Tactical Combat Casualty Care

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En Route Combat Casualty Care

2022 Journal Watch

Journal Article Abstracts

Apr 2022 – Jun 2022

A quarterly literature review of topics related to Tactical Combat Casualty Care (TCCC) and En Route Combat Casualty Care (ERCCC) from the months of Dec 2019 through Mar 2020.

Posting of articles does not imply agreement or disagreement with the contents nor constitute a change in TCCC or ERCCC guidelines, practices, or training. Links are provided to respective publications for further reading and research. Additional log-in requirements may be required at various websites. The Joint Trauma System and Deployed Medicine do not provide downloadable articles or free access to journal sites. Access may be acquired through service medical departments/commands or medical agencies/organizations.

The diagnostic accuracy of prehospital triage tools in identifying patients with traumatic brain injury: A systematic review

Naif Alqurashi, Ahmed Alotaibi, Steve Bell, Fiona Lecky, Richard Body

Injury 2022 Jun;53(6):2060-2068.

Introduction: Prehospital care providers are usually the first responders for patients with traumatic brain injury (TBI). Early identification of patients with TBI enables them to receive trauma centre care, which improves outcomes. Two recent systematic reviews concluded that prehospital triage tools for undifferentiated major trauma have low accuracy. However, neither review focused specifically on patients with suspected TBI. Therefore, we aimed to systematically review the existing evidence on the diagnostic performance of prehospital triage tools for patients with suspected TBI.

Methods: A comprehensive search of the current literature was conducted using Medline, EMBASE, CINAHL Plus and the Cochrane library (inception to 1st June 2021). We also searched Google Scholar, OpenGrey, pre-prints (MedRxiv) and dissertation databases. We included all studies published in English language evaluating the accuracy of prehospital triage tools for TBI. We assessed methodological quality and risk of bias using a modified Quality Assessment of Diagnostic Studies (QUADAS-2) tool. Two reviewers independently performed searches, screened titles and abstracts and undertook methodological quality assessments. Due to the heterogeneity in the population of interest and prehospital triage tools used, a narrative synthesis was undertaken.

Results: The initial search identified 1787 articles, of which 8 unique eligible studies met the inclusion criteria (5 retrospective, 2 prospective, 1 mixed). Overall, sensitivity of triage tools studied ranged from 19.8% to 87.9% for TBI identification. Specificity ranged from 41.4% to 94.4%. Two decision tools have been validated more than once: HITS-NS (2 studies, sensitivity 28.3-32.6%, specificity 89.1-94.4%) and the Field Triage Decision Scheme (4 studies, sensitivity 19.8-64.5%, specificity 77.4%-93.1%). Existing tools appear to systematically under-triage older patients.

Conclusion: Further efforts are needed to improve and optimise prehospital triage tools. Consideration of additional predictors (e.g., biomarkers, clinical decision aids and paramedic judgement) may be required to improve diagnostic accuracy.

Emergency cricothyroidotomy in difficult airway simulation - a national observational study of Air Ambulance crew performance

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BMC Emerg Med. 2022 Apr 9;22(1):64

Background: Advanced prehospital airway management includes complex procedures carried out in challenging environments, necessitating a high level of technical and non-technical skills. We aimed to describe Norwegian Air Ambulance-crews' performance in a difficult airway scenario simulation, ending with a "cannot intubate, cannot oxygenate"-situation.

Methods: The study describes Air Ambulance crews' management of a simulated difficult airway scenario. We used video-observation to assess time expenditure according to pre-defined time intervals and technical and non-technical performance was evaluated according to a structured evaluation-form.

Results: Thirty-six crews successfully completed the emergency cricothyroidotomy with mean procedural time 118 (SD: ±70) seconds. There was variation among the crews in terms of completed procedural steps, including preparation of equipment, patient- monitoring and management. The participants demonstrated uniform and appropriate situational awareness, and effective communication and resource utilization within the crews was evident.

Conclusions: We found that Norwegian Air Ambulance crews managed a prehospital "cannot intubate, cannot oxygenate"-situation with an emergency cricothyroidotomy under stressful conditions with effective communication and resource utilization, and within a reasonable timeframe. Some discrepancies between standard operating procedures and performance are observed. Further studies to assess the impact of check lists on procedural aspects of airway management in the prehospital environment are warranted.

Management of Severe Crush Injuries in Austere Environments: A Special Operations Perspective

Justin Lee Anderson, Meredith Cole, Dylan Pannell

J Spec Oper Med. 2022 May 31;22(2):43-47

Abstract

Crush injuries present a challenging case for medical providers and require knowledge and skill to manage the subsequent damage to multiple organ systems. In an austere environment, in which resources are limited and evacuation time is extensive, a medic must be prepared to identify trends and predict outcomes based on the mechanism of injury and patient presentation. These injuries occur in a variety of environments from motor vehicle accidents (at home or abroad) to natural disasters and building collapses. Crush injury can lead to compartment syndrome, traumatic rhabdomyolysis, arrythmias, and metabolic acidosis, especially for patients with extended treatment and extrication times. While crush syndrome occurs due to the systemic effects of the injury, the onset can be as early as 1 hour postinjury. With a comprehensive understanding of the pathophysiology, diagnosis, management, and tactical considerations, a prehospital provider can optimize patient outcomes and be prepared with the tools they have on hand for the progression of crush injury into crush syndrome.

Comprehensive Review of Chest Tube Management: A Review

Devon Anderson, Sarah A Chen, Luis A Godoy, Lisa M Brown, David T Cooke

JAMA Surg. 2022 Mar 1;157(3):269-274

Importance: Thoracostomy, or chest tube placement, is used in a variety of clinical indications and can be lifesaving in certain circumstances. There have been developments and modifications to thoracostomy tubes, or chest tubes, over time, but they continue to be a staple in the thoracic surgeon's toolbox as well as adjacent specialties in medicine. This review will provide the nonexpert clinician a comprehensive understanding of the types of chest tubes, indications for their effective use, and key management details for ideal patient outcomes.

Observations: This review describes the types of chest tubes, indications for use, techniques for placement, common anatomical landmarks that are encountered with placement and management, and an overview of complications that may arise with tube thoracostomy. In addition, the future direction of chest tubes is explored, as well as the management of chest tubes during the COVID-19 pandemic.

Conclusions and relevance: Chest tube management is subjective, but the compilation of data can inform best practices and safe application to successfully manage the pleural space and ameliorate acquired pleural space disease.

Prehospital body temperature measurement in trauma patients: A literature review

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Injury. 2022 Jun;53(6):1737-1745

Objectives: Accidental hypothermia in trauma patients can contribute to cardiorespiratory dysfunction, acidosis, and coagulopathy, causing increased morbidity and mortality. The early recognition of the clinical signs of hypothermia and the accurate measurement of body temperature by prehospital care providers are essential to avoid deterioration. This review provides an overview of studies that examine the reliability of different core temperature measurement options, with a focus on the prehospital setting.

Methods: A search was performed in PubMed, Embase, Cochrane Library, and CINAHL using combinations of the Medical Subject Headings terms "ambulances," "emergency medical services," "thermometers," "body temperature," "hypothermia," and "body temperature regulation." Studies up to October 2021 were included, and different measurement options were listed and discussed. Eligible studies included those that identified the specific type of thermometer and focused on the out-of-hospital environment.

Results: The search strategy yielded 521 studies, five of which met the eligibility criteria. Four studies focused on tympanic temperature measurement, and one focused on temporal artery temperature measurement. Among the noninvasive options, tympanic temperature measurement was most frequently identified as a reliable option for out-of-hospital use.

Conclusion: A thermistor-based tympanic thermometer that features insulation of the ear and a temperature probe with a cap is likely the most suitable option for prehospital body temperature measurement in trauma patients. These results are based on outdated literature with currently more novel temperature measurement devices available. Future studies are necessary to provide strong recommendations regarding temperature measurement due to emerging technology, the lack of studies, and the heterogeneity of existing studies.

Head Wounds Received During Force-on-Force Training With Non-lethal Ammunition

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Mil Med. 2022 May 3;187(5-6):e787-e791

Abstract

Close quarters combat training is designed to replicate the mental and physiological stressors of firing upon an adversary while in close proximity. One method to replicate combat stressors is to use non-lethal training ammunition specifically designed for force-on-force exercises. These rounds can be fired from slightly modified service-issued weapons and provide a pain sensation upon striking the opponent. The current investigation presents a case study of several injuries when these rounds impacted the head directly, which is a primary area of concern for safety issues. Most impacts produced initial swelling that reduced substantially within the first few hours. Approximately 24 hours later, the swelling disappeared entirely with a visible contusion near the impact center. Bruising would typically clear within a few days. However, another example produced sufficient bleeding to require intervention before continuing with the training exercises and sanguineous crust or scabbing rather than the typical contusion. Pain was minimal for all wounds after only several days, which aligns with previous research on pain from non-lethal training ammunition wounds. Based on the head wounds observed here, loss of eyesight is a realistic possibility. Eye protection should be a requisite across all force-on-force training exercises without exception. This case study documents some potential hazards of force-on-force training, but more importantly, it further highlights the need for medically informed training standards about engagement distances and personal protective equipment.

Relevance of Deployment Experience and Clinical Practice Characteristics on Military Critical Care Air Transport Team Readiness: A Study of Simulation Construct Validity

Daniel J Brown, Lane Frasier, F Eric Robinson, Mark Cheney, William T Davis, Ann Salvator, Mark Andresen, Melissa Proctor, Ryan Earnest, Timothy Pritts, Richard Strilka

Mil Med. 2022 May 27; Online ahead of print

Introduction: The Critical Care Air Transport Team (CCATT) Advanced course utilizes fully immersive high-fidelity simulations to train CCATT personnel and assess their readiness for deployment. This study aims to (1) determine whether these simulations correctly discriminate between students with previous deployment experience ("experienced") and no deployment experience ("novices") and (2) examine the effects of students' clinical practice environment on their performance during training simulations.

Materials and methods: Critical Care Air Transport Team Advanced student survey data and course status (pass/no pass) between March 2006 and April 2020 were analyzed. The data included students' specialty, previous exposure to the CCATT Advanced course, previous CCATT deployment experience, years in clinical practice (<5, 5-15, and >15 years), and daily practice of critical care (yes/no), as well as a description of the students' hospital to include the total number of hospital (<100, 100-200, 201-400, and >400) and intensive care unit (0, 1-10, 11-20, and >20) beds. Following descriptive analysis and comparative tests, multivariable regression was used to identify the predictors of passing the CCATT Advanced course.

Results: A total of 2,723 surveys were analyzed: 841 (31%) were physicians (MDs), 1,035 (38%) were registered nurses, and 847 (31%) were respiratory therapists (RTs); 641 (24%) of the students were repeating the course for sustainment training and 664 (24%) had previous deployment experience. Grouped by student specialty, the MDs', registered nurses', and RTs' pass rates were 92.7%, 90.6%, and 85.6%, respectively. Multivariable regression results demonstrated that deployment experience was a robust predictor of passing. In addition, the >15 years in practice group had a 47% decrease in the odds of passing as compared to the 5 to 15 years in practice group. Finally, using MDs as the reference, the RTs had a 61% decrease in their odds of passing. The daily practice of critical care provided a borderline but nonsignificant passing advantage, whereas previous CCATT course exposure had no effect.

Conclusion: Our primary result was that the CCATT Advanced simulations that are used to evaluate whether the students are mission ready successfully differentiated "novice" from "experienced" students; this is consistent with valid simulation constructs. Finally, novice CCATT students do not sustain their readiness skills during the period between mandated refresher training.

Tactical Combat Casualty Care Maritime Scenario: Shipboard Missile Strike

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J Spec Oper Med. 2022 May 31;22(2):9-28

Abstract

The types of injuries seen in combat action on a naval surface ship may be similar in many respects to the injuries seen in ground combat, and the principles of care for those injuries remain in large part the same. However, some contradistinctions in the care of combat casualties on a ship at sea must be highlighted, since this care may entail a number of unique challenges and different wounding patterns. This paper presents a scenario in which a guided missile destroyer is struck by a missile fired from an unmanned aerial vehicle operated by an undetermined hostile entity. Despite the presence of casualties who require care, the primary focus of a naval vessel that has just been damaged by hostile action is to prevent the ship from sinking and to conserve the fighting force on board the ship to the greatest extent possible. The casualties in this scenario include sailors injured by both blast and burns, as well as a casualty with a non-fatal drowning episode. Several of the casualties have also suffered the effects of a nearby underwater explosion while immersed. Challenges in the care of these casualties include delays in evacuation, the logistics of obtaining whole blood for transfusion while at sea, and transporting the casualties to the next higher level of care aboard a Casualty Receiving and Treatment Ship. As the National Defense Strategy pivots to a focus on the potential for maritime combat, the medical community must continue to maintain readiness by preparing fo.

Prehospital blood transfusion for haemorrhagic shock

Michael Cardinale, Quentin Mathais, Pierre Esnault, Jean Cotte

Lancet Haematol. 2022 Jun;9(6):e395

No abstract available

Opioid sparing effect of ketamine in military prehospital pain management-A retrospective study

Bar Cohen, Tomer Talmy, Shaul Gelikas, Irina Radomislensky, Diana Kontorovich-Chen, Barak Cohen, Avi Benov, Guy Avital

J Trauma Acute Care Surg. 2022 Aug 1;93(2S Suppl 1):S71-S77

Background: Opioids are the most commonly used analgesics in acute trauma, but are limited by slow onset and significant adverse effects. Ketamine is an effective and widely used analgesic. This study was aimed to evaluate the effectiveness and opioid-sparing effects of ketamine when used in prehospital military trauma setting.

Methods: A retrospective analysis of a prehospital military trauma registry between 2014 and 2020. Inclusion criteria were 16 years or older, two or more documented pain assessments, at least one indicating severe pain, and administration of opioids and/or low-dose ketamine. Joint hypothesis testing was used to compare casualties who received opioids only to those who received ketamine on outcomes of pain score reduction and opioid consumption.

Results: Overall, 382 casualties were included. Ninety-one (24%) received ketamine (21 as a single analgesic), with a mean dose of 29 mg (standard deviation, 11). Mean reduction in pain scores (on an 11-point scale) was not significantly different; 4.3-point (2.8) reduction in the ketamine group and 3.7 points (2.4) in the opioid-only group ($p = 0.095$). Casualties in the ketamine group received a median of 10 mg (interquartile range, 3.5-25) of morphine equivalents (MEs) compared with a median of 20 ME (10, 20) in the opioid-only group. In a multivariable multinomial logistic regression, casualties in the ketamine group were significantly more likely to receive a low (1-10 ME) rather than a medium (11-20 ME) dose of opioids compared with the opioid-only group (odds ratio, 0.032; 95% confidence interval, 0.14-0.75).

Conclusion: The use of ketamine in the prehospital military setting as part of a pain management protocol was associated with a low rather than medium dose of opioids in a multivariable analysis, while the mean reduction in pain scores was not significantly different between groups. Using ketamine as a first-line agent may further reduce opioid consumption with a similar analgesic effect.

Lessons Learned on the Battlefield Applied in a Civilian Setting

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J Spec Oper Med. 2021 Spring;21(1):102-105.

Abstract

We report the case of a civilian 27-year-old man treated in a military hospital in France who sustained multiple stab wounds, including one in the left groin, with massive external bleeding. When first responders arrived, the patient was in hemorrhagic shock. A tourniquet and two intraosseous catheters were placed to start resuscitative care. On the patient's arrival at the hospital, bleeding was not controlled, so a junctional tourniquet was put in place and massive transfusion was started. Surgical exploration revealed a laceration of the superficial femoral artery and a disruption of the femoral vein. Vascular damage control was achieved by a general surgeon and consisted of primary repair of the superficial femoral artery injury and venous ligation. The patient was discharged from the intensive care unit after 2 days and from the hospital after 8 days. This case illustrates some of the persistent challenges shared between military and civilian trauma care. The external control of junctional hemorrhage is not easily achievable in the field, and junctional tourniquets have been therefore incorporated in the Tactical Combat Casualty Care guidelines. French lyophilized plasma was used for massive transfusion because it has been proven to be a logistically superior alternative to fresh-frozen plasma. Management of vascular wounds by nonspecialized surgeons is a complex situation that requires vascular damage-control skills; French military surgeons therefore follow a comprehensive structured surgical training course that prepares them to manage complex penetrating trauma in austere environments. Finally, in this case, lessons learned on the battlefield were applied to the benefit of the patient.

Opioid administration in the prehospital setting for patients sustaining traumatic injuries: An evaluation of national emergency medical services data

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Injury. 2022 Sep;53(9):2923-2929

Introduction: Despite concerns about long-term dependence, opioids remain the mainstay of treatment for acute pain from traumatic injuries. Additionally, early pain management has been associated with improved long-term outcomes in injured patients. We sought to identify the patterns of prehospital pain management across the United States.

Methods: We used 2019 national emergency medical services (EMS) data to identify the use of pain management for acutely injured patients. Opioid specific dosing was calculated in morphine milligram equivalents (MME). The effects of opioids as well as adverse events were identified through objective patient data and structured provider documentation.

Results: We identified a total of 3,831,768 injured patients, 85% of whom were treated by an advanced life support (ALS) unit. There were 269,281 (7.0%) patients treated with opioids, including a small number of patients intubated by EMS (n = 1537; 0.6%). The median opioid dose was 10 MME [IQR 5-10] and fentanyl was the most commonly used opioid (88.2%). Patients treated with opioids had higher initial pain scores documented by EMS than those not receiving opioids (median: 9 vs 4, $p<0.001$), and had a median reduction in pain score of 3 points (IQR 1-5) based on the final prehospital pain score. Adverse events associated with opioid administration, including episodes of altered mental status (n = 453; 0.2%) and respiratory compromise (n = 252; 0.1%), were rare. For patients with severe pain (≥8/10), 27.3% of patients with major injuries (ISS ≥15) were treated with opioids, compared with 24.8% of those with moderate injuries (ISS 9-14), and 21.4% of those with minor (ISS 1-8) injuries ($p<0.001$).

Conclusion: The use of opioids in the prehospital setting significantly reduced pain among injured patients with few adverse events. Despite its efficacy and safety, the majority of patients with major injuries and severe pain do not receive opioid analgesia in the prehospital setting.

En Route Critical Care Evacuations From Rarely Utilized Partner Medical Treatment Facilities: A Case Series With Lessons Learned

William T Davis, Mark Cheney, Wesley Trueblood, Shane Runyon, Inez Cruz, Melissa Clemons, Richard Strilka

Mil Med. 2022 Mar 29; Online ahead of print

Abstract

Retaining lessons learned from Critical Care Air Transport (CCAT) missions is essential given the recent decrease in operational currency among CCAT personnel. The objective of this case series was to identify and analyze logistical lessons learned from recent critical care transports involving foreign medical treatment facilities with sufficient detail for the CCAT community to incorporate these lessons into future readiness and sustainment training. The provider from each mission submitted a mission narrative with lessons learned. A qualitative analysis of lessons learned described themes from the lessons, as well as similarities and differences from included missions. Three missions were reviewed and four distinct mission stages were identified: (1) pre-mission, (2) at U.S. aircraft, (3) away from U.S. aircraft, and (4) post-mission. Pre-mission lessons learned included the need for professional civilian attire for deployed CCAT teams and the limited availability of pre-mission clinical information. Lessons learned at the aircraft included the following: the need for flexible mission timelines, coordinate and pre-plan transitions with foreign medical teams when possible, and plan for difficult environmental conditions if flight line transfer is required. Lessons learned away from the aircraft included communication challenges between CCAT and the aircraft, contingency planning for narcotic transports, and equipment interoperability issues. Post-mission lessons learned included the need for written communication to disseminate information to the CCAT community. This case series described logistical challenges that present during transport missions involving foreign hospitals. This published series will enable dissemination to the en route care community for possible incorporation into future training.

Prehospital synergy: Tranexamic acid and blood transfusion in patients at risk for hemorrhage

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J Trauma Acute Care Surg. 2022 Jul 1;93(1):52-58

Background: Growing evidence supports improved survival with prehospital blood products. Recent trials show a benefit of prehospital tranexamic acid (TXA) administration in select subgroups. Our objective was to determine if receiving prehospital packed red blood cells (pRBC) in addition to TXA improved survival in injured patients at risk of hemorrhage.

Methods: We performed a secondary analysis of all scene patients from the Study of Tranexamic Acid during Air and ground Medical Prehospital transport trial. Patients were randomized to prehospital TXA or placebo. Some participating EMS services utilized pRBC. Four resuscitation groups resulted: TXA, pRBC, pRBC+TXA, and neither. Our primary outcome was 30-day mortality and secondary outcome was 24-hour mortality. Cox regression tested the association between resuscitation group and mortality while adjusting for confounders.

Results: A total of 763 patients were included. Patients receiving prehospital blood had higher Injury Severity Scores in the pRBC (22 [10, 34]) and pRBC+TXA (22 [17, 36]) groups than the TXA (12 [5, 21]) and neither (10 [4, 20]) groups ($p < 0.01$). Mortality at 30 days was greatest in the pRBC+TXA and pRBC groups at 18.2% and 28.6% compared with the TXA only and neither groups at 6.6% and 7.4%, respectively. Resuscitation with pRBC+TXA was associated with a 35% reduction in relative hazards of 30-day mortality compared with neither (hazard ratio, 0.65; 95% confidence interval, 0.45-0.94; $p = 0.02$). No survival benefit was observed in 24-hour mortality for pRBC+TXA, but pRBC alone was associated with a 61% reduction in relative hazards of 24-hour mortality compared with neither (hazard ratio, 0.39; 95% confidence interval, 0.17-0.88; $p = 0.02$).

Conclusion: For injured patients at risk of hemorrhage, prehospital pRBC+TXA is associated with reduced 30-day mortality. Use of pRBC transfusion alone was associated with a reduction in early mortality. Potential synergy appeared only in longer-term mortality and further work to investigate mechanisms of this therapeutic benefit is needed to optimize the prehospital resuscitation of trauma patients.

Ketamine Boluses Are Associated with a Reduction in Intracranial Pressure and an Increase in Cerebral Perfusion Pressure: A Retrospective Observational Study of Patients with Severe Traumatic Brain Injury

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Crit Care Res Pract. 2022 May 21;2022:3834165.

Background: Increased intracranial pressure (ICP) and hypotension have long been shown to lead to worse outcomes in the severe traumatic brain injury (TBI) population. Adequate sedation is a fundamental principle in TBI care, and ketamine is an attractive option for sedation since it does not commonly cause systemic hypotension, whereas most other sedative medications do. We evaluated the effects of ketamine boluses on both ICP and cerebral perfusion pressure (CPP) in patients with severe TBI and refractory ICP.

Methods: We conducted a retrospective review of all patients admitted to the neurointensive care unit at a single tertiary referral center who had a severe traumatic brain injury with indwelling intracranial pressure monitors. We identified those patients with refractory intracranial pressure who received boluses of ketamine. We defined refractory as any sustained ICP greater than 20 mmHg after the patient was adequately sedated, serum Na was at goal, and CO2 was maintained between 35 and 40 mmHg. The primary outcome was a reduction in ICP with a subsequent increase in CPP.

Results: The patient cohort consisted of 44 patients with a median age of 30 years and a median presenting Glasgow Coma Scale (GCS) of 5. The median reduction in ICP after administration of a ketamine bolus was -3.5 mmHg (IQR -9 to +1), and the postketamine ICP was significantly different from baseline ($p < 0.001$). Ketamine boluses led to an increase in CPP by 2 mmHg (IQR -5 to +12), which was also significantly different from baseline ($p < 0.001$).

Conclusion: In this single-institution study of patients with severe traumatic brain injury, ketamine boluses were associated with a reduction in ICP and an increase in CPP. This was a retrospective review of 43 patients and is therefore limited in nature, but further randomized controlled trials should be performed to confirm the findings.

The recovery position for maintenance of adequate ventilation and the prevention of cardiac arrest: A systematic review

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Resusc Plus. 2022 Apr 29;10:100236

Aim: To conduct a systematic review of the use of the recovery position in adults and children with non-traumatic decreased levels of responsiveness changes outcomes in comparison with other positioning strategies.

Methods: We searched Medline (Ovid), Embase, Cochrane Library, CINAHL, medRxiv and Google Scholar from inception to 15 March 2021 for studies involving adults and children in an out-of-hospital, first aid setting who had reduced levels of responsiveness of non-traumatic aetiology but did not require resuscitative interventions. We used the ROBINS-I tool to assess risk of bias and GRADE methodology to determine the certainty of evidence.

Results: Of 17,947 citations retrieved, three prospective observational studies and four case series were included. The prone and semi-recumbent positions were associated with a decreased rate of suspected aspiration pneumonia in acute poisoning. Use of the recovery position in paediatric patients with decreased levels of responsiveness was associated with a deceased admission rate and the prone position was the position most commonly associated with sudden unexpected death in epilepsy. High risk of bias, imprecision and indirectness of evidence limited our ability to perform pooled analyses.

Conclusion: We identified a limited number of observational studies and case series comparing outcomes following use of the recovery position with outcomes when other patient positions were used. There was limited evidence to support or revise existing first aid guidance; however, greater emphasis on the initial assessment of responsiveness and need for CPR, as well as the detection and management of patient deterioration of a person identified with decreased responsiveness, is recommended.

An Analysis of the Incidence of Hypocalcemia in Wartime Trauma Casualties

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Med J (Ft Sam Houst Tex). 2022 Apr-Jun;(Per 22-04/05/06):17-21.

Objective: Background: Massive transfusion protocols implement the use of blood products to restore homeostasis. Citrated blood products are required for massive transfusions and can induce hypocalcemia, resulting in decreased cardiac contractility. Recent data suggests that major trauma alone is associated with hypocalcemia. This phenomenon remains poorly described. We seek to characterize the incidence and risk factors for early hypocalcemia in the setting of combat trauma.

Materials and methods: This is a secondary analysis of previously described data from the Department of Defense Trauma Registry from January 2007 to March 2020. In this sub-analysis, we selected only casualties that had at least one ionized calcium measurement. We defined hypocalcemia as an ionized calcium level of less than 1.2mmol/L.

Results: Within our study database, there were 142 adult casualties that met inclusion with at least one calcium value documented. We found 72 (51%) experienced at least one episode of hypocalcemia. Median composite injury severity score (ISS) was significantly lower in the control cohort compared to those with hypocalcemia (9 versus 15, p=0.010). Survival was similar between the two groups (97% versus 90%, p=0.166). On multivariable analysis when evaluating serious injuries by body region, only serious injuries to the extremities were significantly associated with developing hypocalcemia (odds ratio [OR] 1.48, 95% confidence interval [CI] 1.00-2.21). When comparing prehospital interventions, only intravenous (IV) fluid administration was associated with high proportions experiencing hypocalcemia (25% versus 43%, p=0.029). In the multivariable model adjusted for ISS, mechanism of injury, and patient category, IV fluids were associated with the development of hypocalcemia (OR 2.48, 95% CI 1.03-5.94). When comparing vital signs, only respiratory rates were noted to be higher in the hypocalcemia cohort (18.6 versus 20.4, p=0.048).

Conclusions: Approximately half of combat casualties with available ionized calcium (iCa) level were hypocalcemic. Prehospital IV fluid use was associated with the development of hypocalcemia. Our study has implications for forward-staged medical teams with limited laboratory analysis capabilities. Additional research is needed to determine whether calcium replacement improves survival from traumatic injury and to identify the specific indications and timing for calcium replacement. This study will help inform a clinical study intended to aid in the development of clinical practice guidelines for deployed medical personnel.

Analgesia and Sedation for Tactical Combat Casualty Care: TCCC Proposed Change 21-02

Andrew D Fisher, Taylor T DesRosiers, Wayne Papalski, Michael A Remley, Steven G Schauer, Michael D April, Virginia Blackman, Jacob Brown, Frank K Butler Jr, Cord W Cunningham, Jennifer M Gurney, John B Holcomb, Harold R Montgomery, Margaret M Morgan, Sergey M Motov, Stacy A Shackelford, Timothy Sprunger, Brendon Drew

J Spec Oper Med. 2022 May 31;22(2):154-165

Abstract

Analgesia in the military prehospital setting is one of the most essential elements of caring for casualties wounded in combat. The goals of casualty care is to expedite the delivery of life-saving interventions, preserve tactical conditions, and prevent morbidity and mortality. The Tactical Combat Casualty Care (TCCC) Triple Option Analgesia guideline provided a simplified approach to analgesia in the prehospital combat setting using the options of combat medication pack, oral transmucosal fentanyl, or ketamine. This review will address the following issues related to analgesia on the battlefield: 1. The development of additional pain management strategies. 2. Recommended changes to dosing strategies of medications such as ketamine. 3. Recognition of the tiers within TCCC and guidelines for higher-level providers to use a wider range of analgesia and sedation techniques. 4. An option for sedation in casualties that require procedures. This review also acknowledges the next step of care: Prolonged Casualty Care (PCC). Specific questions addressed in this update include: 1) What additional analgesic options are appropriate for combat casualties? 2) What is the optimal dose of ketamine? 3) What sedation regimen is appropriate for combat casualties?

Mechanical Ventilation: A Review for Special Operations Medical Personnel

Jonathan Friedman, Seth M Assar

J Spec Oper Med. 2022 May 31;22(2):97-102

Abstract

Mechanical ventilation is machine-delivered flow of gases to both oxygenate and ventilate a patient who is unable to maintain physiological gas exchange, and positive-pressure ventilation (PPV) is the primary means of delivering invasive mechanical ventilation. The authors review invasive mechanical ventilation to give the Special Operations Force (SOF) medic a comprehensive conceptual understanding of a core application of critical care medicine.

Comparison of emergency airway management techniques in the performance of emergent Cricothyrotomy

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Int J Emerg Med. 2022 May 30;15(1):24

Introduction: Emergent cricothyrotomy (EC) is a rare and lifesaving procedure to secure a difficult airway when other methods have failed. Many techniques have been discussed in the literature. This study aimed to identify major techniques used to perform EC in a regional trauma center and evaluate outcomes associated with the techniques.

Methods: Patients who underwent EC at Arrowhead Regional Medical Center between 1-1-2009 and 1-1-2019 were reviewed for eligibility for this study. Patients' data were extracted from the trauma database. Chi-square tests were conducted to assess the difference on variables between the techniques.

Results: A total of 51 (0.17%) of these patients required EC and were included in the database. The two most prevalent techniques were the scalpel-bougie-tube (SBT) and the surgical cricothyrotomy technique (SCT). More than half (n = 27, 52.9%) of the cohort received the SBT. There was no statistically significant difference between the two techniques with regards to demographic variables, including age (p = 0.7528), injury severity score (ISS, p = 0.896), gender (p = 0.3709), and race (p = 0.8935). However, the SCT group had a statistically higher Glasgow Coma Scale (GCS) than the SBT group (p = 0.0036). There was no statistically significant difference in mortality or complications between these two groups (p = 0.2172 for mortality).

Discussion: Two techniques of EC were identified as preferred techniques. Both procedures were successful in securing an emergency airway, noting a difference in the time to completion of the two techniques. Given the rarity of the procedure, practitioners may choose the method based on their training and the availability of appropriate instruments.

Committee on Surgical Combat Casualty Care position statement on the use of single surgeon teams and invited commentaries

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Background: Over the last 20 years of war, there has been an operational need for far forward surgical teams near the point of injury. Over time, the medical footprint of these teams has decreased and the utilization of mobile single surgeon teams (SSTs) by the Services has increased. The increased use of SSTs is because of a tactical mobility requirement and not because of proven noninferiority of clinical outcomes. Through an iterative process, the Committee on Surgical Combat Casualty Care (CoSCCC) reviewed the utilization of SSTs and developed an expert-opinion consensus statement addressing the risks of SST utilization and proposed mitigation strategies.

Methods: A small triservice working group of surgeons with deployment experience, to include SST deployments, developed a statement regarding the risks and benefits of SST utilization. The draft statement was reviewed by a working group at the CoSCCC meeting November 2021 and further refined. This was followed by an extensive iterative review process, which was conducted to ensure that the intended messaging was clear to senior medical leaders and operational commanders. The final draft was voted on by the entire CoSCCC membership. To inform the civilian trauma community, commentaries were solicited from civilian trauma leaders to help put this practice into context and to further the discussion in both military and civilian trauma communities.

Results: After multiple revisions, the SST statement was finalized in January 2022 and distributed to the CoSCCC membership for a vote. Of 42 voting members, there were three nonconcur votes. The SST statement underwent further revisions to address CoSCCC voting membership comments. Statement commentaries from the President of the American Association for the Surgery for Trauma, the chair of the Committee on Trauma, the Medical Director of the Military Health System Strategic Partnership with the American College of Surgeons and a recently retired military surgeon we included to put this military relevant statement into a civilian context and further delineate the risks and benefits of including the trauma care paradigm in the Department of Defense (DoD) deployed trauma system.

Conclusion: The use of SSTs has a role in the operational environment; however, operational commanders must understand the tradeoff between tactical mobility and clinical capabilities. As SST tactical mobility increases, the ability of teams to care for multiple casualty incidents or provide sustained clinical operations decreases. The SST position statement is a communication tool to inform operational commanders and military medical leaders on the use of these teams on current and future battlefields.

US Central Command military blood utilization practices 2011 to 2020

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J Trauma Acute Care Surg. 2022 Aug 1;93(2S Suppl 1):S30-S34

Background: Military involvement in Afghanistan ended in 2021, and while low-intensity troop engagements continue globally, casualty numbers are dwindling. To understand the clinical and operational connections between blood utilization and clinical paradigm shifts in resuscitation strategies, a review of blood product utilization and the changes in the last decade was conducted within the US Central Command area of responsibility. The intent of this review was to assess patterns of blood use during the last decade of the United States' involvement in the most recent major conflicts to potentially inform future blood requirements.

Methods: Blood product and types transfused between January 1, 2011, and December 31, 2020, were acquired from the Medical Situational Awareness in Theater blood reports. All reported blood usage data in the US Central Command area of responsibility were queried.

Results: Packed red blood cells and fresh frozen plasma (FFP) usage showed no statistically significant change over time ($\tau b = 0.24$, $p = 0.3252$; $\tau b = -0.47$, $p = 0.0603$). Fresh and stored whole blood (SWB) use increased overtime ($\tau b = 0.69$, $p = 0.0056$; $\tau b = 0.83$, $p = 0.0015$). A strong inverse relationship was found between SWB and FFP usage ($r = -0.68$, $p = 0.0309$) and liquid plasma and FFP usage ($r = -0.65$, $p = 0.0407$) over time.

Conclusion: Whole blood usage increased significantly over time with a preference for SWB. Component therapy is anticipated to remain a critical element of resuscitation in the event of large-scale combat operations secondary to supply chain and longer storage times.

The role of tranexamic acid in traumatic brain injury

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J Clin Neurosci. 2022 May;99:1-4

Abstract

Evidence from recent trials evaluating efficacy of antifibrinolytic agents in the context of traumatic brain injury may lead to changes in the management of patients with traumatic brain injury. Tranexamic acid (TXA) reduces the proteolytic action of plasmin on fibrin clots, resulting in an inhibition of fibrinolysis and stabilisation of established blood clots. There has been significant interest in use of the drug as a therapeutic agent in the context of severe haemorrhage; however, considerable controversies regarding its efficacy remain. A number of trials have demonstrated a small but significant decrease in mortality following its administration, but the results have been somewhat inconsistent and may not be generalisable. The results of the CRASH-3 trial were that there was no statistical difference in the number of traumatic brain injury related deaths (18.5% with TXA and 19.8% with placebo; relative risk [RR] 0·94; 95% confidence interval [CI] 0·86-1·02). Nonetheless, there was a subgroup of patients for whom TXA appeared to provide benefit, and this was in patients with mild and moderate injury (with a Glasgow Coma Score > 8). This is potentially a very important finding that may have huge potential implications; however, we believe it does not currently provide indisputable evidence to support the administration of TXA to all patients with TBI. Further work is required to better define the subset of patients who may benefit as well as to evaluate the long-term functional benefit in order to determine which types of severe traumatic brain injury patients would derive more benefits than harms from TXA.

Intranasal ketamine versus intranasal fentanyl on pain management in isolated traumatic patients

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J Res Med Sci. 2022 Jan 29;27:1

Background: Given the inadequate control of pain in patients with the trauma that refer to the emergency departments, the rapid onset of action of intranasal administration in pain management, and the avoidance of administering opioid medications, the present study aimed at evaluating the effect of intranasal ketamine versus intranasal fentanyl on pain management in isolated traumatic patients.

Materials and methods: The current study was performed on 125 patients that were divided into the following three groups: control group (n = 41), 1 mg/kg intranasal ketamine group (n = 40), and 1 µg/kg intranasal fentanyl group (n = 44). Then pain scores, heart rate, respiratory rate, blood pressure, and oxygen saturation were recorded at baseline, 5, 10, 15, 30, and 40 min after the intervention.

Results: Visual analog scale (VAS) scores of patients in the intranasal ketamine group 5 and 10 min after the intervention were 61.50 ± 20.45 and 55.00 ± 21.96, respectively. The mentioned scores were significantly lower than the VAS scores of patients in the control group with the mean of 72.44 ± 22.11 and 66.59 ± 24.25 and the VAS scores of patients in the intranasal fentanyl group with the mean of 71.59 ± 22.09 and 65.00 ± 22.87 at 5 and 10 min after the intervention, respectively ($P < 0.05$).

Conclusion: Given the onset of action in < 10 min, intranasal ketamine can be proposed as an appropriate analgesic medication in pain reduction of patients with isolated limb injuries. Moreover, the incidence rate and severity of adverse effects were insignificantly higher in the intranasal ketamine group as compared with the intranasal fentanyl group.

Pain management of nalbuphine and sufentanil in patients admitted intensive care unit of different ages

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BMC Emerg Med. 2022 Mar 26;22(1):50

Background: Pain relief for patients in the intensive care unit (ICU) can improve treatment outcomes and reduce the burden on doctors and nurses. This study aims to report the clinical analgesic and sedative effects of nalbuphine and sufentanil on ICU patients.

Methods: This study retrospectively analyzed the medical records of 87 critically ill patients who received nalbuphine or sufentanil infusion in the ICU, including demographic data, diagnosis, Acute Physiology and Chronic Health Evaluation (APACHE) II, Critical Care Pain Observation Tool (CPOT), Richmond Agitation-Sedation Scale (RASS), systolic and diastolic blood pressure, heart rate and blood oxygen saturation (SpO2). The primary outcomes of this study were CPOT and RASS scores. The secondary outcomes were hemodynamic changes, including systolic blood pressure, diastolic blood pressure, heart rate, and SpO2. The adverse events recorded during pain management, such as hypoxemia, respiration depression and bradycardia, were also collected and analyzed.

Results: None of the patients in both groups experienced episode of hypoxemia, respiration depression and bradycardia. However, age-stratified analyses showed that nalbuphine has a better analgesic effect than sufentanil for patients aged ≤ 60 ($P < 0.05$). In contrast, sufentanil showed a better analgesic effect than nalbuphine for patients aged > 60 ($P < 0.05$). Furthermore, nalbuphine has a significantly better sedative effect than sufentanil for patients aged ≤ 60 ($P < 0.05$).

Conclusion: ICU patients of different age groups may be suitable for different analgesics. For patients under the age of 60, nalbuphine has better analgesia and sedation than sufentanil, and does not cause respiratory depression and drastic hemodynamic changes.

The Future of Prehospital Critical Care

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J Spec Oper Med. 2022 May 31;22(2):116-118

Abstract

As technology improves, the capabilities of prehospital providers increase. Innovations and realizations from military counterparts are being transitioned to civilian emergency care with the same hopes of increasing survivability of patients. Looking to the future, the incorporation of drone aircraft in the critical care field will likely impact the way medicine is practiced. Education is the key to improving outcomes in the prehospital setting.

Travel-Associated Venous Thromboembolism

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Wilderness Environ Med. 2022 Jun;33(2):169-178

Introduction: Long-distance travel is assumed to be a risk factor for venous thromboembolism (VTE). However, the available data have not clearly demonstrated the strength of this relationship, nor have they shown evidence for the role of thromboprophylaxis.

Methods: We performed a systematic review of the literature. We also summarized available guidelines from 5 groups.

Results: We found 18 studies that addressed this question. Based on the data presented in the review, we conclude that there is an association between VTE and length of travel, but this association is mild to moderate in effect size with odds ratios between 1.1 and 4. A dose-response relationship between VTE and travel time was identified, with a 26% higher risk for every 2 h of air travel (P=0.005) starting after 4 h. The quality of evidence for both travel length and thromboprophylaxis was low. However, low-risk prophylactic measures such as graduated compression stockings were shown to be effective in VTE prevention. There is heterogeneity among the different practice guidelines. The guidelines generally concur that no prophylaxis is necessary in travelers without known thrombosis risk factors and advocate for conservative treatment such as compression stockings over pharmacologic prophylaxis.

Conclusions: We conclude air travel is a risk factor for VTE and that there is a dose relationship starting at 4 h. For patients with risk factors, graduated compression stockings are effective prophylaxis.

Development of Data-Driven Triage Systems for Identifying Mortally Wounded Casualties-Implications for Future Large-Scale Combat Operations

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Med J (Ft Sam Houst Tex). 2022 Apr-Jun;(Per 22-04/05/06):32-39.

Background: Uncontested air movement and advances for medical care of combat casualties have resulted in a decreased case fatality rate. However, in future large-scale combat operations, the military has established a plan for multidomain operations to defeat near-peer adversaries. Prolonged casualty care and mass casualty scenarios will become more prevalent. Prehospital friendly scoring systems such as the shock index (SI) and revised trauma score (RTS) may provide useful triage data. Development of accurate, data-driven, triage systems will be key to optimize management of resources, care, and transport of combat casualties.

Methods: We included data from the Department of Defense Trauma Registry between 01 January 2007 to 17 March 2020. Data comprised of adult US military or coalition service members for analysis as the baseline cohort, and those who died within 24 hours were included in the early death cohort. We performed statistical analysis on demographics and injury data, SI and RTS to measure the receiver operating characteristics (ROC) of each value to predict early death.

Results: The early death cohort had a significantly higher injury severity score (25 vs. 5) and a higher percentage of serious injuries in every body region than the baseline cohort. The early death cohort sustained serious injuries to the head and neck at a rate five times that of the baseline cohort (43.4% vs 8.1%) with odds ratio (OR) of death 8.0 (95% confidence interval 5.7-11.1) followed by skin (13.6% versus 1.9%) with an OR of 6.3 (95% CI 3.8-10.3). The mean SI was 1.21 versus 0.80. The revised trauma score (RTS) was 4.18 versus 7.34. The RTS had a higher area under the receiver operating characteristic (0.896 versus 0.716 for SI).

Conclusions: Serious injuries to the head and skin were most strongly associated with death within the first 24 hours. The RTS appears to be a more accurate tool than SI alone for assessing injury mortality. Military medical personnel should consider these factors when triaging casualties during future conflicts in resource limited settings with delayed evacuation.

Association of Tranexamic Acid Administration With Mortality and Thromboembolic Events in Patients With Traumatic Injury: A Systematic Review and Meta-analysis

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JAMA Netw Open. 2022 Mar 1;5(3):e220625

Importance: Tranexamic acid is widely available and used off-label in patients with bleeding traumatic injury, although the literature does not consistently agree on its efficacy and safety.

Objective: To examine the association of tranexamic acid administration with mortality and thromboembolic events compared with no treatment or with placebo in patients with traumatic injury in the literature.

Data sources: On March 23, 2021, PubMed, Embase, and the Cochrane Library were searched for eligible studies published between 1986 and 2021.

Study selection: Randomized clinical trials and observational studies investigating tranexamic acid administration compared with no treatment or placebo among patients with traumatic injury and traumatic brain injury who were 15 years or older were included. Included studies were published in English or German. The electronic search yielded 1546 records, of which 71 were considered for full-text screening. The selection process was performed independently by 2 reviewers.

Data extraction and synthesis: The study followed the Cochrane Handbook for Systematic Reviews of Interventions and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Data were extracted by 2 independent reviewers and pooled using the inverse-variance random-effects model.

Main outcomes and measures: Outcomes were formulated before data collection and included mortality at 24 hours and 28 and 30 days (1 month) as well as the incidence of thromboembolic events and the amount of blood products administered. Owing to missing data, overall mortality was added and the amount of blood products administered was discarded.

Results: Thirty-one studies with a total of 43 473 patients were included in the systematic review. The meta-analysis demonstrated that administration of tranexamic acid was associated with a significant decrease in 1-month mortality compared with the control cohort (risk ratio, 0.83 [95% CI, 0.71-0.97]; I2 = 35%). The results of meta-analyses for 24-hour and overall mortality and thromboembolic events were heterogeneous and could not be pooled. Further investigations on clinical heterogeneity showed that populations with trauma and trial conditions differed markedly.

Conclusions and relevance: These findings suggest that tranexamic acid may be beneficial in various patient populations with trauma. However, reasonable concerns about potential thromboembolic events with tranexamic acid remain.

The Newest Battlefield Opioid, Sublingual Sufentanil: A Proposal to Refine Opioid Usage in the U.S. Military

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Mil Med. 2022 Mar 28;187(3-4):77-83

Abstract

There is an ongoing opioid epidemic in the USA, and the U.S. military is not immune to the health threat. To combat the epidemic, the Department of Defense (DoD) and Department of Veterans' Affairs (DVA) issued new clinical practice guidelines and launched the Opioid Safety Initiative aimed at reducing opioid prescriptions. Furthermore, the DoD continually refined opioid protocols for acute pain on the battlefield, evolving from intramuscular morphine to intravenous morphine administration to oral transmucosal fentanyl citrate lollipops (Actiq) to finally sublingual sufentanil tablets (SSTs, Dsuvia). Interestingly, the newest introduction of SSTs into the military sparked great controversy, as there are concerns over the drug's potential for misuse. However, although the opioid crisis may understandably foster an aversion to new candidate opioids, the therapeutic benefits of effective opioids in acute trauma settings should not be overlooked. SSTs may offer an improved analgesic option to meet the battlefield's unmet needs with its non-invasive, sublingual delivery system and favorable pharmacologic properties that mitigate the risk for side effects, addiction, and adverse outcomes. Accordingly, this commentary aims to (1) review the evolution of opioid use on the battlefield and discuss the medical benefits and limitations of SSTs in acute trauma settings, (2) highlight the importance of chronic pain management post-deployment through evidence-based non-opioid modalities, and (3) explore avenues of future research. Ultimately, we propose that SSTs are an important improvement from existing battlefield opioids and that refining, not abandoning, opioid usage will be key to effectively managing pain in the military.

Warfighter Personal Protective Equipment and Combat Wounds

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Med J (Ft Sam Houst Tex). 2021 Apr-Jun;(PB 8-21-04/05/06):72-77.

Background: Personal protective equipment (PPE) is crucial to force protection and preservation. Innovation in PPE has shifted injury patterns, with protected body regions accounting for decreased proportions of battlefield trauma relative to unprotected regions. Little is known regarding the PPE in use by warfighters at the time of injury.

Methods: We queried the Prehospital Trauma Registry (PHTR) for all encounters from 2003-2019. This is a sub-analysis of casualties with documented PPE at the time of medical encounter. When possible, encounters were linked to the Department of Defense Trauma Registry (DODTR) for outcome data. Serious injuries are defined as an abbreviated injury scale of 3 or greater.

Results: Of 1,357 total casualty encounters in the PHTR, 83 were US military with documented PPE. We link 62 of this cohort to DODTR. The median composite Injury Severity Score (ISS) was 6 (Interquartile range (IQR) 4-21), and 11 casualties (18%) had an ISS >25. The most seriously injured body regions were the extremities (21%), head/neck (16%), thorax (16%), and abdomen (10%). PPE worn at time of injury included helmet (91%), eye protection (73%), front (75%) and rear plates (77%), left/right plates (65%), tactical vest (46%), groin protection (12%), neck protection (6%), pelvic shield (3%), and deltoid protection (3%).

Conclusion: Our data set demonstrates that the extremities were the most commonly injured body region, followed by head/neck, and thorax. PPE designed for the extremities and neck are also among the least commonly worn protective equipment.

Effectiveness and safety of tranexamic acid in pediatric trauma: A systematic review and meta-analysis

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Objective: Trauma is the leading cause of childhood death in the United States. Our goal was to determine the effectiveness of tranexamic acid (TXA) in improving survival in pediatric trauma.

Methods: MEDLINE (OVID), Embase (OVID), Cochrane Central Register databases, CINAHL (EBSCO), Web of Science (Clarivate Analytics), and grey literature sources were searched for publications reporting survival and safety outcomes in children receiving TXA in acute trauma, with no language restrictions, published until February 11, 2021. Two independent researchers assessed studies for eligibility, bias, and quality. Data on the study setting, injury type, participants, design, interventions, TXA dosing and outcomes were extracted. The primary outcome was survival in children who received TXA following trauma. Forest plots of effect estimates were constructed for each study. Heterogeneity was assessed and data were pooled by meta-analysis using a random-effects model.

Results: Fourteen articles met inclusion criteria - six single-institution and eight multicentre retrospective cohort studies. Overall, TXA use was not associated with increased survival in pediatric trauma (adjusted odds ratio [aOR]: 0.61, 95% CI: 0.30-1.22) after adjustment for patient-level variables, such as injury severity. Increased survival was documented in the subset of children experiencing trauma in combat settings (aOR for mortality: 0.31, 95% CI: 0.14-0.68). There were no differences in the odds of thromboembolic events (OR 1.15, 95% CI: 0.46-2.87) in children who received TXA versus not.

Conclusions: The utility of TXA in children with trauma is unclear. Guidelines supporting TXA use in pediatric trauma may not be based on the available evidence of its use in this context. Rigorous trials measuring survival and other meaningful outcomes and exploring optimal TXA dosing are urgently needed. Study Registration (PROSPERO): CRD42020157683.

United States Military Fatalities During Operation Inherent Resolve and Operation Freedom's Sentinel

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Mil Med. 2022 May 11; Online ahead of print.

Background: Military operations provide a unified action and strategic approach to achieve national goals and objectives. Mortality reviews from military operations can guide injury prevention and casualty care efforts.

Methods: A retrospective study was conducted on all U.S. military fatalities from Operation Inherent Resolve (OIR) in Iraq (2014-2021) and Operation Freedom's Sentinel (OFS) in Afghanistan (2015-2021). Data were obtained from autopsy reports and other existing records. Fatalities were evaluated for population characteristics; manner, cause, and location of death; and underlying atherosclerosis. Non-suicide trauma fatalities were also evaluated for injury severity, mechanism of death, injury survivability, death preventability, and opportunities for improvement.

Results: Of 213 U.S. military fatalities (median age, 29 years; male, 93.0%; prehospital, 89.2%), 49.8% were from OIR, and 50.2% were from OFS. More OIR fatalities were Reserve and National Guard forces (OIR 22.6%; OFS 5.6%), conventional forces (OIR 82.1%; OFS 65.4%), and support personnel (OIR 61.3%; OFS 33.6%). More OIR fatalities also resulted from disease and non-battle injury (OIR 83.0%; OFS 28.0%). The leading cause of death was injury (OIR 81.1%; OFS 98.1%). Manner of death differed as more homicides (OIR 18.9%; OFS 72.9%) were seen in OFS, and more deaths from natural causes (OIR 18.9%; OFS 1.9%) and suicides (OIR 29.2%; OFS 6.5%) were seen in OIR. The prevalence of underlying atherosclerosis was 14.2% in OIR and 18.7% in OFS. Of 146 non-suicide trauma fatalities, most multiple/blunt force injury deaths (62.2%) occurred in OIR, and most blast injury deaths (77.8%) and gunshot wound deaths (76.6%) occurred in OFS. The leading mechanism of death was catastrophic tissue destruction (80.8%). Most fatalities had non-survivable injuries (80.8%) and non-preventable deaths (97.3%).

Conclusions: Comprehensive mortality reviews should routinely be conducted for all military operation deaths. Understanding death from both injury and disease can guide preemptive and responsive efforts to reduce death among military forces.

An Updated Review of Improvised Ground Evacuation Platforms for Austere Special Operations Casualty Transport

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Med J (Ft Sam Houst Tex). 2022 Apr-Jun;(Per 22-04/05/06):56-61

Introduction: In 2018, the Expeditionary Resuscitative Surgical Team 3 (ERST-3) published a retrospective review on the ground casualty evacuation (CASEVAC) options available to a Special Operations Forces (SOF) unit in the Horn of Africa. Seventeen months following their deployment, ERST-7 provided an update on the improvised ground evacuation platforms in the same area of operations and what has and has not worked based on combat experience and new literature.

Methods: This publication is an update to a retrospective review of various modes of ground transportation used by ERST-7 during their deployment with Special Operations Command Africa from July 2020 to January 2021. The authors excluded all hand-carried litter and air evacuation platforms. The authors discuss litter setup, necessary modifications, litter capacity, strengths and weaknesses, and any recommendations for a Mine-Resistant Ambush Protected (MRAP) vehicle, a full-size pickup truck, and a mid-size pickup truck based on their use during the ERST-7 deployment. The authors also used previous literature to support their recommendations.

Results: The SOF unit to which ERST-7 was assigned still uses two of the four platforms included in the original study. The authors recommend continued use of the MRAP for patient extraction with a solely widthwise patient configuration, weather-proofing the open beds of MRAPs, and outfitting all MRAPs for Tactical Combat Casualty Care (TCCC) if the CASEVAC-designated MRAP is disabled. The pickup trucks functioned well for expedient CASEVAC under non-hostile conditions. However, they should be a last resort for CASEVAC outside friendly-controlled areas due to inadequate cover and concealment for patients and medical personnel providing enroute care.

Conclusions: Vehicles of opportunity available to SOF personnel are constantly changing. Continuous evaluation of local platforms is crucial, especially for partner force personnel who may not have access to dedicated air and ground MEDEVAC platforms. The authors recommend baseline readiness training on CASEVAC scenarios for those units traveling to areas without MEDEVAC assets.

Keywords: CASEVAC; austere; casualty evacuation; ground evacuation; medical evacuation; patient transport; prolonged field care; special operations.

Prehospital extremity tourniquet placements-performance evaluation of non-EMS placement of a lifesaving device

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Eur J Trauma Emerg Surg. 2022 May 10. Online ahead of print.

Background: The education of civilians and first responders in prehospital tourniquet (PT) utilization has spread rapidly. We aimed to describe trends in emergency medical services (EMS) and non-EMS PT utilization, and their ability to identify proper clinical indications and to appropriately apply tourniquets in the field.

Methods: A retrospective cohort study was conducted to evaluate all adult patients with PTs who presented at two Level I trauma centers between January 2015 and December 2019. Data were collected via an electronic patient query tool and cross-referenced with institutional Trauma Registries. Medically trained abstractors determined if PTs were clinically indicated (limb amputation, vascular hard signs, injury requiring hemostasis procedure, or significant documented blood loss). PTs were further designated as appropriately or inappropriately applied (based on tourniquet location, venous tourniquet, greater than 2-h ischemic time). Descriptive statistics and univariate analyses were performed.

Results: 146 patients met inclusion criteria. The incidence of yearly PT placements increased between 2015 and 2019, with an increase in placement by non-EMS personnel (police, firefighter, bystander, and patient). Improvised PTs were frequently utilized by bystanders and patients, whereas first responders had high rates of commercial tourniquet use. A high proportion of tourniquets were placed without indication (72/146, 49%); however, the proportion of PTs placed without a proper indication across applier groups was not statistically different ($p = 0.99$). Rates of inappropriately applied PTs ranged from 21 to 46% across all groups applying PTs.

Conclusions: PT placement was increasingly performed by non-EMS personnel. Present data indicate that non-EMS persons applied PTs at a similar performance level of those applied by EMS. Study LevelLevel III.

The new face of war: Craniofacial injuries from Operation Inherent Resolve

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J Trauma Acute Care Surg. 2022 Aug 1;93(2S Suppl 1):S49-S55

Background: During the last 20 years of conflict in the Middle East, improvements in body armor and the use of improvised explosive devices have resulted in an increased incidence of complex craniofacial trauma (CFT). Currently, CFT comprises up to 40% of all casualties. We present new data from the recent conflict in Iraq and Syria during Operation Inherent Resolve.

Methods: Data were collected for patients treated at role 1, role 2, and role 3 facilities in Iraq and Syria over a 1-year period. During this time, a specialized head & neck surgical augmentation team was deployed and colocated with the central role 3 facility. Data included for this cross-sectional study are as follows: injury type and mechanism, triage category, initial managing facility and subsequent levels of care, and procedures performed.

Results: Ninety-six patients sustained CFT over the study period. The most common injuries were soft tissue (57%), followed by cranial (44%) and orbital/facial (31%). Associated truncal and/or extremity injuries were seen in 46 patients (48%). There were marked differences in incidence and pattern of injuries between mechanisms (all $p < 0.05$). While improvised explosive devices had the highest rate of cranial and truncal injuries, gunshot wounds and blunt mechanisms had higher incidences of orbital/facial and neck injuries. Overall, 45% required operative interventions including complex facial reconstruction, craniotomy, and open globe repair. Mortality was 6% with 83% due to associated severe brain injury. Most patients were local nationals (70%) who required discharge or transfer to the local health care system.

Conclusion: Complex craniofacial trauma is increasingly seen by deployed surgeons, regardless of subspecialty training or location. Deployment of a centrally located head and neck team greatly enhances the capabilities for forward deployed management of CFT, with excellent outcomes for both US and local national patients.

Clinical Characteristics of Patients Undergoing Needle Thoracostomy in a Canadian Helicopter Emergency Medical Service

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Prehosp Emerg Care. 2022 May-Jun;26(3):400-405

Objective: Needle thoracostomy (NT) can be a life-saving procedure when used to treat tension pneumothorax. However, there is some question regarding the efficacy of NT in the prehospital setting. Failure to treat tension pneumothorax in a helicopter emergency medical service (HEMS) setting may prove especially deleterious to the patient due to gas expansion with increasing altitude. This study's objective was to identify the characteristics of patients treated with NT in a Canadian HEMS setting and the factors that may influence outcomes following NT use.Methods: This was a retrospective chart review of prehospital records from a Canadian HEMS service. Patients aged 18 years and older who underwent at least one NT attempt using a 14-gauge 8.3 cm needle from 2012 to 2018 were identified. Charts were reviewed to collect demographic data, NT procedural characteristics, vital signs, and clinical response metrics. Descriptive statistics were used to characterize the study sample and overall event characteristics. Binary logistic regression was performed to identify variables associated with a clinical response to the initial NT treatment.Results: 163 patients (1.3%) of 12,407 patients attended received NT. A positive clinical response to NT was recorded in 37% (n = 77) of the total events (n = 208), the most common of which was an improvement in blood pressure (BP) (18.8%, n = 39). Initial NT was associated with a low likelihood of clinical improvement in patients presenting with blunt trauma (OR = 0.18; p = .021; 95% CI [.04, .77]), CPR prior to NT (OR = 0.14; p = .02; 95% CI [.03, .73]), or in those who received bilateral NT treatment (OR = 0.13; p < .01; 95% CI [.05, .37]). A pretreatment BP < 90 mmHg was predictive of a positive clinical response to initial NT (OR = 3.33; p = .04; 95% CI [1.09, 10.20]).Conclusions: Only a small portion of patients in the setting of a Canadian HEMS service were treated with NT. Patients most likely to receive NT were males who had suffered blunt trauma. NT may have questionable benefit for patients presenting with blunt trauma, in cardiac arrest, or requiring bilateral NT.

Burn injuries in US service members: 2001-2018

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Burns. 2022 Mar 23; Online ahead of print.

Introduction: Burns are an important cause of battlefield injury, accounting for 5-20% of the combat injury burden. To date, no report has examined the full range of burns, from mild to severe, resulting from post-9/11 conflicts. The present study leverages the Expeditionary Medical Encounter Database (EMED), a Navy-maintained health database describing all service member medical encounters occurring during deployment, to capture, quantify and characterize burn-injured service members and the injuries they sustained while deployed in support of post-9/11 operations.

Methods: The EMED was queried for all surviving service members with at least one burn injury, identified using injury-specific Abbreviated Injury Scale codes. Demographic and additional injury information were also obtained from the EMED.

Results: From 2001 through 2018, 2507 deployed service members sustained 5551 burns. Blasts accounted for 82% of injuries, largely attributed to the use of improvised explosive devices. Concurrent injury was common, with 30% sustaining a traumatic brain injury and 10% sustaining inhalation injury. Most burns were small, with 92% involving< 20% TBSA; 85% of burns involved< 10% TBSA. The head and the hands were the most commonly affected areas, accounting for 48% of all burns, with 80% of service members sustaining at least one burn to these areas.

Conclusion: The majority of burns tend to be small in size, with the head and hands most commonly affected. As these areas are often left uncovered by the uniform, prevention measures, particularly improvement in and increased usage of personal protective gear, may help reduce these injuries and their consequences.

Arctic Tactical Combat Casualty Care

Kyle Samblanet, Molly Booy

J Spec Oper Med. 2022 Jun 1;22(2):127-128

No abstract available

Training on a virtual reality cricothyroidotomy simulator improves skills and transfers to a simulated procedure

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Trauma Surg Acute Care Open. 2022 Mar 1;7(1):e000826

Objective: The virtual airway skills trainer (VAST) is a virtual reality simulator for training in cricothyroidotomy (CCT). The goal of the study is to test the effectiveness of training and transfer of skills of the VAST-CCT.

Methods: Two groups, control (no training) and simulation (2 weeks of proficiency-based training), participated in this study. Subjects in the control condition did not receive any training on the task whereas those in the simulation received a proficiency-based training on the task during a period of 2 weeks. Two weeks post-training, both groups performed CCT on the TraumaMan to demonstrate the transfer of skills.

Results: A total of (n=20) subjects participated in the study. The simulation group performed better than the control group at both the post-test ($p<0.001$) and retention test ($p<0.001$) on the simulator. The cumulative sum analysis showed that all subjects in the simulation group reached proficiency with acceptable failure rate within the 2 weeks of training. On the transfer test, the simulation group performed better on skin cut ($p<0.001$), intubation ($p<0.001$) and total score ($p<0.001$) than the control group.

Conclusions: The VAST-CCT is effective in training and skills transfer for the CCT procedure.

Efficiency of laryngeal mask airway ProtectorTM and i-gel® as a conduit in Aintree catheter-guided fibreoptic tracheal intubation: a randomised clinical trial

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Anaesthesiol Intensive Ther. 2022;54(2):120-126

Background: Fibreoptic intubation through a supraglottic airway device (SAD) is recom-mended in difficult airway management algorithms. The Difficult Airway Society published a guideline describing the details of this technique in 2011. This study was designed to compare the efficiency of two different 2nd generation SADs as a conduit for Aintree catheter-guided fibreoptic tracheal intubation.

Methods: 80 adult patients with an ASA score of 1-3 undergoing elective surgical procedures were included in the study. The patients were intubated after randomization to two groups: the i-gel group and the laryngeal mask airway (LMA) Protector group. SAD insertion time and tracheal intubation time were recorded separately. Demographic data, changes in haemodynamic parameters during the procedure, and complications were noted.

Results: In the LMA Protector and i-gel groups, the number of attempts (1.14 ± 0.35 vs. 1.24 ± 0.49 times, P = 0.394), device insertion time (14.89 ± 8.11 vs. 17.84 ± 16.59 seconds, P = 0.896), and the need for an optimization manoeuvre (43.2% vs. 37.8%, P = 0.813) were similar (P > 0.05). The fibreoptic laryngeal appearance scale and haemodynamic parameters were similar (P > 0.05). However, the airway complication rate was significantly higher in the LMA Protector group than in the i-gel group (21.6% vs. 2.7%, P = 0.013). The most common complications were bronchospasm and bloody secretion on SAD.

Conclusions: With the stable haemodynamic parameters, acceptable insertion time and lower complication rate, we concluded that the i-gel may be preferable in fibre-optic tracheal intubation. The rigid structure of the LMA Protector compared to the i-gel might contribute to this result.

Simulation-based education improves military trainees' skill performance and self-confidence in tourniquet placement: A randomized controlled trial

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J Trauma Acute Care Surg. 2022 Aug 1;93(2S Suppl 1):S56-S63

Background: Tactical Combat Casualty Care (TCCC) is the standard of care for stabilization and treatment of military trauma patients. The Department of Defense has mandated that all service members receive role-based TCCC training and certification. Simulation education can increase procedural skills by providing opportunities for deliberate practice in safe, controlled environments. We developed and evaluated the effectiveness of a simulation-based TCCC training intervention to improve participants' skill performance and self-confidence in tourniquet placement.

Methods: This study was a single-blinded, randomized trial with waitlist controls. Army Reserve Officers Training Corp cadets from a single training battalion comprised the study population. After randomization and baseline assessment of all participants, group A alone received focused, simulation-based TCCC tourniquet application training. Three months later, all participants underwent repeat testing, and after crossover, the waitlist group B received the same intervention. Two months later, all cadets underwent a third/final assessment. The primary outcome was tourniquet placement proficiency assessed by total score achieved on a standardized eight-item skill checklist. A secondary outcome was self-confidence in tourniquet application skill as judged by participants' Likert scale ratings.

Results: Forty-three Army Reserve Officers Training Corp cadets completed the study protocol. Participants in both group A (n = 25) and group B (n = 18) demonstrated significantly higher performance from baseline to final assessment at 5 months and 2 months, respectively, following the intervention. Mean total checklist score of the entire study cohort increased significantly from 5.53 (SD = 2.00) at baseline to 7.56 (SD = 1.08) at time 3, a gain of 36.7% ($p < 0.001$). Both groups rated their self-confidence in tourniquet placement significantly higher following the training.

Conclusion: A simulation-based TCCC curriculum resulted in significant, consistent, and sustained improvement in participants' skill proficiency and self-confidence in tourniquet placement. Participants maintained these gains 2 months to 5 months after initial training.

How effective are different models of pelvic binders: results of a study using a Pelvic Emergency Simulator

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Eur J Trauma Emerg Surg. 2022 Apr;48(2):847-855

Background: The application of pelvic binders in the preclinical and early clinical phase is advisable to avoid or treat C-problems in unstable and potential bleeding pelvic ring fractures, even if the clinical effectivity is not completely proved. The use for pathologies in the posterior pelvic ring is still debatable.

Questions/purposes: We determined if there is a difference in achievable compression in the dorsal pelvic ring depending on position and pelvic binder model. Can this effect be tested with a simplified artificial model?

Methods: We simulated a Tile type C fracture within the established pelvic emergency trainer and measured in a test series the effectivity of reduction with a non-invasive stabilization technique using 3 different pelvic binders.

Results: Any therapeutic effect of a pelvic binder with compression to the posterior pelvic ring requires at first a reduction maneuver. While the compression effect in the symphysis depends only on positioning of the binder, in the posterior pelvic ring, the result varies with the used model. The achievable pressure in the SI joint with a pelvic binder is only 20-25% (33.5-47 N) compared to the C-Clamp values (156 N).

Conclusions: The use of pelvic binders for non-invasive pelvic ring stabilization, even with a posterior pathology, could be proven in a simplified fracture model. A proper fracture reduction and an adequate device positioning influence the effectiveness.

Traumatic eye injuries: management principles for the prehospital setting

Felipe Serrano, Lawrence B Stack, R Jason Thurman, Lara Phillips, Wesley H Self

JEMS. 2013 Dec;38(12):56-62.

No abstract available

Evidence-based principles of time, triage and treatment: Refining the initial medical response to massive casualty incidents

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J Trauma Acute Care Surg. 2022 Aug 1;93(2S Suppl 1):S160-S164

Background: The overall approach to massive casualty triage has changed little in the past 200 years. As the military and civilian organizations prepare for the possibility of future large-scale combat operations, terrorist attacks and natural disasters, potentially involving hundreds or even thousands of casualties, a modified approach is needed to conduct effective triage, initiate treatment, and save as many lives as possible.

Methods: Military experience and review of analyses from the Department of Defense Trauma Registry are combined to introduce new concepts in triage and initial casualty management.

Results: The classification of the scale of massive casualty (MASCAL) incidents, timeline of life-saving interventions, immediate first pass actions prior to formal triage decisions during the first hour after injury, simplification of triage decisions, and the understanding that ultra-MASCAL will primarily require casualty movement and survival needs with few prehospital life-saving medical interventions are discussed.

Conclusion: Self aid, bystander, and first responder interventions are paramount and should be trained and planned extensively. Military and disaster planning should not only train these concepts, but should seek innovations to extend the timelines of effectiveness and to deliver novel capabilities within the timelines to the greatest extent possible.

Prehospital aortic blood flow control techniques for non-compressible traumatic hemorrhage

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Injury. 2021 Jul;52(7):1657-1663

Abstract

Non-compressible hemorrhage in the junctional areas and torso could be life-threatening and its prehospital control remains extremely challenging. The aim of this review was to compare commonly used techniques for the control of non-compressible hemorrhage in prehospital settings, and thereby provide evidence for further improvements in emergency care of traumatic injuries. Three techniques were reviewed including external aortic compression (EAC), abdominal aortic junctional tourniquet (AAJT), and resuscitative endovascular balloon occlusion of the aorta (REBOA). In prehospital settings, all three techniques have demonstrated clinical effectiveness for the control of severe hemorrhage. EAC is a cost- and equipment-free, easy-to-teach, and immediately available technique. In contrast, AAJT and REBOA are expensive and require detailed instructions or systematic training. Compared with EAC, AAJT and REBOA have greater potentials in the management of traumatic hemorrhage. AAJT can be used not only in the junctional areas but also in pelvic and bilateral lower limb injuries. However, both AAJT and REBOA should be used for a limited time (less than 1 hour) due to possible consequences of ischemia and reperfusion. Compared with EAC and AAJT, REBOA is invasive, requiring femoral arterial access and intravascular guidance and inflation. Mortality from non-compressible hemorrhage could be reduced through the prehospital application of aortic blood flow control techniques. EAC should be considered as the first-line choice for many non-compressible injuries that cannot be managed with conventional junctional tourniquets. In comparison, AAJT or REBOA is recommended for better control of the aorta blood flow in prehospital settings. Although these three techniques each have advantages, their use in trauma is not widespread. Future studies are warranted to provide more data about their safety and efficacy.

Training trial of critical care paramedics for non-medical authorisation of blood

Hazel Smith, Heidi Doughty

Br Paramed J. 2022 Mar 1;6(4):55-59

Abstract

The use of pre-hospital blood transfusion by air ambulance crews is increasing. Blood transfusion is traditionally 'authorised' by doctors, not prescribed. However, there is an increasing interest in extending the capability of authorisation to other practitioners - that is, non-medical authorisation (NMA). A UK framework for nurses and midwives has existed since 2007, but training for critical care paramedics (CCPs) has been limited. The Resuscitation with Pre-Hospital Blood Products (RePHILL) trial was launched in 2016, requiring pre-hospital administration of red cells and LyoPlas. Authorisation was initially restricted to doctors, leading to missed recruitment by paramedic-only crews. The trial protocol was amended in 2019 to permit NMA following suitable training and stakeholder consultation. We present a targeted training programme designed to support paramedic-led transfusion within the framework of the pre-hospital trial. We considered the knowledge and skills required for NMA and compared this with baseline knowledge from paramedic training to identify the training gap. We examined examples of existing military and civilian NMA training to develop a targeted programme for a single air ambulance. The four elements of our training programme were pre-course online training, previous trial participation, face-to-face training and competency assessment. Training was delivered to three CCPs, who cascaded the training to 14 colleagues. The training time was one morning, including a face-to-face session and assessment. Novel topics included physiological triggers for transfusion and transfusion risks in the pre-hospital environment. Paramedics were encouraged to recognise and report new patterns of adverse events. Reflective feedback suggests the programme provided CCPs the knowledge to autonomously recruit trial patients and authorise transfusion.

Optimal Out-of-Hospital Blood Pressure in Major Traumatic Brain Injury: A Challenge to the Current Understanding of Hypotension

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Ann Emerg Med. 2022 Jul;80(1):46-59

Study objective: Little is known about the out-of-hospital blood pressure ranges associated with optimal outcomes in traumatic brain injuries (TBI). Our objective was to evaluate the associations between out-of-hospital systolic blood pressure (SBP) and multiple hospital outcomes without assuming any predefined thresholds for hypotension, normotension, or hypertension.

Methods: This was a preplanned secondary analysis from the Excellence in Prehospital Injury Care (EPIC) TBI study. Among patients (age ≥10 years) with major TBIs (Barell Matrix type 1 and/or Abbreviated Injury Scale-head severity ≥3) and lowest out-of-hospital SBPs of 40 to 299 mmHg, we utilized generalized additive models to summarize the distributions of various outcomes as smoothed functions of SBP, adjusting for important and significant confounders. The subjects who were enrolled in the study phase after the out-of-hospital TBI guideline implementation were used to validate the models developed from the preimplementation cohort.

Results: Among 12,169 included cases, the mortality model revealed 3 distinct ranges: (1) a monotonically decreasing relationship between SBP and the adjusted probability of death from 40 to 130 mmHg, (2) lowest adjusted mortality from 130 to 180 mmHg, and (3) rapidly increasing mortality above 180 mmHg. A subanalysis of the cohorts with isolated TBIs and multisystem injuries with TBIs revealed SBP mortality patterns that were similar to each other and to that of the main analysis. While the specific SBP ranges varied somewhat for the nonmortality outcomes (hospital length of stay, ICU length of stay, discharge to skilled nursing/inpatient rehabilitation, and hospital charges), the patterns were very similar to that of mortality. In each model, validation was confirmed utilizing the postimplementation cohort.

Conclusion: Optimal adjusted mortality was associated with a surprisingly high SBP range (130 to 180 mmHg). Below this level, there was no point or range of inflection that would indicate a physiologically meaningful threshold for defining hypotension. Nonmortality outcomes showed very similar patterns. These findings highlight how sensitive the injured brain is to compromised perfusion at SBP levels that, heretofore, have been considered adequate or even normal. While the study design does did not allow us to conclude that the currently recommended treatment threshold (<90 mmHg) should be increased, the findings imply that the definition of hypotension in the setting of TBI is too low. Randomized trials evaluating treatment levels significantly higher than 90 mmHg are needed.

Battlefield pain summit 2022: Expert consensus statements

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J Trauma Acute Care Surg. 2022 Aug 1;93(2S Suppl 1):S12-S15

Background: Battlefield pain occurs in combat casualties who experience multiple severe injuries. The nature of battlefield scenarios requires a distinct approach to battlefield pain research. A battlefield pain summit was thus convened to identify shortcomings in the current understanding of battlefield pain management, review the current state of battlefield pain research, and shape the direction of future research.

Methods: On January 10 to 11, 2022, a hybrid in-person and virtual meeting hosted by the US Army Institute of Surgical Research defined research priorities for the Combat Casualty Care Research Program's Battlefield Pain research portfolio. Summit participants identified the following key focus areas under the umbrella of battlefield pain research: battlefield injury patterns; use of ketamine and nonopioid analgesics; analgesic delivery systems; the impact of analgesia on performance, cognition, and survival; training methods; battlefield regional anesthesia; and research models. Preliminary statements presented during the summit were refined and rank ordered through a Delphi process.

Results: Consensus was achieved on 7 statements addressing ideal analgesic properties, delivery systems, operational performance concerns, and pain training. Ketamine was identified as safe and effective for battlefield use, and further research into nonopioid analgesics represented a high priority.

Conclusion: The 7 consensus statements that emerged from this battlefield pain summit serve as a template to define the near-term research priorities for military-specific battlefield pain research.

The Importance of Acknowledging an Intermediate Category of Airway Management Devices in the Prehospital Setting

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Healthcare (Basel). 2022 May 23;10(5):961

Abstract

Prehospital airway devices are often classified as either basic or advanced, with this latter category including both supraglottic airway (SGA) devices and instruments designed to perform endotracheal intubation (ETI). Therefore, many authors analyze the impact of SGA and ETI devices jointly. There are however fundamental differences between these instruments. Indeed, adequate airway protection can only be achieved through ETI, and SGA devices all have relatively low leak pressures which might compromise both oxygenation and ventilation when lung compliance is decreased. In addition, there is increasing evidence that SGA devices reduce carotid blood flow in case of cardiac arrest. Nevertheless, SGA devices might be particularly useful in the prehospital setting where many providers are not experienced enough to safely perform ETI. Compared to basic airway management (bag-valve-mask) devices, SGA devices enable better oxygenation, decrease the odds of aspiration, and allow for more reliable capnometric measurement by virtue of their enhanced airtightness. For all these reasons, we strongly believe that SGA devices should be categorized as "intermediate airway management devices" and be systematically analyzed separately from devices designed to perform ETI.

Success Rate on Endotracheal Intubation with Prone versus Kneeling Position in Mannequin Model with Limitation of Neck Movement: A Cross Over Study

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Open Access Emerg Med. 2022 Apr 19;14:177-182

Purpose: Endotracheal intubation is a lifesaving procedure for airway management but is more complex when performed in patients lying on the ground and requiring cervical spine immobilization. This study aims to compare the optimal technique between prone and kneeling positions in increasing intubation success rate on these prehospital trauma patients.

Patients and methods: This study was an experimental study on a mannequin. Paramedic students performed intubation on the supine mannequin, which was applied with a rigid cervical collar and manual in-line stabilization. The participants were randomly assigned to intubate in a prone or kneeling position as the first method, then perform another method seven days later. Study outcomes include the percentage of successful intubation, time to perform intubation successfully, and Cormack and Lehane's classification of laryngeal view.

Results: Thirty-nine participants were enrolled in this study; 22 were male (56.41%). The mean age, weight, and height were 23.15 ± 4.75 years, 67.38 ± 17.39 kg, and 167.36 ± 8.70 cm., respectively. The percentage of successful intubation in prone (37 [94.90%]) was higher than kneeling position (35 [89.74%]), but there was no statistically significant (p-value = 0.675). Time to intubation successfully, the number of attempts, and Cormack & Lehane's laryngeal view classification were not significantly different between prone and kneeling groups (p-value = 0.808, 0.814, and 0.948, respectively).

Conclusion: Intubation with the prone or kneeling position on a mannequin, lying on the ground with cervical spine immobilization, has no statistical difference. Both intubation approaches appear to be effective in successful and rapid intubation, proper glottic visualization and low attempts.

Battle Injury Patterns Sustained Noncombatant Military Occupational Specialty Service Members

Giselle Tapia, Jason F Naylor, Michael D April, Steven G Schauer

Med J (Ft Sam Houst Tex). 2022 Apr-Jun;(Per 22-04/05/06):78-82

Background: The US military has been engaged in the Global War on Terrorism for nearly 2 decades. This asymmetric warfare has exposed many noncombat military occupational specialties (MOS) personnel to combat. We assessed what proportion of casualties were combat versus noncombat MOS personnel.

Methods: This is a secondary analysis of a previously described dataset from the Department of Defense Trauma Registry (DODTR). We included US military casualties sustaining battle injuries from January 2007 to March 2020 with a documented MOS. We classified each casualty as combat versus noncombat MOS personnel.

Results: There were 2,037 casualties who met inclusion for this analysis. Within these groups, there were 1,554 (76%) combat and 483 (24%) noncombat personnel. The median ages were 24 and 25, with more males among the combat MOS personnel (99% versus 93%). Army personnel comprised the largest proportion of both groups (78% versus 75%) with most injured by explosive (73% versus 78%). Median injury severity scores were similar (9 in both groups) as was survival (98% versus 98%). The annual proportion of battle injuries comprised of noncombat MOS personnel fluctuated year-to-year. The proportion of noncombat personnel with a medic in their chain of care was similar to combat personnel (25% versus 26%), as was the proportion undergoing medical evacuation by ground (11% versus 11%) or air (87% versus 86%). All prehospital interventions occurred in similar proportions except for ketamine administration (8% combat versus 3% noncombat MOS personnel).

Conclusions: Our study showed noncombat MOS personnel comprised nearly one in four casualties. Injury patterns were similar between combat and noncombat MOS personnel with nearly identical consumption of resources except for ketamine. More data is necessary on noncombatant MOS personnel battle injury patterns to guide commanders and medical leaders for future mission planning in resource constrained environments.

Tranexamic acid - A narrative review for the emergency medicine clinician

Kellie Wang, Ruben Santiago

Am J Emerg Med. 2022 Jun;56:33-44

Introduction: Over the last decade, tranexamic acid (TXA) has been incorporated into treatment algorithms for a multitude of emergent conditions and the evidence surrounding its role in emergency medicine continues to evolve.

Objective: The objective of this literature review is to provide an evidence-based approach to the utilization of TXA in the emergency department.

Discussion: The most robust trials suggest TXA may offer a modest improvement in mortality in patients at risk of significant bleeding from trauma, but is not beneficial in spontaneous intracranial hemorrhage or gastrointestinal bleeding. The role of TXA in other clinical scenarios is less clear and requires clinical judgment.

Conclusion: Tranexamic acid appears to be a reasonable adjunct for the emergency medicine clinician to consider in the management of many hemorrhagic conditions and angiotensin converting enzyme inhibitor-induced angioedema. Additional high-quality research in these areas is needed to further identity patients who may benefit most from TXA.

Safety and Efficacy of Sufentanil and Fentanyl Analgesia in Patients with Traumatic Brain Injury: A Retrospective Study

Wenhan Xia, Chunli Yang

Med Sci Monit. 2022 May 13;28:e934611

BACKGROUND This study aimed to retrospectively assess and compare the safety and efficacy of sufentanil and fentanyl in the treatment of patients with traumatic brain injury.

MATERIAL AND METHODS A total of 85 patients with traumatic brain injury from June 2016 to September 2018 were included in this study, and were enrolled into a sufentanil group and a fentanyl group according to different treatment methods. The patients in both groups were assessed with the Critical care Pain Observation Tool (CPOT) for analgesic score, and Richmond Agitation-Sedation Scale (RASS) for sedation score.

RESULTS The scores of CPOT and RASS in the 2 groups were significantly lower than before treatment ($P<0.05$), but there was no significant difference between the 2 groups ($P>0.05$). The heart rate (HR), rate of spontaneous respiration (RR), and mean arterial pressure (MAP) of the 2 groups were significantly lower than before treatment ($P<0.05$), and the RR of the sufentanil group was significantly lower than that of the fentanyl group at all time points after treatment ($P<0.001$).

CONCLUSIONS Sufentanil has a rapid onset of effect, and it is safe, stable, and effective for patients with traumatic brain injury in the intensive care unit (ICU). Compared with fentanyl, sufentanil can also effectively shorten mechanical ventilation time, time to obtain satisfactory sedation and analgesia, and the length of hospitalization in the ICU.

Descriptive Analysis of Intratheater Critical Care Air Transport Team Patient Movements During Troop Drawdown: Afghanistan (2017-2019)

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Mil Med. 2022 Apr 21; Online ahead of print

Background: The majority of critical care air transport (CCAT) flights are regulated, meaning that a theater-validating flight surgeon has confirmed that the patient is medically cleared for flight and that evacuation is appropriate. If the conditions on the ground do not allow for this process, the flight is unregulated. Published data are limited regarding CCAT unregulated missions to include the period of troop drawdown at the end of the Afghanistan conflict. The objective of our study was to characterize the unregulated missions within Afghanistan during troop drawdown and compare them to regulated missions during the same timeframe.

Study design: We performed a retrospective review of all CCAT medical records of patients transported via CCAT within Afghanistan between January 2017 and December 2019. We abstracted data from the records, including mission characteristics, patient demographics, injury descriptors, preflight military treatment facility procedures, CCAT procedures, in-flight CCAT treatments, in-flight events, and equipment issues. Following descriptive and comparative analysis, a Cochran-Armitage test was performed to evaluate the statistical significance of the trend in categorical data over time. Multivariable regression was used to assess the association between vasopressors and preflight massive transfusions, preflight surgical procedures, injury patterns, and age.

Results: We reviewed 147 records of patients transported via CCAT: 68 patients were transported in a regulated fashion and 79 on an unregulated flight. The number of patients evacuated increased year-over-year (n = 22 in 2017, n = 57 in 2018, and n = 68 in 2019, P < .001), and the percentage of missions that were unregulated grew geometrically (14%, n = 3 in 2017; 37%, n = 21 in 2018; and 81%, n = 55 in 2019, P < .001). During the time studied, CCAT teams were being used more to decompress forward surgical teams (FST) and, therefore, they were transporting patients just hours following initial damage control surgery in an unregulated fashion. In 2 instances, CCAT decompressed an FST following a mass casualty, during which aeromedical evacuation (AE) crews assisted with patient care. For the regulated missions, the treatments that were statistically more common were intravenous fluids, propofol, norepinephrine, any vasopressors, and bicarbonate. During unregulated missions, the statistically more common treatments were ketamine, fentanyl, and 3% saline. Additional analysis of the mechanically ventilated patient subgroup revealed that vasopressors were used twice as often on regulated (38%) vs. unregulated (13%) flights. Multivariable regression analysis demonstrated that traumatic brain injury (TBI) was the only significant predictor of in-flight vasopressor use (odds ratio = 3.53, confidence interval [1.22, 10.22], P = .02).

Conclusion: During the troop drawdown in Afghanistan, the number of unregulated missions increased geometrically because the medical footprint was decreasing. During unregulated missions, CCAT providers used ketamine more frequently, consistent with Tactical Combat Casualty Care guidelines. In addition, TBI was the only predictor of vasopressor use and may reflect an attempt to adhere to unmonitored TBI clinical guidelines. Interoperability between CCAT and AE teams is critical to meet mass

casualty needs in unregulated mission environments and highlights a need for joint training. It remains imperative to evaluate changes in mission requirements to inform en route combat casualty care training.