAL SURGEON: A STITCH IN TIME, OR HELD AT BAY?

Christine T Trankiem, MD, Laura S Johnson, MD, Michael Morgan, MD, Jack A Sava, MD, James H Street III, MD, Susan O Kennedy, BSN, Hahn Soe-Lin, MS, James C Jeng*, MD, David Milzman, MD. Washington Hospital Center.

Objective: For the patient with acute appendicitis at a Level 1 trauma center, to determine whether an Emergency General Surgery service staffed by in-house trauma surgeons affects the time to operation, hospital length of stay, and complication rate.

Methods: A retrospective chart review at an urban Level 1 trauma center and tertiary care hospital. Patients with acute appendicitis between January 2005 and January 2008 were identified. Comparison was made between patients during the eighteen months prior to implementation of an Emergency General Surgery service (PRE) and the eighteen months after implementation (EGS). The first sixty cases in each group were analyzed.

Results: Time from surgical evaluation to operation averaged 97 minutes for PRE; this decreased to 37 minutes for EGS ($p < 0.02$). Within the EGS cohort, in looking at the longest times from surgical evaluation to OR, there was no difference in number of traumas on those days (6.83 vs 6.375). The hospital length of stay for PRE was 4.1 days and for EGS was 3.8 days (p = NS). The rate of complications including postoperative wound infection, peritoneal abscess, obstruction, ileus, and bowel obstruction for PRE was 14% and for EGS was 5% ($P = 0.05$).

Conclusions: The presence of an in-house trauma surgeon decreases the time to operation for the patient with acute appendicitis. This is associated with a decreased rate of complications but no change in hospital length of stay. Interestingly, there was no correlation between increased time to OR and number of traumas called on that day. Discussions of the future of trauma surgery include concerns that emergent general surgery cases may be delayed due to the demands of the trauma service. Trepidation may not be warranted; our study shows that the acute appendicitis patient reaches the operating room sooner now than in the pre Emergency General Surgery era.

Session X

Poster # SII-25

TEN-YEAR RETROSPECTIVE STUDY OF DELAYED DIAGNOSIS OF INJURY IN PEDIATRIC TRAUMA PATIENTS IN A LEVEL II TRAUMA CENTER

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Background: Missed injuries in trauma patients may lead to serious morbidity and mortality. Published rates of delayed diagnosis of injury (DDI) in pediatric trauma vary from 1.0% to 18%, with no existing study longer than six years. The purpose of this study was to determine the long-term trend of DDI over ten years, to identify risk factors associated with DDI, and to elucidate patterns of DDI.

Methods: All patients age 14 and under who were admitted to Parkview Hospital for major trauma between January 1, 1996 and December 31, 2005 were included in this study. Data was collected from a trauma registry that is maintained of all trauma admissions.

Results: A total of 1101 patients were included. A total of 47 delayed diagnoses of injury were found in 44 patients for a rate of 4.0%. The rate of DDI remained relatively constant. Patients with a DDI were more likely to have been intubated in the emergency department, transported by air, have mental alteration, have an Injury Severity Score (ISS) >15, have a GCS below 8 ($p<0.05$). Mean length of stay was 7.4 days for the DDI group compared to the non-delay group ($p<0.05$) and mean length of stay was 5.5 in the DDI group compared to 2.8 days in the non-delay group ($p<0.05$). Missed injuries resulted in a change in therapy in 80% of cases where treatment was known. There were five missed intraabdominal injuries, four of which required surgery. Three patients had injuries that were discovered upon outpatient follow-up. There was a trend for more missed upper extremity injuries in older patients and missed lower extremity injuries in younger patients.

Conclusions: Despite improvements in the trauma system, the rate of missed injuries remained relatively constant over the past ten years at our institution. More severely injured patients are more likely to have missed injuries. Special attention to the lower extremities of the younger trauma patient may be warranted.

Session X

Poster # SII-26

TRAUMA REFERRALS FROM RURAL LEVEL III HOSPITALS: SHOULD OUR COMMUNITY COLLEAGUES BE DOING MORE, OR LESS?

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Objective: Rural citizens are more frequently injured, and die more often, as a result of trauma than their urban counterparts. Skill maintenance is a significant issue amongst rural surgeons. The purpose of this study was to evaluate the acuity and outcome of severely injured patients referred from Level III and IV trauma centers, to improve patient care.
Methods: All severely injured patients (ISS>12) referred to a level 1 trauma center from level III and IV hospitals, over a 48-month period were evaluated. Prehospital, referring hospital, and level I center data was obtained. Comparisons between level III and IV center referrals, and between those discharged dead versus alive were completed.
Results: 1230 patients (35%)(ISS≥12) were transferred from level III (33%) and level IV (67%) trauma centers. 43% underwent an operative procedure. 13% required a laparotomy, while the remainder (87%) needed orthopedic, neurosurgical, plastics or vascular procedures. 57% of all patients were transferred via aircraft. Referred patients had a mean ISS of 28, length of stay of 28 days, and mortality rate of 26%. More patients arrived hemodynamically unstable from level IV (55%) compared to level III (35%) hospitals ($p<0.05$). Patients who died after referral from level III centers were more likely to have arrived via aircraft (100%), regardless of geography, than from level IV hospitals (55%)($p<0.05$). More level IV patients also underwent splenectomies (89% vs. 35%) and multiple intraperitoneal procedures (51% vs. 26%)($p<0.05$). 91% of all definitive general surgery related procedures could have been completed at level III centers, however 90% of these patients had multisystem injuries requiring treatment by other subspecialty services.
Conclusion: The majority of severely injured trauma referrals from level III and IV trauma centers are appropriate, and have a high operative rate. Most transfers to a level I center were required because of concurrent multisystem injuries or the absence of subspecialty coverage. Surgeons at level III centers treat a significant number of injured patients locally. This data will be used to engage rural physicians in an education outreach program.

Session X

Poster # SII-27

EMERGENCY MEDICAL PERSONNEL FREQUENCY OF PREHOSPITAL INTUBATIONS IMPACTS SUCCESS RATES OF PREHOSPITAL INTUBATIONS

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Objective: The purpose of this study was to assess the frequency with which emergency medical personnel (EMT) perform prehospital endotracheal intubations and assess whether the frequency with which EMTs performs endotracheal intubations impact intubation success rates.

Methods: During a 2-year period (1/01-12/02), EMT patient care reports (PCRs) from the state of Alabama were queried for patients who required prehospital endotracheal intubations. The PCRs were also queried for number of attempts of intubation and success of intubations. Frequency of intubations and intubation failures were tabulated for all EMTs who attempted at least one intubation. An intubation failure was defined as a single intubation failure without a second attempt, two intubation attempts that failed or more than two intubation attempts in a single patient.

Results: During the two-year period, 5,590 patients underwent prehospital intubation or attempted intubation. During the study period, 1,693 EMTs reported at least one intubation. 957 (57%) of EMTs reported two or less intubation attempts during the study period.

Attempted patient intubations per EMT during 2-yr period	Number of EMTs	Total Number of All (Medical & Trauma) Attempted Intubations	Total Number of All (Medical & Trauma) Succesful Intubations	% Success of All (Medical & Trauma) Intubations	% Successful Intubations for All MVC Patients
1-5 intubations	1405	2953	2295	77.7	65.5
6-10 intubations	223	1641	1329	80.1	76.0
11-15 intubations	47	596	509	85.4	82.9
16-20 intubations	12	216	190	87.0	90.0
> 20 intubations	6	184	166	90.2	87.5

Conclusion: Most EMTs in the State of Alabama infrequently intubate patients in the prehospital setting. This incurs low success rates of EMT prehospital endotracheal intubations. EMT clinical continued education in operating room or simulation settings may improve endotracheal intubation success rates.

Session X

Poster # SII-28

DEVELOPMENT OF AN IMPROVED CHITOSAN-BASED HEMOSTATIC DRESSING WITH ANTIMICROBIAL PROPERTIES

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Introduction: Although chitosan hemostatic dressings have successfully controlled bleeding in many instances on the battlefield, these dressings have not been effective in some animal models of severe hemorrhage. This study aims to develop a more effective chitosan-based hemostatic dressing by incorporating polyphosphate, which has been shown to accelerate blood coagulation and delay clot lysis. Antimicrobials (silver nanoparticles) were also incorporated to enhance the dressing's ability to kill bacteria.

Methods: Polyphosphates of varying chain lengths were mixed with chitosan in different ratios, before freezing the composites and freeze-drying into sponges. Sponges were evaluated *in vitro* for their ability to aggregate erythrocytes, adhere and activate platelets (ATP secretion), accelerate thrombin generation (thrombin-antithrombin complex), and absorb blood. To measure the bacteria kill rate, silver-containing dressings were immersed in a bacteria broth culture, and colonies remaining at various time points were counted.

Results: A specific mixing ratio of chitosan and polyphosphate (Chi-PP) was found to adhere erythrocytes, activate platelets, accelerate thrombin formation, and absorb blood significantly better than pure chitosan. In bacteria time kill assays, it was found that dressings can kill > 99.9% of gram-negative and gram-positive bacteria for up to 72 hours.

	Chitosan (N=5)	Chi-PP (N=5)	p-value
Erythrocyte aggregation (OD_{540})*	0.111 ± 0.021	0.066 ± 0.014	0.011
Platelets adhered (x 10^7)	2.07 ± 0.53	3.43 ± 0.42	0.002
Platelet activation (x 10^{-10} moles ATP/L)	3.23 ± 0.14	4.46 ± 0.09	< 0.001
Thrombin-Antithrombin (µg)	318.23 ± 21.55	396.73 ± 22.4	0.002
Blood absorption (g/g)	8.19 ± 0.79	16.27 ± 1.82	< 0.001

* Measures absorbance of hemoglobin released from erythrocytes not trapped in the clot

Conclusions: The chitosan-polyphosphate sponge can potentially present an improved hemostatic method that is light, portable and cheap for military applications. Sponges containing silver nanoparticles may help to prevent infection in contaminated war wounds, especially when evacuation to definitive care is delayed.

Session X

Poster # SII-29

RISK FACTORS FOR ICU ADMISSION FOLLOWING FALL FROM STANDING

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Introduction: Fall from standing (FFS) is a common mechanism of injury, especially in the elderly. We sought to determine which characteristics are associated with ICU admission following FFS.

Methods: A retrospective evaluation of the trauma registry from 2000-2005 identified patients. In addition to demographic descriptors, the following initial variables were recorded: Glasgow coma score (GCS), systolic blood pressure (SBP) and heart rate, warfarin use, blood alcohol level (BAC), and injury severity score (ISS). Injuries and disposition were recorded. Univariate analysis was conducted using Fisher exact test and a multivariate logistic regression model was created using variables with a $p < 0.1$.

Results: A total of 808 patients appeared in the database. The average age and ISS were 61±22 years and 7.8±8.5, respectively. Nineteen percent had a BAC greater than 80 mg/dL, 5% used warfarin, 16% had a GCS ? 12, and SBP was ? 100mmHg in 67%. Injuries noted were: TBI 40%, concussion 6%, extremity fracture 17%, and spine 5%. Only 1.4% of patients had no injury. Stroke and MI were noted in 3% and 1%, respectively. Univariate analysis found the following factors associated with ICU admission: ISS, age > 65 years, warfarin use, GCS < 12, and SBP < 100mmHg. Intoxication was not associated with injury or need for ICU care. The following were associated with ICU admission on multivariate regression analysis (OR, 95% CI): ISS (1.1, 1.07-1.12), warfarin use (3.42, 1.56-7.52), and GCS > 12 (0.33, 0.2-0.55). Age > 65 years, SBP < 100mmHg, and heart rate > 100 were not associated with ICU admission. Regarding disposition, 75% required hospitalization and 8% of the cohort died. Of the admissions, 25% required ICU care.

Conclusion: Fall from standing is a morbid diagnosis, especially in those who are not intoxicated and have a GCS < 12 or those who use warfarin. Intoxicated patients without these risk factors do not require evaluation in a trauma center.

Session X

Poster # SII-30

PAYER STATUS AND THE DECISION TO TRANSFER TRAUMA PATIENTS

Oliver L. Gunter, MD, John M. Green, MD, Kevin W. McConnell, MD, Timothy G. Buchman*, PhD MD, Douglas J. E. Schuerer*, MD. Washington University in Saint Louis.

Introduction: With decreased community availability of emergency surgical care, more patients are being transferred to regional centers for definitive management. Payer status has previously been suspected to affect this decision.[1] The purpose of this study was to investigate changes in the transferred trauma population over time to improve efficiency and resource allocation.

Methods: Retrospective study of all trauma patients admitted from 2002-2007 to an urban level-1 trauma center. Demographic and clinical data were collected. Comparisons were made among fiscal years and between transferred and ED primary (non-transferred) patients. Parametric and nonparametric comparisons were made as appropriate.

Results: Over the study period, admissions increased by 65% while the number of transferred patients increased by 81%. Although transferred patients required longer hospitalization, they were more likely to be insured and require operative intervention.

Conclusions: Insurance status is not a determining factor for transfer of patients to regional trauma centers. Although transferred patients may utilize more bed resources, their insurance status and higher requirement of operative intervention may have favorable revenue effects. Regionalization of trauma care and efficiency of prehospital transfer systems should continue to be emphasized.

	ED primary (n=5848)	Transferred (n=3611)
Age (years)	40 (25-55)	42 (27-61)
ISS	9 (4-16) [11.88]	9 (4-16) [11.85]
Hospital LOS (days)	3 (2-7)	4 (2-7)
ICU LOS (days)	0 (0-1) [2.0]	0 (0-1) [1.8]
Any insurance	3339 (57%)	2489 (69%)
Required OR	2726 (47%)	1883 (52 %)
Mortality	474 (8.1%)	158 (4.4%)

*Median (IQR) or n (%) with or without [mean]; $p<0.05$ for all comparisons

[1]Nathens AB, et al. Payer status: the unspoken triage criterion. J Trauma, 2001.

Session X

Poster # SII-31

CAN TRAUMA SYSTEM TRIAGE CRITERIA IMPACT THE BOTTOM LINE? FINANCIAL IMPLICATIONS TO A REGIONAL TRAUMA CENTER

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Objective: In an effort to maintain the capacity of regional trauma centers (RTCs) to treat the most severely injured patients, trauma systems often direct patients with "softer" triage criteria (mechanism of injury, EMT discretion) to other hospitals to avoid over-saturation of the RTC. Such concentration of the severely injured, however, may have a detrimental financial impact on RTCs. We hypothesized that while patients with "softer" triage criteria may be less severely injured, they may also contribute positively to the hospital margin.

Methods: Consecutive patients entered into a regional trauma system and directed to a level I RTC from Sept 2005 through May 2007 were stratified by triage criteria (physiologic, anatomic, mechanism of injury [MOI], EMT discretion [EMT-d]). ISS, mortality, length of stay, payor mix, and contribution to hospital margin were compared.

Results: 3181 patients met study criteria. The physiologic group had a higher mean ISS, length of stay and mortality rate than the other groups. The MOI and EMT-d groups had comparatively favorable payor mixes. Hospital profit margin was positive only for the MOI and EMT-d groups.

	Physiologic n=769	Anatomic n=690	MOI n=587	EMT-d n=1,135	p-value
Mean ISS	22.3	12.8	13.0	12.0	<0.0001
Mortality (%)	21.3	3.6	1.2	1.1	<0.0001
Mean length of stay	10.2	7.8	5.7	4.6	<0.0001
Commercial and worker's comp (%)	51.4	44.9	66.9	68.8	<0.0001
Self-pay and Medicaid (%)	32.8	46.1	21.0	20.0	<0.0001
Total direct cost ($)	12,722,035	9,575,340	5,478,307	7,724,728	<0.0001
Total gain ($)	-2,095,561	-2,650,293	807,311	182,491	0.0045

Conclusion: While trauma system stratification by triage criteria may serve to maintain RTC capacity for the most severely injured, exposure of the RTC to patients with a relatively positive margin contribution may concomitantly be limited. The preservation of RTCs demands financial viability. The differential contribution to hospital margins should be considered in trauma system planning.

Session X

Poster # SII-32

PLANNED DELAYED TRANSFER OF COMPLEX PELVIC FRACTURES FROM LEVEL III TO LEVEL I TRAUMA CENTERS

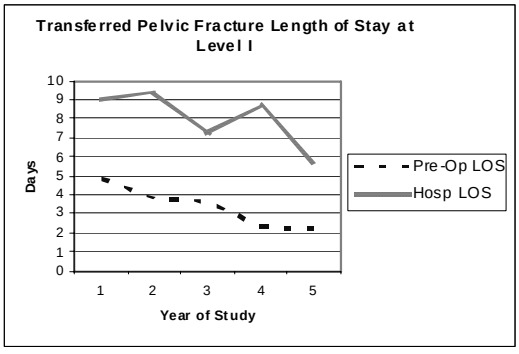
Anthony P. Borzotta*, MD, Michael T. Archdeacon, MD, John D. Wyrick, MD, Jay A. Johannigman*, MD. Bethesda North Hospital.

Introduction Regionalized Level I orthopedic management of complex pelvic fractures is normative, but scheduling delays after immediate transfer consume valuable bed days. We reviewed an evolving process of deliberately staging the transfer of such patients from a Level III to an adult Level I center. We hypothesized that planned, delayed transfer of patients with complex acetabular fractures would reduce preop bed utilization at the Level I center without compromising patient safety.

Methods Retrospective analysis of trauma registry (CDM, Conifer, CO), hospital and office records of 109 patients with any pelvic fracture seen at a Level III center from June 2002 to July 2007. Demographics, injury character and payer of retained and transferred patients were compared to outcomes: length of stay (Level I pre-operative and hospital LOS for both centers) and safety (mortality, new injury diagnoses).

Results Only 3 of 82 retained patients had pelvic repairs, the rest having nonoperative sacral or iliac fractures. 25 of 27 transferred patients required acetabular repairs. Deaths were unrelated to pelvic injury. No major injuries were missed at the Level III.

	RETAINED	TRANSFER
Number	82	27
Male	43 (52.4%)	19 (70.3%)
Age X +/- SD	46.2+18.8	50 +18.2
ISS X +/- SD	13 ± 9.9	9 ± 5.1
Died	2 (2.4%)	1 (3.7%)
Level III LOS (days)	3.7 + 2.6	2.1 + 1.8
Hypotension in ED	15 (18.3%)	3 (11.1%)
OR trips-all causes	26 (31.7%)	3 (10.3%)
PAYER		
Insuror	40 (48.8%)	9 (33.3%)
Government	15 (18.3%)	5 (18.5%)
Workman's	5 (6.1%)	1 (3.7%)
Self	22 (26.8%)	12 (44.4%)



Conclusions With system maturation and growing confidence between centers, initial stabilization and care at a Level III center with staged transfer for repair of complex pelvic fractures steadily and safely reduced pre-op and total length of stay at the Level I.

Session X

Poster # SII-33

HUMAN CYTOKINE RESPONSE TO TEXAS CROTALINE ENVENOMATION: A CASE CONTROL STUDY

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Objective: to characterize the human cytokine response to Texas crotaline envenomation.

Methods: This study enrolled crotaline bite victims presenting to a regional trauma center and children's hospital from March to November 2007 and age-matched unbitten controls. Blood spot cards were obtained from bite victims at presentation, one hour and six hours after antivenom administration. One control sample was drawn from each of the age-matched controls selected from minor care patients presenting for non-inflammatory complaints. Samples were delivered to a lab using a new proprietary method for quantitative evaluation of large number of biomarkers in parallel with bead-based multiplex immunoassays.

Results: Enrolled were 14 crotaline bite victims (age range 5-85, median 45, 47% female) (Snake Bite Severity Score 2-7, median 3) and 14 age-matched controls. There were six Copperhead (*Agkistrodon contortrix)* bites, four rattlesnake bites (probably Western Diamondback *Crotalus atrox)*, two cottonmouth bites (*Agkistrodon piscivorus)* and two unidentified snakes. Compared to controls, levels for IL-16, MCP-1 and MMP-2 were elevated in 64% (9/14) compared to controls; IL-18 and Myoglobin in 43% (6/14); IL-8 in 35% (5/14); IL-6 and TNF- α in 29% (4/14); MIP-1β in 21% (3/14) and RANTES in 14% (2/14). Levels of IL-4 were decreased in all bite patients compared to controls with the exception of one 6-hour sample.

Conclusions: Crotaline venom produces a broad cytokine response in human bite victims. Understanding this profile might lead to improved therapies and better prognostic indicators.

Session X

Poster # SII-34

ONCE-DAILY VERSUS TWICE-DAILY ENOXAPARIN FOR VENOUS THROMBOEMBOLISM PROPHYLAXIS IN HIGH-RISK TRAUMA PATIENTS

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Introduction: Low-molecular weight heparin (LMWH) is the preferred agent for venous thromboembolism (VTE) prophylaxis in high-risk trauma patients. Practice at our institution shifted from once-daily to twice-daily dosing of enoxaparin for VTE prophylaxis in all trauma patients, however, comparable effectiveness is unknown.

Objective: To compare the incidence of VTE in high-risk trauma patients receiving enoxaparin 40 mg SC once daily or enoxaparin 30 mg SC twice daily.

Methods: A retrospective chart review was conducted of all trauma patients older than 18 years of age admitted to Shands at the University of Florida between July 1, 2005 and June 30, 2007 who received either enoxaparin dosing regimen. Excluded were patients with Injury Severity Score (ISS) < 9, surviving < 2 days, hospital length of stay < 2 days, receipt of > 1 agent and/or dosing regimen for VTE prophylaxis during hospitalization, interruption in enoxaparin therapy, pregnancy, and diagnosis of a VTE within 24 hours of admission. VTE was defined as a pulmonary embolus (PE) or deep vein thrombosis (DVT). DVT was defined as thrombosis of the proximal lower extremity, including femoral, iliac, and popliteal veins.

Results: 631 patients were included in the analysis. Relative comparability of cohorts is evidenced by demographics. VTE occurred at an unadjusted relative risk of 4.2 between the once-daily and twice-daily dosing regimens.

		Demographics				Outcomes		
Exposure	n	Age, yrs* (mean)	Male* (%)	ISS* (median)	IVC filter (%)	VTE* n (%)	PE n (%)	DVT n (%)
40 mg daily	372	42.8	67.2	14	18.5	12 (3.23)	4 (1.08)	8 (2.15)
30 mg BID	259	40.1	74.1	17	17.8	2 (0.77)	1 (0.39)	1 (0.39)

* $p<0.05$

Conclusion: Within the limitations of an observational design, our analysis suggests a higher effectiveness of the twice-daily regimen of enoxaparin. Future objectives include a larger sample and safety evaluations.

Session X

Poster # SII-35

ROLL OUT THE BARELL MATRIX: A NEW TOOL FOR BENCHMARKING US TRAUMA OUTCOMES UTILIZING SURVIVAL RISK RATIOS

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Background: Recent quality assurance initiatives call for trauma outcomes comparisons, despite a lack of detailed standards and methodologies for making such assessments. The Barell Matrix (BM) organizes injury data by tabulating the frequency of different nature of injuries (fracture, blood vessel laceration, internal organ injury) by body region. It is used to make injury data comparisons across populations, and has established use in Europe and Israel. This study demonstrates creation of a BM for the US using a national hospital discharge dataset and calculation of survival risk ratios (SRRs) for each injury of a distinct nature and body region.

Methods: US trauma patients were identified from the 2004 National Inpatient Sample (NIS) using ICD-9 codes. A 35 row by 12 column BM was constructed resulting in 420 cells. Each cell represents the nature of injury (column) for different body regions (row). Frequency of injury and number of deaths were used to calculate SRRs for each cell.

Results: The NIS contained 483,403 trauma patients with a crude mortality rate of 2.7%, yielding an overall SRR of 0.97 for hospitalized patients in the US. Head injuries were associated with 34% of deaths while thoracic and abdomen injuries accounted for 14% and 10% of deaths respectively. The table, an excerpt from the complete BM presents cell specific SRR's.

Survival Risk Ratios for Specific Body Regions by Nature of Injury

Body Region	Region Specific Fracture	Internal Organ*	Major Vessel Injury
Head	0.85	0.88	n/a
Chest	0.97	0.94	0.82
Abdomen	n/a	0.94	0.77

Patients with an injury including a major abdominal blood vessel injury have a lower SRR (0.77) compared to patient with an injury including chest fracture (0.97)
*region specific e.g. splenic laceration, pulmonary contusion or epidural bleed

Conclusion: Cell specific SRR's of the Barell Matrix represent precise survival risk for injuries of an exact body region and nature. These derived SRRs can be utilized as a benchmarking tool to compare trauma centers and systems within the US and internationally and is a potentially important first step towards advancement of trauma systems quality improvement programs.

Session X

Poster # SII-36

ANALYSIS OF THE DISASTER RESPONSE TO THE 35W BRIDGE COLLAPSE

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Objective: To optimize disaster planning, we reviewed the response of an urban level 1 trauma center to the 35W bridge collapse on August 1, 2007 in Minneapolis, MN.

Methods: Hospital response including notification, personnel response, communications, capacity, documentation and patient management strategies were evaluated.

Results: Multiple critical personnel were not notified due to failure of the disaster pager system. Media coverage and non-cell phone personal communication prevented significant delay in response. Rapid and appropriate triage and stabilization were performed in the emergency department. Representatives of all surgical specialties responded and directed ongoing care of critically-injured patients. Medical colleagues were integral in managing bed availability. Resident physicians were essential in providing care, transport and continuity. Early in the response, when anticipated patient numbers were presumed to be high, damage control operative technique was utilized to facilitate operative availability. Senior surgeons floated between rooms to assist and advise regarding ongoing anticipated patient volumes, surgical options and observed patterns of injury in the group of injured patients. Central coordination of care was limited by inadequate communication. Real-time utilization of a recently-implemented electronic health record was inefficient and ineffective. An ad-hoc paper process and notes written on patients' skin were effective.

Conclusions: Media response is a potential backup resource for disaster personnel notification. A paper record secured to the patient should be considered to facilitate rapid documentation and patient tracking in systems with an electronic health record. Communication updates regarding patient volumes and patterns of injury improve operative decision-making. Non-surgical physician response is effective in facilitating bed availability. Resident workforce is an unrecognized manpower resource and may be an important consideration in pre-hospital disaster triage when multiple level 1centers are available.

Session X

Poster # SII-37

THE EFFICACY OF A TWO-TIERED TRAUMA ACTIVATION SYSTEM AT A LEVEL I TRAUMA CENTER

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Background: Using current ACS triage criteria, 52% of trauma patients seen at our Level I trauma center are discharged home from the ED. After identifying that the majority of trauma transports were based only on mechanism of injury, we instituted a two-tiered trauma team activation system. Patients are triaged into major and minor trauma alert categories based on pre-hospital provider information. For minor trauma patients respiratory therapy, OR staff, and blood bank do not respond.

Hypothesis: A differential trauma activation system accurately identifies seriously injured patients requiring evaluation by a full trauma team.

Methods: Prospectively collected data on all minor and major trauma activations from 2000-2006 were analyzed using SPSS software.

Results: There were 12,626 trauma activations: 3609 were patients triaged as major trauma, 9017 were triaged as minor trauma. The mean ISS in major vs. minor patients was significantly different (11.7 vs. 3.6, $p < 0.0001$). Other findings are presented below:

Triage group	ISS≥16	Initial ED BP<90	ED GCS ?12	Intubated in ED	To OR from ED	Admitted to ICU	Discharged Home	Died
Major	969 27 %	195 5.4%	591 17%	248 6.9%	439 12 %	614 17%	691 19 %	231 6.4%
Minor	295 3.4 %	79 0.9%	121 1.4%	13 0.1%	205 2.3%	184 2%	5851 65%	13 0.14%

P< 0.0001 for all listed values

The 13 minor trauma deaths occurred after hospital admission; all were physiologically stable in the ED. One patient with apnea at the scene was mis-triaged. The remaining 12 deaths were due to: progression of brain injury (7), a preexisting medical condition (metastatic cancer) (2), delayed diagnosis of blunt intestinal injury (1), delayed aortic rupture (normal chest CT) (1), and heart failure from papillary muscle rupture (1).

Conclusion: A two-tiered trauma activation system identifies patients who require the services of a full trauma team and leads to more effective use of trauma center resources.

Session X

Poster # SII-38

INCIDENCE AND OUTCOME OF MAJOR TRAUMATIC INJURY IN A LARGE POPULATION-BASED COHORT: OBSERVATIONS FROM THE RESUSCITATION OUTCOMES CONSORTIUM TRAUMA EPISTRY

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Introduction: The true incidence of major traumatic injury that utilizes organized Emergency Medical Services (EMS) resources and its outcome is unknown. The purpose of this study was to determine if the incidence of, and mortality from major trauma that utilizes EMS resources varies across regions of North America.

Methods: Design**:** Population-based cohort study. Setting**:** EMS agencies in 9 of 11 US and Canadian urban and rural sites participating in the Resuscitation Outcomes Consortium (ROC), a pre-hospital resuscitation trials network. Inclusion criteria**:** Individuals who sustained traumatic injury during the 1 year period from 4/1/2006 to 3/31/2007 who were evaluated by EMS personnel and had any of: a) abnormal vital signs (systolic blood pressure $\leq$ 90 mmHg, respiratory rate < 10 or > 29, or GCS score $\leq$ 12), b) intubation in the field, or c) died in the field. Analyses**:** Incidence rates and fatal incidence rates were standardized to the North American population after adjusting for age and sex. Multiple imputation was used to estimate incidence and outcome in agencies with missing data. A priori subgroups were those with blunt or penetrating injury. Differences in incidence across sites were assessed with asymptotic χ^2 tests.

Results: 7211 patients (67% male; median age 36 years) met inclusion criteria and 1910 died (25.5%). The table shows the mean and range for all major trauma incidence rates and fatality incidence rates (per 100,000 population) as well as incidence rates based on injury mechanism across the ROC sites. Data: mean (lowest, highest individual ROC site).

	Incidence	χ^2 p-value	Fatal Incidence	χ^2 p-value
All Major Trauma	34.3 (15.0, 97.4)	< 0.001	8.7 (3.9, 28.9)	< 0.001
Blunt	22.6 (12.2, 74.7)	< 0.001	5.1 (2.7, 14.0)	< 0.001
Penetrating	5.3 (1.7, 20.0)	< 0.001	2.4 (0.7, 8.5)	< 0.001

Conclusions: The incidence of major traumatic injury and its outcome differ significantly across ROC sites. Research is needed to understand these differences so that measures can be taken to reduce the impact of this major public health problem.

Session X

Poster # SII-39

EFFICIENCY OF INTEGRATION OF EMERGENCY MANAGEMENT INFORMATION SYSTEMS BY A GEOGRAPHICAL FEATURE DATABASE SERVICE

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It is crucial to give emergency responders detailed and complete information in rescue planning under major incidents including disasters. The Japanese Emergency Management Information System (J-EMIS) is a computer database system for disaster response, but at present, J-EMIS provided responders with non-graphic text data concerning only medical institutions. In this study, we attempted to graphically integrate data from J-EMIS with ones from other existing lifeline and/or traffic information services, and examined its efficiency. Methods: In a catastrophic disaster simulation in Osaka city, we prepared for dummy data on J-EMIS and public services of water supply and traffic information. These data were integrated on Google Earth, a popular virtual geographic program, by using MISP, an originally developed protocol for sharing mitigation information, DaRuMa, a prototype of database system for MISP. For example, the number of patients accommodated in a suffered hospital was demonstrated as a vertical bar partitioned by severity on a map. Malfunctions of medical institutions, regions with suspension of water supply or traffic restriction were emphasized with special icons or colors. Six volunteers were set to make a rescue planning for suffered hospitals and to determine proper approach routes to those hospitals, and to guess medical conditions of neighbor hospitals with lack of data. Results: The MISP/DaRuMa tool programs successfully integrated all information systems. All the data were visualized geographically by Google Earth in a personal computer. Even inexperienced responders could easily handle the software and take required data. Results of the volunteer study demonstrated that graphically integrated data were more useful for emergency response than separate text data.
Discussion: Integration of various information systems by geographical feature database services could promote the efficiency of existing emergency management information systems. Flexible, multi-platform, and open DaRuMa would have wide applications and be a promising tool for emergency response.

Session X

Poster # SII-40

THE PRESENCE OF OXIDATIVE BIOMARKERS IN DONATED PACKED RED BLOOD CELLS: EFFECTS OF LENGTHY STORAGE

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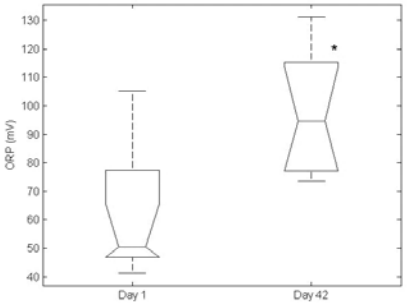
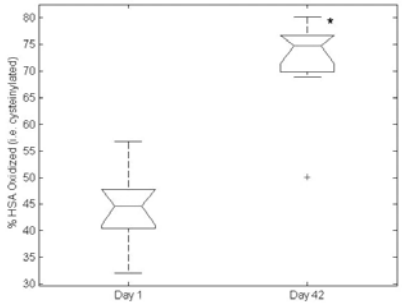
Introduction: Transfusion-related acute lung injury (TRALI) is a life-threatening condition characterized by oxidative stress. Longer storage times of packed red blood cells (PBRCs) and other blood products have been implicated with an increased risk in developing TRALI in transfused patients.

Methods: A total of 10 transfusion bags containing PBRCs stored in ACD buffer at 4°C were included in the study. At Bonfils Blood Center (Denver, CO), samples were collected on storage day 1 and day 42. Samples were immediately centrifuged, and the supernatants were collected and stored at -80°C until further analysis. Oxidation-reduction potential (ORP) and protein oxidation were measured in both the day 1 and day 42 samples.

Results: ORP significantly increased ($p < 0.05$) in the day 42 sample (98.1 mV ± 21.9 SD) versus the day 1 sample (62.6 mV ± 21.5 SD). The oxidation of human serum albumin (HSA) increased by 63.6% during the storage time. Other serum proteins such as apolipoprotein A1 and transthyretin demonstrated similar increases in protein oxidation. Also, proteins with a cleaved C-terminal amino acid were observed indicating the presence of carboxypeptidase activity, a marker of inflammation.

Conclusion: The presence of an oxidative environment in transfused PBRCs increases with storage time. This could partially explain the increased risk of developing TRALI related to the transfusion of older blood products.





Session X

Poster # SII-41

INITIAL CLINICAL EXPERIENCE USING 5% HYPERTONIC SALINE AS A SAFE ALTERNATIVE FLUID FOR USE IN TRAUMA

Joseph J. DuBose, MD, Pedro G.R. Teixeira, MD, Alfredo Lozornio, MD, D.J. Green, MD, David Plurad, MD, Kenji Inaba*, MD, Demetrios Demetriades*, MD, Peter Rhee*, MD MPH.
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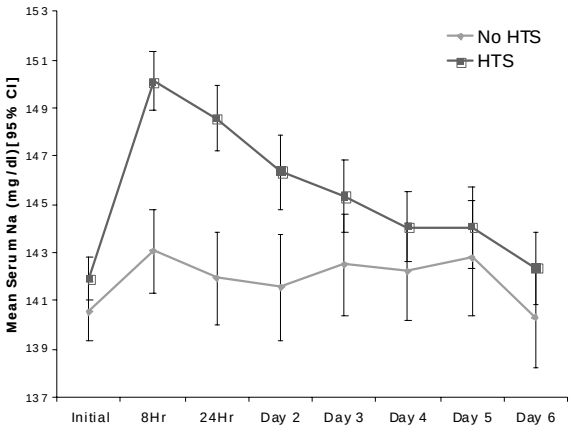
Introduction: Published experience of hypertonic saline (HTS) use in resuscitation has described the use of commercially unavailable 7.5% solutions. The purpose of this study was to compare our experience with the administration of commercially available 5% HTS solution to that of well-matched controls who did not receive HTS.

Methods: Prospective observational study of 51 trauma patients receiving 500 cc of 5% HTS during initial resuscitation. HTS patients were 1:2 matched using age, gender, ISS, GCS, Head AIS and injury mechanism to trauma patients who did not receive HTS. The laboratory values and outcomes of the two groups were compared.

Results: Patients receiving HTS demonstrated no difference from the matched cohort in mean pH, INR or p/f ratios at 8 or 24 hours. The mean serum sodium of the HTS group was higher than controls at 8 hours (143.1 vs. 150.1 mg/dL, $p < 0.001$) and remained significantly more elevated for 3 days without any adverse sequelae related to hypernatremia. No difference in mortality was noted between the two groups. A trend in decreased mortality was observed in patients with GCS ? 8 and Head AIS ? 3. (25.0% vs. 42.5%) and the mean ventilator days was 7.3 for HTS group and 9.2 days for the non-HTS group.



Conclusion: Although serum sodium remained elevated for several days after HTS administration, no adverse sequelae due to hypernatremia resulted. Commercially available 5% HTS solution is safe for use in the resuscitation of trauma patients and may improve outcomes in a selected subset of patients with head injury.

Session X

Poster # SII-42

ALCOHOL INTOXICATION AND THE TRAUMA PATIENT; I DRINK THEREFORE I AM...HYPOTENSIVE

Victor McCray, MD, John Bilello, MD, Dana Forman, MD, Deborah Lemaster, RN, Steven Parks*, MD (sponsor). Community Regional Medical Center, UCSF-Fresno.

Introduction: Many trauma patients are acutely intoxicated with alcohol. Animal studies have demonstrated that acute alcohol intoxication inhibits the normal release of epinephrine, norepinephrine, and vasopressin in response to acute hemorrhage. Ethanol also increases nitric oxide release and inhibits antidiuretic hormone secretion.

Purpose: To determine effects of alcohol intoxication (measured by blood alcohol level, or BAL), on the presentation and resuscitation of trauma patients with blunt hepatic injuries.

Methods: A retrospective registry and chart review was conducted of all patients presenting with blunt liver injuries at a level I trauma center. Data collected included blood alcohol level, systolic blood pressure, hematocrit, hepatic injury grade, injury severity score (ISS), units of blood transfused, and mortality.

Results: From 9/2002 to 10/2007, 723 patients were admitted with blunt hepatic injuries. Admission BAL was obtained in 545 with 26% having levels >0.08. Significantly more intoxicated patients were hypotensive on admission despite no significant increase in liver injury grade, ISS, or mortality. There was no significant difference in the number of intoxicated patients receiving blood transfusion. However, transfused intoxicated patients received significantly more blood than their non-intoxicated counterparts.

	BAL ?0.08	BAL >0.08	p value
% Hypotensive	12	21	<0.02
Hematocrit %	37	38	<0.02
% Transfused	30%	31%	0.83
# units PRBC's	9.5	16	0.02

Conclusion: Alcohol intoxication impairs the ability of trauma patients to compensate for acute blood loss, making them more likely to be hypotensive on admission and increasing their blood product utilization. All trauma patients should have BAL drawn upon admission and their resuscitation should be performed with an understanding of the physiologic alterations associated with acute alcohol intoxication.

Session X

Poster # SII-43

IDENTIFYING PATIENTS WHO WILL REQUIRE MASSIVE TRANSFUSION: SIMPLE AS ABC?

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Background: Massive Transfusion (MT) occurs in 3-5% of civilian and 8-10% of military trauma patients. While many centers have implemented MT protocols, most do not have standardized policies for their activation and scoring methods to rapidly identify patients who require MT are needed. The purpose of this study was to validate two described MT scores in a civilian setting and to compare these scores to a simplified, non-laboratory dependent scoring system (ABC: Assessment of Blood Consumption score).

Methods: Our institution's TRACS registry (07/05-06/06) was queried for all adult patients who received at least one unit of PRBC in the first 24 hours and were transported directly from the scene. Trauma Associated Severe Hemorrhage (TASH) and McLaughlin scores were calculated according to published methods. The ABC score is based on four non-weighted parameters—penetrating mechanism, positive FAST exam, arrival systolic blood pressure ?90 mmHg, and arrival heart rate ?120 bpm. MT was defined as receiving ?10 units of PRBC in the first 24 hours. The area under the receiver operating characteristic curve (AUROC) was calculated to compare predictive ability of each score.

Results: 596 patients were available for analysis, with an overall MT rate of 12% (n=74). Patients receiving MT had higher TASH (median 6 vs 13, $p<0.001$), McLaughlin (2.4 v 3.4, $p<0.001$) and ABC (median 1 vs 2, $p<0.001$) scores. TASH (AUROC=0.84), McLaughlin (AUROC=0.77), and ABC (AUROC=0.81) scores were all good predictors of MT, and the difference between TASH and ABC ($p=0.16$), and McLaughlin and ABC ($p=0.15$) scores were not statistically significant. An ABC score of two or greater was 60% sensitive and 87% specific for predicting MT (correctly classified 84%).

Conclusions: The TASH, McLaughlin, and ABC scores accurately predict MT in civilian trauma patients. The ABC score, however, allows for the rapid identification of patients who will require MT without the need for parameter weighting, injury score calculation, or laboratory values.

Session X

Poster # SII-44

IMPACT OF BLOOD TRANSFUSION ON MONOCYTE CHEMOTACTIC PROTEIN (MCP-1)

Obeid Ilahi, MD, Grant Bochicchio, MD MPH, Kaspar Keledjian, MD, Kelly Bochicchio, RN BSN MS, Thomas Scalea*, MD. University of Maryland School of Medicine.

Objectives: To evaluate the impact of blood transfusion on Monocyte Chemotactic Protein 1 (MCP-1) expression in a dose dependent manner and correlate levels with outcome in critically injured trauma patients.

Methods: A prospective study was conducted on 78 consecutive patients admitted to the ICU who underwent blood transfusion during the first 24 hours of hospitalization. Number of units of packed red blood cells (PRBCs) were calculated on a daily basis. Serum samples of MCP-1 were measured on admission, day 3 and day 7. Outcome was evaluated by infection rate, ICU and hospital length of stay and mortality. Multivariate regression models were used to determine significance controlling for age, gender, and ISS.

Results: The mean age of the study cohort was 46 ± 21 years with a mean ISS of 31 ± 15, APACHE score of 15 ± 7 and SOFA score of 5 ± 3. The majority (71%) were male and admitted for blunt trauma (75%). The mean number of PRBC units transfused during the first week was 8.5 ± 11 in which the majority of the units (83%) were transfused in the first 24 hours. The mean ICU and hospital length of day were 16 ± 12 and 22 ± 15 days respectively and 23% of patients were diagnosed with infection within the first 2 weeks. The overall mortality of the study cohort was 19%. When controlling for age, gender and ISS, MCP-1 increased by 9 units for each unit of blood transfused on day 3. In addition, HLOS increased by 0.02 days for each unit increase in MCP-1 [95% CI 0.004-0.03] (p=0.01) and ICU length of stay increased by 0.02 day for each point increase in MCP-1 [95% CI 0.01-0.02] (p=0.003) in the same model. This association was not maintained on day 7. MCP-1 was not predictive of infection during week 1 or mortality in this model.

Conclusion: There is a dose dependent association between blood transfusion and MCP-1 expression which is delineated by day 3 of hospitalization and is associated with increased ICU and hospital length of stay. Further research is warranted to better understand this association.

Session X

Poster # SII-45

INCREASED PLATELET TO RED BLOOD CELL RATIO IS ASSOCIATED WITH IMPROVED SURVIVAL IN MASSIVELY TRANSFUSED COMBAT CASUALTIES

Jeremy G. Perkins, MD, Phillip C. Spinella, MD, Kurt W. Grathwohl, MD, Andrew P. Cap, MD PhD, Charlie E. Wade, PhD, John B. Holcomb*, MD. Walter Reed Army Medical Center.

Background: Patients with severe traumatic injuries often present with coagulopathy and require massive transfusion. To treat the coagulopathy of trauma, some have suggested early, aggressive correction using plasma, whereas platelets have generally been considered only late in the resuscitation. We examined the relation of platelet and red blood cell (RBC) unit ratios and their association with outcomes.

Methods: Retrospective chart review of 593 massive transfusion patients (?10 units of RBCs in 24 hours) at a US Army Combat Support hospital, each of whom required a massive transfusion from 12/2003 to 12/2006. Three groups were selected according to apheresis platelet to RBC ratios transfused (low <1:16, medium 1:16 to <1:8, and high ?1:8). Morbidity and mortality rates were compared.

Results: There were no differences in the age, admit temperature, INR, HR, ISS_98, RTS, or TRISS between the low (n=215), medium (n=166), and high (n=212) ratio groups respectively. Base deficit was worse in the high platelet ratio group as compared to low (9.0 versus 10.8, p = 0.03) and medium (8.8 versus 10.8, p=0.02) platelet ratio groups. Forty-eight hour survival was 61%, 82%, and 89% for low, medium, and high ratio groups respectively (p<0.001). Thirty-day survival was 42%, 55%, and 69% for low, medium, and high ratio groups respectively (p<0.001). There were no differences between groups for the development of ARDS, MOFS, or thrombotic events, though infection was increased in the highest ratio group. On multivariate logistic regression, higher ratios were independently associated with improved survival.

Conclusions: In patients with combat related trauma requiring massive transfusion, a high platelet to RBC ratio (? 1:8) may improve survival. This is countered by a potential increase in infectious complications. Massive transfusion protocols should consider incorporating apheresis platelets during resuscitation with a 1:8 apheresis platelet to RBC ratio for patients who are expected to require massive transfusion.

Session X

Poster # SII-46

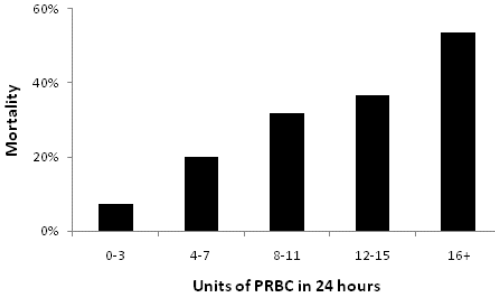
DEFINITION AND PREDICTION OF MASSIVE TRANSFUSION IN TRAUMA

TC König, MD, S Stanworth, MD, C Gaardner, MD, T Morris, MSc, JF Pittet, MD, M Cohen*, MD, K Brohi*, MD. Royal London Hospital.

Objectives: There is a need to re-examine the concept of massive transfusion given the recent identification of the early coagulopathy of trauma-shock, the development of the concept of damage control resuscitation and the application of new therapeutic regimens for massive transfusion. This study was conducted to: 1. Determine if there is a clinically relevant definition of massive transfusion based on outcome and 2. Identify admission predictors of massive transfusion which may be used to activate optimal transfusion algorithms and inform the design of future clinical trials.

Methods: We reviewed prospectively collected datasets from three international academic trauma centers. Data were collected on demographics, mechanism of injury, ED systolic blood pressure, base deficit, prothrombin time, 24-hour packed red blood cell (PRBC) requirement and mortality. Multivariate modeling using Bayesian information criterion (BIC) was used to develop a prediction model.

Results: 2900 patients were included in the study. There was a linear increase in mortality with the number of PRBCs transfused with no identified step increases. Base deficit was the strongest single predictor of a 6 or more PRBC transfusion. A multivariate model of BD, SBP and PT best predicted PRBC requirements (BIC 502).



Risk factor	BIC	Odds ratio	(95% c.i.)
BD	544.7	1.24	(1.19-1.29)
SBP	623.6	0.97	(0.96-0.98)
PT	667.0	1.14	(1.08-1.20)
APTT	706.8	1.61	(0.87-2.97)
Age	707.2	1.36	(0.90-2.06)
Penetrating	707.9	1.32	(0.83-2.09)
Sex	709.2	0.91	(0.57-1.47)

Conclusion: Definitions of massive transfusion are arbitrary and do not select patients on the basis of outcome. Better prediction of transfusion requirements may allow earlier activation of protocols for optimal transfusion while avoiding wastage of blood.

Session X

Poster # SII-47

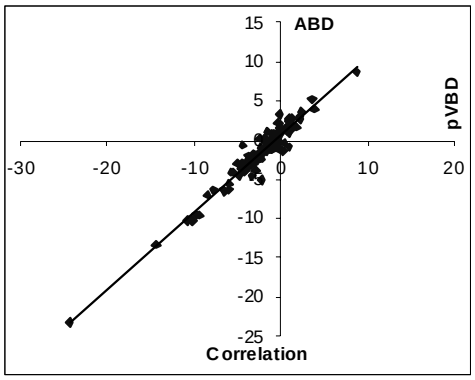
PERIPHERIAL VENOUS BASE DEFICIT IS AN ACCURATE TOOL TO DETERMINE THE SEVERITY OF THE TRAUMATIC SHOCK-RELATED METABOLIC ACIDOSIS DURING TRAUMA RESUSCITATION

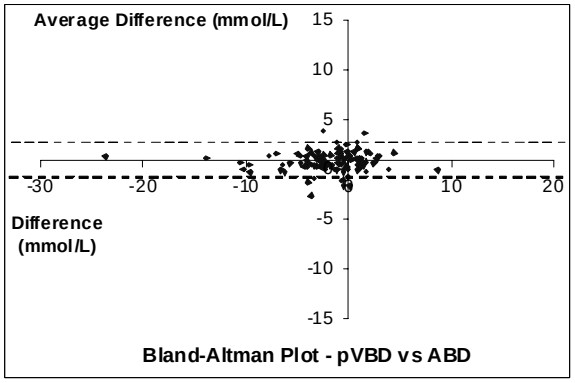
Zsolt Balogh*, MD PhD, Timothy Arnold, BMed, Mark Miller, MD, Peter Mackay, RN, Julie Evans, RN, Laszlo Toth, MD, Karlijn van Wessem, MD, Timothy Pollitt, MD. Deapartment of Traumatology, Division of Surgery, John Hunter Hospital, University of Newcastle.

Introduction: Arterial base deficit (ABD) is crucial to assess trauma patient's metabolic response to shock, but venous blood is available earlier. The aim of this study is to determine the difference (correlation, agreement, clinical relevance) between the first peripheral venous base deficit (pVBD) and the first ABD during trauma resuscitation.

Methods: During the 9-month study period ending Oct-2007 consecutive trauma patients presenting to a Level-1 Trauma Center requiring ABD had simultaneous pVBD test by the same operator. The paired measurements were tested with Pearson correlation and Bland-Altman (B-A, for agreement) tests. Survey of local and AAST trauma clinicians was performed to establish the clinically relevant difference between 2 serial BD measurements.

Results: The 116 study patients' (78% male, 47.5±18.4 yrs, ISS 16±9) mean ABD was -2.0mmol/L and the mean pVBD was -1.2 mmol/L .The mean difference between pVBD and ABD was 0.8 [95% CI 0.6 to 1.0]. Pearson correlation: r = 0.97 (p <0.0001). The clinically relevant difference of BD measurements was determined as 2 mmol/L by the survey participants (11 local, 62 AAST). The difference between the paired measurements was 96% (111/116) of the samples sat within the clinically acceptable limits (B-A plot).





Conclusion: There is an excellent correlation and agreement between simultaneous ABD and pVBD, the difference between them is clinically irrelevant. A pVBD test from the first iv access can be used accurately to assess traumatic shock-related metabolic response.

Session X

Poster # SII-48

THE BENEFICIAL EFFECTS OF HTS WITH EP ON HEMORRHAGIC SHOCK FOR FIELD USE

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Introduction: Hemorrhagic shock is the major life-threaten damage in combat casualties. This study aims to investigate the resuscitative effects of hypertonic saline solution (HTS) with ethyl pyruvate (EP), which give the benefits of small volume resuscitation and anti-oxidant activity, respectively, on hemorrhagic shock.

Methods: Hemorrhagic shock in rats was initiated by withdrawing of blood via carotid artery catheter. Resuscitative fluids were given at 30 min of shock. At 4 hr of resuscitation, shed blood was re-infused to mimic the scenario for delayed evacuation.

Results: HTS+EP effectively improved animal survivability and mean arterial blood pressure (MABP).

Group	Survivability			MABP (mmHg, mean±SEM)		
	4 hr of resuscitation	1 day of blood re-infusion	5 days of blood re-infusion	30 min of shock	4 hr of resuscitation	2 hr of blood re-infusion
Sham Operation	100%	100%	100%	90.5±18.1	82.7±26.0	80.9±23.2
Untreated	0%	0%	0%	17.8±4.8	0.0±0.0	
HTS	80%	80%	20%	18.8±4.2	75.1±18.6	76.5±10.6
HTS+EP	100%	100%	60%	21.8±6.3	58.2±26.8	109.4±24.9

Conclusion: HTS with EP showed the beneficial effects for resuscitation following hemorrhagic shock. Given the advantage of small volume resuscitation, it may be considered as a potential fluid for future use in the pre-hospital setting. The mechanisms of the effects of HTS with EP need to be further investigated.

Session X

Poster # SII-49

ESTROGENIC HORMONE MODULATION ABROGATES CHANGES IN RED BLOOD CELL DEFORMABILITY AND NEUTROPHIL ACTIVATION IN TRAUMA HEMORRHAGIC SHOCK

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Introduction: Decreased red blood cell (RBC) deformability and activation of neutrophils (PMN's) after hemorrhagic shock have been implicated in the development of distant organ injury after T/HS with female rats being more resistant to these changes than males. Since this appears to be related to the effects of estradiol (E2) on the two cell types, we tested the roles of estrogen receptors (ERα and ERβ) in transducing estrogen's protective effects.

Methods: To test this hypothesis, hormonally intact (PE) and ovarectomized (OVX) females were subjected to trauma (laparotomy) and hemorrhagic shock (30+/-5 mmHg for 90mins; T/HS) as well as OVX females reconstituted with A)E2, B)ERα agonist PPT and c)ERβ agonist DPN. Three hours post-shock, blood samples were collected. RBC's were isolated and deformability measured (elongation index) using LORRCA at various shear stresses. PMN activity was determined by measuring the ability to induce respiratory bursts under flow cytometry.

Results: RBC deformability in T/SS group was (0.071±0.005), this was not decreased in the T/HS females (0.072±0.002) but did decrease in the T/HS ovarectomized group (0.052±0.004 $p<0.001$). PMN activation increased in T/HS vs. T/SS group (291±50; 209±9 MFI respectively; $p<0.001$) and further increased after ovarectomy (403±37 $p<0.001$). Administration of E2 to OVX T/HS restored both parameters to that of the intact female T/HS group. Estradiol's suppressive effect on PMN activity was related to ERβ (DPN and not PPT found to be protective) while both ERα and ERβ agonists partially restored the deformability of the RBC towards normal (ERα=0.062±0.006; ERβ= 0.060±0.008).

Conclusion: Estrogen protective effects are mediated by different receptors in various cell populations.

Session X

Poster # SII-50

RATIO OF 1:1:1 PRBC TO FFP TO PLATELETS DOES NOT CONVEY A SURVIVAL ADVANTAGE WHEN COMPARED TO 1:1 PRBC TO FFP RATIO ALONE DURING DAMAGE CONTROL RESUSCITATION

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Objective: Damage control resuscitation (DCR) with PRBC to FFP ratio of 1:1 conveys a survival advantage in trauma patients with severe hemorrhage. Recent reports advocate the use of 1:1:1 ratio for PRBC, FFP and Platelets (PLT) as part of DCR. We hypothesize no survival advantage when a ratio of 1:1:1 is compared to ratio of 1:1.

Methods: Seven year retrospective review of trauma patients requiring >10u PRBC during initial surgery. Patient characteristics and outcomes were compared for 1:1 vs. 1:1:1 resuscitation strategies. Univariate analysis of continuous data was done with Students t-test followed by multiple logistic regression. Coagulopathy was defined as initial emergency department INR >1.2. Data included demographics, initial: hemoglobin and INR; pre and post surgery PLT count; hospital LOS and 30 day mortality.

Results: Total of 51 and 76 patients received a 1:1 and 1:1:1 ratio respectively. After adjusting for age, mechanism, ISS and systolic pressure a ratio of 1:1:1 in multivariate analysis did not convey a survival advantage when compared to 1:1, (OR; 95% CI: 1.15 (0.67-1.99), p=0.61). Results:

	1:1 (n:51)	1:1:1 (n:76)	p-value
Age (SD)	33 (13)	35 (14)	0.34
Penetrating Injury (%)	36 (70.5)	44 (57.8)	0.19
ED Systolic (SD)	100 (26)	105 (31)	0.31
Initial Hemoglobin (SD)	10.3 (1.2)	10.7 (1.4)	0.23
ISS (SD)	24 (11)	22 (8)	0.21
Initial INR (SD)	1.45 (.80)	1.39 (.38)	0.22
Pre-op PLT count	173,000	195,000	0.34
Post-op PLT count	119,000	109,000	0.47
LOS, days			
Mean (SD)	21 (22)	25 (28)	0.48
30 Day Mortality (%)	16 (32)	25 (33)	0.86

Conclusion: Early aggressive resuscitation with 1:1:1 ratio doesn't convey any survival advantage when compared to 1:1 resuscitation. Its use during damage control resuscitation is not warranted.

Session X

Poster # SII-51

LIPID EMULSION IS SUPERIOR TO RINGER'S LACTATE IN OXYGEN CONTENT AND INCREASING BLOOD PRESSURE OF MICE IN SEVERE HEMORRHAGIC SHOCK

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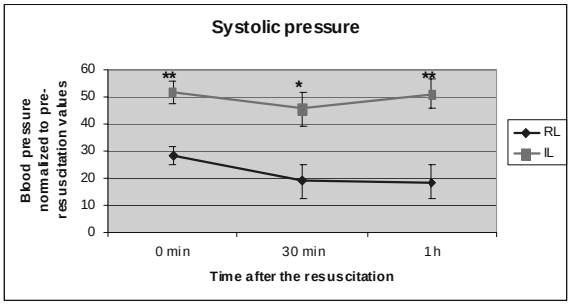
LSU Health Sciences Center.

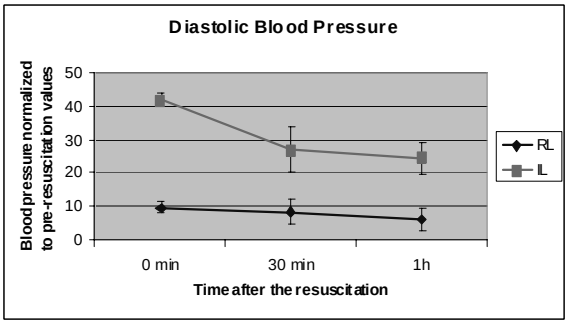
Background: Lipid micelles (IL) should absorb the lipophilic gases oxygen and nitric oxide. We hypothesized that IL would carry oxygen and increase blood pressure.

Methods: Mice were anesthetized (xylazine/ketamine) and the carotid artery cannulated. All blood was removed over 2 minutes. Once respirations stopped, IL (20% Intralipid) or Ringer's lactate (RL) was rapidly infused in a volume equal to the volume of blood removed. Univariate analysis with Student's t test was used.

Results: O2 content (room temp/1 Atm.) of IL, by mass spectrometry, was 61mg/L or 84% greater than RL or water both equal at 33.1 mg/L. O2 was extracted from IL nearly as rapidly as from RL. The reported O2 value for perfluorcarbon is 40.7mg/L. IL (n=6) raised the BP significantly higher than RL (n=6 $p<0.01$). All mice in the IL group lived until euthanized at 1-4 hours. 2 mice in the RL group died after less than 10 minutes. Infusion of IL at 2 x the volume of removed blood raised the blood pressure beyond the pre-hemorrhage value ($p<0.01$).

Conclusions: 1. IL is an oxygen carrying and releasing emulsion that increases the blood pressure 2. IL is superior to RL and did not demonstrate any adverse effects in severe hemorrhagic shock





Session X

Poster # SII-52

THE PHYSIOLOGICAL AND HEMODYNAMIC EFFECTS OF VARYING TIDAL VOLUMES AND RESPIRATORY RATES IN HEMORRHAGIC CONDITIONS

Paul E Pepe*, MD MPH, Demetris Yannopoulos, MD, Tim Matsuura, Carly Alexander, Scott H McKnite, BS, Jane G Wigginton, MD, Ahamed H Idris, MD, Keith G Lurie, MD. University of Texas Southwestern Medical Center at Dallas.

Introduction: Although it has been well-demonstrated that overzealous ventilation can be detrimental to blood flow, particularly in hemorrhagic states, the relative contributions of tidal volume (TV) and respiratory rate (RR) have not been well-delineated. The purpose here was to evaluate physiological effects of varying TV and RR in moderate hemorrhage.
Methods: Anesthetized with isoflurane and receiving endotracheal intubation (FiO_2=1.0) and multiple instrumentations, 24 female farm pigs (weight range 28 – 32 kg) were bled to 40% of estimated blood volume or a systolic aortic blood pressure (AoBP) of 30 mmHg (whichever came first). After 5 minutes of stabilization, multiple baseline measurements were recorded, including TV, RR, arterial oxygen saturation (SaO_2), AoBP, carotid blood flow (CaBF), cardiac output (Q_T), arterial pH, and arterial CO_2 tension ($PaCO_2$). The animals were divided into 2 groups of 12 with Group 1 assigned to a RR of 6/min and Group 2 receiving 12/min. Using a randomly-assigned cross-over design within both groups, each pig received a TV of 6 ml/kg for 10 min., then 10 ml/kg for 10 min. (or vice versa; 10 ml/kg, then 6m l/kg, according to the equalizing randomization table).
Results: In this particular model, there were no significant differences in the majority of comparisons, although mean CaBF was higher with the lower TV in both Group 1 (RR = 6/min; 117 vs. 105 ml/min; p=.07) and Group 2 (RR = 12/min; 128 vs. 110 ml/min; p=.03). There was also a strong trend toward a higher mean Q_T with the lower TV in both Group 1 (2.85 vs. 2.46 L/min; p=.09) and Group 2 (2.70 vs. 2.40 L/min; p=0.1) comparisons. As expected, mean $PaCO_2$ was significantly higher and mean pH significantly less in both the lower RR and lower TV measurements, but mean SaO_2 remained >98% in all scenarios.
Conclusions: After moderate hemorrhage, intubated pigs (receiving 100% oxygen) may have better blood flow to the brain with a relatively lower TV (6ml/kg) while still maintaining a good SaO_2. Recognizing the limitations of the model examined, additional studies are recommended, particularly before applying these findings to the clinical setting.

Session X

Poster # SII-53

SYMPATHETIC FAILURE AND THE LOSS OF COMPENSATORY RESPONSE AFTER SEVERE HEMORRHAGIC SHOCK

Hernando Gomez, MD, Linda Hermus, MD, Sven Zenker, MD, Patricio Polanco, MD, Rajaie Namas, MD, Gilles Clermont, MD, Yoram Vodovotz, PhD, Michael R Pinsky, MD, Juan Carlos Puyana*, MD. University of Pittsburgh Medical Center.

Background: It has been postulated that one of the reasons why refractory shock (in the absence of further bleeding) does not respond to therapy is failure of the sympathetic drive. Indeed refractory decompensation and subsequent circulatory collapse after severe trauma/hemorrhage may be associated with exhaustion of the acute stress response. We developed a model of severe shock characterized by repetitive bleeding and severe decompensation and hypothesized that hemodynamic decompensation was characterized by failure of the sympathetic response (loss of vascular tone) accompanied by endocrine/inflammatory inertia.

Methods 9 Yorkshire-Durock pigs were submitted to thoracotomy and severe repetitive controlled bleeding until unable to compensate. They were then resuscitated and observed for 2 hours. Epinephrine, Glucose, Lactate and TNF were measured and correlated to pulse pressure/stroke volume interactions. (ΔG) was calculated as the change in blood glucose between time points. Vascular tone index (VTI) was calculated as arterial pulse pressure/stroke volume index. Sympathetic tone index (STI) was calculated as VTI x heart rate. Data were analyzed using non-parametric methods.

Results 7 animals survived (S) and 2 died (NS) after resuscitation. STI and VTI correlated with Ep (rho=0.455, p=0.003; 0.347, p=0.026 respectively), TNF (rho=0.394; 0.427, both $p<0.0001$) and lactate levels (rho=0.593; 0.575, both $p<0.0001$). Ep, ΔG and VTI were lower in NS than S (0 vs. 154 pg/ml, p=0.003; -20 vs.-2.5 g/dl, p=0.019; 1.31 vs.1.69, p=0.013), but not STI (138 vs.174, p=0.061).

Conclusion. The strength of the hemodynamic compensatory mechanisms (VTI, STI) was associated with a greater production of sympathetic hormones, improved glucose levels, higher lactate and higher TNF response. These data suggest that therapeutic interventions during decompensated shock targeted at supporting sympathetic/metabolic/immune interaction in addition to fluid replenishment may be beneficial.

Session X

Poster # SII-54

ELEVATION OF NEUTROPHIL ELASTASE ACTIVITY IN INTRA-OPERATIVE SALVAGED BLOOD

Soichi Maekawa, MD, PhD , Mayuki Aibiki, MD, PhD , Kensuke Umakoshi, MD, Satoshi Kikuchi, MD, Hironori Matsumoto, MD, and Takashi Nishiyama, MD, PhD. Ehime University School of Medicine.

Purpose: The aim of this study was to evaluate whether neutrophil elastase (NE) activity may increase in intra-operative salvaged blood using "Cell-Saver TM" and whether the storage duration of salvaged blood may affect such changes in NE.

Materials and Methods: Thirteen patients undergoing spine surgery were divided into two groups. NE activities in autologous red cell concentrates from six patients were measured soon after the preparation (Group A): such activities in red cell concentrates from seven subjects were determined post-operatively (Group B). NE activity in salvaged blood was measured by ELISA. In thirty-two banked packed red cells, NE activity was also measured on 3, 5, 10, 14, 21 days after the storage. This study was approved by the IRB. Statistical analysis was done by Mann-Whitney U-test ($p<0.05$).

Results: In Group B, NE levels in red cell concentrates was significantly higher than those in Group A (Fig.1). In the bank bloods, NE activities gradually increased after the storage. In Group B, NE activity was two times higher than that in the bank blood stored for 21 days.

Conclusions: In intra-operative salvaged red cell concentrates, NE activation occurred. Especially such change was prominent if stored even for several hours. These results suggest that autologous transfusion of intra-operative salvaged blood should be administered soon after the preparation.

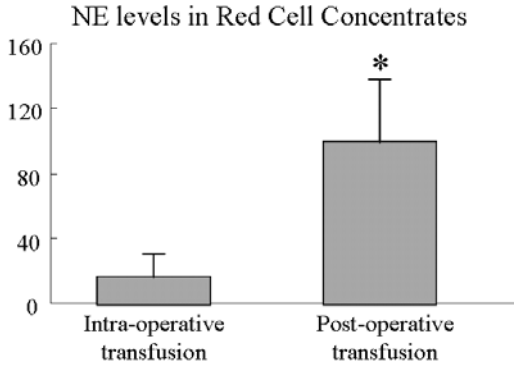


Fig 1

Session X

Poster # SII-55

BLOOD AMMONIA LEVELS IN PATIENTS WITH TRAUMATIC HEMORRHAGES

Akiyoshi Hagiwara, MD, Naoyuki Kaneko, MD*, Akira Takasu, MD*, Youichi Yanagawa, MD, Toshihisa Sakamoto, MD, and Yoshiaki Okada, MD. National Defense Medical College.

Objective: It has been reported in animal studies, blood levels of ammonia are elevated by hemorrhagic shock, but no clinical reports have appeared to date. This research was performed to survey ammonia levels immediately after traumatic hemorrhages.

Method and subjects: The subjects were trauma patients whose blood concentrations of ammonia were measured on admission between July 2006 and November 2007. The hemorrhage group (HG) consisted of 1) patients given blood transfusions of $\geq$ 4U within 24 hours, or 2) patients undergoing transcatheter arterial embolization (TAE) or surgery for active hemorrhages. The non-HG consisted of patients excluded from the criteria of the HG Children under 10 years of age, patients with chronic liver disease, and patients given infusions before admission were excluded. $P < 0.05$ was taken as statistically significant.

Results: The subjects were 242 patients (229 with blunt trauma and 13 with penetrating trauma) consisting of 59 women and 183 men. The mean age was 44.1 ± 20.7 years of age and ISS was 15.6 ± 12.8. The surgery for hemorrhage was performed in 13 patients and TAE in 7 patients. Blood transfusions of > 4 U were performed in 21 patients. Consequently, the HG consisted of 27 patients and the non-HG of 215 patients. Ammonia levels were 110.1 ± 25.2 ug/dL in the HG and 57.9 ± 25.2 ug/dL in the non-HG. The value was significantly higher in the HG. The shock index on admission and infusion volume per hour after admission each showed a significant correlation with ammonia values ($r = 0.44$, 0.54, respectively). ROC curve analysis was performed on the ammonia values and shock index with the HG taken as positive. The areas under the curve were 0.91 and 0.86, respectively. The optimum ammonia cut-off value was 80 ug/dL. The sensitivity and specificity for the HG were 0.89 and 0.88 respectively.

Conclusion: The blood ammonia level on admission is a predictive factor of traumatic hemorrhaging requiring treatment.

Session X

Poster # SII-56

A NATIONAL EVALUATION OF LITIGATION PATTERNS AMONG TRAUMA PATIENTS

David Zonies, MD, Frederick Rivara, MD MPH, Gregory Jurkovich*, MD, Mathew Sorensen, MD, Jin Wang, PhD, Ellen MacKenzie, PhD. Harborview Medical Center.

Introduction: Although perceptions of malpractice risk among trauma patients admitted to hospitals have been studied, a thorough investigation of general civil litigation patterns among severely injured patients has not been conducted. We sought to define the prevalence of civil litigation up to 1-year after severe injury and the associated risk factors.

Methods: A nested case-control design was applied to prospectively collected data from the National Study on the Costs and Outcomes of Trauma. Cases and controls were defined as discharged patients who either did or did not seek legal action within one year of injury, respectively. The study was conducted at 18 level I trauma centers and 51 non-trauma centers between 1/2001 and 12/2002. Data was obtained through chart abstraction and telephone interviews conducted at 3-months and 1-year after injury.

Results: Complete data were available for 2,965 patients, representing a weighted population of 10,117 patients. There were 1,416 patients (14.0%) who filed a lawsuit within 1-year of injury. Likely litigants were younger (39 v 44 yrs), more severely injured (ISS 19.5 v 16.8), and had a higher baseline self-perception of health (42% v 34%). Litigants had more complications (29% v 22%), prolonged hospitalization (11.3 v 9.8 days), and persistent ADL impairment at 1-year (54% v 40%). Independent predictors of litigation were blunt injury, highway occurrence v other, hospital discharge with continued services, age, and decreased 3-month SF-36 physical scores after injury (table). At 1-year, 4.2% had dropped their case, 11.6% settled, and 83% were still pending.

Independent risk factors to litigate	Odds Ratio	95% CI	p-value
Blunt Injury	6.24	(2.88-13.53)	<0.001
Injury occurring on Highway	9.24	(5.13-6.64)	<0.001
Discharge home with continued services	1.47	(1.05-2.06)	=0.026
Age (per year of age)	0.99	(0.98-0.99)	=0.001
SF-36 Physical Score	0.96	(0.95-0.97)	<0.001

Conclusion: Significant injury and complicated hospitalization are associated with the likelihood to litigate. There is significant loss of ADLs among these patients. Few legal cases settle and most are unresolved at one year.

Session X

Poster # SII-57

TRAUMA ACTIVATION CHARGE CODES: A GROSSLY UNDERUTILIZED OPPORTUNITY FOR ENHANCED TRAUMA CENTER REVENUE

Samir M Fakhry *, MD, Connie Potter, RN MBA, Wallace Crain, Ronald Maier *, MD. National Foundation for Trauma Care.

Objective: To survey Trauma Center (TC) members of the National Foundation for Trauma Care (NFTC) to determine usage and consistency of trauma team activation charge codes and critical care accommodation charges for critically injured patients. Potential over and under-utilization of these enhanced reimbursements was assessed. **Methods:** All TC members of the NFTC were surveyed (2007) on usage of codes UB 68x; FL 19 patient type 5 "Trauma Center", UB 208 and CMS codes G 0390 and APC 0681. Data were collected on use of 68x "Trauma Response" in combination with Emergency Room UB 450 HCPCS Critical Care E&M 99291.

Results: We received 57 responses of 217 requests (response rate 26.3%). Most TCs are charging for either full (86%) or partial (79%) trauma activation. Fewer are charging for E&M fees (51%) and UB 208 (33%). Charges are extremely variable between and across TC levels and among regions. Full Trauma Activation fees ranged from $837 to $24,964 (Table) with Level II TCs charging more on average than Level I TCs. As many as 63% of TCs failed to use or did not recognize codes 68x and ED 450 HCPCS 99291. **Conclusion:** Significant under-utilized opportunities exist for enhanced revenue from full implementation of activation codes. Wide ranges in charges and the low frequency of full implementation suggest that education and coordination are needed among hospital departments involved as well as among the trauma care community at large to realize optimal reimbursement for trauma care services.

		Max	Min	% Charging
Full Activation	Level 1	$7,888	$1,625	76.7
	Level 2	$24,964	$837	100.0
	Level 3	$7,517	$3,433	88.9
Partial Activation	Level 1	$6,650	$1,281	70.0
	Level 2	$19,744	$694	90.9
	Level 3	$4,698	$1,361	88.9
Evaluation	Level 1	$4,015	$135	40.0
	Level 2	$15,433	$645	59.1
	Level 3	$3,506	$603	66.7
UB 208	Level 1	$3,618	$250	16.7
	Level 2	$6,986	$500	45.5
	Level 3	$2,268	$742	44.4

Session X

Poster # SII-58

INCREASING FINANICAL PRODUCTIVITY ON A TRAUMA ACUTE CARE SURGERY SERVICE WITH AN ELECTRONIC MEDICAL RECORD SYSTEM

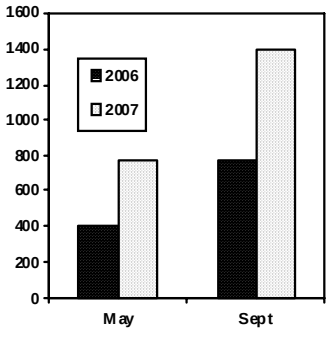
Raquel M Forsythe, MD, Andrew B Peitzman*, MD, Louis Alarcon*, MD, Marcie M Ward, RN BSN, Juan B Ochoa, MD. University of Pittsburgh Medical Center.

Introduction: To improve overall documentation as well as compliance and billing on a trauma acute care surgery (TACS) service, we implemented an electronic note system in May of 2006. Prior to initiation, H&P, consult and follow up notes were either hand written or dictated by attending physicians. In the old system, only dictated notes became a part of the electronic medical record (EMR) system.

Methods: Number of notes, E/M codes generated, charges and payments were compared prior to implementation and one year and 17 months post-implementation. Data were generated by reviewing billing records. Operative notes were not included in this system.

Results: The total number of notes generated on the TACS Service has increased by 93% from May 2006 to May 2007 and by 82% from September 2006 to September 2007. This far exceeds the increase in volume on the Trauma Service over this period, which was 24% and 21% for May and September from 2006 to 2007, respectively. Total charges increased from $130,813 in September 2006 to $194,061 in September 2007. Payments increased by 73% from September 2006 to 2007. This includes both Trauma patients as well as inpatient General Surgery consults. Rollout of a General Surgery consult note occurred in May of 2007. Compared to May 2006 there was a 46% increase in Consult E/Ms generated after one year. There was an increase in complexity of the consult codes billed over this time period.

Total Number of E/M Billed



Conclusion: The initiation of a computerized note system on the TACS service has significantly increased E/M codes and billing. This has led to an increase in both charges and payments that exceeds the increase in patient volume over the study period. In contrast to our previous system, all notes become part of the permanent patient EMR.

Session X

Poster # SII-59

TOURNIQUETS REVISITED

Kenneth G. Swan*, MD, Betsy C. Swan, BS RN, Deborah Swan-Wright, MS, Stephanie Swan-Barbagiovanni, DO, KG Swan Jr, MD. University of Medicine and Dentistry of New Jersey.

Purpose: Controversy persists concerning the optimal technique for initial control of life-threatening hemorrhage from an injured extremity. Unanswered are four critical questions: 1.What is the simplest, effective tourniquet? 2. Will it be successful distal to elbow or knee? 3. Is pain a factor? 4. What data support so called "Pressure Points?"

Methods: We measured the effects of the three most commonly described tourniquets [sphygmomanometer (SM), ½ inch rubber tubing (RT), cloth with windlass (CW)] upon arterial pulses (Doppler signals) at wrist and ankle of ten healthy adult volunteers. Tourniquets were applied sequentially to arm, forearm, thigh and leg. Ease of application (1 – 3, 3 easiest) was recorded by applicant, pain (none, light, moderate, severe) by subject. "Pressure points" (4) were brachial artery [BA (arm and cubital fossa)], common femoral artery [CFA (groin)] and popliteal artery [PA (knee)]. Tourniquet and "pressure point" success was defined as sustained (> 60 sec) elimination of distal pulse. Data were meaned, standard error computed.

Data: Subject age was 36 ± 6 years; blood pressure, 123 ± 6 / 72 ± 4 mm Hg. All three tourniquets were successful in all patients in all four locations with these exceptions: thighs of two subjects were too large for SM and one person experienced test terminating pain with RT on arm and thigh and CW on thigh. Ease of application favored CW (2.95 ± 0.03). Digital occlusion of the BA in the arm (pressure point) was successful in all but one subject; however, Doppler signals at the wrist returned within 40.6 ± 6.5 seconds, despite sustained pressure in all but one of the remaining nine subjects. "Pressure point control" of the CFA resulted in identical findings except that pulse return was 20.6 ± 4.7 seconds. Attempts at control of BA at elbow and PA at knee were even less successful.

Summary: Tourniquets are as successful below as above elbow or knee. A cloth with windlass is the easiest to apply (and probably to procure/improvise). Pain is irrelevant. "Pressure point control" of extremity arterial hemorrhage is a euphemistic misnomer.

Session X

Poster # SII-60

CRANIECTOMY IN CONJUNCTION WITH CRANIOTOMY: WHAT ROLE IN THE MANAGEMENT OF TRAUMATIC BRAIN INJURY?

Gabrielle M. Paci, BA, Michael J. Sise*, MD, Steven R. Shackford*, MD, Daniel I. Sack, BA, Kimberly A. Peck, MD, Sohaib A. Kureshi, MD, C. Beth Sise, JD RN MSN, Randall S. Yale.
Scripps Mercy Hospital.

Background: Patients with severe Traumatic Brain Injury (TBI) require aggressive management to avoid secondary brain injury. Preemptive craniectomy (PC) – craniectomy performed in conjunction with craniotomy for evacuation of an intracranial lesion (CR) – has gained interest. However, the indications and outcomes for PC are not well defined.
Methods: We reviewed 62 consecutive patients who underwent PC in a 78-month period at our Level I trauma center, their TBI patterns, indications for operation, outcomes, and the rates of PC by our neurosurgeons to evaluate the role of PC in the management of TBI.
Results: Of 197 TBI patients who underwent CR, 62 (31.5%) had PC and 135 (68.5%) had only craniotomy (OCR). Mean age for PC vs. OCR was 41.5 vs. 51.1 ($p < 0.01$). Mean admission GCS was lower in PC vs. OCR (7.6 vs. 11.8, $p< 0.001$); ISS was higher (30.2 vs. 26.3, $p<0.01$). Indications for operation in PC vs. OCR were epidural or subdural hematoma in 43 (69.4%) vs. 109 (80.7%) (p=NS), cerebral contusion or hematoma in 12 (19.4%) vs. six (4.4%) ($p<0.001$), and other in seven (11.3%) vs. 20 (14.8%) (p=NS). A preoperative decision for PC was made in only 20 (32.3%) patients. Reoperation was required after nine (14.5%) PC and 11 (8.1%) OCR (p=NS). Probability of survival vs. observed survival was 67% vs. 58% for PC (p=NS) and 81% vs. 77% for OCR (p=NS). This difference in survival was significant ($p<0.01$). Postoperative ICP was monitored in 48 (77.4%) PC and 44 (32.6%) OCR patients ($p<0.001$). ICP <20 was maintained in 26 (54.2%) post PC and 31 (70.5%) post OCR (p=NS). Discharge GCS in PC vs. OCR was 14.3 vs. 14.5 (p=NS). The PC rate by neurosurgeon varied from 8.6% to 75.0% ($p <0.001$).
Conclusion: We found significant variability in the use of PC by our neurosurgeons managing TBI. We could not identify improvement in outcomes with PC. This may have been due to both the higher severity of injury in the patients who underwent PC and the variability among our neurosurgeons. This study demonstrates the need for practice guidelines based on multicenter trials that fully evaluate PC in the management of TBI.

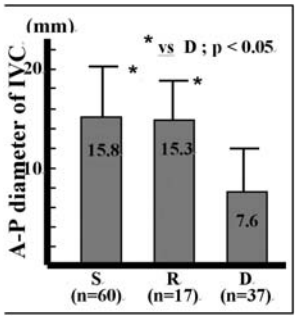
Session X

Poster # SII-61

CRUSH INJURY INDUCES SYSTEMIC INFLAMMATION: THE EFFECT OF ANTITHROMBIN III

Hideaki Sonoi, MD, Naoya Matsumoto, MD, Hiroshi Ogura, MD*, Hideo Hosotsubo, BS, Kazuo Noguchi, MD, Yasuyuki Kuwagata, MD, and Hisashi Sugimoto, MD*. Osaka University Graduate School of Medicine.

Background: We aimed to investigate the value of the diameter of the inferior vena cava (IVC) on initial CT to predict hemodynamic deterioration in patients with blunt torso trauma. **Patients and Methods**: We reviewed the initial CT scans, taken within 30 minutes after admission to ER, of 114 patients with blunt torso trauma who were consecutively admitted to our trauma center over a 24-month period. We measured the maximal anteroposterior and transverse diameters of the IVC at the level of the renal vein. A flat vena cava (FVC) was defined as a maximal transverse-to-anteroposterior ratio of less than 4:1. According to the response to initial fluid resuscitation, the patients were categorized into the following three groups: hemodynamically stable, no shock (**S**, n=60); rapid response, initial shock with return to normal hemodynamics just after volume loading (**R**, n=17); and hemodynamic deterioration, shock after CT (**D**, n=37). The medical records were reviewed for demographics, Injury Severity Score (ISS), hemodynamic change, fluid resuscitation, and blood transfusion or other therapeutic intervention to maintain hemodynamic stability within 24 hours from the time of admission.



Results: The anteroposterior diameter of the IVC in group D was significantly smaller than in groups R and S (7.6±4.4 mm, 15.8±5.5 mm and 15.3±4.2 mm, respectively; $p<0.05$). Of the 93 patients without FVC, 16 patients (17%) were in group D, 14 patients (15%) required blood transfusion, and 8 patients (9%) required intervention. However, of the 21 with FVC, all of the patients were in group D, 20 (95%) required blood transfusion, and 17 (80%) required intervention. The patients with FVC had higher mortality (52%) than the other patients (2%). **Conclusion**: In cases of blunt torso trauma, patients with a flat vena cava on initial CT may hemodynamically deteriorate, necessitating early blood transfusion and therapeutic intervention.

Session X

Poster # SII-62

SUSTAINABLE IMPROVEMENT IN ICU OUTCOMES USING A QUALITY ROUNDING CHECKLIST: ONE YEAR EXPERIENCE

Joseph J. DuBose, MD, Pedro G.R. Teixeira, MD, Kenji Inaba*, MD, Bradley Putty, MD, Lydia Lam, MD, Matthew Hannon, MD, Howard Belzberg, MD, Demetrios Demetriades*, MD. Los Angeles County / University of Southern California Hospital.

Introduction: We have previously demonstrated that the use of a daily "Quality Rounds Checklist" (QRC) can increase compliance with evidence based prophylactic measures and decrease complications in a busy trauma intensive care unit (ICU) over a three month period. The current study was designed to determine the sustainability of QRC use over one year and examine the relationship between compliance and outcome improvement.

Methods: A prospective before-after design was utilized to examine the effectiveness of the QRC tool in documenting compliance with 16 prophylactic measures for VAP, DVT, PE, CRBSI and other ICU complications. The QRC was implemented on a daily basis for a one year period by the ICU fellow on duty. Monthly compliance rates were assessed by a multi-disciplinary team for development of strategies for real-time improvement. Compliance and outcomes were captured over one year of QRC use.

Results: QRC use was associated with sustained improvement of VAP bundle and other compliance measures over a year of use. After multivariable analysis adjusting for age (>55), injury mechanism, GCS (? 8) and ISS (>20), the rate of VAP was significantly lower after QRC use; with an adjusted mean difference of - 6.65 (per 1000 device days) (95% CI: - 9.27,- 4.04; p = 0.008). During the year of QRC use, 3% of patients developed a VAP if all 4 daily bundle measures were met for the duration of ICU stay, versus 14% in those with partial compliance (p = 0.04). The overall VAP rate with full compliance was 5.29, versus 9.23 (per 1000 device days) with partial compliance. Compared to the previous year, a 24% decrease in the number of pneumonias was recorded for the year of QRC use, representing an estimated cost savings of approximately $400,000.

Conclusion: The use of a QRC facilitates sustainable improvement in compliance rates for clinically significant prophylactic measures in a busy Level I Trauma ICU. The daily use of the QRC, requiring just a few minutes per patient to complete, equates to cost-effective improvement in patient outcomes.

Session X

Poster # SII-63

DOES EARLY TRACHEOSTOMY LEAD TO BETTER OUTCOMES IN PEDIATRIC TRAUMA PATIENTS?

Breena R. Taira, MD, Hongdao Meng, PhD, Kimberly E. Fenton, MD, Adam J. Singer, MD, Jane E. McCormack, RN, Thomas K. Lee, MD, Marc J. Shapiro*, MD. Stony Brook University Medical Center.

Introduction: No study has evaluated outcomes of early versus late tracheostomy in the pediatric trauma population.

Methods: Secondary analysis of the National Trauma Data Bank (NTDB) Setting**:** 700 trauma facilities contributing to the NTDB from 2001-2005. Subjects: Trauma patients under 18 years of age who survived > 7 days, and underwent non-emergent tracheostomy. Measures: Demographic information, Injury Severity Score (ISS), Glascow Coma Scale (GCS), presence of head injury, and hospital day of tracheostomy. Early tracheostomy was defined as tracheostomy on or before hospital day 7. Outcome measures included development of pneumonia, ventilator days, hospital length of stay (HLOS), ICU Length of Stay (ICU LOS), and mortality. Analysis: Univariate analysis using chi square, student's t and ANOVA, and multivariate linear regression were used to evaluate the effect of early tracheostomy on patient outcomes. Ventilator days, HLOS, and ICU LOS were log-transformed to account for non-normal distributions.

Results: Mean age of the pediatric group was 9.5 years and 39% were female. About a third (54/159) pediatric patients had early tracheostomy, compared to 45.5%(818/1798) of adult patients (p=0.005). In pediatric patients, early tracheostomy is associated with a lower rate of pneumonia [5.6% (3/54) vs 23.8% (25/105); p=0.004], shorter average ventilator days [11.2 vs 26.1 days (p<0.001)], shorter average ICU LOS [16.4 vs 36.6 days (p<0.001)] and HLOS [29.9 vs 44.5 days, (p<0.001)]. Mortality rates were similar between early and late tracheostomy patients [5.6% (3/54) vs 3.8% (4/105), (p=0.611)]. Findings for ventilator days, ICU LOS, and HLOS remained statistically significant in multivariate analyses adjusting for major risk factors (p<0.01 for all).

Conclusions: Early tracheostomy is performed less frequently in pediatric trauma patients when compared to adults, however it resulted in lower rates of pneumonia, fewer ventilator days, and decreased ICU and HLOS.

Session X

Poster # SII-64

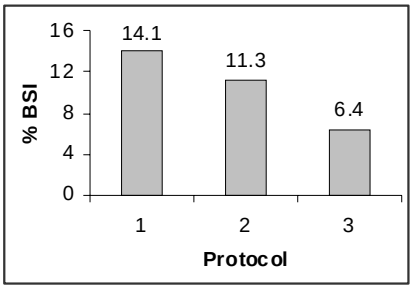
A CVL PROTOCOL DECREASES BLOOD STREAM INFECTIONS AND LENGTH OF STAY IN A TRAUMA ICU POPULATION

Therese M. Duane*, MD, Holly Brown, Luke G. Wolfe, MS, Ajai K. Malhotra*, MD, Michel B. Aboutanos*, MD MPH, Rao R. Ivatury*, MD. Virginia Commonwealth University Medical Center.

Objective : To evaluate the benefit of a central venous line (CVL) protocol on blood stream infections (BSI) and outcome in a trauma ICU population.

Methods: Prospective study from 1/03-7/06 comparing 3 groups: Group 1 (1/03-6/04) before institution of the protocol; Group 2 (7/04-6/05) after start of the protocol that included minimizing CVL use, removal of CVL as soon as possible, no routine CVL changes and strict universal precautions and Group 3 (7/05-7/06) after the addition to the protocol of a line supply cart and nursing checklist that empowered nurses to stop the procedure if the protocol was violated.

Results: There were 1392 patients admitted to the trauma ICU during the study period of whom 501 had a CVL. Group 3 had a higher ISS compared to both group 2 and 1 (28.2 ± 13.0 vs. 23.5 ± 11.7 vs. 22.8 ± 12.0, p=0.0004) but had a lower BSI rate/ 1000 line days (Group 1: 8.75; Group 2: 15.0; Group 3: 16.5). The bar graph shows the decrease in the number of patients with BSI in the three groups. Adjusting for ISS group 3 had shorter ICU LOS compared to group 1 (12.01 ± 1.47 vs. 18.14 ± 1.51, p=0.01), and both group3 (20.15 ± 2.01) and group 2 (23.40 ± 1.73) had shorter hospital LOS compared to group 1 (30.52 ± 2.08, p=0.0012 and 0.02, respectively). BSI rates were also lower in both group 3 (5/83,6.02%)) and group 2 (8/111,7.21%)) vs. group 1 (15/84,17.86%), p=0.03) for ISS< 25. Logistic regression showed ISS (p=0.04, OR 1.025, CI 1.001-1.050) and no CVL protocol compared to group 3 (p=0.05, OR 3.1, CI 1.28.7.53) to be independent predictors of BSI.



Conclusions: CVL protocols decrease both BSI and LOS in trauma patients. Strict enforcement of the protocol by an observer (nurse) further decreases BSI rate by preserving the integrity of the protocol.

Session X

Poster # SII-65

VEHICLE ROLLOVER AS A FIELD TRIAGE CRITERION

Howard R. Champion*, MD, Louis V. Lombardo. Uniformed Services University of the Health Sciences.

Objective: To review the importance of vehicle rollover as a field triage criterion

Background: In 1987, field triage criteria were developed by the American College of Surgeons Committee on Trauma and have been propagated repeatedly over 20+ years time. The field triage decision scheme is based on abnormal physiology, obvious abnormal anatomy, mechanism of injury likely to result in severe injury, and other factors (age, etc.) and was loosely supported by available science. In 2005, the triage scheme was revised by a committee, and vehicle rollover as a crash scene triage criterion was dropped in 2006.

Methods: Data were retrieved from the DOT/NHTSA Fatal Accident Reporting System (FARS) for 2004 and 2005 and analyzed to determine the contribution of rollover to morbidity and mortality.

Results: In 2005, 10,816 people were killed and 222,000 injured in rollover crashes. Fatalities alone resulted in an estimated comprehensive cost of about $36 billion. In 2004, the risk of injury and death associated with rollover was 3 and >15 times (respectively) the risk in non-rollover crashes (see Table). Vehicle rollover is a relatively infrequent type of crash but a dangerous one, and is associated with 33% of occupant fatalities and about 30,000 of AIS 3+ serious injuries. Rollovers are associated with the second highest number of vehicle occupant deaths by crash mode and three times the risk of injury when compared with other impact directions ($p < 0.0001$).

Rollover vs. Non Rollover Crash Injury and Involvement in 2004

	Rollover		No Rollover	
	#	% of all occupants	#	%
* Fatalities	10,553	2.7	21,140	0.15
**Injured	232,000	59	2,685,000	19.6
**Involved occupants	393,000	100	13,700,000	100

** Fatal Accident Reporting System FARS – Census* and *HS 810 741*
***General Estimates System GES (sample of 50,000 police/accident reports)*

Discussion: It is difficult to devise simple, accurate decision rules for point of wounding and vehicle crash scene triage. Simple, powerful relationships should be used when possible; thus, the exclusion of rollover as a triage criterion appears to be ill-advised.

Session X

Poster # SII-66

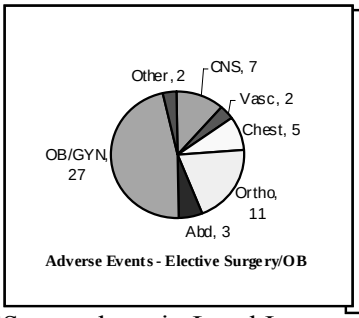
HOW SAFE IS ACUTE CARE SURGERY?

David J. Dries*, MSE MD, Diane Rydrych. Regions Hospital.

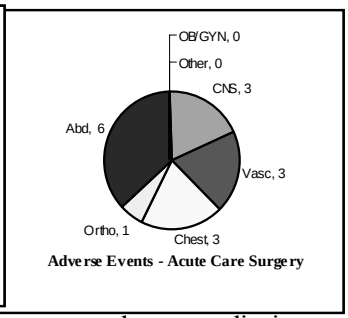
Introduction: State law requires medical facilities to report adverse events including surgical procedures on the wrong body part, wrong patient, wrong procedure and retention of foreign bodies. Using this state database, complications related to Acute Care Surgery (ACS) are compared to Elective Surgery and Obstetrics (EOB). Procedures specific to Trauma Centers and other state hospitals were also assessed.

Methods: State database for health adverse events was queried from January 2006 to December 2007. ACS procedures in the Emergency Department (ED) and OR were identified along with adverse events associated with EOB.

Results: Seven adverse events for ACS procedures were identified in the ED or OR of Level I trauma centers performing 77,310 procedures (1:11,044). Nine complications of ACS were identified in hospitals which were not Level I trauma centers performing 316,710 procedures (1:35,190). Fifty-seven adverse events were identified in EOB procedures. Retained foreign body was more common in EOB procedures (75% vs 44%; p=0.036) while wrong site procedures were more common in ACS (14% vs 44%; p=0.024). When retained foreign body OB patients were eliminated from the elective surgery group, there was no difference in this adverse event (EOB 17/31 events, 55%; ACS 7/16 events, 44%; p=0.684). Case rate for EOB adverse events was comparable for Trauma Centers and nontrauma hospitals (1:7,731 vs 1:6,739). Adverse events for ACS were evenly distributed while OB events were most common in EOB (opposite).



Adverse Events - Elective Surgery/OB



Adverse Events - Acute Care Surgery

Conclusion: Performance of ACS procedures in Level I trauma centers does not eliminate adverse events. Wrong site concerns are most important for ACS.

Session X

Poster # SII-67

SHOULD TRAUMA PATIENTS WITH ELEVATED BASE DEFICIT BE ADMITTED TO THE ICU?

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Introduction: Elevated base deficit (BD) has been associated with worse outcomes. Therefore, some have established guidelines for mandatory admission of such patients to the ICU. We hypothesized that trauma patients with elevated BD who are admitted to the ICU will have improved outcomes.

Methods: National Study on the Costs and Outcomes of Trauma database includes 5043 (weighted n=14477) patients at 69 centers between 07-2001 to 11-2002. Inclusion criteria were age 18-84 and at least one AIS ? 3. Patients without measured BD, ED death and discharges were excluded, reducing the number to 1996 (weighted n=5523). The initial BD was classified as mildly (above 2), moderately (above 5), or severely (above 9) elevated.

Results: Of the patients with elevated BD, 561 (weighted n=1363) were admitted to ICU and 546 (weighted n=1585) were not admitted to the ICU. BD remained an independent predictor of fatal outcome. Column 2 of the table demonstrates the adjusted odds ratio [OR (95% CI)] for elevated BD vs normal. However, admission to the ICU was not associated with improved outcomes. Column 3 demonstrates the adjusted mortality OR for non-ICU vs. ICU admissions at different BD categories.

BD category	Mortality Elevated BD vs Normal	Mortality non-ICU vs ICU	Analyses are performed via multivariate logistic regression with adjustments for age, gender, race, Charlson comorbidity score, mechanism of injury, alcohol use, ISS, head AIS and ED motor-GCS.
Normal	Reference	0.8 (0.5-1.4)	
Mild	0.8 (0.5-1.3)	0.9 (0.4-1.8)	
Moderate	1.3 (1-1.7)	1.5 (0.7-3.4)	
Severe	3.1 (2.0-4.9)*	1.2 (0.7-2.4)	

Conclusions: Physicians consider various variables, including BD, for admission to the ICU, which may be a limited resource in busy centers. A mandatory ICU admission policy based only on elevated BD may not improve outcomes.

Session X

Poster # SII-68

TOWARDS ELIMINATION OF CENTRAL LINE ASSOCIATED BLOOD STREAM INFECTIONS IN THE TRAUMA-SURGICAL ICU: IMPACT OF HOSPITAL-WIDE INTERVENTIONS

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Introduction: Central line associated bloodstream infections (CLBSI) are associated with increased morbidity and mortality in ICU patients. Our aim was to report the impact of hospital-wide interventions initially begun as part of a multicenter collaborative effort, on CLBSI rates in a 24-bed trauma-surgical ICU (TSICU).

Methods: Data were gathered retrospectively from January 2001 to December 2007. CLBSI were determined based on Centers for Disease Control and Prevention criteria. The chi-square test and analysis of variance were used to analyze the data where appropriate.

Results: Of 7,037 TSICU admissions, 43% were due to trauma. Initial interventions focused on standardization of evidence-based line insertion and maintenance practices. A booklet delineating practice standards issued in 2004 was expanded in 2005 to an internet-based mandatory educational module for residents and nurses combined with hands-on training for physicians achieved through proctored mannequin sessions. In late 2006, a chlorhexidine- impregnated patch was placed on every insertion site. During this period, CLBSI rates declined from 6.1 to 0 per 1000 line-days ($p=0.0001$). At the same time, there were increases in bed-days ($p=0.0001$), ventilator–days ($p=0.0001$) and total line-days. Average length of stay (median 3, mean 6.6 days) and ventilator duration did not correlate with changes in CLBSI rates although overall mortality rates declined (14.7% in 2001 to 8.4% in 2007, $p<0.0001$). Peripherally inserted central catheters (PICCs) inserted by a designated hospital-wide team accounted for an increasing proportion of line-days over the last three years (45% in 2005 to 60% in 2007, $p=0.0001$), but no differences in CLBSI rates between different line insertion sites were noted.

Conclusions : The near elimination of CLBSI in a trauma-surgical ICU coincided with multiple interventions including standardization of processes of line care and insertion, and a formal educational program delivered through practical sessions and the internet. The impact of a designated PICC insertion team on CLBSI rates remains to be determined.

Session X

Poster # SII-69

TRAUMA CENTER VOLUME: WHEN IS ENOUGH, ENOUGH?

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Introduction – Owing to the greater experience and resources higher volume trauma centers have been shown to have improved survival compared those with lower volume. Despite this improved survival, it has been suggested that, within individual higher volume trauma centers, patient volume at any given time may exceed resources thereby adversely impacting patient outcomes. However, to date no study has evaluated the specific relationship between daily patient volume and patient outcomes.

Methods – Over an eight year period at an academic level I trauma center, information regarding the number of patients on the trauma service was obtained daily. The association between the daily rate of patient complications, including both clinical and process of care events, and in-hospital mortality and daily patient volume was estimated using Poisson regression adjusting for specific patient (age, Injury Severity Score [ISS], blunt vs. penetrating injury), service (# of residents, # of attendings, % of patients in non-trauma service beds) and temporal (weekend vs. weekday) characteristics.

Results – During the study period the average inpatient census was 68.8 patients (min. 38, max. 99) which increased from a low of 49 in 2001 to a high of 79 in 2005 where it has remained to date. The average patient ISS and age was 19.3 and 42.4, respectively; approximately 75% of patients sustained blunt trauma. These patient characteristics remained constant over the study period. For the entire study period the complication and mortality rates were 1.7 per 100 pt. days and 6.9 per 1,000 pt. days, respectively. With every additional 10 patients added to the daily census the complication and mortality rates both increased 8% (p-values 0.02 and 0.09, respectively).

Conclusion – Though higher volume trauma centers have improved patient survival, the results of this study suggest that intra-facility volume variations influence patient outcomes. Trauma center resources are finite and when increasing patient volumes outpace these resources, outcomes are compromised.

Session X

Poster # SII-70

ANTIPLATELET AND ANTICOAGULATION THERAPIES DO NOT INCREASE THE RISK OF MORTALITY IN THE ABSENCE OF TRAUMATIC BRAIN INJURY

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Introduction: As the population continues to age, the number of patients undergoing traumatic injury while on antiplatelet or anticoagulation therapies is increasing. Recently, much attention has been given to reports of increasing mortality in traumatic brain injury patients on Warfarin therapy. Whether this increased mortality is seen in trauma patients without traumatic brain injury remains controversial. Also of interest is the increasing frequency of patients on a combination of anticoagulation and antiplatelet therapies. We investigated whether patients on antiplatelet and/or anticoagulation therapy were at increased risk of death from traumatic injury in the absence of head injury.

Methods: A retrospective review of our Level I trauma center database was performed from 2002-2007. Inclusion criteria included all patients admitted to the trauma service over the age of 60. Only patients with a CT scan negative for intracranial injury were analyzed.

Results: A total of 212 patients were found. Of these, 67 were found to be taking Aspirin, Warfarin, Clopidogrel, or a combination of the three. Injury Severity Score (21 vs. 21), Length of Stay (11 days vs. 9 days), days in the ICU (5 days vs. 4 days) and deaths (13% vs. 10%) were similar between those patients on antiplatelet/anticoagulation therapy and those that were not, respectively.

Conclusion: We conclude that in the absence of traumatic brain injury, the use of pre-injury antiplatelet and/or anticoagulation therapy does not significantly increase the risk of morbidity and mortality in the trauma patient. As the number of active seniors rises, and with the expanding indications for the use of anticoagulation, this patient population will continue to present to the trauma service. To the best of our knowledge, this study is one of the largest addressing this question, and the only study examining the addition of antiplatelet therapy

Session X

Poster # SII-71

A DEPLOYED COMBAT CASUALTY RESEARCH TEAM INCREASES THE OUTPUT OF IN-THEATER RESEARCH AND PROMOTES RAPID TRAUMA SYSTEM POLICY CHANGE

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Objective: Research teams have not been deployed by the US Army since Vietnam. We sought to demonstrate the positive impact of the recently deployed six person combat casualty care research team (DC^2RT) on battlefield trauma care and research systems.

Methods: A retrospective review of research efforts in the deployed setting from Operation Iraqi Freedom was performed, (2003-2008, 70 months). Descriptive statistics were used to compare research efforts, including numbers of protocols generated, data source and project completion before and after the deployment of the dedicated DC^2RT to the combat support hospital in Baghdad. Challenges of accomplishing institutional review board approval for research conducted in a war zone were reviewed. Changes to military trauma care and research practices were analyzed.

Results: Prior to the deployment of the DC^2RT in October 2006 (70 months), 18 research theatre–based protocols were IRB approved. Six of these protocols were submitted by a single combat support hospital's organized research group. All of these protocols were retrospective reviews of data collected in theater or from the Joint Theater Trauma Registry. In the 15 months following the deployment of the DC^2RT, 90 research protocols have been submitted or approved. These protocols included both retrospective and prospective studies as well as a first ever multi-level, multi-institutional, trans-continental (theatre and US military hospitals in Europe and US) study. The findings of these studies have informed Command wide combat casualty care policies and stimulated the dissemination of best practices across the combat theater.

Conclusion: A dedicated, deployed combat casualty research team has substantially increased both the quantity and quality of research protocols submitted and the speed of approval of in-theater combat casualty research - resulting in policy changes. Finally, the team's creativity and productivity has galvanized changes in Military research procedures.

Session X

Poster # SII-72

AGE MATTERS: TRAUMA CONSULTS THAT DIE

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Objective Tiered trauma team activation directs appropriate resources to the injured . Death is an unexpected outcome at the lowest level of alert. Patient outcomes for lowest level trauma activation were reviewed to identify likely indicators of increased mortality.

Methods A 10-year (1996-2006) retrospective review of lowest level trauma activations. Comparisons were made between survivors and those who expired on age, sex, ISS, LOS, vital signs, labs, co-morbidities, mechanism of injury, protective devices, and mode of transport. Multivariate logistic regression identified cofactors independently impacting mortality. Adjusted odd's ratios and 95% confidence intervals (CI) were also calculated.

Results 5939 eligible patients were identified aged 12 -97, of which 44 died and 5895 survived. Only age and ISS were independently significant ($P < 0.0001$) predictors of death. Sharp mortality increases were seen in the 6th decade of age. Odds ratio's (OR) for mortality adjusted for ISS increased linearly from the 5th to 8th decade of life. Hypertension (HTN), coronary artery disease (CAD), immunosuppresion (Immune) and anticoagulation therapy (Rx) were seen more frequently in the patients who expired. Alcohol use (EtOH) was more prevalent in survivors.

Age Groups (years)	31-40	41-50	51-60	61-70	71-80	>80
Death/1000 admissions	2.6	2.8	13.8	17.1	36.8	60.8
Median ISS	16	13	24	17	21	22
Adjusted Odds Ratio		3.26	11.42	20.85	32.6	31.31
95% Confidence Interval		0.87,12.2	3.6,36.3	7.1,61.4	11.4,93.2	7.2,136.3

Co-morbidity	CAD	HTN	Immune	Rx	EtOH
Survivors	0.4%	13.7%	0.1%	2.0%	19.0%
Dead	27.3%	28.6%	3.9%	6.5%	5.2%

Conclusions Age is an independent risk factor for death following injury and should be considered in level of trauma team activation. Current activation criteria may not give due recognition to this higher risk patient group.

Session X

Poster # SII-73

INTENSIVE CARE DECREASES MORTALITY IN ELDERLY PATIENTS WITH RIB FRACTURES

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Background: Rib fractures, even as isolated injuries, are associated with increased mortality in the geriatric population. In 2005, in an attempt to aggressively monitor these at risk patients, our Level I trauma center adopted a practice guideline that calls for automatic admission to the SICU for patients over the age of 60 with at least one rib fracture. We hypothesized that through intensive monitoring and intervention we could positively impact mortality. This study assesses the influence and impact of our 2005 "Elderly Rib Fracture" practice guideline (2005 RibFxPG).

Methods: A Trauma Registry query of patients sustaining rib fractures during the period from 1/95 to 12/07 was performed. Data was retrospectively analyzed, comparing patients over the age of 60 before and after the implementation of the 2005 RibFxPG . The primary endpoint was mortality. Other variables evaluated included ISS, days on mechanical ventilation, hospital LOS, SICU LOS, and complications. Statistical analysis was performed using a homoscedastic, two-tailed Student t-test.

Results: Our query returned 1453 patients with rib fractures, of which 430 were > 60. Within this older population, 292 were admitted before the 2005 RibFxPG took effect (<2005), 138 admitted after (>2005). The two groups had similar baseline characteristics: age (74.4 v. 73.2), ISS (16.8 v. 16.5), days on mechanical ventilation (1.8 v. 2.4), and hospital LOS (8.8 v. 9.7). There were two apparent differences: the <2005 group had a mean SICU LOS of 3.3 compared to 4.3 in the >2005 group. In addition, the <2005 group had a mean mortality of 13.4% compared to 8.7% in the >2005 group. The population under 60 years of age had no difference in mortality before or after 2005 (6.8% v. 6.6%).

Conclusion: While controlling for age and ISS, increased SICU monitoring and intervention displayed a mortality benefit in patients over 60 that sustained at least one rib fracture. This benefit was not apparent in younger patients. Consistent with the 2005 RibFxPG, patients over 60 had longer SICU stays after 2005 than before.

Session X

Poster # SII-74

RELATIVE BRADYCARDIA IN HYPOTENSIVE TRAUMA PATIENTS: A REAPPRAISAL

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Background: Tachycardia (T) is considered the normal physiologic response in hypotensive trauma patients. The inability to mount a tachycardic response has been referred to as relative bradycardia (RB). Several small series have described the incidence and prognosis of RB. The objective of this study was to examine its incidence and prognosis in a large cohort of patients.

Methods: The Los Angeles County Trauma System database, consisting of admissions from 5 Level I and 8 Level II trauma centers, was queried for all adult (>14 years) hypotensive (SBP?90) trauma patients admitted between 1998 and 2005. RB was defined as SBP?90 with HR?90, and T was defined as SBP?90 with HR>90. Demographics, injury severity, mechanism and outcomes were compared between the RB and T groups. Multivariate logistic regression was used to determine significant risk factors for mortality.

Results: Of 130,906 adult trauma patients, 7123 (5.4%) were hypotensive. After excluding patients' dead on arrival and those with missing data, 3727 patients were identified. RB was observed in 1630 (44%) of patients, while 2097 (56%) were T. RB patients were older (20% vs. 14%, age?55, p<0.0001), less severely injured (49% vs. 58%, ISS?16, p<0.0001) but had significantly higher mortality (30% vs. 23%, RR 1.34, 95% CI: 1.20-1.49, p<0.0001) compared to the T group. However, RB was protective in patients age?55 (Mortality: 28% vs. 35%, RR 0.79, 95% CI: 0.62-0.99, p<0.0001). Logistic regression identified RB as an independent risk factor for mortality (OR 1.60, 95% CI: 1.33-1.94, p<0.0001).

Conclusion: Relative bradycardia is commonly seen in hypotensive adult trauma patients. Its presence is associated with significantly worse outcome, except in a subset of patients older than 55 years of age.

Session X
Poster # SII-75

A HOLISTIC MODEL FOR OCCUPATIONAL FUNCTION AFTER INJURY

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Objective: To examine the relative and interdependent aspects of physical, psychological, social and spiritual factors in adult patients' return to occupational function after injury.
Methods: Adult trauma patients were evaluated during admission and at 6 and 12 mo. after injury (by interview in-house and self-report in follow-up). Validated measures for occupational (Sickness Impact Profile work score – SIPw), social (Duke Social Support Index: subSS), general health (SF36 physical [SF36pf] and mental health [SF36mh]), and spiritual (Daily Spiritual Experience Scale) status were used. The Trauma Registry (Collector®) provided demographic and injury data (ISS). Factors associated with SIPw at 12 mo. were evaluated in a linear regression model that controlled baseline SIPw, SF36mh, SF36pf, and ISS. Significance is noted at the 95% confidence level ($p<.05$).
Results: 250 patients entered, and 179 (71.6%) completed the study 12 mo. after injury. They were 43.3 ± 1 yr old, 63% male, had an ISS of 9.8 ± 0.42 and a hospital LOS of 5.5 ± .52 days. 72% of the patients had returned to work at 12 mo. after injury. A linear regression for SIPw at 12 mo. explained 56.3% of the variance in outcome work status.

Dependent Variable: Sickness Impact Profile – work score 12 months after INJURY

	beta	R square	R square change	significance
t1 SIP work	.047	.031	.031	.451
t1 SF36 physical function	-.003	.068	.037	.971
t1 SF36 mental health	-.068	.118	.050	.282
ISS	.139	.139	.021	.023
t3 SF36 physical function	-.303	.348	.209	.000
t3 SF36 mental health	-.447	.477	.128	.000
t1 subjective social support	-.206	.495	.019	.002
t3 daily spiritual experiences	-.273	.563	.067	.000

Conclusions: After controlling for baseline state, 56% of occupational function 12 mo. post-injury is expressed by separate measures of injury severity, physical function, mental health, subjective social support and daily spiritual experiences. We believe this is the first mathematical demonstration of the significant, independent and integrated contributions of a patient's mind, body, spirit, and social support to any health related outcome.

Session X

Poster # SII-76

MODEL FOR END STAGE LIVER DISEASE SCORE PREDICTS MORTALITY IN INJURED PATIENTS WITH LIVER CIRRHOSIS.

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Introduction: Liver cirrhosis is associated with poor outcomes in the setting of trauma. Child Pugh score (CP) as well as the Model for End Stage Liver Disease score (MELD) both predict mortality in cirrhotic patients. We hypothesize that MELD score is predictive of mortality in trauma patients with cirrhosis and is more available than Child Pugh score. We also hypothesize that TRISS underestimates mortality in patients with cirrhosis.

Methods: All trauma patients from 1997-2007 admitted our level 1 trauma center with liver disease or cirrhosis as determined by hospital record and trauma registry queries were included. Demographics, mechanism, degree and location of injury, MELD, CP, ISS, and TRISS scores were gathered (n=164). Liver disease was confirmed by laparotomy, biopsy, or abdominal CT. The primary outcome was in-hospital mortality. For analysis, patients were classified by ISS: ?9, ?15, ?25 >25 and by TRISS ?.5 and >5. Any Wald statistic ?3.84 is significant; higher values indicate stronger significance.

Results: For the group as a whole, MELD was a stronger predictor of mortality (Wald 12.73, $p<0.001$) than CP (Wald 4.85, $p=0.03$), though not as strong as ISS (Wald 21.23, $p<0.001$) or TRISS (Wald 18.58, $p<0.001$). In patients with mild to moderate injury (ISS <15), MELD was a stronger predictor of mortality (Wald 7.89, $p=0.005$) than ISS (Wald 4.69, $p=0.07$) (n=131) or CP. In patients with a higher probability of survival (TRISS >.5) MELD was also a stronger predictor of mortality (Wald 7.06, $p=0.008$) than TRISS (Wald 3.01, $p=0.08$), or CP (Wald 2.19, $p=0.14$). In the entire cohort (n=164) MELD score was more available than CP (93% vs 76%).

Conclusion: MELD score strongly predicts mortality in trauma patients with cirrhosis. MELD predicts mortality more strongly than TRISS or ISS in less severely injured trauma patients. MELD score, as compared to CP, is also a more objective and a more easily obtained predictor of outcome in trauma patients with cirrhosis.

Session X

Poster # SII-77

RACIAL DISPARITIES IN OUTCOMES AFTER ABDOMINAL TRAUMA

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Objectives: Racial/ethnic disparities in access and outcomes have been described in medical care in the United States. Recently, racial disparities in trauma outcomes, namely traumatic brain and spinal cord injuries, have been found. No study to date has looked at racial disparities in outcomes after abdominal trauma. Our objective was to assess if race is associated with an increased risk of morbidity and/or mortality after abdominal trauma for both blunt and penetrating mechanisms.

Methods: Using the National Trauma Data Bank (NTDB), we examined the racial differences in outcomes after abdominal trauma in individuals 16 years and older between the years 2002 to 2005. We restricted our analyses to Blacks, Hispanics, and Whites. Primary outcomes assessed included in-hospital mortality and complication rates. Both univariate and multivariate logistic regression models were used with the covariates of age, sex, number of co-morbidities, quintiles of injury severity score (ISS) (<5, 5-9, 10-16, 17-26, $\geq$ 27), and injury type (blunt vs. penetrating).

Results: We examined 108,627 cases of trauma with concomitant abdominal injuries, of which 21.5% were Black, 13.7% Hispanic, and 64.7% White, with an overall death rate of 8.7%. The unadjusted Odds Ratio (OR) of death is 1.1 for both Blacks and Hispanics (p-values < 0.01) with Whites as the reference group. Using logistic modeling, the OR of death is 1.1 among Blacks and 1.5 for Hispanics (p-values < 0.01). ISS quintile is the most significant predictor of death, with the odds of death relative to the lowest quintile increasing from 2.0 to 4.8 to 13.5 to 71.1 as the quintiles increase. Both male gender (OR = 1.1) and penetrating trauma (OR = 2.8) were also significant predictors of mortality.

Conclusions: Black and Hispanic minorities have higher adjusted mortality following abdominal trauma compared to Whites in the NTDB. Race appears to be an independent predictor of death even after controlling for other important factors. Further research is necessary to design strategies to eliminate these health care disparities in outcomes.

Session X

Poster # SII-78

ADULT BLUNT CERVICAL SPINE INJURIES-WHEN IS ICU ADMISSION WARRANTED?

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Introduction: Respiratory failure, delayed apnea and neurogenic shock are complications that have been reported in patients with cervical spinal cord injury. These patients would likely benefit from ICU admission on presentation. However, it is less clear if ICU admission is warranted for selected patients presenting with cervical spine injuries(CSI) but without spinal cord injury.

Methods: The hospital trauma database was retrospectively reviewed for all patients 18 years and older with blunt CSI from 2003-7. Patients with GCS <13, intubation within one hour of or prior to admission, neurological deficit, spinal cord injury or systolic blood pressure <100mmHg were excluded as these patients would likely have been admitted to the ICU regardless of cervical spine status. Main outcomes measured were requirement for intubation and mortality. The Fisher exact test and student t test were used where appropriate for categorical and continuous data. A binary logistic regression model was used to determine if there were risk factors contributing to post-admission respiratory deterioration.

Results: 784 patients met inclusion criteria. 208 were admitted directly to the ICU with 576 going to a regular floor. The incidence of deterioration requiring intubation was 76/784 (9.7%). Mortality rate was 29/784 (3.7%). Intubation was associated with subsequent mortality (28% vs 1%, $p<0.001$). Logistic regression identified admission to an ICU as well as two or more co-morbidities as independent risk factors for intubation. Age, injury severity score and gender were not predictive of intubation.

Conclusions: Respiratory deterioration following CSI is not uncommon, and is associated with a significant mortality rate. Pre-existing comorbidities are predictive of adverse outcomes. This data suggests that there is a subset of patients with CSI that should be admitted routinely to an ICU.

Session X

Poster # SII-79

M-STUDY FROM AN URBAN TRAUMA CENTER IN TOKYO: THE TIME HAS COME TO ANALYZE THE JAPAN-TRISS COEFFICIENTS

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Background: The original TRISS methodology from the Major Trauma Outcome Study (MTOS) is the most widely used outcome prediction model. We still use the coefficients from the MTOS cohorts in the Japan Trauma Data Bank (JTDB) for evaluating the quality of patient care.

Purpose: We hypothesized that our database would not be well matched to the MTOS, and that the original TRISS coefficients would not accurately predict the outcome in Japan.

METHODS: We calculated the M-statistics score based on the trauma registry from 2000 to 2003 in Teikyo University.

Results: Eight hundred and fifty-four cases were analyzed. The crude mortality rate was 10.5%. The mean Injury Severity Score was 15.8±0.5. The mean Revised Trauma Score was 7.00±0.05. The M-statistic score was 0.821.

Conclusion: The trauma population in our study differed significantly from that of the MTOS. Modified TRISS coefficients should therefore be adapted for the outcome assessment while including the location of the injured population. This is the first report regarding the M-study from Japan in the English language.

Table; Details of the M-static Calculation, as Described by Boyd et al. for Evaluating the differences Severity Case Mix Between Two Populations

Ps range	No. of patients within Ps range	Fraction of study patients in Ps range	Fraction of MTOS patients in Ps range	Smaller Ps fractions
0.96-1.0	574	0.672	0.828	0.672
0.91-0.95	81	0.095	0.045	0.045
0.76-0.90	109	0.128	0.044	0.044
0.51-0.75	6	0.007	0.029	0.007
0.26-0.50	42	0.049	0.017	0.017
0.0-0.25	42	0.049	0.036	0.036
	854	1		0.821

Session X

Poster # SII-80

EFFECTS OF COMBINATION VASOPRESSIN AND DOBUTAMINE THERAPY ON SYSTEMIC REGIONAL BLOOD FLOW IN A PORCINE (SUS SCROFA) MODEL OF VASODILATORY SEPTIC SHOCK

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Introduction: Vasopressin in septic shock is reserved as a second-line agent due to the concern of gastrointestinal ischemia and decreased cardiac output. Dobutamine has been recommended in combination with vasopressor therapy given its reported ability to improve cardiac index, oxygen delivery, and splanchnic perfusion.

Methods: To elucidate the regional hemodynamic effects of combination therapy, vasopressin (0.04 units/min) alone (n=11) or in combination (n=15) with dobutamine (10μg/kg/min) was administered to anesthetized piglets with endotoxin-induced hypotension (mean arterial pressure, MAP = 46 ± 2.0 mmHg).

Results: Vasopressin was able to completely reverse hypotension alone (MAP = 85 ± 4.5 mmHg) or in combination with dobutamine (MAP = 77 ± 4.9 mm Hg). Endotoxin decreased cardiac output (CO) (227 ± 10.7 ml/min/kg) from baseline (174 ± 12.4 ml/min/kg). Vasopressin did not further decrease the CO nor did the addition of dobutamine improve the CO. The overall drop in systemic oxygen delivery caused by endotoxin (12.2 ± 0.62 to 8.32 ± 0.45 ml/min/kg) did not recover with vasopressin alone or in combination with dobutamine (7.24 ± 0.97, 7.07 ± 0.95 ml/min/kg). The previously reported shifting of regional blood flow by vasopressin from the skin and GI tract to vital organs such as the brain and kidneys was not altered with the addition of dobutamine, and dobutamine did not improve gut blood flow in vasopressin-treated pigs.

Conclusion: Results indicate that dobutamine is ineffective in increasing CO or improving mesenteric blood flow when used in combination with vasopressin, perhaps due to the overwhelming physiological action of vasopressin.

Session X

Poster # SII-81

CLINICAL IMPLICATIONS OF HYPERGLYCEMIA AFTER PEDIATRIC BLUNT TRAUMA

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Introduction: Pediatric head injuries and burns have worse outcomes when associated with hyperglycemia (HG). The incidence of HG in severely injured children with blunt injuries at admission is not known. We explored the incidence of and potential factors linking HG to adverse outcomes in a pediatric blunt trauma population.

Methods: 7272 children under 15 years admitted to two centers July, 2000 – December 2006 were identified via trauma registries. Records sorted for ISS >15 and LOS > 48 hours were reviewed for survival, length of stay (LOS), infection, and highest glucose during first 24 hours. Patients dying were excluded. Infections were defined as positive cultures. Data were analyzed using Fishers Exact, Student's t, and Pearson's r tests.

Results: 672 children with ISS> 15 survived to discharge. Patients were subdivided by glucose: (HG, n= 403, glc ≥150 mg/dL) and normoglycemia (NG, n=269, glc <150). 60% had HG at admission. HG patients were younger ($p<.03$). Mean ISS was higher with HG ($p< .0001$). As ISS increased, glucose increased ($p< .01$). Head injuries were more common with HG ($p< .0001$). HG children developed significantly more infections ($p< .0001$)) and remained hospitalized significantly longer than NG ($p< .0001$).

Conclusion: Hyperglycemia is very common after pediatric blunt trauma and rises with ISS. Early post-injury hyperglycemia is closely linked to more nosocomial infections and longer hospitalizations. Head injury may play a role in HG. Strict glucose control might reduce infections and improve outcomes for severely injured children.

	n	Age	ISS	CNS Injury	Infections	LOS
HG	n=403	7.7 ±.2*	26±.53*	75%*	37%*	12.5±.6*
NG	n=269	8.5 ±.3	22±.42	62%	17%	8±.5

Mean ± SEM * indicates $p<0.05$ or less

Session X

Poster # SII-82

INHIBITION OF A3 ADENOSINE RECEPTOR IMPROVES THE EFFICACY OF HS-RESUSCITATION IN A MOUSE MODEL OF ACUTE LUNG INJURY

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Objective: Treatment with hypertonic saline (HS) prior to the onset of sepsis attenuates acute lung injury (ALI) by suppressing polymorphonuclear neutrophil (PMN) function, while delayed HS-treatment aggravates ALI. HS induces the release of cellular ATP and formation of extracellular adenosine, which regulate PMN via suppressive A2a-type and stimulatory A3-type adenosine receptors on the cell surface of PMN. Here we studied if A3 receptor antagonists can ameliorate aggravated ALI by delayed HS-treatment.

Methods: ALI was induced in C57B/6J mice by cecal ligation and puncture (CLP) and HS (4 ml/kg of 7.5 % NaCl) with or without the A3 receptor antagonist MRS1191 (2 ng/kg), was administered via a femoral artery catheter either 10 min before or 60 min after CLP. ALI was assessed 2 h after CLP by assaying neutrophil elastase activity in lung tissue homogenates. Survival data and histological specimens to assess lung tissue injury were acquired 24 h after CLP. The combined treatment of human PMN with HS and MRS1191 was tested *in vitro*. PMN isolated from healthy human volunteers were treated with 40 mM HS and increasing concentrations of MRS1191 before and after stimulation with formyl peptide (fMLP) and PMN degranulation was determined.

Results: Delayed HS-treatment significantly increased ALI and mortality compared to early HS-treatment. However, the combination of HS and MRS1191 significantly reduced the extent of ALI and improved survival in animals that received delayed HS-treatment. This improvement was also reflected in reduced lung tissue damage. Pre-treatment of human PMN with HS inhibited degranulation *in vitro*. By contrast, delayed HS-treatment augmented degranulation, and this response was abolished by the combined treatment with HS and MRS1191.

Conclusion: These data suggest that A3 receptor antagonists may be useful to improve the efficacy of HS-resuscitation therapy by preventing potentially deleterious effects that could result from HS-administration to patients whose PMN are activated prior to HS-treatment.

Session X

Poster # SII-83

DURATION OF ANTIBIOTICS IN FACIAL FRACTURES DOES NOT PREDICT INFECTION

Lejla Hadzikadic, MS MD, Emily Vanheukelom, DMD, Jack B.Thigpen, DMD, Erwin Hirsch*, MD, Pushkar Mehra, DMD, Suresh Agarwal*, MD, Peter A. Burke*, MD. Boston Medical Center.

Introduction: The duration of antibiotic treatment in the setting of facial fractures remains controversial and unsubstantiated by clinical trials: yielding little consensus on their use. We examined our experience of antibiotic use in the setting of facial fractures to determine whether the application of a 24 hour protocol of peri-operative antibiotics affects the rate of osteomyelitis or superficial wound infection.

Methods: Prospectively collected data of blunt maxillofacial trauma patients, managed by the Divisions of Oral and Maxillofacial Surgery and Trauma Surgery, stratified patients according to type of fracture: simple or compound; location of fracture: mandibular or LeFort (and type); and, antibiotic duration: peri-operative (<24 hours) or prolonged (>24 hours). Examination for the presence of operative infection (cellulitis, osteomyelitis, and dehiscence) was performed at weeks 1, 2, 4, and 8. Patients excluded from evaluation included: unknown antibiotic regimen, penetrating injury, and gross infection at the time of operative therapy.

Results: Over a 42 month period, 312 patients presented with facial fractures of which 126 required operative therapy. Of these, 91 patients received prolonged antibiotics and 35 received peri-operative antibiotics exclusively. There were 5 infections (3 cellulitis and 2 dehiscence) found in the prolonged antibiotic group (5.5%) and 2 infections (1 cellulitis and 1 dehiscence) in the peri-operative antibiotic group (5.7%) at time of follow up. The difference in the rate of infection was not found to be statistically significant.

Conclusions: Treating patients with exclusively peri-operative antibiotics in facial fractures repaired within 72 hours has shown no increase in infection rates at our institution. Standardizing antibiotic usage with our protocol has increased the number of patients that receive only prophylactic antibiotics, potentially decreasing health care costs and possibly decreasing complications associated with antibiotic resistance.

Session X

Poster # SII-84

ABROGATION OF PULMONARY VASCULAR INJURY AFTER ENTEROCYTE EXPOSURE TO HYPOXIA AND ETOH

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Introduction: Alcohol (EtOH) potentiates acute lung injury (ALI) and development of acute respiratory distress syndrome (ARDS) following hemorrhagic shock (HS). Gut ischemia reperfusion following HS has been causally linked to the development of ALI and ARDS. Potential mediators include oxidant products, the effects of which may be ameliorated by antioxidants and/or modulation of the Heme-Oxygenase (HO) pathway. This was studied *in vitro*.

Methods: Caco-2 intestinal cell monolayer's were incubated with 0.1% EtOH and normal gut flora (*Escherichia coli*), in a hypoxic (5% O_2) environment followed by reoxygenation. Cell culture supernatants were obtained and co-cultured with human pulmonary endothelial cell (HMVEC) monolayers. In some experiments, HMVEC were held in a low carbon monoxide (CO) environment (250ppm) and in others the cells were pretreated with n-acetyl cysteine (NAC) prior to challenge with the culture supernatant. HMVEC injury and inflammatory potential were indexed by percent apoptosis, permeability to FITC-dextran and ICAM expression. HMVEC co-culture with supernatants from Caco-2 cells alone served as control.

Results: (N = 3, mean ± SD)

	% Apoptosis	% Permeability	ICAM (MFI)
Control	4.0±0.5	20.1±0.9	8.7±0.4
H/R+EC+EtOH	41.7±0.8	93.6±1.6	18.9±0.4
H/R+EC+EtOH+CO	17.1±1.1*	71.2±1.4*	13.3±0.3*
H/R+EC+EtOH+NAC	30.5±0.6*#	34.4±0.7*#	17.7±0.6#

*$p<0.001$ vs. H/R+EC+EtOH, #$p<0.001$ vs. H/R+EC+EtOH+CO

Conclusions: Modulation of the HO pathway by CO or antioxidant pretreatment ameliorated the effects of gut I/R and EtOH on pulmonary vascular injury. This suggests a possible therapeutic potential for these agents either alone or in combination to prevent ALI and subsequent ARDS in this setting.

Session X

Poster # SII-85

IMMUNOLOGIC FUNCTION FOLLOWING SPLENIC EMBOLIZATION FOR TRAUMA --- IS THERE A DIFFERENCE?

Gail T. Tominaga*, MD, Fred J. Simon Jr, MD, Imad S. Dandan*, MD, Kathryn B. Schaffer, MSH, Jess F. Kraus, PhD, Michael Kan, MD, Stephen R. Carlson, MD, Stephen Moreland, MD, Peter Schultz, RN, A. Brent Eastman*, MD. Scripps Memorial Hospital La Jolla.

Objective: To determine whether there is an advantage of splenic embolization (SE) over splenectomy (S) following traumatic splenic injury based on immunologic status following treatment.

Methods: Traumatic splenic injury patients treated at one Level II Trauma Center were eligible for study. SE patients were compared to those who underwent splenectomy (S) and controls (C = patients with blunt abdominal trauma and negative abdominal CT scans). Patients underwent a clinical examination, medical survey, blood sampling, and nuclear medicine spleen scans. IgM, IgG, C3 complement, properdin, helper T cells (CD3, CD4), suppressor T-cells (CD8), presence of Howell-Jolly bodies, CBC, and HIV status were tested. Radionuclide spleen scans were analyzed for total spleen volume, splenic defects, abnormal radionuclide uptake and ectopic sites of tracer uptake.

Results: There were no significant differences in age, gender, or ISS between groups. Follow-up time was comparable (S = 2.67 yrs; SE = 2.88 yrs). There were no significant differences in all studies measured except for higher CD8 levels in the S group, although all values were within the normal range. CD3 levels showed a trend of being higher in the S group, but were not statistically significant.

Patients (N)	Mean CD3 (cells per mcL)	Mean CD4 (cells per mcL)	Mean CD8 (cells per mcL)	Mean IgM (mg/dL)	Mean IgG (mg/dL)	Mean Properdin (mg/dL)
C (10)	1371.9	837.6	480.6	129.5	1106.6	49
SE (17)	1397.2	913.5	452.13	121.0	1118.1	37.2
S (9)	1709.3	944.1	730.1*	91.56	1268.3	37.4
Normal	684-2170	381-1469	138-858	22-240	540-1822	20-51

*$p<0.002$

Conclusion: The data suggest that the immunologic profile of embolized patients is similar to controls. This supports the safe use of splenic embolization in managing the traumatically injured spleen. Randomized clinical trials are needed to elucidate definitive answers.

Session X

Poster # SII-86

THE DURATION OF SIRS BEFORE ORGAN FAILURE (DSOF) AS A NOVEL PROGNOSTIC FACTOR FOR SEPSIS

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Objective: The mortality rate of the septic patients, who are complicated with organ failure or shock, remains high, although they are treated with intensive cares. Here we defined the duration of systemic inflammatory response syndrome (SIRS) before organ failure, DSOF, as a prognostic factor. DSOF means the speed of progression from sepsis without organ failure into sepsis with organ failure or shock (Fig.). The purpose of this study is evaluating whether DSOF can predict the prognosis of septic patients with organ failure or shock.

Study design: Retrospective cohort study,

Setting: 11-beds medical and surgical intensive care unit in university hospital

Patients: From September 2001 to February 2007, 118 septic patients with organ failure or shock were enrolled. Finally we focused our analysis on 110 patients.

Measurements and Main Results: Overall five days mortality rate and in-hospital mortality rate were 13.6 % and 36.9 %, respectively. The patients were divided into two groups as follows: group 1 (n=50); the patients with DSOF < 24 hours, group 2 (n=60); the patients with DSOF > 24 hours. There are statistically significant differences in five days mortality rate and in-hospital mortality rate between group 1 and group 2 (28.0 % vs. 1.7 %, $p<0.001$, 52.0 % vs. 25.0 %, $p=0.004$, respectively), while there is no difference in APACHE II score (23.3 ± 1.0 vs. 22.1 ± 0.9) between two groups. Furthermore, multivariate analysis revealed that DSOF < 24 hours (odds ratio: 5.89, 95% CI: 1.46-23.8, P=0.013), was a significant independent prognostic factor as well as APACHE II score, AT III levels, age and lung as the location of primary infection (Table).

Conclusion: The present study indicates that DSOF may be a novel prognostic factor for sepsis, which is worth using clinically.

Figure:The Progression of Infection

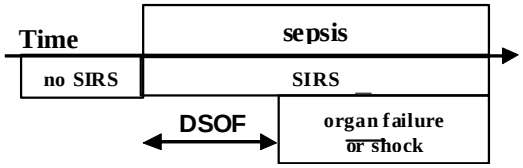

Table: Multivaliate Analysis of Risk Factors for In-Hospital Mortality

Risk Factor	In-Hospital Mortality OR (95% CI)	P Value
DSOF (< 24 h)	5.371 (1.358-21.235)	**0.017**
Pneumonia	11.494 (2.347-55.556)	**0.003**
APACHE II score	1.189 (1.060-1.334)	**0.003**
AT_III	0.956 (0.923-0.991)	**0.013**
Age	1.068 (1.014-1.125)	**0.021**
Gender (Female)	0.388 (0.101-1.381)	0.153
T-Biliru bin	1.030 (0.921-1.153)	0.602
BUN	0.994 (0.961-1.028)	0.717
Cr	0.911(0.496-1.675)	0.765

Session X

Poster # SII-87

THE PATTERN OF GRAM STAINED FECAL FLORA WAS RELATED WITH SEPTIC MORTALITY IN PATIENTS WITH SEVERE SIRS

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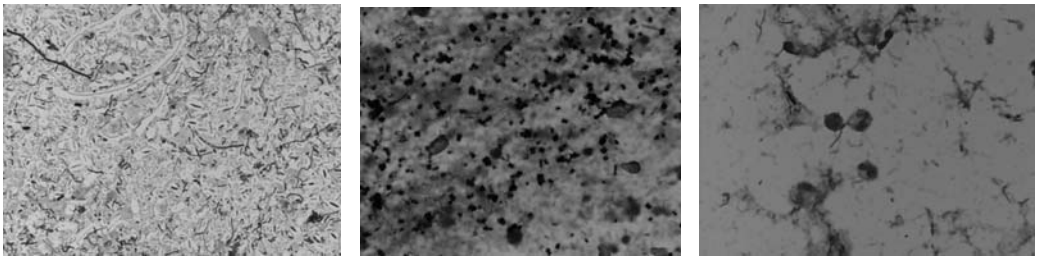
Backgrounds: The gut is an important target organ of injury following severe insult such as sepsis and trauma. The gram stained fecal flora has not been fully evaluated under critically ill condition. In the present study, we evaluated the pattern of gram stained fecal flora for quick diagnosis of gut environment in patients with severe SIRS and determine its relation with septic complications and prognosis.

Patients and Methods: Forty-two patients with SIRS**,** who had a serum CRP level > 10 mg/dL, and were treated in the ICU for more than 7 days, were included. The pattern of gram stained fecal flora was divided into three patterns. In Pattern 1, numerous number of multiple kinds of bacteria totally covered the field. In Pattern 2, specified bacteria (only one or two kinds of bacteria) dominantly covered the field. In Pattern 3, most bacteria were diminished in the field. The incidence of bacteremia and the mortality due to MODS were evaluated in each pattern.

Results: The incidence of bac? eremia was 40% (6/15) in Pattern 1, 55% (11/20) in Pattern 2, 86% (6/7) in Pattern 3. The mortality due to MODS was 7% (1/15) in Pattern 1, 45% (9/20) in Pattern 2, 100% (7/7) in Pattern 3 ($p<0.05$ vs. Pattern 1,2).

Conclusions: The pattern of gram stained fecal flora was significantly related with septic mortality in patients with severe SIRS. Gram stained fecal flora can be used as a quick diagnostic marker of gut environment for early enteral treatment in critical illness.

Pattern 1 Pattern 2 Pattern 3



Session X

Poster # SII-88

THE AGING ROAD WARRIOR: NATIONAL TREND TOWARD OLDER RIDERS IMPACTS OUTCOME FOLLOWING MOTORCYCLE INJURY.

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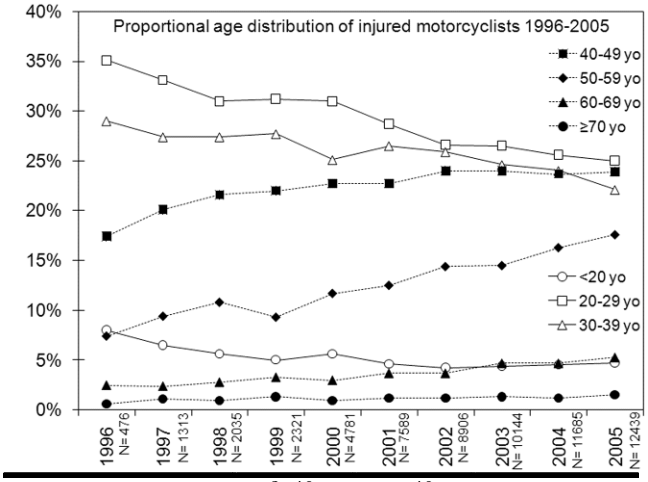
Introduction: Industry studies (IS) suggest that the age of those purchasing and riding motorcycles in the United States is increasing. Our objective was to analyze the impact of this demographic shift on injury patterns and outcomes following motorcycle crash.

Methods: The National Trauma Data Bank was used to identify all injured motorcyclists between the ages of 17 and 89 over a10-year period (1996 to 2005). Subjects were divided into 2 groups (? 40 vs. <40) based on trends seen in prior IS and outcomes were examined.

Results: 61,689 subjects were included. Over the study period, the mean age increased from 33.9 to 39.1 years (p< 0.01) and the proportion of each decade age group over 40 increased (Figure). We found worse outcomes, higher ISS, more comorbidities and more complications in the ? 40 group (table), but older riders were also more likely to die with an ISS < 9 (OR 2.2; CI 1.5-3.1), or ISS 9-15 (OR 1.4; CI 1.1-1.8). Helmet use was use was similar between both groups (72.9% vs. 73.2%, p=0.52).



	? 40 N=26745	< 40 N=34944	p value/OR (CI)
ISS (±SEM)	14.2±0.1	12.9±0.1	< 0.01
LOS (days±SEM)	7.7±0.1	6.4±0.1	< 0.01
ICU LOS (days±SEM)	7.3±0.1	6.4±0.1	< 0.01
ICU required (%)	32.2	27.3	1.26 (1.2-1.3)
Comorbidities (%)	20	9.7	2.33 (2.2-2.4)
Complications (%)	7.6	5.5	1.41 (1.3-1.5)
Mortality (%)	5.5	4.9	1.13 (1.05-1.2)

Conclusion: Injured motorcyclists are getting older, presenting with more comorbidities, having more complications and doing worse following motorcycle injury. Older motorcycle riders are also more likely to die following less severe injury. This pattern emerges in motorcycle riders as young as 40 years of age. Safety initiatives should be expanded to target this unrecognized at-risk population.

Session X

Poster # SII-89

NEW SOFTWARE TOOLS FOR CHARACTERIZING COMBAT INJURY

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Objective: Development and evaluation of new tools to characterize combat injury

Background: Combat injuries are largely explosion-related, comprising multiple fragment injuries and mechanisms of injury (blast overpressure, whole or partial body translocation and fireball in additional to fragment penetration) and high-kinetic-energy bullets that result in massive tissue damage and high lethality. Searchable databases providing actionable knowledge of points of surface entry and resulting organ injury severity are essential in improving body and vehicle armor. Two tools have been developed to address these unique aspects of combat injury: (1) AIS 2005-Military, an Abbreviated Injury Scale (AIS) 2005 modification by a panel of military trauma surgeons to account for multiple-injury etiology from explosions and other high-kinetic-energy weapons; and (2) Surface Wound Mapping™ (SWM), database and analytic software that generates 3D density maps of point-of-surface wound entry and resultant anatomic injury severity.

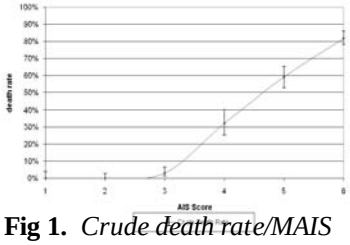

Fig 1. *Crude death rate/MAIS*

Methods: Combined data from the Joint Theatre Trauma Registry, Navy/Marine Combat Trauma Registry and the Armed Forces Medical Examiner mortality registry (N=1043) were coded in AIS 2005-Military and entered into the SWM database.

Results: Because the database was focused on opportunities to improve personal protective equipment (PPE), there is a skew to axial and torso injuries. The 1043 patients had 2412 entrance wounds and 6430 internal injuries. ***Fig 1*** shows the relationship between maximum AIS (MAIS) and mortality. Mean MAIS was 3.27 in survivors and 5.49 in decedents.

Discussion: The SWM was designed to demonstrate the relationship between surface entrance wounds (3.2/casualty) and internal injuries (6.2/casualty). These new tools have been successfully implemented to describe combat injury, mortality, and distribution and to assist in improvements in personnel/vehicle protection, and in quality of care assessment.

Session X

Poster # SII-90

EPIDEMIOLOGY AND OUTCOME OF OUT-OF HOSPITAL CARDIAC ARREST AFTER TRAUMA IN CHILDREN AND ADOLESCENTS

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Objective: Trauma is the leading cause of death for children in North America, yet the rate for any given community on its own is relatively low. Using a multi-center approach, we evaluated the epidemiology and outcomes of the uncommon yet high-stakes problem of pediatric out-of-hospital cardiac arrest (OHCA) secondary to trauma.

Methods: This cohort study includes prospectively collected OHCA of traumatic etiology in children <18 years, from 7 regions in Canada and the United States representing 30 different EMS ALS agencies (pop. 27 million). With IRB approval, each community collected data from EMS, dispatch and hospital records for consecutive 12-month periods between 2000-2004. Analysis included descriptive statistics with 95% CIs.

Results: Characteristics of the 104 included patients: median age 11 years (IQR 4-15); male 75%; race – black 58%, Hispanic 20%, white 17%; location – residential 51%, street/highway 29%; bystander witnessed 33%; bystander CPR 19%; EMS-witnessed 9%; intubation – attempt 95%, success 79%; IV – attempt 73%, success 72%; IO – attempt 16%, success 71%; initial recorded rhythm – asystole 57%, PEA 30%, VF/VT 4%; median intervals in minutes (IQR) – call to arrival 5.4 (3.8-7.6), on scene 12.8 (8.4-18.8), transport 7.2 (4.3-11.0). Unlike blunt trauma or strangulation/hanging, most post-arrest patients who survived the first 24 hours after penetrating trauma or drowning were discharged alive:

Trauma Mechanism	ROSC	24-Hr	Discharge (95% CI)
All traumatic cardiac arrests, N=104	21.2%	11.5%	6.8% (1.9 – 11.7)
Blunt trauma, n=35 (33.7%)	17.1%	8.6%	2.9% (0.0 – 8.6)
Penetrating trauma, n=22 (21.1%)	18.2%	9.1%	9.1% (0.0 – 21.1)
Drowning, n=21 (20.2%)	38.1%	23.8%	19.1% (2.2 – 35.8)
Strangulation/Hanging, n=17 (16.3%)	23.5%	11.8%	0.0%
Other – e.g. electrocution/fire, n=9 (8.7%)	0.0%	0.0%	0.0%

Conclusions: Overall survival rates for pediatric traumatic arrest are poor but similar to prior reports for non-trauma and adult OHCA. Meaningful survival exists for some mechanisms. Future research and prevention strategies should focus on those over-represented populations and high-risk mechanisms to improve survival.

Session X

Poster # SII-91

IMPACT OF STATE HELMET LAWS ON ALL-TERRAIN VEHICLE RELATED HEAD INJURIES IN CHILDREN

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Purpose: Mandatory helmet laws have been passed in several states to reduce the severity of all-terrain vehicle (ATV) related head injuries. The aim of this study is to compare the severity of head injuries between states with and without mandatory helmet laws.

Methods: The 2005-2006 Pediatric Health Information System data was reviewed for nine states with helmet laws (HL), and four states without helmet laws (NHL). Patients ? 16 years of age hospitalized with ATV-related injuries were identified (n=336). Data included age, diagnosis and procedure codes, length of stay (LOS), and total hospital charges. Diagnosis and procedure codes were used to identify patients with traumatic brain injury (TBI), injuries to other organ systems, and to calculate Injury Severity Scores (ISS). Analyses were performed using student t-tests and nonparametric Mann-Whitney tests.

Results: The mean age of patients was 11.1±3.6 years. The table below contains comparative data for states with and without mandatory helmet laws.

Conclusions: These data suggest that helmet laws alone do not decrease the severity of ATV-related head injuries in children. Further investigation is necessary to determine whether the absence of a protective effect is due to non-compliance with helmet laws or other factors.

	Helmet Law (n=161)	No Helmet Law(n=175)	p-value
Head Injury (TBI)	37.3% (60)	36.0% (63)	NS
Thoracic Injury	13.7% (22)	12.6% (22)	NS
Abdominal Injury	19.3% (31)	24.o% (42)	NS
Extremity Injury	43.5% (70)	44.o% (77)	NS
Neurosurgery procedure	4.3% (7)	4.0% (7)	NS
ISS, average	7.8 ± 5.6	7.9 ± 6.3	NS
ISS, TBI patients	10.7 ±5.6	11.5 ± 6.7	NS
LOS	3.9±6.8	5.5±9.2	p=.34
Total charges (TBI pt)	$26,151±52648	$31,421±38699	p=.001

Session X

Poster # SII-92

MINOR TRAUMA IS AN UNRECOGNIZED CONTRIBUTOR TO POOR FETAL OUTCOMES: A POPULATION-BASED STUDY OF 78,552 PREGNANCIES

Peter E. Fischer, MD, Ben L. Zarzaur*, MD MPH, Timothy C. Fabian*, MD, Louis J. Magnotti, MD, Martin A. Croce*, MD. University of Tennessee Health Science Center.

Introduction: Fetal outcomes after trauma have received some interest, but outcomes following minor injury have been ignored as these patients are discharged after emergency room evaluation and not placed on trauma registries. The purpose of this study was to determine the association of both minor and severe injury on fetal demise, premature birth, and low birth weight in a large population-based study utilizing robust state databases.

Methods: The state Fetal Birth and Death Data Systems were merged with the state Hospital Discharge Data System using patient identifiers. All women with an e-code requiring inpatient admission during their pregnancy were considered severely injured (SI) while those discharged after emergency room evaluation were considered to have minor injury (MI). The impact of trauma on unintentional fetal demise, premature birth (< 37 weeks), and low birth weight (< 2,500 grams) was assessed using multivariable logistic regression to calculate adjusted odds ratios (aOR) after adjusting for known maternal risk factors including medical conditions, age, race, education level, and prenatal care.

Results: 78,552 pregnancies occurred in 2005. There were 376 fetal deaths, 9,813 premature births, and 7,457 children with low birth weight. When compared with *uninjured* pregnant women, *injured* women were younger, less educated, and more likely to smoke (all $p < 0.0001$). SI was significantly associated with fetal demise, prematurity, and low birth weight. Unexpectedly, first-trimester MI was also associated with fetal demise (aOR 1.9, $p = 0.02$), premature delivery (aOR 1.4, $p < 0.0001$), and low birth weight (aOR 1.3, $p < 0.0001$).

Conclusions: Fetal mortality and morbidity were increased following SI. Importantly, MI was associated with fetal demise, premature delivery, and low birth weight. These patients should be carefully followed after even minor trauma, and injury prevention programs aimed at educating expectant mothers should be instituted to limit risks to the fetus and improve birth outcomes.

Session X

Poster # SII-93

INEFFICIENCIES IN A RURAL TRAUMA SYSTEM: THE BURDEN OF REPEAT IMAGING IN INTER-FACILITY TRANSFERS

Rajan Gupta*, MD, Sarah E Greer, MD, Eric D Martin, MD. Dartmouth Hitchcock Medical Center.

Background: Local hospitals transferring patients to regional trauma centers often obtain CT scans to diagnose injuries and justify transfer. However, these imaging studies are often repeated at the receiving trauma center. This study was performed to examine how frequently CT scans were repeated in inter-facility transfers in a rural trauma system, as well as identify the most common reason for repeating the studies.

Methods: Patients transferred to a rural Level 1 trauma center (TC) from Oct. 2007 through Feb. 2008 were prospectively evaluated. Data abstracted included CT scans performed at local hospitals (LH), and CT scans repeated at the trauma center. Additionally, the reason for repeating each study was recorded: 1=scan not sent, 2=software not compatible, 3=inadequate technique (no IV contrast), 4=inadequate technique (no reconstructions), 5=clinically indicated.

Results: During the study period, 138 patients were transferred to the TC. Of these, 104 (75%) underwent CT imaging prior to transfer. Sixty (58%) of these patients underwent repeat CT imaging at the TC. Overall, 98 out of 243 scans (40%) were repeated (table).

CT scan	Head	Chest	Abdomen	C-spine	T-spine	L-spine	Total
TF (#)	75	36	46	67	10	9	243
TC(#)	39	11	9	31	5	3	98
Percent	52%	31%	20%	46%	50%	33%	40%
Reason	5	3	3	4	4	4	

Conclusions: CT scans are repeated in 40% of inter-facility transfers. Head CT scans are most commonly repeated for clinical indications. All other body region CT scans are repeated due to inadequate technique at the LH. Repeat CT scans inevitably result in increased radiation exposure to patients as well as additional charges, and may be an important patient safety and cost issue for trauma systems.

Session X

Poster # SII-94

TRENDS IN RADIOGRAPHIC EVALUATION OF TRAUMA PATIENTS

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Objective: Recent literature suggests that the use of diagnostic tests and overall patient exposure to radiation in trauma centers is increasing. We evaluated the use of diagnostic studies in acutely injured trauma patients to determine trends in usage and radiation exposure.

Methods: Registry records for all trauma activation patients encountered during two 1-year periods were evaluated (Period I: Jan-Dec 2004, Period II: Oct 2005-Sep 2006). The number and type of all diagnostic studies performed during the entire stay was evaluated, as were the studies performed during the initial trauma resuscitation period. Significance was presumed for $p<0.05$ using the Fisher Exact Test or χ^2.

Results:

Entire Hospital Stay			
Period	**I**	**II**	**%chg**
# Patients	**616**	**605**	**-1%**
Tot Studies	**7623**	**7071**	**-7%**
Studies/Pt	**12.4**	**11.7**	**-6%**
Conventional xray	2932	2673	-8%
CT Scan	3510	3229	-9%
Fluoroscopy	587	542	-8%
MRI	175	193	+10%

Conventional xray = chest, pelvis, spines, orthopantogram

Initial Resuscitation			
Period	**I**	**II**	**%chg**
Portable chest	591	577	-2%
Portable pelvis	407	370	-9%
Total	**998**	**947**	**-5%**
Head CT	395	431	+9%
Cervical CT	357	451 *	+26%
Chest CT	37	233 *	+530%
Abd/Pelvis CT	408	413	+1%
Maxillofacial CT	77	119 *	+55%
Total CT	**1274**	**1647 ***	**+29%**

* $p < 0.05$

Conclusion: The total number of diagnostic studies decreased by 7% over the two periods, although this did not reach statistical significance. The majority of the decrease occurred in the use of conventional xrays, CT scan and fluoroscopy. However, CT techniques used during initial evaluation increased, especially scans of the face, cervical spine and chest. Increased use of higher exposure, better resolution studies during initial resuscitation may decrease the number of studies required during the remainder of the hospital stay, reducing total radiation exposure.

Session X

Poster # SII-95

SELF INFLICTED INJURIES IN THE UNITED STATES: TRAUMA CENTERS SEE ONLY THE TIP OF THE ICEBERG

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Background: Self inflicted injuries (SII) are the leading cause of death for 10 - 44 year olds in the US. This study examines the burden of SII on trauma services at 700 US trauma centers contributing data to the National Trauma Data Bank (NTDB).

Methods: Review of injuries reported to NTDB (v 6.2) and the Centers for Disease Control (CDC) WISQARS database in the year 2005. Injury mechanisms and intents were identified using International Classification of Diseases (ICD) E codes. For each specific injury mechanism, we calculated the proportion of patients hospitalized in the US (CDC#) that are in NTDB (NTDB#) and compared them to the proportion for all injury with χ^2.

Results: Nearly 1/5th of all hospitalized trauma patients are reported to the NTDB. Motor vehicle occupants (46.7%) and assault victims (35.1%) were more likely to be hospitalized by NTDB reporters. SII patients were rarely admitted to trauma services (2.6%) and account for only 1.5% of NTDB patients. SII patients admitted to NTDB trauma services had severe violent mechanisms (ie. gun shot wounds, hangings). Poisoning, the most common cause for SII admission was rare in NTDB (0.51%). (*$p<0.05$)

Mechanism	Hospitalized (CDC#)	Hospitalized (NTDB#)	NTDB# / CDC#
All injury	1,608,502	300,685	18.7
Motor Vehicle Crash	196,794	91,900	46.7*
Falls	626,644	73,555	11.7*
Assault	94,425	33,111	35.1*
All Self Inflicted Injury	154,598	4,086	2.64*
Self Inflicted Poisoning	105,212	537	0.51*
Self Inflicted Hanging	1,097	328	29.9*
Self Inflicted Stabbing	18,756	1,600	8.53*
Self Inflicted Gun Shot	2,479	1,609	64.9*

Conclusion: The burden of self inflicted injury on trauma services that submit data to the NTDB is minimal. Because trauma surgeons do not treat the bulk of SII patients they must look beyond trauma services/registries and partner with others to impact SII prevention.

Session X

Poster # SII-96

ACCURATE AND EARLY PREDICTION OF MASSIVE TRANSFUSION IN TRAUMA PATIENTS

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Background: Massive transfusion (MT; ?10 PBRC units/24 hours) is associated with increased morbidity and mortality. Early identification of patients requiring MT is needed to activate transfusion protocols, assuring availability of appropriate blood components.
Methods: Retrospective data for patients (n=1574) receiving a transfusion during a one year period was obtained from 17 Level 1 trauma centers. Multivariate logistic regression was use to predict the requirement of MT from data routinely available upon admission.
Results: The model to predict whether or not a MT is required was $\log[\pi/(1-\pi)] = \beta_1 \times SBP + \beta_2 \times HR + \beta_3 \times pH + \beta_4 \times HCT + \beta_0$, where the covariates were: Systolic Blood Pressure (SBP), Heart Rate (HR), pH, and Hematocrit, and π was the probability of MT given the values of the covariates. Fitting the model on the retrospective data base gave $\beta_1 = -0.0113$, $\beta_2 = 0.0158$, $\beta_3 = -0.0932$, $\beta_4 = -0.0395$, and $\beta_0 = 32.8738$, based on patients with non-missing values for the covariates (n=838). A patient was (not) predicted to require MT if $\pi > 0.5$ ($\pi \leq 0.5$), resulting in 240 (29%) patients positive predicted (PP) to require MT and 598 (71%) not predicted (NP) to require MT. Of the 838 patients, 322 (38%) actually received MT. The model yielded a positive predictive value of 75%, negative predictive value of 72%, sensitivity of 87%, and specificity of 53%. The Injury Severity Score (ISS) mean±SD of the 240 PP patients was 32±15.7, in contrast to 24±13.5 for the 598 NP patients ($p<0.001$). Survival at 6 hours was 82% for PP and 98% for NP ($p<0.001$). This initial survival difference persisted at 24 hours, 75% PP and 94% NP ($p<0.001$), and at 30 days, 62% PP and 83% NP ($p<0.001$). 55% (48/88) of the PP patients died of truncal bleeding as compared to 18% (18/98) of the NP patients ($p<0.001$), suggesting that a hemorrhagic cause of death likely contributed to survival differences between the PP and NP groups.
Conclusion: The need for MT can be predicted very early after hospital admission from basic physiological data. Patients with a PP are those who will benefit from rapid interventions, as differences in survival are noted at 6 hours and persist for 30 days.

Session X

Poster # SII-97

THE MEDICAL IMPLICATIONS OF NONLETHAL LAW ENFORCEMENT TECHNIQUES

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Objectives: A number of modern law enforcement techniques, "non-lethal weapons," such as Taser (an electrical incapacitation device), are being used by police to incapacitate or subdue violent or dangerous suspects in order to avoid causing serious harm or death. Analysis of the relative severity of injuries caused by different non-lethal methods may help ED personnel assess these injuries, help police personnel determine which type of force is most appropriate, and thus reduce medical consequences of legal interventions.

Methods: Using hospital database and patient medical records at our Level I Trauma Center, we retrospectively studied all 84 patients from 2005-2007 with injuries resulting from non-lethal law enforcement interventions. Records were analyzed for patient demographics, type of force used, sustained injuries, preexisting conditions, toxicology, evidence of exited delirium, length of hospitalization, and outcomes.

Results: Law enforcement methods were grouped into: unarmed restraint, Taser use, blunt weapons (including baton, club, night stick and unspecified blunt weapons), and others (including pepper spray, hand cuffs and not specified, n=27). There were no deaths. Of subjects injured after unarmed restraint, 56 % were discharged from ED to home or jail, compared to 50% with Taser, and 36 % from blunt weapons. Most hospitalizations in the Taser group were because of fractures secondary to falling during incapacitation or/and additional use of blunt weapons. Other data from the study are in the table below:

INTERVENTION	Avg ISS	Hospital stay	Wounds or lacerations	Fractures	Sprains	Contusions
Unarmed (n=30)	6.7	1.3 d	14 (46 %)	13 (43 %)	9 (30 %)	10 (33 %)
Taser (n=16)	9.0	2.3 d	13 (81 %)	4 (25 %)	2 (12 %)	5 (31 %)
Blunt weapons (n=11)	9.8	7.0 d	1 (9 %)	8 (73 %)	1 (9 %)	3 (27 %)

Conclusions: With respect to medical consequences of non-lethal force, the Taser causes less severe injuries and shorter hospital stays than other armed interventions.

Session X

Poster # SII-98

EARLY WIDE DECOMPRESSIVE CRANIECTOMY AS INTIAL TREATMENT OF TRAUMATIC ACUTE SUBDURAL HEMATOMAS

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Introduction Acute traumatic subdural hematoma (ASDH) with progressive neurological deterioration is extremely morbid. Craniotomy (C), evacuation of the hematoma with post op ICP monitoring is the most common therapy utilized, despite of significant morbidity & mortality (M&M). Decompressive craniectomy (DC) is utilized commonly as second tier operation in severe neurological injury. In our opinion, ASDH is akin to a compartment syndrome, which will benefit from an early wide DC with vascular tunnels.

Method Retrospective study of 25 consecutive patients, that underwent an early wide lateral DC (13-15H10-12 cm) for the evacuation of ASDH.

Indications for DC in ASDH: progressive neurological deterioration (> 2 points on GCS) regardless of initial GCS, or patients with a GCS of 9 and at least one of the following: a) progressive neurological deterioration, b) Unilateral dilated pupil, c) CT head with an ASDH 10mm thickness or more, d) Midline shift of 5mm or more, e) Obliteration of basal cisterns.

Results: Mean age 40 years (20 – 84), 88% men. Preoperative GCS was 8 (4∀13). Neurological deficit 88%. Pupillary abnormalities 48%. Midline shift on CT 8mm (0∀ 26). Demonstrating basal cistern compression 48%. The mortality was 12% (3/25) with a good outcome, (Glasgow outcome scale -GOS 4 and 5) in 64% (16/25) at 6 months follow up. 24% had poor results (GOS 3), none in vegetative state. Complications included, post cranioplasty bone flap infection and seizures (1patient), and hydrocephalus requiring a VP shunt (1 patient)

Conclusion Wide DC is safe and yields improved outcomes with lower M&M rates as initial treatment of ASDH, this in our opinion is due to adequate initial decompression when compared to C. As our sample size is small, a multi-center trial is warranted with DC as initial the treatment of ASDH.

Session X

Poster # SII-99

ICP RESPONSE TO 23.4% HYPERTONIC SALINE EXCEEDS RESPONSE TO MANNITOL IN TRAUMATIC BRAIN INJURY

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Background: Severe traumatic brain injury (TBI) may produce high intracranial pressure (ICP), which is associated with poor outcomes. 23.4% hypertonic saline (23-HS) has been shown to successfully decrease ICP and has beneficial hemodynamic, vasoregulatory, and immunomodulatory effects. The aims of this study are to assess the efficacy of the use of small-volume injections of 23-HS for the treatment of ICP, and to compare the magnitude of ICP change between HS and mannitol use.

Methods: Retrospective review (03/00-09/07) of adult TBI patients who received mannitol and 23-HS. The decrease in ICP following treatment (Δ ICP) was recorded and compared. Mannitol and HS doses that were administered simultaneously were excluded.

Results: 54 patients received a total of 540 doses of mannitol (125-450 mL) and 294 doses (30 mL) of 23-HS. Mannitol and 23-HS independently decreased ICP successfully (from 22.42 ± 11.15 to 14.54 ± 8.59 for mannitol and from 32.26 ± 13.08 to 15.32 ± 11.33 for 23-HS, $p < 0.0001$ for both).

The ΔICP for Mannitol was 8.19 ± 11.37 and for 23-HS was 17.16 ± 12.37 ($p<0.0001$). There were no significant differences in electrolytes after the administration of either Mannitol or 23-HS.

Conclusion: Both Mannitol and 23-HS decrease ICP successfully, however, 23-HS had a 2-fold greater magnitude of change than mannitol.

Session X

Poster # SII-100

FUNCTIONAL OUTCOME AFTER DECOMPRESSIVE CRANIECTOMY

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Objective: Determine functional outcomes after decompressive craniectomy (DC).
Methods: IRB approved retrospective review over one year at a Level I center. Demographics and outcomes were derived from hospital charts and physicians office notes. DC patients were compared to craniotomy patients during the same year. Functional Assessment Measure (FAM) a graded testing of self care, mobility, movement, communication, adjustment and cognition was used to assess outcome (a score of 84 is fully functional). T-test and Chi square test were used for statistical analysis.
Results: 3710 patients were admitted and 55 had neurosurgical operative intervention; 43 survived to hospital discharge. DC was performed for generalized cerebral edema on CT, inability to close at craniotomy due to swelling or intractably elevated intracranial pressures. All were performed within 36 hours of admission. DC patients were younger and had a higher ISS but not a significantly lower GCS. DC patients had longer ICU stays, but survival (NS by Chi squares) and FAM scores were not worse. Mean follow-up was 2 months. Nine of 17 DC survivors have had their bone flaps replaced. Only one DC patient remains in coma at 6 months.

	DC	Craniotomy	P Value
Number	22	33	
Age	26.8	43.0	<0.05
ISS	38.6	29.7	0.001
GCS	5.6	7.5	NS
ICU LOS	15.8	9.3	0.02
FAM	76.3	80.0	NS

Conclusion: DC allows severely injured patients with cerebral edema to survive with near normal functional recovery.

Session X

Poster # SII-101

THERAPEUTIC ANTICOAGULATION CAN BE SAFELY ACCOMPLISHED IN PATIENTS WITH TRAUMATIC INTRACRANIAL HEMORRHAGE

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Introduction: Therapeutic anticoagulation is an important treatment of thromboembolic complications, such as DVT, PE, and carotid dissection. Traumatic intracranial hemorrhage has traditionally been considered to be a contraindication to anticoagulation.

Hypothesis: Therapeutic anticoagulation can be safely accomplished in select patients with traumatic intracranial hemorrhage.

Methods: Medical records of patients admitted to a level one trauma center were evaluated. Patients who developed thromboembolic complications of DVT, PE, or carotid dissection were stratified according to mode of treatment. Patients who underwent therapeutic anticoagulation with a heparin infusion or enoxaparin (1 mg/kg BID) were evaluated for neurologic deterioration or hemorrhage extension by CT scan.

Results: There were 40 patients with a traumatic intracranial hemorrhage that subsequently developed a thrombotic complication. Thirty-five patients developed a DVT or PE. A vena cava filter was thrombosed in one patient. Carotid dissection was diagnosed in four patients. 25 patients received therapeutic anticoagulation, which was initiated an average of 13 days after injury. 88% of patients had no extension of the hemorrhage after anticoagulation was started. The degree of hemorrhagic extension in the remaining three patients was minimal and was not felt to affect the clinical course. Seven patients were anticoagulated within 7 days of presentation. These patients were not more likely to have extension of the intracranial hemorrhage than patients who were anticoagulated in a delayed fashion ($p=0.72$).

Conclusion: Therapeutic anticoagulation can be accomplished in select patients with intracranial hemorrhage, although close monitoring with serial CT scans is necessary to demonstrate stability of the hemorrhagic focus.

Session X

Poster # SII-102

NECESSITY OF REPEAT HEAD CT AND ICU MONITORING IN PATIENTS WITH MINIMAL BRAIN INJURY

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Background: Recent publications have dismissed the need for routine repeat CT scans in patients with minimal brain injury (GCS 13-15 with positive initial CT) unless physical exam changes. In an attempt to better allocate scarce resources, we hypothesized that not only was repeat head CT unnecessary but also routine ICU monitoring of these patients with minimal brain injury and stable exams was unnecessary.

Methods: All blunt injured patients admitted to a Level 1 trauma center from 1/05 through 12/06 who met our criteria for minimal brain injury (GCS 14-15 with positive initial CT) were reviewed. All patients had ICU monitoring and repeat CT done (at 12-24 hours) regardless of clinical exam. Patients with skull fractures, facial fractures needing urgent repair, those requiring immediate neurosurgical intervention and those with other injuries requiring ICU monitoring were excluded. Demographics, initial brain injury, follow-up CT results, changes in clinical exam, neurosurgical interventions and ICU days were recorded.

Results: 2986 patients with GCS 14-15 were identified. 147 patients met criteria. 45 patients (31%) developed worsening findings on follow-up CT. 13 required neurosurgical intervention (6 ICP monitors, 7 craniotomies) and 1 died (stroke). Those requiring ICP monitors had worsening IPHs with clinical exam changes while those requiring craniotomy had worsening SAH (1 patient) and SDH (7 patients). 2 of the SDH patients remained asymptomatic prior to craniotomy. ICU days were significantly increased in those patients with worsening CT findings that did not require neurosurgical intervention compared to those patients with unchanged or improved CT scans (5 vs 2, $p<.0001$).

Conclusions: Routine follow-up CT scans are beneficial in those patients with minimal brain injury and may lead to higher levels of medical management or neurosurgical intervention in patients with worsening CT findings. These patients should be kept in an ICU setting until head CT has stabilized. With these dissimilar results from previous studies, a prospectively randomized multicentered trial would be beneficial.

Session X

Poster # SII-103

40-SLICE COMPUTED TOMOGRAPHY TECHNOLOGY - IS MAGNETIC RESONANCE IMAGING STILL NECESSARY FOR CERVICAL SPINE CLEARANCE AFTER BLUNT TRAUMA?

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Objective: Recent publications have stated that 16-slice computed tomography (CT) alone is not sufficient for cervical spine (CS) clearance in some patient populations based on follow up magnetic resonance (MR). No publication to date has assessed 40-slice CT technology for CS clearance in these patients. We hypothesized that an *admission CS CT with no acute injury, using 40-slice CT technology, is not sufficient for CS clearance.*

Methods: Between July 2006 and July 2007 a clinical guideline was in place whereby patients with unreliable exams or persistent symptoms had an MR despite a normal admission CS CT. The trauma registry was used to identify blunt trauma patients having a CS CT with no acute injury and a MR during this time period. Medical records were reviewed for demographics, Glasgow Coma Score (GCS) at time of MR, and injury specific data.

Results: 213 patients were identified. Mean age was 41.4 (±18.7) and mean ISS was 17.0 (±13.9). MRI was performed on mean hospital day 4.4 (±6.8). 96 patients with unreliable exams had a mean of ISS 26.0(±12.3). 117 patients who were awake and alert had persistent symptoms with a mean of ISS 9.6(± 10.3). 75.6% of patients had a negative MR. 24.4% of patients had an abnormal MR. Findings are shown in the table. 14 patients required operative repair; 25 required extended cervical collar. 13 patients, at the discretion of the spine attending, had collars removed.

MR Findings	
	n
Ligamentous Injury	
With Cord Contusion	3
Without Cord Contusion	13
Cord Compression	
With Cord Contusion	9
Without Cord Contusion	20
Isolated Cord Contusion	4
Fracture	3
Total Injuries	**52**

Conclusion: 40-slice CT technology continues to miss CS injuries. MR changed clinical practice in 18.3% of patients. Despite newer 40-slice CT technology, MR continues to be necessary for CS clearance in patients with unreliable exams or persistent symptoms.

Session X

Poster # SII-104

23.4% HYPERTONIC SALINE SOLUTION IS MORE EFFECTIVE THAN MANNITOL FOR REDUCTION OF INTRACRANIAL HYPERTENSION IN CHILDREN WITH SEVERE TRAUMATIC BRAIN INJURY

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Introduction: Both mannitol and varied concentrations of hypertonic saline (HTS) have been shown to be effective therapy for intracranial hypertension (ICP). We have previously demonstrated the efficacy of 23.4% HTS in adults. This study compares the dose response of 23.4 % HTS to mannitol for ICP reduction in pediatric patients with severe traumatic brain injury (TBI).

Methods: After IRB approval the records of pediatric patients admitted with severe TBI requiring ICP monitoring were reviewed. Demographic and physiologic data included ICP, cerebral perfusion pressure (CPP), serum sodium and serum osmolality at initiation of therapy. Proportion of patients with any response to either mannitol or HTS, ICP reduction following dose administration, and duration of dose response were compared using *t* test and Fisher's test, accepting $p<.05$ as significant.

Results: Ten children with severe TBI received 75 doses of either mannitol or 23.4% HTS. Nine patients suffered severe blunt injury and one patient suffered a gunshot wound to the head (mean ISS 30.8). Mean admission GCS was 5.7 (range 3-11). There was no difference in ICP or CPP between the two groups at the time of dose administration. More patients demonstrated a reduction in ICP following 23.4% HTS than mannitol (96.2% HTS vs. 70% mannitol, $p=.0028$). Mean ICP reduction one hour following administration of 23 doses of mannitol and 52 doses of HTS was significantly greater for patients receiving HTS (14.6 vs. 8, HTS vs. mannitol, $p = 0.0046$). There was no significant difference between groups in the duration of ICP reduction following dose administration (7 vs. 2 hours; HTS vs. mannitol).

Conclusions: 23.4% HTS more effectively reduces ICP than mannitol in pediatric patients with severe TBI.

Session X

Poster # SII-105

TWO-YEAR FOLLOW-UP OF THE EFFECTS OF INTRATHECAL BONE MARROW STROMAL CELL ADMINISTRATION TREATMENT IN A PATIENT WITH SPINAL CORD INJURY

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Purpose: To clarify the long-term effects of intrathecal administration of incubated and multiplied autologous bone marrow stromal cells (BMSCs) in the first clinical case of spinal cord regeneration trial.

Method: A 35-year-old man fell down from about 7-m height, and transported with complaints of loss of sensation and movement below C5 level. The injury was classified as American Spinal Injury Association (ASIA) Impairment Scale A with C5 spine dislocation and fracture. Bone marrow cancellous bone of the ilium was collected at the operation of spinal stabilization. BMSCs were isolated and cultured. He was administered with 3.1×10^7 autologous BMSCs in the cerebrospinal fluid (CSF) on day 10, and was evaluated neurologically according to the International Standards for Neurological and Functional Classification of Spinal Cord Injury (ISCSCI), with MRI and radiographs, with electrophysiological studies, and so on for two years.

Result: ISCSCI scores definitely improved from motor score 6 (full score =100), 32 pin prick score 16 (112), and light touch score 16 (112) on admission, to 16, 34, and 43, respectively at 3 months after treatment. However, little improvement in the neurological function was observed thereafter. In MRI, the cavity size in the cord that reflects necrotic tissue decreased by 6 months, and further decreased later. No deleterious effect such as ossification of BMSCs was observed up to 2 years in the images and neurological function by the administration of BMSCs into CSF.

Discussion: Although we have studied only a single case, the results of long-term follow-up of this study suggest the safety of this trial. Single injection of BMSCs is planned in the present protocol designed as a phase I and II study, but this study suggests that a repeated administration of BMSCs into CSF in the acute phase of spinal cord injury may be beneficial in the future trial design. We also would like to identify the humoral factors released by the BMSCs in the future study.

Session X

Poster # SII-106

EFFICACY OF DECOMPRESSIVE CRANIECTOMY AND SELECTION OF SECOND-TIER THERAPY FOR REFRACTORY INTRACRANIAL HYPERTENSION WITH SEVERE TRAUMATIC BRAIN INJURY IN CHILDREN

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Object: To determine whether decompressive craniectomy after severe traumatic brain injury (TBI) is beneficial for refractory intracranial hypertension in children and to discuss selection of the second-tier therapy based on the guidelines for management of severe TBI. **Methods:** A retrospective chart review of data was performed using a database of pediatric patients who underwent decompressive craniotomy between January 2000 and December 2007. We conducted a study at single trauma unit of 45 patients of severe TBI with intracranial hypertension. Decompressive craniectomy was performed when first-tier therapy failed to decrease ICP lower than 20 mmHg. The patient's chart was reviewed to determine the admission motor Glasgow Coma Scale (mGCS) score, the extent of systemic injury, the time to craniectomy, the finding of neuroimage. Outcome was evaluated using the Glasgow Outcome Scale (GOS). **Results:** In 16 patients (36%), decompressive craniectomy was performed and 29 patients (64%) were managed with medical treatments. The mean patient age was 12.9 years (range 3-17 years). The mean m GCS score at presentation was 3.8 ± 1.2. The mean time from to craniectomy was 45±8.2 minutes. Seven of 16 patients (43.8%) suffered from other systemic injuries. In all patients, the CT scan performed at presentation revealed radiographic abnormalities such as diffuse axonal injury subdural hematoma, cerebral contusion, subarachnoid hemorrhage. Postoperative intracranial pressure (ICP) decreased below 20 mmHg in 10 patients (62.5%: group A) and no change in 6 patients (37.5%: group B). The outcome at discharge in group A was 6 good recovery (GR) (60%), 4 mild disability (MD) (40%), whereas the outcome in group B was 3 dead (D) (50%) and one severe disability (SD) (16.6%) with mGCS? 4, one GR (16.6%) and one MD (16.6%) with mGCS? 4. Eleven (68.8%) of 16 patients returned to school and 2 patients (12.5%) were continued to be hospitalized. **Conclusion:** Decompressive craniectomy is a safe therapeutic option of second-tier therapy for severe TBI in children and is beneficial for reducing ICP to achieve favorable outcome.

Session X

Poster # SII-107

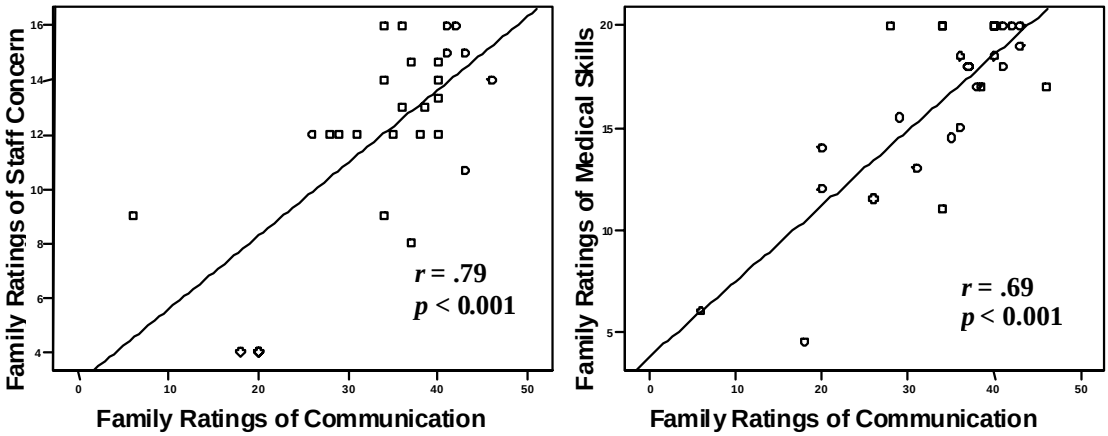
QUALITY OF CARE AND CARING IN THE ICU: FAMILY PERCEPTIONS

David A. Spain, MD, Eve B. Carlson, PhD, Carol Thomson, RN, Janet Neff, RN. Stanford University.

Numerous factors may influence a family's perception of the care provided in the intensive care unit (ICU). To examine the relationship between perceptions of family members about communication and concern with perceptions about the quality of patient care, we collected data from close family members of trauma patients in the ICU.

Methods: Relatives (defined as spouse/partner, parent, adult child or sibling) of trauma patients in the ICU were recruited within 10 days of admission. Informed consent was obtained (IRB approved). Two months after injury, relatives completed a validated 38 item questionnaire about ICU care satisfaction that included ratings of staff skills (ICU nurses and MDs), communication and concern.

Results: In 28 family members of ICU patients, ratings of communication, staff concern, and staff skills were strongly correlated.



Conclusions: There is a strong relationship between a family's perception of our communication skills and their assessment of our care (i.e. skills) and caring (i.e. concern). It's likely that extra efforts to communicate with "difficult" family members may increase their perceptions of our quality of care as well our concern for the patient.

Session X

Poster # SII-108

BISPECTRAL INDEX MONITORING IN THE TRAUMA INTENSIVE CARE UNIT: ENSURING ADEQUATE SEDATION DURING BEDSIDE SURGERY

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Background: The volume and complexity of bedside intensive care unit surgery (ICUSRG) has increased in the past decade. The approach to anesthesia during ICUSRG is variable. Following implementation of a protocol using bispectral index (BIS) monitoring, a non-invasive measure of depth of sedation, we sought to analyze the effect of BIS monitoring on drug administration during ICUSRG.

Methods: A retrospective cohort comparison was completed comparing 100 randomly selected ICUSRG tracheostomy with percutaneous gastrostomy procedures performed prior to (1/1/02-7/1/04) and after (8/1/04-2/1/08) BIS, utilizing a prospectively collected ICUSRG database. To compare like regimens, only patients receiving the combination of vecuronium (VEC), midazolam (MID), and morphine (MOR) were selected. Patients receiving pre-procedure lorazepam (LOR), propofol (PRO), or fentanyl infusions were included, with fentanyl converted to morphine equivalents (ME). Procedure duration was recorded, with paralytic, sedative, and analgesic converted to milligrams per minute. Drug amounts were compared between cohorts using t test, with significance at $p < 0.05$*.

Results: Within the random samples, 94 pre-BIS and 74 BIS patients received the standard regimen. Drug amounts between cohorts are compared below.

mg/min	VEC	MID*	LOR	PRO	ME
Pre-BIS	0.30±0.13	0.22±0.15	0.03±0.07 (n=18)	4.2±3.6 (n=18)	0.47±0.27
BIS	0.32±0.14	0.27±0.11	0.06±0.02 (n=21)	3.6±2.2 (n=15)	0.54±0.34

Conclusion: When compared to heart rate and blood pressure alone, BIS monitoring led to a significant increase in the amount of midazolam and a non-significant increase in analgesia administered during ICUSRG with pharmacologic paralysis. These data suggest the potential for under sedation during longer and more complex ICUSRG procedures. BIS monitoring should be considered to ensure adequate sedation during ICUSURG when pharmacologic paralysis is utilized.

Session X

Poster # SII-109

A POPULATION BASED ASSESSMENT OF TRUNCAL GUNSHOT WOUNDS

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Objective: Despite the high frequency of gunshot wounds (GSW), few epidemiologic data are available on their impact on a population. Most studies only address patients who survive to receive treatment and do not investigate population-based risk or mortality.

Methods: We utilized data from our gunshot wound registry to include circumstance and outcome of all truncal GSWs in our community. Additional data were collected from police, medical examiner autopsy reports, medical records and the trauma registry to ensure complete capture of all records. IRB approval was obtained for this study.

Results: There were 1085 GSW victims in a population of 701,000 from 2005-2007, giving an injury rate of 1.54/1,000 persons. 35% involved the chest or abdomen (truncal injuries). Violent crime related GSW accounted for most of these injuries (75%) with a high mortality (30%). Twenty-eight percent of GSW assaults involved adolescents. Attempted suicide was the reason for about 12% of injuries with 41% of attempts resulting in a fatality. Handguns were responsible for most injuries with 55% of GSW occurring in 10/99 total zip codes representing the lower socioeconomic region of the county. Most weaponry was high caliber. Multiple GSWs to several anatomic sites were common (50% of injuries were multisite) with an Odds Ratio for lethality of 1.24 (95% CI; 1.11-1.39). Central thoracic wounds carried the highest mortality (79%) with most sustaining cardiac injury. Total mortality was 39% or 0.21 deaths/1,000 population over the study period.

	Number Victims	Multisite Injury	Central Wound Mortality	Scene Mortality	Total Mortality	Suicide/ Attempt	Homicide/ Attempt
Chest	124	60	79%	39%	43%	13%	70%
Abd	258	115	32%	26%	37%	12%	76%

Conclusions: Truncal GSWs represented 35% of the gunshot related injuries in this population. Mortality was high and increased with suicide, thoracic injury, central chest injury and multiple GSWs. Violent crime was responsible for ¾ of the injuries. Targeted strategies are needed in select neighborhoods to address handgun related violence, particularly in adolescents.

Session X

Poster # SII-110

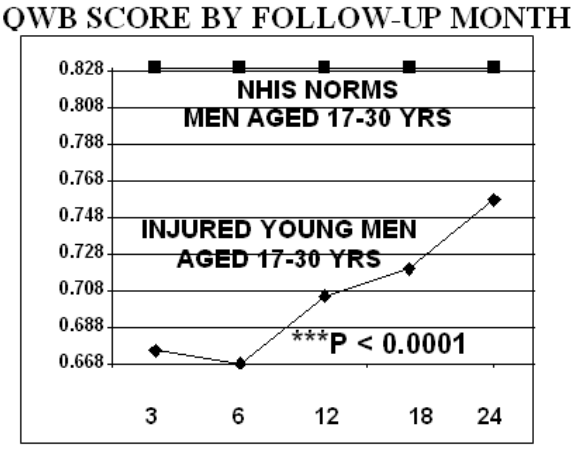
TRAUMA IN YOUNG MEN AGED 17 TO 30 CAUSES LONG-TERM MARKED DEFICITS IN QUALITY OF LIFE COMPARED TO NATIONAL NORMS: IMPORTANT NEW DATA FOR RECOVERY AND QUALITY OF LIFE OUTCOME IMPROVEMENT IN YOUNG MALE MILITARY PERSONNEL INJURED IN THE WAR IN IRAQ

Troy Lisa Holbrook*, MS PhD, Peggy P Han, BA MPH, Michael J Sise*, MD, Daniel I Sack, BA, John P Anderson, PhD. EPI-SOAR Consulting.

Introduction: Injury is a leading cause of death and preventable morbidity in young men aged 17 to 30. Little is known about long-term Quality of Life (QoL) outcomes in injured young men. The objectives of the present report are to describe long-term QoL outcomes and compare post-trauma QoL to National norms for QoL in uninjured young men from the National Health Interview Survey (NHIS).

Methods: 448 male trauma patients aged 17 to 30 years were enrolled in the study. Enrollment criteria excluded spinal cord injury. QoL after trauma was measured using the Quality of Well-being (QWB) scale, a sensitive and well-validated functional index (range; 0 = death to 1.000 = optimum functioning). Patient outcomes were assessed at 3, 6, 12, 18 and 24 months after discharge. NHIS data was based on 3 survey years and represents a population-based U.S. National random sample of uninjured young males aged 17 to 30 (N = 7,023,668).

Results: Major trauma in young men aged 17 to 30 was associated with significant and marked deficits in QoL throughout the 24-month follow-up period, compared to NHIS norms for this age group, shown in the Figure. PTSD rates were 35% in this population. QoL deficits were strongly associated with Injury Severity Score, perceived threat to life, and PTSD onset.



Conclusions: Major trauma in young men is associated with significant and marked QoL deficits in QoL outcomes, compared to U.S. norms for healthy uninjured young men. These findings have significant and important implications for recovery and QoL outcome improvement in young male military personnel injured in the war in Iraq.

Session X

Poster # SII-111

CONSERVATIVE MANAGEMENT FOR BLUNT AORIC INJURY

Yasukazu Shiino, MD, Satoshi Ishihara, MD*, Tsuyoshi Ishimaru, MD, Ryukoh Ogino, MD*, and Kouichiro Suzuki, MD. Kawasaki Medical School.

Background: Since Conn, et al. reported conservative management for blunt aortic injury (BAI) in 1971, there have been little data available to evaluate this non-operative treatment without intravascular stent grafting, or open chest surgery.

Methods: Excluding cardiopulmonary arrest on arrival at the hospital, 17 patients were diagnosed as BAI from Nov. 2003 through Nov. 2007. Of those, conservative management was applied in 9 cases. Their medical charts were reviewed.

Results: All nine patients were diagnosed and periodically followed by contrasted high resolution CT. It revealed small hematomas in the mediastinum and hemothorax. All patients had major associated injuries (Pelvic fracture 8, Head injury 3, Surgical abdomen 1), and received medical management to control blood pressure. Causes of deaths were occlusion of the aorta due to embolism on the 17th day, and rupture of BAI on the day of the event. Seven patients were successfully resuscitated and have been surviving until March 2008. There was no significant difference in mean blood pressure between the survived and died groups. Indications for elected surgery were enlargement of aneurysm and occluding trend of the aorta. Pseudolumen of the dissection was not organized during the observation period.

age, gender	29,M	56,M	71,F	51,F	75,M	61,M	71,F	19,M	82,F
outcome	D	D	S	S	S	S	S	S	S
elected surgery	-	-	-	-	-	+	-	+	-
diameter of aneurysm	40	43	35	29	29	36	30	27	28
A/N ratio	2.22	1.65	1.3	1.31	2.07	1.33	1.36	1.68	1.47
initial shock	+	-	+	-	+	+	+	-	+

D; died, S; survived, A/N; maximum diameter (mm) of the aneurysm/normal aorta

Conclusion: As indicated by initial CT findings, some cases could be managed without acute surgery. Large pseudoaneurysm may be a predicting factor of impending rupture.

Session X

Poster # SII-112

MASSIVE HEMOTHORAX FOLLOWING THORACIC VERTEBRAL FRACTURE

Masao Okamoto, MD, PhD , Hisashi Ohtsuka, MD, Masayoshi Nishimoto, MD, PhD , and Hiroshi Akimoto, MD, PhD. Osaka Mishima Emergency Critical Care Center.

Purpose: Hemothorax is common in major trauma and the majority of these patients could be managed by simple chest tube drainage. Massive hemothorax following thoracic spinal fracture is very rare and could be associated with significant morbidity and mortality. We report five cases of massive hemothorax following thoracic spinal fracture and discuss the initial management.

Patients and Methods: Five patients with massive hemothorax associated with thoracic vertebral fracture treated from 2003 to 2008 were evaluated. There were five men with a mean age of 62 years (range, 39 to 79 years). Mechanisms of injury included car crash in two and fall in three. Time between injury and admission to the emergency department averaged fifty four minutes and the Injury Severity Score averaged 35.8.

Results: Three patients arriving at the Emergency Department in shock were resuscitated and required an emergency thoracotomy thereafter. Since hemostasis of active bleeding from the site of the vertebral fracture failed, thoracic packing was used. One survived but the others died from uncontrolled bleeding within three hours. One of two patients whose hemodynamics was stable on arrival received bilateral thoracostomy tubes and intubated due to subsequent unstable hemodynamics. Despite continuing hemorrhage, hemostasis was obtained by repeated clamping and releasing of the tubes. The other patient did not undergo immediate drainage or intubation due to spontaneous hemostasis by tamponade effect with rigorous hemodynamic and respiratory monitoring. Subsequently drainage was performed on the fifth day.

Discussion: Immediate drainage may promote continuing hemorrhage. It is very difficult to surgically control bleeding from a vertebral fracture. Without respiratory distress or cardiovascular collapse, tube clamping or delayed drainage could be options for this condition.

Session X

Poster # SII-113

REPAIR OF IMPLOSION FLAIL CHEST WITHOUT THORACTOMY: TECHNIQUE AND CLINICAL OUTCOMES

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Purpose: The purpose of this series is to describe a forequarter implosion pattern, surgical technique to reduce and repair the thoracic cage deformity without thoracotomy and report outcomes in 9 patients.

Materials and Methods: Nine patients were admitted over a 3 year period with flail chest injuries from side impact injuries. All patients had an implosion deformity along the postero-lateral thoracic cage, pulmonary contusion and clavicular fractures. Rib fractures were repaired through a para-midline posterior approach without thoracotomy using standard 2.4 mm titanium implants. Seven patients treated conservatively were used as a historical control. Intubation time, ICU length of stay and final shoulder function using the Constant scoring system were compared between the two groups.

Results: Average age for the operative group and control groups was 39 and 41 with a male to female ratio of 6/3 and 5/2 respectively (p=0.69). ISS averaged 21 for both groups (p= 0.93) with an average follow-up of 16 vs. 12 months (p = 0.11). In the surgical group, eight of nine (89%) patients were extubated within 24 hours of surgery with 3 of them (33%) extubated immediately post-operatively in the OR. Seven patients underwent ORIF of the clavicle and went on to union with a mean Constant score of 93. Two clavicular fractures were treated non-operatively and both requiring secondary intervention with a mean constant score of 78 (p=0.12). Total intubation time for the surgery group (1.9 days) was significantly shorter than the historical control (13.3 days, p <0.001) and length of ICU stay was 5.4 (4-9) vs. 16.9 (8-31) days respectively (p=0.003).

Conclusion: Flail chest injuries with forequarter implosion can be effectively managed with a posterior para-midline approach without thoracotomy. Reduction of the deformity and repair of the rib fractures led to a dramatic reduction in time to extubation and ICU length of stay. Repair of the clavicular fracture appeared to be beneficial.

Session X

Poster # SII-114

OMISSION OF ROUTINE CHEST X-RAY FOLLOWING CHEST TUBE REMOVAL IS SAFE IN SELECTED TRAUMA PATIENTS

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Introduction: The need for tube thoracostomy (TT) is common following thoracic trauma. However, definitive practice guidelines regarding the utility of chest x-ray (CXR) following TT removal in trauma patients have not been established. We hypothesized that selective use of chest radiography following chest tube removal is safe and cost effective.

Methods: We reviewed 759 TT insertions performed in 489 trauma patients at an urban Level One trauma center over a three-year period. Of these, 387 TT removals were followed by CXR and 221 were not. For data analysis, we excluded 60 intraoperative removals and 91 deaths without TT removal. Baseline patient characteristics were determined. Outcome measures included number of CXR obtained, duration of TT therapy, post-TT removal hospital length of stay (LOS), and need for further intervention following TT removal. Data are as expressed mean ± SEM.

Results: Patients who underwent TT removal without subsequent CXR were, on average, younger and had a lower mean Injury Severity Score (Table). Patients in whom CXR was not obtained received fewer total CXR, had shorter durations of TT therapy and shorter LOS following TT removal. Subsequent reinterventions were performed more frequently in the CXR group. Notably, post-TT removal CXR was obtained for all mechanically ventilated patients. Based on a total institutional cost of $221 per CXR, potential annual cost savings by selectively foregoing a post-removal CXR in the No-CXR group was $16,207.

	No CXR	CXR	P value
Age	34.8 ± 0.99	37.9 ± 0.86	<0.05*
ISS	18.8 ± 0.78	27.0 ± 0.73	<0.01*
Total # CXR	4.8 ± 0.4	16.1 ± 0.85	<0.01*
# CXR post removal	0.2 ± 0.07	7.3 ± 0.57	<0.01*
Days with TT	4.2 ± 0.18	5.7 ± 0.19	<0.01*
LOS	1.5 ± 0.2	9.1 ± 0.61	<0.01*
Reintervention rate	0.9%	6.7%	<0.05*

Conclusions: Selective omission of CXR following TT removal in less severely injured, nonventilated patients does not adversely affect patient outcomes or increase reintervention rates. Avoiding routine post-removal CXR could provide significant cost savings in the care of traumatically injured patients.

Session X

Poster # SII-115

IMPROVING SURVIVAL IN CARDIOVASCULAR INJURY AT AN ACS COT LEVEL 1 COMMUNITY TRAUMA CENTER: 1991-2007

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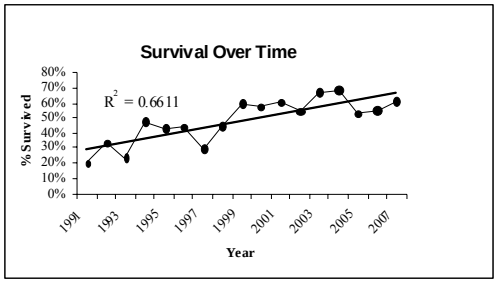
Background: Cardiac and great vessel (CGV) injury remains a major cause of mortality and morbidity. This study examines the experience with CGV at a large community ACS COT Level 1 Trauma Center over the course of implementation of a comprehensive trauma system including full time trauma surgeons, 24/7 in-house coverage, helicopter certification and ACS COT Level I verification.

Methods: A retrospective chart review was conducted of patients with CGV (ICD9 861.0-861.13, 900.01-902.1) from 1991-2007. Survival served as the primary outcome measure. Analysis included descriptive, chi square and regression techniques. The mortality of CGV in the National Trauma Data Base (NTDB) was determined for 2002-06.

Results: The sample included 334 patients (male 74 %, mean age 39, mean ISS 36, 66% blunt trauma). There were 143 aortic injuries (93% blunt), 87 cardiac injuries (40% blunt), and 87 other great vessel injuries (49% blunt). Survival improved significantly over time (Fig 1). When early (1991-98) and late (1999-2007) cohorts were compared, patients in the late cohort were 3 times more likely to survive: 34.9% (95% CI: 43, 73) in the early period compared to 59.6% in the late period (95% CI: 127,188). There were no significant differences in age, ISS or ED BP between the cohorts. Survival for the years 2002-06 was equal to or exceeded comparable centers in the NTDB.



Conclusion: Significant improvement in CGV survival occurred at the study center over the seventeen year period. This was coincident with the implementation of a comprehensive trauma system at this community Level 1 trauma center. This study supports the concept that community based trauma centers with comprehensive trauma systems can provide state of the art care for these complex injuries.

Session X

Poster # SII-116

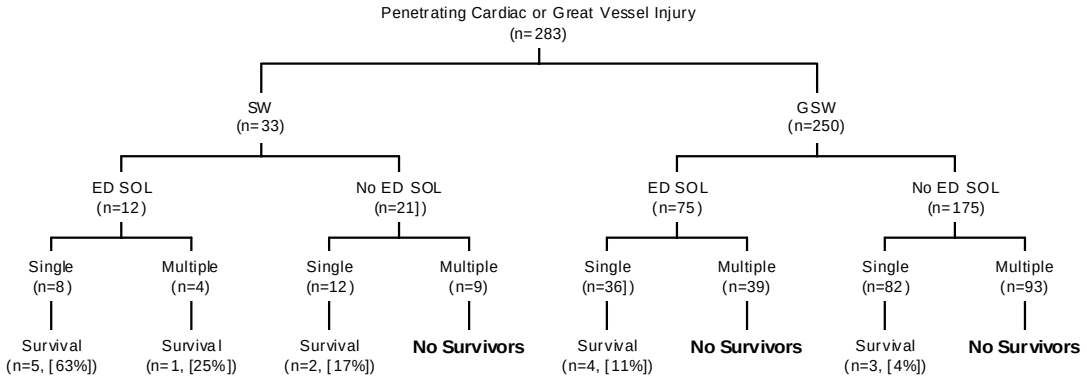
RE-EVALUATING EMERGENCY DEPARTMENT THORACOTOMY FOR PENETRATING INJURIES TO THE HEART AND GREAT VESSELS: AN APPRAISAL OF 283 CONSECUTIVE CASES FROM TWO URBAN TRAUMA CENTERS

Mark J Seamon, MD, Adam M Shiroff, MD , Michael Franco, BS, Heather Kulp, MPH , John P Gaughan, PhD , C William Schwab*, MD , John P Pryor*, MD, Amy J Goldberg*, MD. Temple University Hospital.

Background: Emergency department thoracotomy (EDT) survival predictors are well described. While cardiac injuries are considered to be the anatomic injury with the greatest EDT survival potential, we hypothesized that in trauma centers where firearm injuries predominate, cardiac injuries are no longer a positive predictor. Our primary study objective was to determine whether patients with cardiac or great vessel gunshot wounds (GSW) are salvageable by EDT.

Methods: A retrospective review of all patients who underwent EDT for penetrating cardiac or great vessel injuries in two urban, level I trauma centers during 2000-2007 revealed 283 patients. Demographics, injury (mechanism, anatomic injury), physiology (signs of life [SOL], vital signs, cardiac rhythm), and prehospital care were analyzed.

Results: Patients were primarily young (mean 27.8±10.1 years) males (96%) injured by GSW (88%). Hospital survival after EDT for penetrating cardiac or great vessel injury was



4% (stab wound [SW], 24%; GSW, 3%). However, no patients survived (0 of 132, 0%) with multiple cardiac or great vessel GSW and none survived (0 of 102, 0%) multiple penetrating (SW or GSW) cardiac or great vessel injuries without the presence of ED SOL.

Conclusions: Further resuscitative efforts should be terminated when multiple cardiac or great vessel GSW are encountered during EDT. Our results suggest that continuing care in this subset of unsalvageable patients with multiple cardiac or great vessel wounds is futile.

Session X

Poster # SII-117

RADIOGRAPHIC INDICATORS ASSOCIATED WITH NEED FOR ANGIOGRAPHIC EMBOLIZATION AFTER TRAUMATIC RENAL INJURY: BEYOND THE AAST ORGAN INJURY GRADING SCALE

Geoffrey R. Nuss, MD, Adam C. Jenkins, Brian Morse, Jeffrey H. Pruitt, MD, Shahrokh F. Shariat, MD, Allen F. Morey*, MD. UT Southwestern.

Introduction: Although the AAST Organ Injury Scale is the gold standard for staging renal trauma, it does not address characteristics of perirenal hematomas that may indicate significant hemorrhage. We evaluated two novel radiographic indicators--perirenal hematoma size and intravascular contrast extravasation (ICE)--to test their association with subsequent angiographic embolization performed for urgent hemostasis.

Methods: Among 194 patients in the Parkland Memorial Hospital renal trauma database from 1999 to 2004, 36 (19%) had a grade III (n=18) or grade IV (n=18) renal laceration. CT scans were reviewed by a single blinded radiologist and correlated with clinical outcomes. ICE was defined as contrast within the perirenal hematoma 30-60 seconds after infusion having signal density matching contrast in the renal artery. Hematoma size was determined in four ways as follows: 1) Hematoma area (HA)--cross-sectional area within Gerota's fascia calculated by anterior-posterior x transverse diameter; 2) Hematoma-to-kidney size ratio (HKR); 3) Hematoma-kidney area difference (HKD); 4) Perirenal hematoma rim distance (PRD)—distance in cm from renal capsule to Gerota's fascia.

Results: Within our group of 36 patients, 8 had ICE and 4 of these (50%) required embolization, whereas none of the 28 patients without ICE needed embolization (p=0.001). The 4 who required angiographic embolization had significantly larger average hematoma size than those with lacerations which did not warrant embolization. All 4 measures of perirenal hematoma size were significantly greater in patients requiring embolization [HA (103.5 vs 65.7 cm^2, p=0.008), HKR (2.8 vs 1.8, p=0.007), HKD (65.6 vs 29.0 cm^2, p=0.006), and PRD (4.2 vs 2.7 cm, p=0.041)].

Conclusion: Although most major renal injuries may be safely treated non-operatively, some patients will benefit from minimally invasive techniques to control renal hemorrhage. Perirenal hematoma size and ICE are radiographic findings that suggest significant renovascular injury and may be predictive of the need for angiographic embolization.