Committee on Surgical Combat Casualty Care (CoSCCC)

Journal Watch

1st Quarter

FY2020

Journal Watch Key Terminology Searched:

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

BMJ Open. 2019 Nov 25;9(11):e033557. doi: 10.1136/bmjopen-2019-033557.

Facial injury management undertaken at US and UK medical treatment facilities during the Iraq and Afghanistan conflicts: a retrospective cohort study.

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Abstract

OBJECTIVES:

To perform the first direct comparison of the facial injuries sustained and treatment performed at USA and UK deployed medical treatment facilities (MTFs) in support of the military campaigns in Iraq and Afghanistan.

SETTING:

The US and UK Joint Theatre Trauma Registries were scrutinised for all patients with facial injuries presenting alive to a UK or US deployed MTF between 1 March 2003 and 31 October 2011.

PARTICIPANTS:

US and UK military personnel, local police, local military and civilians.

PRIMARY AND SECONDARY OUTCOME MEASURES:

An adjusted multiple logistic regression model was performed using tracheostomy as the primary dependent outcome variable and treatment in a US MTF, US or UK military, mandible fracture and treatment of mandible fracture as independent secondary variables.

RESULTS:

Facial injuries were identified in 16 944 casualties, with the most common being those to skin/muscle (64%), bone fractures (36%), inner/middle ear (28%) and intraoral damage (11%). Facial injuries were equally likely to undergo surgery in US MTF as UK MTF (OR: 1.06, 95% CI 0.4603 to 1.142, p=0.6656); however, variations were seen in injury type treated. In US MTF, 692/1452 (48%) of mandible fractures were treated by either open or closed reduction compared with 0/167 (0%) in UK MTF (χ^2: 113.6; p≤0.0001). US military casualties who had treatment of their mandible fracture (open reduction and internal fixation or mandibulo-maxillary fixation) were less likely to have had a tracheostomy than those who did not undergo stabilisation of the fractured mandible (OR: 0.61, 95% CI 0.44 to 0.86; p=0.0066).

CONCLUSIONS:

The capability to surgically treat mandible fractures by open or closed reduction should be considered as an integral component of deployed coalition surgical care in the future.

KEYWORDS: face; fracture; military; tracheostomy; trauma
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Trauma Surg Acute Care Open. 2019 Sep 20;4(1):e000376. doi: 10.1136/tsaco-2019-000376. eCollection 2019.

Clinical use of resuscitative endovascular balloon occlusion of the aorta (REBOA) in civilian trauma systems in the USA, 2019: a joint statement from the American College of Surgeons Committee on Trauma, the American College of Emergency Physicians, the National Association of Emergency Medical Services Physicians and the National Association of Emergency Medical Technicians.

Bulger EM[1], Perina DG[2], Qasim Z[3], Beldowicz B[4], Brenner M[5], Guyette F[6], Rowe D[7], Kang CS[8], Gurney J[9], DuBose J[10], Joseph B[11], Lyon R[12], Kaups K[13], Friedman VE[14], Eastridge B[15], Stewart R[15].

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Abstract

This is a joint statement from the American College of Surgeons Committee on Trauma, the American College of Emergency Physicians, the National Association of Emergency Medical Services Physicians and the National Association of Emergency Medical Technicians regarding the clinical use of resuscitative endovascular balloon occlusion of the aorta (REBOA) in civilian trauma systems in the USA. This statement addresses the system of care needed to manage trauma patients requiring the use of REBOA, in light of the current evidence available in this patient population. This statement was developed by an expert panel following a comprehensive review of the literature with representation from all sponsoring organizations and the US Military. This is an update to the previous statement published in 2018. It has been formally endorsed by the four sponsoring organizations.

KEYWORDS: Shock resuscitation; endovascular treatment; shock management

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Patterns of Anatomic Injury in Critically Injured Combat Casualties: A Network Analysis.

Janak JC[1], Mazuchowski EL[2,3,4], Kotwal RS[2,5,6], Stockinger ZT[7], Howard JT[2,8], Butler FK[2], Sosnov JA[9], Gurney JM[2], Shackelford SA[2].

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Abstract

A mortality review of death caused by injury requires a determination of injury survivability prior to a determination of death preventability. If injuries are nonsurvivable, only non-medical primary prevention strategies have potential to prevent the death. Therefore, objective measures are needed to empirically inform injury survivability from complex anatomic patterns of injury. As a component of injury mortality reviews, network structures show promise to objectively elucidate survivability from complex anatomic patterns of injury resulting from explosive and firearm mechanisms. In this network analysis of 5,703 critically injured combat casualties, patterns of injury among fatalities from explosive mechanisms were associated with both a higher number and severity of anatomic injuries to regions such as the extremities, abdomen, and thorax. Patterns of injuries from a firearm were more isolated to individual body regions with fatal patterns involving more severe injuries to the head and thorax. Each injury generates a specific level of risk as part of an overall anatomic pattern to inform injury survivability not always captured by traditional trauma scoring systems. Network models have potential to further elucidate differences between potentially survivable and nonsurvivable anatomic patterns of injury as part of the mortality review process relevant to improving both the military and civilian trauma care systems.

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Balkan Med J. 2019 Oct 9. doi: 10.4274/balkanmedj.galenos.2019.2019.8.79. [Epub ahead of print]

Focused Assessment with Sonography in Trauma for Assessing the Injury in the Military Settings: A Meta-Analysis

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Abstract

Background:
Non-invasive, rapid, and precise assessment of injury in the military settings is extremely important, but difficult. Focused Assessment with Sonography in Trauma (FAST) has been increasingly employed for assessing the location and severity of injury and guiding further treatment decision.

AIMS:
However, the evidence regarding utility of FAST in the military settings is scattered. We conducted a meta-analysis to evaluate the diagnostic performance of FAST for assessing injury in the military settings.

STUDY DESIGN:
Meta-analysis study.

METHODS:
We identified all relevant papers via the PubMed, EMBASE, and Cochrane Library databases. We evaluated the quality of included studies by the QUADAS-2 tool. We pooled the area under curve (AUC), sensitivity, specificity, positive and negative likelihood ratio, and diagnostic odds ratio as the effect sizes. We evaluated the heterogeneity by P value and I^2.

RESULTS:
Six papers were included. The AUC of FAST for assessing the injury was 0.85. The pooled sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and diagnostic odds ratio were 0.66, 0.98, 33.1, 0.34, and 97, respectively. The heterogeneity among studies was statistically significant (P=0.006, I^2=78%).

CONCLUSION:
FAST is potentially valuable for assessing the injury in the military settings. Due to its high specificity, FAST may be appropriate to rule in significant injury. However, due to its poor sensitivity, the ability of FAST to rule out injury cannot be relied upon.

KEYWORDS: Injury; trauma; ultrasound; combat; military medicine

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Injury. 2019 Nov 23. pii: S0020-1383(19)30758-2. doi: 10.1016/j.injury.2019.11.037. [Epub ahead of print]

Impact of high-dose norepinephrine during intra-hospital damage control resuscitation of traumatic haemorrhagic shock: A propensity-score analysis.

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Abstract

INTRODUCTION:
The use of norepinephrine (NE) during uncontrolled haemorrhagic shock (HS) has mostly been investigated in experimental studies. Clinical data including norepinephrine dose and its impact on fluid resuscitation and organ function are scarce. We hypothesized that there is great variability in NE use and that high doses of NE could lead to increased organ dysfunction as measured by the sequential organ failure assessment (SOFA).

METHOD:
We included patients with HS (systolic blood pressure < 90 mmHg in severely injured patients) who required haemostasis surgery and a transfusion of more than 4 packed red blood cells (PRBC) in the first 6 h of admission and the used of norepinephrine infusion to maintain the blood pressure goal, between admission and the end of haemostasis surgery in a prospective trauma database. A ROC curve determined that, using Youden's criterion, a dose of NE ≥ 0.6 µg/kg/min was the optimal threshold associated with intrahospital mortality. Patients were compared according to this threshold in a propensity score (PS) model. In a generalized linear mixed model, we searched for independent factors associated with a SOFA ≥ 9 at 24 h RESULTS: A total of 89 patients were analysed. Fluid infusion rate ranged from 1.43 to 57.9 mL/kg/h and norepinephrine infusion rate from 0.1 to 2.8 µg/kg/min. The HDNE group received significantly less fluid than the LDNE group. This dose is associated with a higher SOFA score at 24h: 9 (7-10) vs. 7 (6-9) (p = 0.003). Factors independently associated with a SOFA score ≥ 9 at 24 h were maximal norepinephrine rate ≥ 0.6 µg/kg/min (OR 6.69, 95% CI 1.82 - 25.54; p = 0.004), non-blood resuscitation volume < 9 mL/kg/h (OR 3.98, 95% CI 1.14 - 13.95; p = 0.031) and lactate at admission ≥ 5 mmol/L (OR 5.27, 95% CI 1.48 - 18.77; p = 0.010)

CONCLUSION:
High dose of norepinephrine infusion is associated with deleterious effects as attested by a higher SOFA score at 24 h and likely hypovolemia as measured by reduced non-blood resuscitation volume. We did not find any significant difference in mortality over the long term.

KEYWORDS: Norepinephrine; Sequential organ failure assessment scores; Shock; Traumatic

PMID: 31791590 DOI: 10.1016/j.injury.2019.11.037

Mil Med. 2019 Nov 1;184(Supplement_2):18-25. doi: 10.1093/milmed/usz027.

After the Battlefield: Infectious Complications among Wounded Warriors in the Trauma Infectious Disease Outcomes Study.

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Abstract

INTRODUCTION:

During recent wars in Iraq and Afghanistan, improved survivability in severe trauma corresponded with a rise in the proportion of trauma-related infections, including those associated with multidrug-resistant organisms (MDROs). Significant morbidity was reported in association with the infections. There is also concern regarding potential long-term impacts of the trauma-related infectious complications. Therefore, to meet the critical need of prospective collection of standardized infection-related data to understand the disease burden and improve outcomes of wounded personnel, the Trauma Infectious Disease Outcomes Study (TIDOS) was developed. Herein, we review accomplishments and key peer-reviewed findings of TIDOS.

METHODS:

The TIDOS project is a multicenter observational study of short- and long-term infectious complications following deployment-related trauma. Wounded military personnel medevac'd to Landstuhl Regional Medical Center (LRMC; Germany) before transfer to a participating US military hospital between June 2009 and December 2014 were eligible for inclusion. An infectious disease module to supplement the Department of Defense Trauma Registry by collecting infection-related data from all trauma patients admitted to participating hospitals was developed. Specimens from trauma patients were also collected and retained in a microbiological isolate repository. During the initial hospitalization, patients were given the opportunity to enroll in a prospective follow-up cohort study. Patients who received Department of Veterans Affairs (VA) care were also given the opportunity to consent to ongoing VA follow-up.

RESULTS:

A total of 2,699 patients transferred to participating military hospitals in the USA, of which 1,359 (50%) patients enrolled in the TIDOS follow-up cohort. In addition, 638 enrolled in the TIDOS-VA cohort (52% of TIDOS enrollees who entered VA healthcare). More than 8,000 isolates were collected from infection control surveillance and diagnostic evaluations and retained in the TIDOS Microbiological Repository. Approximately 34% of the 2,699 patients at US hospitals developed a trauma-related infection during their initial hospitalization with skin and soft-tissue infections being predominant. After discharge from the US hospitals, approximately one-third of TIDOS cohort enrollees developed a new trauma-related infection during follow-up and extremity wound infections (skin and soft-tissue infections and osteomyelitis) continued to be the majority. Among TIDOS cohort enrollees who received VA healthcare, 38% developed a new trauma-related infection with the incident infection being diagnosed a median of 88 days

(interquartile range: 19-351 days) following hospital discharge. Data from TIDOS have been used to support the development of Joint Trauma System clinical practice guidelines for the prevention of combat-related infections, as well as the management of invasive fungal wound infections. Lastly, due to the increasing proportion of infections associated with MDROs, TIDOS investigators have collaborated with investigators across military laboratories as part of the Multidrug-Resistant and Virulent Organisms Trauma Infections Initiative with the objective of improving the understanding of the complex wound microbiology in order to develop novel infectious disease countermeasures.

CONCLUSIONS:
The TIDOS project has focused research on four initiatives: (1) blast-related wound infection epidemiology and clinical management; (2) DoD-VA outcomes research; (3) Multidrug- Resistant and other Virulent Organisms Trauma Infections Initiative; and (4) Joint Trauma System clinical practice guidelines and antibiotic stewardship. There is a continuing need for longitudinal data platforms to support battlefield wound research and clinical practice guideline recommendation refinement, particularly to improve care for future conflicts. As such, maintaining a research platform, such as TIDOS, would negate the lengthy time needed to initiate data collection and analysis.

KEYWORDS: combat-related infections; military health; trauma-related infections; wound infections

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Ophthalmology. 2019 Oct 19. pii: S0161-6420(19)32148-7. doi: 10.1016/j.ophtha.2019.10.014. [Epub ahead of print]

Comparing the Management of Eye Injuries by Coalition Military Surgeons during the Iraq and Afghanistan Conflicts.

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Abstract

PURPOSE:
To compare incidences, ocular injury types, and treatment performed on United States and United Kingdom military service members and host nation civilians within the Iraq and Afghanistan conflicts to inform future military surgical training requirements and military medical planning. The United States routinely deployed ophthalmologists, whereas the United Kingdom did not.

DESIGN:
Retrospective cohort study of the United States and United Kingdom military Joint Theatre Trauma Registries.

PARTICIPANTS:
All patients with eye injuries treated at a deployed Military Treatment Facility between March 2003 and October 2011.

METHODS:
An adjusted multiple logistic regression model was performed using enucleation or evisceration and primary open-globe repair as dependent variables and casualty nationality, location, and the presence of an ophthalmic surgeon as independent variables.

MAIN OUTCOME MEASURES:
Incidence of eye removal (enucleation or evisceration) or primary repair for open globe injury.

RESULTS:
Five thousand seven hundred nineteen of 67 586 (8%) survivors or those who died of wounds were recorded to have sustained eye injuries. The most common eye injuries were open-globe injury without intraocular foreign body (3201/5719 [56%]). Adnexal injuries (eyelid lacerations and damage to lacrimal apparatus) were recorded in 1265 of 5719 patients (22%). The odds of undergoing evisceration or enucleation for open-globe injury was highest in host nation civilians (odds ratio [OR], 9.23; $P < 0.001$), but there was no evidence of a difference between United States and United Kingdom military service member casualties ($P = 0.38$). The presence of an ophthalmic surgeon (OR, 16.3; $P < 0.001$) significantly affected the odds of eye removal.

CONCLUSIONS:
Eye injuries were more likely to have been treated definitively in United States Medical Treatment Facilities (MTFs), reflecting the absence of ophthalmologists in most deployed United Kingdom MTFs. The Iraq and Afghan conflicts were notable for coalition air dominance; the shape of future conflicts may mandate delays in evacuation, which may affect visual outcomes negatively, particularly if primary repair of patients with open-globe injuries is delayed. This study provides evidence to support the maintenance of specialist ophthalmic surgical competencies in deployed coalition MTFs for future conflicts.

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JAMA Surg. 2019 Nov 13. doi: 10.1001/jamasurg.2019.4547. [Epub ahead of print]

A Consensus Framework for the Humanitarian Surgical Response to Armed Conflict in 21st Century Warfare.

Wren SM[1], Wild HB[1], Gurney J[2], Amirtharajah M[3], Brown ZW[4], Bulger EM[5,6], Burkle FM Jr[7], Elster EA[4], Forrester JD[1], Garber K[8], Gosselin RA[9], Groen RS[10], Hsin G[1], Joshipura M[11], Kushner AL[12], Norton I[13], Osmers I[3], Pagano H[3], Razek T[14], Sáenz-Terrazas JM[15], Schussler L[16], Stewart BT[5], Traboulsi AA[1], Trelles M[3], Troke J[17], VanFosson CA[2], Wise PH[1].

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Abstract

IMPORTANCE:

Armed conflict in the 21st century poses new challenges to a humanitarian surgical response, including changing security requirements, access to patients, and communities in need, limited deployable surgical assets, resource constraints, and the requirement to address both traumatic injuries as well as emergency surgical needs of the population. At the same time, recent improvements in trauma care and systems have reduced injury-related mortality. This combination of new challenges and medical capabilities warrants reconsideration of long-standing humanitarian surgery protocols.

OBJECTIVE:

To describe a consensus framework for surgical care designed to respond to this emerging need.

DESIGN, SETTING, PARTICIPANTS:

An international group of 35 representatives from humanitarian agencies, US military, and academic trauma programs was invited to the Stanford Humanitarian Surgical Response in Conflict Working Group to engage in a structured process to review extant trauma protocols and make recommendations for revision.

MAIN OUTCOMES AND MEASURES:

The working group's method adapted core elements of a modified Delphi process combined with consensus development conference from August 3 to August 5, 2018.

RESULTS:
Lessons from civilian and military trauma systems as well as recent battlefield experiences in humanitarian settings were integrated into a tiered continuum of response from point of injury through rehabilitation. The framework addresses the security and medical requirements as well as ethical and legal principles that guide humanitarian action. The consensus framework includes trained, lay first responders; far-forward resuscitation/stabilization centers; rapid damage control surgical access; and definitive care facilities. The system also includes non-trauma surgical care, injury prevention, quality improvement, data collection, and pre-deployment training requirements.

CONCLUSION AND RELEVANCE:
Evidence suggests that modern trauma systems save lives. However, the requirements of providing this standard of care in insecure conflict settings places new burdens on humanitarian systems that must provide both emergency and trauma surgical care. This consensus framework integrates advances in trauma care and surgical systems in response to a changing security environment. It is possible to reduce disparities and improve the standard of care in these settings.

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J Trauma Acute Care Surg. 2019 Nov;87(5):1015-1025. doi: 10.1097/TA.0000000000002378.

Titrate to equilibrate and not exsanguinate! Characterization and validation of a novel partial resuscitative endovascular balloon occlusion of the aorta catheter in normal and hemorrhagic shock conditions.

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BACKGROUND:
Resuscitative endovascular balloon occlusion of the aorta (REBOA) is a significant advancement in the control of non-compressible truncal hemorrhage. However, its ischemic burden and reperfusion injury following balloon deflation limits its utilization. Partial restoration of aortic flow during REBOA has the potential to balance hemorrhage control and ischemia. This study validates the mechanics, physiology, and optimal partial flow rates using a prototype partial REBOA (pREBOA) device.

METHODS:
Twenty-five swine underwent placement of aortic flow probes and zone 1 pREBOA. Experiment 1 (N = 5) animals were not injured and assessed the tested the catheters ability to titrate and control flow. Experiment 2 (N = 10) added 20% hemorrhage and either solid organ, or abdominal vascular injury to compare flow rate and rebleeding from injuries. Experiment 3 (N = 10) swine were similarly prepared, hemorrhaged, and underwent pREBOA at set partial flow rates for 2 hours followed by complete deflation for 30 minutes.

RESULTS:
Balloon volume at minimum flow (mean, 0.09 L/min) was 3.5 mL to 6.0 mL. Half maximal flow was achieved with 56.5% of maximum balloon inflation. Partial REBOA allowed very fine titration of flow rates. Rebleeding occurred at 0.45 L/min to 0.83 L/min. Distal flow of 0.7 L/min had 50% survival, 0.5 had 100% survival, and 0.3 L had 50% survival with mean end lactates of 9.6, 12.6, and 13.3, respectively. There was a trend toward hyperkalemia and hypocalcemia in non-survivors.

CONCLUSION:
The pREBOA device demonstrated a high level of titratability for restoration of aortic flow. An optimal partial flow of 0.5 L/min was effective at hemorrhage control while limiting the burden of ischemic injury, and extending the tolerable duration of zone 1 occlusion. Aggressive calcium supplementation prior to and during partial occlusion and reperfusion may be warranted to prevent hyperkalemic arrest.

J Trauma Acute Care Surg. 2019 Nov;87(5):1026-1034. doi: 10.1097/TA.0000000000002439.

Effect of partial and complete aortic balloon occlusion on survival and shock in a swine model of uncontrolled splenic hemorrhage with delayed resuscitation.

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Abstract

BACKGROUND:

Resuscitative endovascular balloon occlusion of the aorta (REBOA) is accepted as a resuscitation adjunct and bridge to definitive hemostasis. The ischemic burden of REBOA may be mitigated by a partial REBOA (P-REBOA) strategy permitting longer occlusion times and military use for combat trauma. We evaluated REBOA and P-REBOA in a swine multiple trauma model with uncontrolled solid organ hemorrhage and delayed resuscitation and surgical hemostasis.

METHODS:

Anesthetized swine (51.9 ± 2.2 kg) had 20 mL/kg hemorrhage and closed femur fracture. Splenic transection was performed and free bleeding permitted for 10 minutes. Controls (n = 5) were hemorrhaged but had no REBOA, REBOA (n = 8) had 60 minutes complete zone 1 occlusion, P-REBOA (n = 8) had 15 minutes complete occlusion and 45 minutes 50% occlusion. Splenectomy was performed and plasma (15 mL/kg) resuscitation initiated 5 minutes prior to deflation. Resuscitation goal was 80 mm Hg systolic with epinephrine as needed. Animals were monitored for 6 hours.

RESULTS:

An initial study with 120-minute occlusion had universal fatality in three REBOA (upon deflation) and three P-REBOA animals (after 60 minutes inflation). With 60-minute occlusion, mortality was 100%, 62.5%, and 12.5% in the control, REBOA, and P-REBOA groups, respectively ($p < 0.05$). Survival time was shorter in controls (120 ± 89 minutes) than REBOA and P-REBOA groups (241 ± 139, 336 ± 69 minutes). Complete REBOA hemorrhaged less during inflation (1.1 ± 0.5 mL/kg) than Control (5.6 ± 1.5) and P-REBOA (4.3 ± 1.4), which were similar. Lactate was higher in the REBOA group compared with the P-REBOA group after balloon deflation, remaining elevated. Potassium increased in REBOA after deflation but returned to similar levels as P-REBOA by 120 minutes.

CONCLUSION:

In a military relevant model of severe uncontrolled solid organ hemorrhage 1-hour P-REBOA improved survival and mitigated hemodynamic and metabolic shock. Two hours of partial aortic occlusion was not survivable using this protocol due to ongoing hemorrhage during inflation. There is potential role for P-REBOA as part of an integrated minimally invasive field-expedient hemorrhage control and resuscitation strategy.

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Is E-FAST possible and useful on the battlefield? A feasibility study during medical courses in hostile environment (MEDICHOS): preliminary results.

Renard A[1], Martinet C[2], Cungi PJ[3], Combes E[2], Gasperini G[2], Cazes N[4], Carfantan C[5], Faivre A[3], Travers S[6], Kelway C[7], Benner P[2].

INTRODUCTION:
The extent of the French forces' territory in the Sahel band generates long medical evacuations. In case of many victims, to respect the golden hour rule, first-line sorting is essential. Through simulation situations, the aim of our study was to assess whether the use of ultrasound was useful to military doctors.

METHODS:
In combat-like exercise conditions, we provided trainees with a pocket-size ultrasound. Every patient for whom the trainees chose to perform ultrasound in role 1 was included. An extended focused assessment with sonography for trauma (E-FAST) was performed with six basic sonographic views. We evaluated whether these reference views were obtained or not. Once obtained by the trainees, pathological views corresponding to the scenario were shown to assess whether the trainees modified their therapeutic management strategy and their priorities.

RESULTS:
168 patients were treated by 15 different trainee doctors. Of these 168 patients, ultrasound (E-FAST or point-of-care ultrasound) was performed on 44 (26%) of them. In 51% (n=20/39) of the situations, the practitioners considered that the realisation of ultrasound had a significant impact in terms of therapeutic and evacuation priorities. More specifically, it changed therapeutic decisions in 67% of time (n=26/39) and evacuation priorities in 72% of time (n=28/39).

CONCLUSION:
This original work showed that ultrasound on the battlefield was possible and useful. To confirm these results, ultrasound needs to be democratised and assessed in a real operational environment.

KEYWORDS: battlefield; military medicine; triage; ultrasound

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Combat Casualty Care Statistics as Outcome Measures for Medical Treatment on the Battlefield: A Review and Reconsideration of the Data

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Abstract

PURPOSE OF REVIEW:
This review focuses on the use of the case fatality rate (CFR), the killed in action percentage (%KIA) and died of wounds (%DOW) as battlefield medical outcome measures and reports the current statistical data for recent conflicts. Further, the review defines each statistic, and identifies their usefulness and limitations in medical research.

SUMMARY:
Battlefield lethality is significantly impacted by non-medical factors. Some medical researchers, likely unknowingly, continue to use these statistics, especially the CFR, without taking all battlefield confounders into account. The Department of Defense Trauma Registry provides opportunity for improved data collection, performance improvement, and standardization of the combat casualty care statistics thereby allowing for meaningful comparisons and a better understanding of battlefield trauma care.

KEYWORDS: Case fatality rate Died of wounds Killed in action Performance improvement Department of Defense Trauma Registry