

Committee on Surgical Combat Casualty Care (CoSCCC)



Journal Watch

2nd Quarter

FY2020

Journal Watch Key Terminology Searched:

| | | |
|---------------------------------|---------------------------|-------------------------------|
| Microcirculation | Trauma Management | Haemorrhage |
| Shock | Sublingual | Ethics committees |
| Human subject research | IDF | Institutional review board |
| Haemorrhagic shock | Multiple trauma | Shock index |
| Traumatic brain injury | Coagulopathy | Diagnostic accuracy |
| Plasma | Pre-hospital | Thrombelastography (TEG) |
| Transfusion | Trauma | Imaging |
| RBCs | Resuscitation | Severe trauma |
| Stability | Ultrasound | Afghanistan |
| Blast | Facial trauma | War |
| Amputation | Multiple | Transfusion |
| Traumatic Clinical outcomes | Clinical parameters | Damage control Surgery |
| Injury | Pelvic fracture | Battlefield Trauma |
| Coagulopathy | Cryoprecipitate | Fibrinogen |
| Fibrinogen concentrate | Massive transfusion | ABO |
| Viscoelastic haemostatic assays | Angiography | External fixation |
| Guidelines | Internal fixation | Pelvic ring |
| Fractures | X-ray | Pre-peritoneal pelvic packing |
| REBOA | Antibiotic prophylaxis | Long bone fractures |
| Orthopaedic trauma | Perioperative antibiotics | Surgical site infection |
| Wound ballistics | Faecal diversion | Primary repair |
| Cause of injury | Head injuries | Poly-trauma |
| Damage Control Resuscitation | Battlefield injury | Prolonged field care |
| Tension pneumothorax | Thoracotomy | Military Medicine |
| Blast Injury | Died of Wounds | Killed in Action |

Optic Nerve Sheath Ultrasound.

Authors [Richards E](#)¹, [Mathew D](#)².

Source StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan 30.

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Excerpt The use of point-of-care ultrasound (POCUS) has expanded considerably over the past two decades allowing for enhanced and swift evaluations, rapid triage, improved diagnostic capabilities in austere situations, and real-time assessment of focused clinical questions in critically ill patients in the intensive care unit (ICU).[1] Emergency medicine physicians have led the way in the establishment and education of bedside use of ultrasound. In 2001, the American College of Emergency Physicians (ACEP) published the first Emergency Ultrasound Guidelines to clarify the primary indications, the scope of practice, training, and continuing education regarding the use of emergency ultrasound.[2] These guidelines have continued to expand alongside the ever-growing use of ultrasound. They have been adopted by several other specialties, especially in the application of “procedural ultrasound” to assist in real-time guidance of vascular access, peripheral nerve blockade, and pre-surgical evaluations.[3][4] The main difference between POCUS and dedicated ultrasound exams is the ability to answer a focused clinical question rapidly, to facilitate serial examinations in the setting of clinical deterioration, or to guide a bedside procedure rather than provide a detailed report with the grading of pathology.[2][5] With small, portable models of ultrasound becoming available, advanced diagnostics are becoming more accessible in remote environments and on the battlefield. Physicians and advanced paramedical providers in these settings are becoming trained to perform extended focused assessment with sonography in trauma (eFAST), optic nerve sheath ultrasound (ONSUS) for the evaluation of intracranial hypertension, inferior vena cava collapsibility assessments for the evaluation of volume status, and countless other examples of image-guided procedures.[6][7] The focus of this article will be on optic nerve sheath ultrasound for the diagnosis, monitoring, and management of elevated intracranial pressure (ICP).

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Viscoelastic Testing in Combat Resuscitation: Is it Time for a New Standard?

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Abstract

BACKGROUND: Traumatic hemorrhage and coagulopathy represent major sources of morbidity and mortality on the modern battlefield. Viscoelastic testing (VET) offers a potentially more personalized approach to resuscitation. We sought to evaluate outcomes of combat trauma patients who received VET-guided resuscitation compared to standard balanced blood product resuscitation.

METHODS: Retrospective analysis of the Department of Defense Trauma Registry, 2008-2016 was performed. Multivariate logistic regression analyses of all adult patients initially presenting to NATO Role III facilities who required blood products were performed to identify factors associated with VET-guided resuscitation and mortality. A propensity score matched comparison of outcomes in patient cohorts treated at VET versus non-VET Role III facilities was performed.

RESULTS: 3320 patients predominately male (98%), median age range 25-29 years, ISS 18.8, with a penetrating injury (84%) were studied. Overall mortality was 9.7%. 594 patients had VET during their initial resuscitation. After adjusting for confounders, VET during initial resuscitation was independently associated with decreased mortality (OR 0.63; $p=0.04$). Propensity analysis confirmed this survival advantage with a 57% reduction in overall mortality (7.3% vs 13.1%; $p=0.001$) for all patients requiring blood products.

CONCLUSION: Viscoelastic testing offers the possibility of a product-specific resuscitation for critically injured patients requiring transfusion in combat settings. Routine VET may be superior to non-VET-guided resuscitation for combat trauma victims.

LEVEL OF EVIDENCE: Therapeutic study, level IV.

PMID: 32118819 DOI: [10.1097/TA.0000000000002634](https://doi.org/10.1097/TA.0000000000002634)

Analysis of Casualties That Underwent Airway Management Before Reaching Role 2 Facilities in the Afghanistan Conflict 2008-2014.

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Abstract

INTRODUCTION: Airway compromise is the second leading cause of potentially survivable death on the battlefield. The purpose of this study was to better understand wartime prehospital airway patients.

MATERIALS AND METHODS: The Role 2 Database (R2D) was retrospectively reviewed for adult patients injured in Afghanistan between February 2008 and September 2014. Of primary interest were prehospital airway interventions and mortality. Prehospital combat mortality index (CMI-PH), hemodynamic interventions, injury mechanism, and demographic data were also included in various statistical analyses.

RESULTS: A total of 12,780 trauma patients were recorded in the R2D of whom 890 (7.0%) received prehospital airway intervention. Airway intervention was more common in patients who ultimately died (25.3% vs. 5.6%); however, no statistical association was found in a multivariable logistic regression model (OR 1.28, 95% CI 0.98-1.68). Compared with U.S. military personnel, other military patients were more likely to receive airway intervention after adjusting for CMI-PH (OR 1.33, 95% CI 1.07-1.64).

CONCLUSIONS: In the R2D, airway intervention was associated with increased odds of mortality, although this was not statistically significant. Other patients had higher odds of undergoing an airway intervention than U.S. military. Awareness of these findings will facilitate training and equipment for future management of prehospital/prolonged field care airway interventions.

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PMID: 32074383 DOI: [10.1093/milmed/usz383](https://doi.org/10.1093/milmed/usz383)

Mortality Review of US Special Operations Command Battle-Injured Fatalities.

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Abstract

BACKGROUND: Comprehensive analyses of battle-injured fatalities, incorporating a multi-disciplinary process with a standardized lexicon, is necessary to elucidate opportunities for improvement (OFI) to increase survivability.

METHODS: A mortality review was conducted on United States Special Operations Command (USSOCOM) battle-injured fatalities who died from September 11, 2001 to September 10, 2018. Fatalities were analyzed by demographics, operational posture, mechanism of injury, cause of death, mechanism of death, classification of death, and injury severity. Injury survivability was determined by a subject matter expert panel and compared to injury patterns among Department of Defense Trauma Registry survivors. Death preventability and OFI were determined for fatalities with potentially survivable or survivable injuries (PS-S) using tactical data and documented medical interventions.

RESULTS: Of 369 USSOCOM battle-injured fatalities (median age, 29 years; male, 98.6%), most were killed in action (89.4%) and more than half died from injuries sustained during mounted operations (52.3%). The cause of death was blast injury (45.0%), gunshot wound (39.8%), and multiple/blunt force injury (15.2%). The leading mechanism of death was catastrophic tissue destruction (73.7%). Most fatalities sustained non-survivable injuries (74.3%). For fatalities with PS-S injuries, most had hemorrhage as a component of mechanism of death (88.4%); however, the mechanism of death was multifactorial in the majority of these fatalities (58.9%). Only 5.4% of all fatalities and 21.1% of fatalities with PS-S injuries had comparable injury patterns among survivors. Accounting for tactical situation, a minority of deaths were potentially preventable (5.7%) and a few preventable (1.1%). Time to surgery (93.7%) and prehospital blood transfusion (89.5%) were the leading OFI for PS-S fatalities. Most fatalities with PS-S injuries requiring blood (83.5%) also had an additional prehospital OFI.

CONCLUSIONS: Comprehensive mortality reviews of battlefield fatalities can identify OFI in combat casualty care and prevention. Standardized lexicon is essential for translation to civilian trauma systems.

LEVEL OF EVIDENCE: Performance Improvement and Epidemiological, level IV.

PMID: 32039975 DOI: [10.1097/TA.0000000000002610](https://doi.org/10.1097/TA.0000000000002610)

Survival after traumatic brain injury improves with deployment of neurosurgeons: a comparison of US and UK military treatment facilities during the Iraq and Afghanistan conflicts.

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Abstract

INTRODUCTION: Traumatic brain injury (TBI) is the most common cause of death on the modern battlefield. In recent conflicts in Iraq and Afghanistan, the US typically deployed neurosurgeons to medical treatment facilities (MTFs), while the UK did not. Our aim was to compare the incidence, TBI and treatment in US and UK-led military MTF to ascertain if differences in deployed trauma systems affected outcomes.

METHODS: The US and UK Combat Trauma Registries were scrutinised for patients with HI at deployed MTFs between March 2003 and October 2011. Registry datasets were adapted to stratify TBI using the Mayo Classification System for Traumatic Brain Injury Severity. An adjusted multiple logistic regression model was performed using fatality as the binomial dependent variable and treatment in a US-MTF or UK-MTF, surgical decompression, US military casualty and surgery performed by a neurosurgeon as independent variables.

RESULTS: 15 031 patients arrived alive at military MTF after TBI. Presence of a neurosurgeon was associated with increased odds of survival in casualties with moderate or severe TBI ($p < 0.0001$, OR 2.71, 95% CI 2.34 to 4.73). High injury severity (Injury Severity Scores 25-75) was significantly associated with a lower survival (OR 4×10^4 , 95% CI 1.61×10^4 to 110.6×10^4 , $p < 0.001$); however, having a neurosurgeon present still remained significantly positively associated with survival (OR 3.25, 95% CI 2.71 to 3.91, $p < 0.001$).

CONCLUSIONS: Presence of neurosurgeons increased the likelihood of survival after TBI. We therefore recommend that the UK should deploy neurosurgeons to forward military MTF whenever possible in line with their US counterparts.

Aortic balloon occlusion (REBOA) in pelvic ring injuries: preliminary results of the ABO Trauma Registry.

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Abstract EndoVascular and Hybrid Trauma Management (EVTM) has been recently introduced in the treatment of severe pelvic ring injuries. This multimodal method of hemorrhage management counts on several strategies such as the REBOA (resuscitative endovascular balloon occlusion of the aorta). Few data exist on the use of REBOA in patients with a severely injured pelvic ring. The ABO (aortic balloon occlusion) Trauma Registry is designed to capture data for all trauma patients in hemorrhagic shock where management includes REBOA placement. Among all patients included in the ABO registry, 72 patients presented with severe pelvic injuries and were the population under exam. 66.7% were male. Mean and median ISS were respectively 43 and 41 (SD \pm 13). Isolated pelvic injuries were observed in 12 patients (16.7%). Blunt trauma occurred in 68 patients (94.4%), penetrating in 2 (2.8%) and combined in 2 (2.8%). Type of injury: fall from height in 15 patients (23.1%), traffic accident in 49 patients (75.4%), and unspecified impact in 1 patient (1.5%). Femoral access was gained pre-hospital in 1 patient, in emergency room in 43, in operating room in 12 and in angio-suite in 16. REBOA was positioned in zone 1 in 59 patients (81.9%), in zone 2 in 1 (1.4%) and in zone 3 in 12 (16.7%). Aortic occlusion was partial/periodical in 35 patients (48.6%) and total occlusion in 37 patients (51.4%). REBOA associated morbidity rate: 11.1%. Overall mortality rate was 54.2% and early mortality rate (\leq 24 h) was 44.4%. In the univariate analysis, factors related to early mortality (\leq 24 h) are lower pH values ($p = 0.03$), higher base deficit ($p = 0.021$), longer INR ($p = 0.012$), minor increase in systolic blood pressure after the REBOA inflation ($p = 0.03$) and total aortic occlusion ($p = 0.008$). None of these values resulted significant in the multivariate analysis. In severe hemodynamically unstable pelvic trauma management, REBOA is a viable option when utilized in experienced centers as a bridge to other treatments; its use might be, however, accompanied with severe-to-lethal complications.

KEYWORDS: ABO; EVTm; Hemodynamic; International; Morbidity; Mortality; Pelvis; REBOA; Registry; Trauma

PMID: 32130669 DOI: [10.1007/s13304-020-00735-4](https://doi.org/10.1007/s13304-020-00735-4)

Epidemiology of Injuries Sustained by Civilians and Local Combatants in Contemporary Armed Conflict: An Appeal for a Shared Trauma Registry Among Humanitarian Actors.

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Abstract

BACKGROUND: Conflict-related injuries sustained by civilians and local combatants are poorly described, unlike injuries sustained by US, North Atlantic Treaty Organization, and coalition military personnel. An understanding of injury epidemiology in twenty-first century armed conflict is required to plan humanitarian trauma systems capable of responding to population needs.

METHODS: We conducted a systematic search of databases (e.g., PubMed, Embase, Web of Science, World Health Organization Catalog, Google Scholar) and grey literature repositories to identify records that described conflict-related injuries sustained by civilians and local combatants since 2001.

RESULTS: The search returned 3501 records. 49 reports representing conflicts in 18 countries were included in the analysis and described injuries of 58,578 patients. 79.3% of patients were male, and 34.7% were under age 18 years. Blast injury was the predominant mechanism (50.2%), and extremities were the most common anatomic region of injury (33.5%). The heterogeneity and lack of reporting of data elements prevented pooled analysis and limited the generalizability of the results. For example, data elements including measures of injury severity, resource utilization (ventilator support, transfusion, surgery), and outcomes other than mortality (disability, quality of life measures) were presented by fewer than 25% of reports.

CONCLUSIONS: Data describing the needs of civilians and local combatants injured during conflict are currently inadequate to inform the development of humanitarian trauma systems. To guide system-wide capacity building and quality improvement, we advocate for a humanitarian trauma registry with a minimum set of data elements.

PMID: 32100067 DOI: [10.1007/s00268-020-05428-y](https://doi.org/10.1007/s00268-020-05428-y)

Outcomes following resuscitative thoracotomy for abdominal exsanguination, a systematic review.

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Abstract

BACKGROUND: Resuscitative thoracotomy is a damage control procedure with an established role in the immediate treatment of patients in extremis or cardiac arrest secondary to cardiac tamponade however its role in resuscitation of patients with abdominal exsanguination is uncertain.

OBJECTIVE: The primary objective of this systematic review was to estimate mortality based on survival to discharge in patients with exsanguinating haemorrhage from abdominal trauma in cardiac arrest or a peri arrest clinical condition following a resuscitative thoracotomy.

METHODS: A systematic literature search was performed to identify original research that reported outcomes in resuscitative thoracotomy either in the emergency department or pre-hospital environment in patients suffering or suspected of suffering from intra-abdominal injuries. The primary outcome was to assess survival to discharge. The secondary outcomes assessed were neurological function post procedure and the role of timing of intervention on survival.

RESULTS: Seventeen retrospective case series were reviewed by a single author which described 584 patients with isolated abdominal trauma and an additional 1745 suffering from polytrauma including abdominal injuries. Isolated abdominal trauma survival to discharge ranged from 0 to 18% with polytrauma survival of 0-9.7% with the majority below 1%. Survival following a thoracotomy for abdominal trauma varied between studies and with no comparison non-intervention group no definitive conclusions could be drawn. Timing of thoracotomy was important with improved mortality in patients not in cardiac arrest or having the procedure performed just after a loss of signs of life. Normal neurological function at discharge ranged from 100 to 28.5% with the presence of a head injury having a negative impact on both survival and long-term morbidity.

CONCLUSIONS: Pre-theatre thoracotomy may have a role in peri-arrest or arrested patient with abdominal trauma. The best outcomes are achieved with patients not in cardiac arrest or who have recently arrested and with no head injury present. The earlier the intervention can be performed, the better the outcome for patients, with survival figures of up to 18% following a resuscitative thoracotomy. More high-quality evidence is required to demonstrate a definitive mortality benefit for patients.

PMID: 32028977 PMCID: [PMC7006065](#) DOI: [10.1186/s13049-020-0705-4](#)

Prehospital Life-Saving Interventions Performed on Pediatric Patients in a Combat Zone: A Multicenter Prospective Study.

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Abstract

OBJECTIVES: We aimed to describe and evaluate prehospital life-saving interventions performed in a pediatric population in the Afghanistan theater of operations.

DESIGN: Our study was a post hoc, subanalysis of a larger multicenter, prospective, observational study.

SETTING: We evaluated casualties enrolled upon admission to one of the nine military medical facilities in Afghanistan between January 2009 and March 2014.

PATIENTS: Adult and pediatric (<17 yr old) patients.

MEASUREMENTS: We conducted initial descriptive analyses followed by comparative tests. For comparative analysis, we stratified the study population (adult vs pediatric), and subsequently, we compared injury descriptions and the interventions performed. Following tests for normality, we used the t test or Wilcoxon rank-sum test (nonparametric) for continuous variables and chi-square or Fisher exact for categorical variables. We reported percentages and 95% CIs.

MAIN RESULTS: We enrolled 2,106 patients, of which 5.6% (n = 118) were pediatric. Eighty-two percent of the pediatric patients were male, and 435 had blast related injuries. A total of 295 prehospital life-saving interventions were performed on 118 pediatric patients, for an average of 2.5 life-saving interventions per patient. Vascular access (IV 96%, intraosseous 91%) and hypothermia prevention-related interventions (69%) were the most common. Incorrectly performed life-saving interventions in pediatric patients were rare (98% of life-saving interventions performed correctly) and n equals to 24 life-saving interventions over the 6-year period were missed. The most common incorrectly performed and missed life-saving interventions were related to vascular access. When compared with adult life-saving interventions received in the prehospital environment, pediatric patients were more likely to receive intraosseous access (p < 0.0001), whereas adult patients were more likely to have a tourniquet placed (p = 0.0019), receive wound packing with a hemostatic agent (p = 0.0091), and receive chest interventions (p = 0.0003).

CONCLUSIONS: In our study, the most common intervention was vascular access followed by hypothermia prevention and hemorrhage control. The occurrence of missed or incorrectly performed life-saving interventions were rare.

PMID: 32150122 DOI: [10.1097/PCC.0000000000002317](https://doi.org/10.1097/PCC.0000000000002317)
[Prehosp Emerg Care](https://doi.org/10.1080/10903127.2020.1737280). 2020 Mar 2:1-11. doi: 10.1080/10903127.2020.1737280. [Epub ahead of print]

Prehospital vasopressor use is associated with worse mortality in combat wounded.

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Abstract

Introduction: Vasopressor medications are frequently used in the management of hypotension secondary to shock. However, little data exists regarding their use in hypotensive trauma patients and their use is controversial.

Methods: The Department of Defense Trauma Registry was queried from January 2007 to August 2016 using a series of procedural codes to identify eligible casualties, which has been previously described. Mortality was compared between hypotensive casualties with documentation of receipt of vasopressor medications versus casualties not receiving vasopressors. To control for potential confounders, comparisons were repeated by constructing a multivariable logistic regression model including that utilized patient category, mechanism of injury, composite injury severity score, total blood products transfused, prehospital heart rate and prehospital systolic pressure. Survival was compared between these groups using propensity matching.

Results: Our search strategy yielded 28,222 patients, 124 (0.4%) of whom received prehospital vasopressors. On univariable analysis vasopressor use was associated with a lower odds of survival (OR 0.09, 0.06-0.13). The lower odds of survival persisted in the multivariate logistic regression model (OR 0.32, 0.18-0.56). Survival was lower among the vasopressor group (71.3%) when compared to a propensity matched cohort (94.3%).

Conclusions: In this dataset, prehospital vasopressor use was associated with lower odds of survival. This finding persisted when adjusting for confounders and in a propensity matched cohort model.

KEYWORDS: combat; hemorrhagic shock; hypotension; prehospital; vasopressor

PMID: 32119580 DOI: [10.1080/10903127.2020.1737280](https://doi.org/10.1080/10903127.2020.1737280)