

Abstract - Podium

Abstract Title:

To Give or Not to Give? Pre-hospital Blood for Pediatric Trauma Patients

Author(s):

Gabrielle Shirek BA, Ryan Phillips MD, Niti Shahi MD, Kaci Pickett MS, Maxene Meier MS, John Recicar RN, Steven Moulton MD

Background:

Advanced Trauma Life Support (ATLS) recommends resuscitating pediatric patients with an initial bolus of 20 ml/kg of crystalloid followed by packed red blood cells (pRBC). Little is known about the applicability of the ATLS guidelines in the prehospital setting. This study evaluates the safety and clinical outcomes associated with prehospital blood transfusion in pediatric trauma patients.

Methods:

All trauma activations at a level 1 pediatric trauma center (PTC) from 2009-2019 were reviewed. The activations were divided into two groups: patients (≤ 18 years) who received prehospital blood (preBlood) and a matched cohort who received only prehospital crystalloid resuscitation (preCrystalloid). Patients were matched by transport times, age, ISS, GCS, trauma activation level, and with those who received a blood transfusion within six hours of arrival at the PTC. Univariate analyses were performed to compare outcomes between the groups.

Results:

Of 1,269 highest level trauma activations, 80 met inclusion criteria (preBlood cohort) and 80 were matched controls (preCrystalloid). There was no significant difference in mortality between preBlood and preCrystalloid cohorts (33% vs. 26%; $p=0.488$). Prehospital SIPA scores were not significantly different in the preBlood and preCrystalloid groups (1.69 vs. 1.47, $p=0.059$). PreBlood patients received significantly more prehospital crystalloid fluids (39.47 ml/kg vs. 21.89 ml/kg, $p<0.001$). At the PTC, preBlood patients received significantly less volume of blood products within 6 hours of arrival ($p=0.002$). (Table 1). No significant differences were seen in ventilator days, ICU length of stay, and hospital length of stay. There were no significant differences in rates of pneumonia, acute renal failure, and deep vein thrombosis.

Conclusion:

Administration of prehospital blood to hemorrhaging pediatric trauma patients is safe. Trauma patients who received prehospital blood received almost double the amount of crystalloid prior to blood transfusion when compared to a matched cohort. This highlights the need for a noninvasive, real-time method of monitoring patient hemodynamic status during prehospital transport to aid in identifying patients who may benefit from enroute blood product administration.

Abstract - Podium

Abstract Title:

Associated risks for Abusive Head Trauma in children 5 years old and younger

Author(s):

David M Notrica, MD, Lisa Kirsch, MD, Shivani Misra, MD, Cara Kelly, MSW PhD, Jodie Greenberg MA, Rachel L Stottlemire, BS, J Bryce Ortiz, PhD, Rachel K Rowe, PhD, Jonathan Lifshitz, PhD, P David Adelson, MD, Lois Sayrs PhD.

Background:

Abusive head trauma (AHT) is the leading cause of traumatic death in children ≤ 5 years of age. While 18-25% of children sustaining significant AHT die, up to 80% of survivors have lifelong physical, developmental, and emotional sequelae. Less severe AHT remains seriously under-surveilled, increasing the risk of subsequent injury and death. This study assesses the clinical, radiographic, family and injury risks associated with fatal and non-fatal AHT at a Level I pediatric trauma center.

Methods:

A single-institution, retrospective review of suspected AHT patients ≤ 5 years of age between 2010-2017 using a prospective hospital forensic registry data yielded demographic, clinical, family, psycho-social and other follow-up information. Descriptive statistics were used to assess differences between patients with AHT and accidental head trauma. Logistic regression estimated adjusted odds ratios (AOR) for AHT. Receiver operating characteristic (ROC) curve was calculated to determine model sensitivity and specificity.

Results:

Forensic evaluations of 791 children age ≤ 5 years with head trauma met the inclusion criteria, 38 were fatal. Of 753 non-fatal patients, the median[IQR] age was 7[3-10] months; 54.7% male; 343 patients (46%) presented with a skull fracture, 185 (25%) with a cephalohematoma; 222 (30%) with an intracranial hemorrhage. Thirty-one percent (234) were adjudicated AHT, 45% (338) were accidental, 181 were undetermined. Associated clinical risks for AHT included multiple fractures ($\text{Exp}(\beta)=9.9[p=0.001]$), bruising ($\text{Exp}(\beta)=5.7[p<0.001]$), subdural blood ($\text{Exp}(\beta)=5.3[p=0.001]$), seizures ($\text{Exp}(\beta)=4.9[p=0.02]$), and unknown mechanism of injury (MOI) ($\text{Exp}(\beta)=3.9[p=0.001]$); skull fracture reduced the risk of AHT by half ($\text{Exp}(\beta)=0.5[p=0.011]$). Family-associated risks included prior police involvement ($\text{Exp}(\beta)=5.9[p=0.001]$), substance abuse ($\text{Exp}(\beta)=5.7[p=.001]$), unknown number of adults in the home ($\text{Exp}(\beta)=4.1[p=0.001]$) and intimate partner violence ($\text{Exp}(\beta)=2.3[p=0.02]$). Area under the ROC attained 73% sensitivity; 91% specificity.

Conclusion:

To improve surveillance of AHT, in addition to clinical evaluation, interviews should include caregiver substance abuse, intimate partner violence, prior police involvement and household size. An unknown number of adults in home is associated with AHT.

Abstract - Podium

Abstract Title:

Elevated Pediatric Age-Adjusted Shock-Index (SIPA) in Blunt Solid Organ Injuries

Authors (s):

Ryan Phillips MD, Maxene Meier MS, Shannon Acker MD, Niti Shahi MD, Gabrielle Shirek BA, John Recicar RN, Steven Moulton MD and Denis Bensard MD.

Background:

Shock index-pediatric age-adjusted (SIPA) is a proven tool to predict outcomes in blunt pediatric trauma. Blood transfusion and/or operative hemorrhage control are rarely required in hemodynamically stable children with blunt liver or spleen injuries (BLSI). We sought to examine the change in SIPA from the pre-hospital setting to the emergency department (ED). We hypothesized that a persistently elevated SIPA would identify children with BLSI in need of blood transfusion and/or failure of non-operative management (NOM).

Methods:

Pediatric patients (ages 1-18 years old) in the ACS pediatric-TQIP database (2014-2016) with any grade BLSI, and complete pre-hospital and ED vital signs were included. We excluded patients with penetrating injuries, incomplete vital signs, or missing transfusion data. We stratified patients by the need for blood transfusion within the first 4 hours and the need for abdominal operation within the first 24 hours of ED arrival. A multivariable model was created to determine factors associated with blood transfusion and failure of NOM.

Results:

A total of 3,561 patients had BLSI during the study period, of which 4% received a blood transfusion, and 4% underwent an abdominal operation. Patients who received blood had significantly higher ISS scores (27.0 vs. 5.0, $p < 0.001$) and mortality (22% vs. 0.4%, $p < 0.001$). Similarly, patients who failed NOM had significantly higher ISS scores (17.0 vs. 5.0, $p < 0.001$) and mortality (7.9% vs. 0.9%, $p < 0.001$) (Table 1). One third (34%) of those who received a blood transfusion also failed NOM. On multivariable regression, an elevated SIPA score in either setting (pre-hospital or ED) was significantly associated with blood transfusion (Odds ratio (OR) 8.2, confidence intervals (CI) 5.8-11.5, p -value = < 0.001) and failure of NOM (OR 2.3, CI 1.5-3.4, p -value = < 0.001).

Conclusion:

Hemodynamic instability, represented by an elevated pre-hospital or ED SIPA, accurately identifies children with BLSI who may need blood products and/or operative intervention.

Abstract - Podium

Abstract Title:

PEDIATRIC POSTERIOR TRAUMATIC KNEE DISLOCATION: A RARE BUT DEVASTATING INJURY

Author(s):

Raphael Parrado MD, David M Notrica MD.

Background:

Posterior knee dislocations in children are uncommon but highly devastating injuries. Associated vascular injuries lead to amputation in some cases, but literature on the topic is scarce. The purpose of this study is to characterize the demographics, hospital types, associated injuries, and clinical outcomes of the pediatric population with knee dislocation.

Methods:

This study utilized the National Trauma Data Set (NTDS) from the American College of Surgeons on years 2015 and 2016. All demographic and clinical data on pediatric patients (≤ 18 years) with the ICD codes for posterior knee dislocation were obtained. Primary outcomes were interventions and amputations. Secondary outcomes were designation, other complications.

Results:

Of 257,758 pediatric admissions, 44 posterior knee dislocations were identified (0.02%); Trauma center types shown in table 1. Median age 17y [IQR 15,18], 70% male; 49% white and mean BMI 31.4 ± 9.4 vs. 21.4 ± 7.4 for all admissions ($p < 0.001$). Vascular injury was present in 16 patients (36%); 10 underwent repair (8 with saphenous vein graft) and fasciotomies in 8 patients. Mechanisms were fall from height ($n=11$), ground level fall ($n=8$), MVC occupant ($n=8$), sports-related ($n=6$). The most common procedure was closed reduction. Associated injuries included tibial fractures in 7 (15%) and pneumothorax in 4 (9%). Nerve injury was present in 5 patients (11%). Six complications were noted in 3 patients (compartment syndrome, sepsis, pulmonary embolism, unplanned return to surgery, acute kidney injury, unplanned return to intensive care ($n=1$, each)). Lower extremity amputation was performed in 3 patients (7%).

Conclusion:

Pediatric posterior knee dislocations occur more commonly in obese male patients. Vascular injury occurs in 36% of these patients and 23% of posterior knee dislocations require vascular repair. Repairs are typically done with saphenous vein. Fasciotomies were done in 62% with vascular injury. The amputation frequency after posterior knee dislocation is 7%.

Abstract - Podium

Abstract Title

Decision-Making in Pediatric Blunt Solid Organ Injury: A Deep Learning Approach to Predict Massive Transfusion, Surgery and Mortality Risk

Authors:

Niti Shah MD, Ashwani K. Shahi MS, Ryan Phillips MD, Gabrielle Shirek BA, Denis Bensard MD, and Steven Moulton MD.

Background:

The principal triggers for operative management of pediatric blunt solid organ injury (BSOI) are a declining hemoglobin and/or sudden change in hemodynamic status. Deep learning, computer-based models were developed to predict the need for massive transfusion (MT), surgery, and mortality within 4 hours of emergency department (ED) presentation.

Methods:

Children (<18 years) who sustained a BSOI (kidney, liver, spleen) between 2009-2018 were identified in a pediatric level 1 trauma center's registry. Deep learning models were developed using serial clinical values [vital signs, shock index-pediatric adjusted (SIPA), organ injured, and blood transfusion products received], laboratory findings [hemoglobin, base deficit, INR, lactate, thromboelastography (TEG)], and imaging findings [grade of injury, focused assessment with sonography in trauma (FAST)] from pre-hospital to ED settings for prediction of MT, surgery, and mortality. Inputs were used as continuous variables and as categorical variables (abnormal/normal) based on institutional ranges. Due to unbalanced datasets (22 deaths vs. 455 survivors), the majority class was under-sampled to create a balanced set for model training. Sensitivity, specificity, and accuracy were used to evaluate model performance.

Results:

A total of 477 patients were included, of which 6.5% required MT (31/477), 6.7% required surgery (32/477), and 4.4% died (21/477). The accuracy of the models in the validation set were as follows: MT (86.1%), surgical intervention (85.2%), and mortality (91.2%). Serial vital signs, grade of organ injury, hemoglobin, and positive FAST had low correlations with MT, need for surgery, or mortality (all r values <0.2).

Conclusion:

Deep learning models were >80% sensitive and specific in identification of children with BSOI, who may need MT or surgery. Vital sign trends, grade of injury, and serial hemoglobin did not improve the model's predictive ability. Denser patient data, including continuous physiological data and natural language processing of semantic data, are next steps to improving the models.

Abstract - Podium

Abstract Title

It's All About the Angle: Meaningful Viscoelastic Abnormalities in Children Who Sustain Physical Abuse

Authors(s):

Ryan Phillips MD, Niti Shahi MD, Gabrielle Shirek BA, John Recicar, RN, Daniel M. Lindberg MD, John Kim MD, Steven Moulton MD

Background:

Child physical abuse is a leading cause of death in children less than five years old. The American Pediatric Surgical Association (APSA) recently endorsed screening potential abuse patients with coagulation studies, including international normalized ratio (INR). There remains a paucity of data on the utility of thromboelastography (TEG) in the management of abuse patients. We hypothesize that abnormalities on admission TEG will differ in abuse patients, compared to those accidentally injured.

Methods:

Pediatric trauma patients who were admitted to a Level I trauma center from 2010-2020 were analyzed. Patients <10 years old who had an admission TEG were included. Patients were stratified into two cohorts: those with confirmed abuse, and accidental trauma. TEG abnormalities were based on the institution's normative values (R-time = 4-9 minutes, alpha-angle = 59-74 °, maximum amplitude (MA) = 55-74 mm, and LY30 = 0.9-3%) and compared between the groups.

Results:

Of 34 children included, 21 had confirmed abuse. Four of the abused patients and two of the accidentally injured patients died. Abused patients had significantly decreased R-time (67% vs. 23%, $p=0.03$) and increased alpha angles (47% vs. 0%, $p<0.001$). Abused patients were less likely to have decreased MA values (9.5% vs. 54%, $p<0.001$), and less likely to have an elevated INR >1.3 (33% vs. 77%, $p=0.03$) compared to accidentally injured patients. There was no significant difference in the LY30 (lysis or shutdown) between the groups, as two-thirds of the abused patients and all the accidental trauma patients presented with a fibrinolysis abnormality. All patients who died presented in fibrinolysis shutdown (LY30 $<0.9\%$).

Conclusion:

Abused children were more likely to present with a hypercoagulable injury pattern, suggesting that abused patients may benefit less from plasma transfusion. These findings support updating the APSA abuse management guidelines to include TEG.

Abstract - Podium

Abstract Title:

Supervised Machine Learning Techniques for Mortality Prediction in Pediatric Trauma: Validation Using Pediatric Trauma Within the Combat Zone

Author(s):

Lammers DT, Marengo CW, Conner JR, Mote KR, Bingham JR, Martin MJ, Escobar MA, Eckert MJ

Background:

The early identification of pediatric trauma patients at the highest risk for death may aid in optimizing the therapeutic and logistical decision-making processes. This becomes increasingly important when operating within austere settings with constrained overall medical capabilities. Various trauma scores exist to stratify pediatric and adult trauma patients based on their overall mortality risk; however, more technologically advanced techniques have yet to be widely explored. This study aimed to develop and compare various predictive models using supervised machine learning techniques to identify pediatric warzone trauma patients at the highest risk for mortality.

Methods:

Supervised learning approaches using logistic regression (LR), support vector machine (SVM), neural network (NN), and random forest (RF) techniques were used to create predictive models for mortality using known prehospital and arrival datapoints from the Department of Defense Trauma Registry, 2008-2016 for all patients less than 18 years old. The training dataset utilized 70% of the patient population for model development, and performance was validated using the remaining 30% of the population. Models were tested and compared via standard statistical measures and area under the receiver operator characteristic curve (AUROC) analyses to determine the optimal predictor for mortality.

Results:

2,007 patients (79% male, median age range 7-12 YO, 62.5% sustaining penetrating injury) met the inclusion criteria. Severe injury (ISS > 15) was noted in 32.4% of patients while overall mortality was 7.13%. All four models were highly sensitive in mortality prediction for the testing data (LR = 0.9065, RF = 0.9558, SVM = 0.9456, and NN = 0.9065). Of the models, RF outperformed LR, SVM, and NN on ROC analysis demonstrating an AUROC of 0.9815 versus 0.9594, 0.9704, and 0.9362, respectively.

Conclusion:

Machine learning techniques may prove useful in identifying those at the highest risk for mortality within pediatric trauma patients in austere settings. Utilization and incorporation of advanced computational algorithms should be further explored to optimize and supplement the diagnostic and therapeutic decision-making process.

Abstract - Podium

Abstract Title:

Can hospital length of stay for children with blunt solid organ injury be safely decreased? Implementation of an evidence based accelerated pathway

Author(s):

SC Stokes, JE Jackson, KJ Yamashiro, CM Theodorou, DL Farmer, P Saadai, S Hirose, EG Brown, JT Stephenson

Background:

Trauma is the leading cause of death in children. Blunt abdominal injuries occur in 10-15% of pediatric trauma patients, resulting in solid organ injuries which are often managed non-operatively. Blunt solid organ injuries have historically been managed with in-hospital bedrest for the grade of injury plus one day. Recent work has demonstrated that a shorter length of stay is safe. We hypothesized that implementation of an accelerated blunt solid organ injury protocol would decrease length of stay (LOS) and hospitalization cost without increase in morbidity or mortality.

Methods:

A retrospective review of patients under 15 years of age presenting to a level 1 pediatric trauma center between 2015 and 2019 with blunt liver and splenic trauma injuries was performed. Patients presenting prior to protocol implementation were compared to those who presented after implementation. Protocol patients were admitted to the ward or the intensive care unit (ICU) based on hemodynamic status and injury grade. Diet and activity were advanced based on hemodynamic status and abdominal exam. Patients were discharged when they were hemodynamically stable, tolerating a diet and had stable hematocrits on lab draws. Hospitalization cost data was available for patients presenting from 2016 onwards. The primary outcome was LOS. Secondary outcomes were ICU LOS, cost of hospitalization, readmission and mortality rates.

Results:

93 patients were evaluated, 72 pre-protocol and 21 post-protocol. There was no difference in age, injury severity score, liver injury grade or spleen injury grade between the groups. LOS was significantly shorter in the post-protocol group (3.19 days vs 5.49 days, $p=0.001$). The ICU LOS was unchanged (1.47 days vs 1.93 days, $p=0.215$). There was a decrease in total hospitalization cost per patient from \$158,153 pre-protocol to \$106,483 post-protocol ($p=0.054$). There were no deaths and no readmissions.

Conclusion:

Implementation of an accelerated pathway for management of blunt solid organ injury in pediatric patients was associated with decreased length of stay and decreased costs with no increased morbidity or mortality.

Abstract - Podium

Abstract Title:

Firearm injuries in children: a missed opportunity for gun safety education

Author(s):

SC Stokes, NR McFadden, KJ Yamashiro, CM Theodorou, JE Jackson, AL Beres

Background:

Firearm injury is a leading cause of death in children. The extent to which patients and their families are counseled on gun safety after a child sustains a gunshot wound (GSW) is unknown. We hypothesized that at a level one pediatric trauma center the majority of patients presenting with GSWs would not have gun safety discussed.

Method:

A retrospective review of patients <18 years presenting with GSWs to a level one pediatric trauma center from 2009-2019 was performed. The primary outcome was discussion of gun safety with the patient or family. Secondary outcomes included notification of child protective services (CPS). We sought to identify differences in patient populations who received counseling and CPS notification from those who did not.

Results:

A total of 226 patients with GSWs were identified, with 22 (9.7%) deaths. Median age was 15 years [IQR 5], median injury severity score (ISS) was 9 [IQR 12]. 22.1% (50) were unintentional, 1.8% (4) were intentional self-inflicted, 61.0% (138) were intentional by others, 2.7% (6) were crossfire, and 10.2% (23) did not have sufficient information for classification. 93.3% (211) of these patients were evaluated by a hospital social worker. A gun safety discussion took place in 4.6% (10) of cases. This discussion was performed by social workers in all 10 cases, with additional physician discussion in 2 cases. A discussion of gun safety was more likely to occur in patients who presented after accidental injuries compared to other mechanisms (16.0% vs 1.1%, $p<0.001$). There was no association between gun safety conversations and age or ISS. CPS was contacted in 12.8% (29) of cases. CPS was more likely to be contacted for accidents compared to other causes (50% vs 3.8%, $p<0.001$), for younger patients (6.83 years vs 13.82 years, $p<0.001$) and for those with injuries inflicted by a powder gun, compared to a BB gun (47.8% vs 25%, $p<0.001$).

Conclusion:

A discussion of gun safety was only performed in 4.6% of all pediatric patients presenting with a GSW. A patient encounter after a GSW presents an opportunity for education and intervention and there is significant room for improvement.

Abstract - Podium

Abstract Title:

Dynamic Trend or Static Variable: Shock Index Pediatric-Adjusted (SIPA) in Warzone Trauma

Author(s):

Christopher Marengo, Daniel Lammers, Woo Do, John Horton, Matthew Eckert

Background:

Recent work has validated Shock Index Pediatric-Adjusted (SIPA) for the prediction of resource utilization and outcomes in pediatric warzone trauma. Civilian studies suggest that trending SIPA values from pre-hospital to arrival can prove more useful in the prediction of trauma outcomes. The value of such trends in pediatric warzone trauma, in which penetrating and blast injuries predominate, has yet to be explored. The purpose of this study was to evaluate the utility of trends in SIPA for the prediction of outcomes in pediatric warzone trauma.

Methods:

We performed a retrospective review of the Department of Defense Trauma Registry from 2008 to 2015. We included all patients age ≤ 17 years evaluated for traumatic injuries during that time period. We excluded those patients without vital signs recorded both prior to arrival (pre-hospital) and immediately upon arrival to the initial level of care with surgical capabilities. SIPA was calculated for each time point and classified as either "normal" or "abnormal" based upon previously validated thresholds for predefined age cohorts. Patients were then stratified into 4 groups based on the trend of their SIPA values (Group 1- normal to normal, Group 2- normal to abnormal, Group 3- abnormal to normal, and Group 4- abnormal to abnormal). Key trauma outcomes including ICU admission, severe injury (ISS >15), need for mechanical ventilation, and mortality were then compared between groups.

Results:

A total of 669 patients were included in the study. The majority of patients were male (82.1%) and in the age range of 7-12 years (50.7%). The most common mechanism of injury was blast injury (46.5%), followed by gunshot wounds (23.3%). Overall, 43% were stratified into Group 1, 13.9% into Group 2, 14.8% into Group 3, and 28.0% into Group 4. Those patients with a persistently abnormal SIPA (Group 4) had significantly increased incidence of severe injury, ICU admission, need for mechanical ventilation, and mortality (Figure 1).

Conclusion:

Trends in SIPA may be used to predict trauma outcomes for children injured in warzones, with persistently abnormal values predictive of worse outcomes overall.

Abstract - Podium

Abstract Title:

Pediatric trauma telemedicine in a rural state: Lessons learned from a one-year experience

Author(s):

Mark A. Taylor, MD; Miguel Knochel, MD; Spencer Proctor, MD; Douglas Brockmeyer, MD; Lisa Runyon, CPNP; Stephen J Fenton, MD; Katie Russell, MD

Background:

Previous research from our center has shown that 27% of the pediatric trauma transfers from referring facilities are potentially preventable. Our hospital is the only level 1 pediatric trauma center (PTC) in our state, and we are developing a pediatric trauma telehealth network to help keep certain injured children closer to home. We instituted a pediatric trauma telehealth program with a partnering community-based hospital in our state and aim to report our experience over the first year.

Methods:

All pediatric trauma patients that presented to our partnering hospital from January 2019 to February 2020 were reviewed. Disposition was: a) telehealth consultation, b) admission to the children's unit without a telehealth consultation per the head trauma protocol (Figure 1), or c) transfer without telehealth consultation. Data on demographics, hospital course, and disposition were collected via chart review.

Results:

Eight patients underwent telehealth consults and another 8 patients were admitted to the partnering hospital's children's unit based on the head trauma protocol without a telehealth consult. Patient's ages ranged from 7 months to 15 years. Of the patients that underwent telehealth consult, 7 presented with a head injury and 1 presented with a rib fracture/small pneumothorax. The patient with a pneumothorax was observed for 6 hours and discharged home after a repeat chest x-ray was stable. All 15 patients with head injuries were observed and discharged from either the emergency department or children's unit after passing concussion testing. No patients required transfer to our PTC after observation, and none were readmitted. Thirty patients were transferred without telehealth consultation, and 5 of these patients could potentially have avoided transfer with a telehealth consultation.

Conclusions:

Telehealth in pediatric trauma is a safe mechanism for preventing the transfer of patients that can be safely observed at a partnering hospital. From a facility that transfers an average of 30 trauma patients per year to our hospital, this program prevented 16 such transfers. Development of a head trauma protocol in collaboration with a pediatric neurosurgeon leads to an unexpected number of patients being admitted to the partnering hospital for observation without utilization of a telehealth consultation.

Abstract - Podium

Abstract Title:

Pediatric Adjusted Reverse Shock Index Multiplied by Glasgow Coma Scale as a Prospective Predictor for Mortality in Pediatric Trauma

Author(s):

Lammers DT, Marengo CW, Do WS, Conner JR, Horton JD, Martin MJ, Escobar MA, Bingham JR, Eckert MJ

Background:

Shock index (SI) and its pediatric adjusted derivative (SIPA) have demonstrated utility as prospective predictors of mortality in adult and pediatric trauma populations. Although basic vital signs provide promise as triage tools, factors such as neurologic status on arrival have profound implications for trauma-related outcomes. Recently, the reverse SI (rSI) multiplied by Glasgow Coma Scale (GCS) (rSIG) has been validated in adult trauma as a tool combining early markers of physiology and neurologic function to predict mortality. This study sought to compare the performance characteristics of rSIG against SIPA as a prospective predictor of mortality in pediatric war zone injuries.

Methods:

Retrospective review of the Department of Defense Trauma Registry, 2008 – 2016, was performed for all patients less than 18 years old with documented vital signs and GCS on initial arrival to the trauma bay. Optimal age specific cut off values were derived for rSIG via the Youden Index using receiver operating characteristic analyses. Multivariate logistic regression was performed to validate accuracy in predicting early mortality.

Results:

A total of 2,007 pediatric patients with a median age range of 7-12, 79% male, average ISS 11.9, and 63% with predominately penetrating injury were included in the analysis. The overall mortality was 7.1%. A total of 874 (43.5%) and 685 (34.1%) patients had elevated SIPA and pediatric rSIG scores, respectively. After adjusting for demographics, mechanism of injury, initial vital signs and presenting laboratory values, rSIG (OR=4.054; p=0.013) was found to be superior to SIPA (OR=2.742; p=0.005) as an independent predictor of early mortality.

Conclusion:

rSIG more accurately identifies pediatric patients at the highest risk of death following war zone injuries when compared to SIPA alone. These findings may help refine early risk assessments for patient management and resource allocation in constrained settings. Further validation is necessary to determine applicability to the civilian population.