Tactical Combat Casualty Care

&

En Route Combat Casualty Care

2020 Journal Watch

Journal Article Abstracts

Dec 2019 – March 2020

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 CoTCCC is the branch of the JTS focused on the standard of care for prehospital battlefield medicine. The CoERCCC is the branch of the JTS focused on the standard of care for en route care medicine through the evacuation echelons of care. The JTS is the Department of Defense Center of Excellence for Trauma and division of the Defense Health Agency (DHA) providing clinical practice guidelines and performance improvement for all levels of military trauma care.

Prehospital transfusion of low titer cold-stored whole blood through the intraosseous route in a trauma patient with hemorrhagic shock

Raviv Allon, Danny Epstein , Itai Shavit

Transfusion 2020 Apr;60(4):875-878

Abstract

Background: Damage control resuscitation, avoidance of dilutional coagulopathy, and increased blood component therapy reduce mortality after major trauma hemorrhage. Improved outcomes seen in recent warfare have placed whole blood as the preferred product for resuscitation of severe traumatic hemorrhage. As of 2018, flight physicians of the Israeli Airborne Combat Search and Rescue Unit (ACSRU) treat these patients with low titer cold-stored O-positive whole blood (LTCSO+ WB). Intraosseous (IO) is the preferred route if intravenous access is not available. To date, no study has described the administration of LTCSO+ WB via the IO route in the prehospital setting.

Case report: We present a case of whole blood transfusion via the IO route in a 30-year-old car accident patient who suffered major injuries and developed severe hemorrhagic shock. Intravenous access could not be obtained at the scene. En route, two units of LTCSO+ WB were administered, using an IO hand drill, and the patient's hemodynamic status improved. The patient survived the injury with a good outcome.

Conclusion: This is the first report of whole blood infusion via the IO route in traumatic hemorrhagic shock in the prehospital setting. Our positive experience suggests that this approach may have a role in hemorrhagic trauma patients when intravenous access cannot be obtained.

Severity of hemorrhage and the survival benefit associated with plasma: Results from a randomized prehospital plasma trial

Vincent P Anto, Frank X Guyette, Joshua Brown, Brian Daley, Richard Miller, Brian Harbrecht, Jeffrey Claridge, Herb Phelan, Matthew Neal, Raquel Forsythe, Brian Zuckerbraun, Jason Sperry, PAMPer study group

J Trauma Acute Care Surg 2020 Jan;88(1):141-147

Abstract

Background: Recent randomized clinical trial evidence demonstrated a survival benefit with the use of prehospital plasma in patients at risk of hemorrhagic shock. We sought to characterize the survival benefit associated with prehospital plasma relative to the blood transfusion volume over the initial 24 hours. We hypothesized that the beneficial effects of prehospital plasma would be most robust in those with higher severity of hemorrhage.

Methods: We performed a prespecified secondary analysis using data derived from a prospective randomized prehospital plasma trial. Blood component transfusion volumes were recorded over the initial 24 hours. Massive transfusion (MT) was defined a priori as receiving ≥10 units of red cells in 24 hours. We characterized the 30-day survival benefit of prehospital plasma and the need for MT and overall 24-hour red cell transfusion volume utilizing Kaplan-Meier survival analysis and Cox proportional hazard regression.

Results: There were 501 patients included in this analysis with 230 randomized to prehospital plasma with 104 patients requiring MT. Mortality in patients who received MT were higher compared with those that did not (MT vs. NO-MT, 42% vs. 26%, p = 0.001). Kaplan-Meier survival curves demonstrated early separation in the NO-MT subgroup (log rank p = 0.008) with no survival benefit found in the MT group (log rank p = 0.949). Cox regression analysis verified these findings. When 24-hour red cell transfusion was divided into quartiles, there was a significant independent association with 30-day survival in patients who received 4 to 7 units (hazard ratio, 0.33, 95% confidence interval, 0.14-0.80, p = 0.013).

Conclusion: The survival benefits of prehospital plasma was demonstrated only in patients with red cell requirements below the transfusion level of MT. Patients who received 4 to 7 units of red cells demonstrated the most robust independent survival benefit attributable to prehospital plasma transfusion. Prehospital plasma may be most beneficial in those patients with moderate transfusion requirements and mortality risk.

Level of evidence: Therapeutic, Level I

An Applied Test of Knowledge Translation Methods Using a Mobile Health Solution

Christina M Armstrong, Robert P Ciulla, Suzanne A Williams, Logan J Micheel

Mil Med 2020 Jan 7;185(Suppl 1):526-535

Introduction: The study's objectives were to improve providers' knowledge of mobile health core competencies; increase providers' knowledge and clinical use of the Virtual Hope Box (VHB) mobile app as an evidence-based treatment tool; and test elements of a structured knowledge translation paradigm.

Materials and methods: knowledge translation best practices were integrated into a training workshop with the goal to increase provider adoption of the VHB. Providers were trained at three sites and provided feedback before the training, post-training, and at 3, 6, and 12 months following the training.

Results: Pretraining, <22% of respondents indicated that they had used the VHB in clinical practice; post-training, 89% of respondents reported their intent to use the VHB. At 3 and 6 months, 82% of evaluation respondents indicated actual use of the VHB.

Conclusions: Using a public-facing technology, this study successfully integrated knowledge translation methods within an existing provider training program. Implementation planning should be deliberate and consider a target site's capacity for new ideas and potential adoption barriers. Lessons learned have implications for future efforts to bridge the gap between research and practice in improving the quality and impact of clinical care.

Combat Application Tourniquet fares well in a chemical, biological, radiological or nuclear dress state

Alastair Beaven 1, E Sellon, M Ballard, P Parker

BMJ Mil Health 2020 Feb 20;jramc-2019-001261

Abstract

Introduction: There is a need for a military tourniquet to control catastrophic haemorrhage in a chemical, biological, radiological or nuclear (CBRN) threat environment. No published data exist as to the efficacy of tourniquets while wearing British military CBRN individual protective equipment (IPE).

Methods: 12 volunteers from the counter CBRN instructors' course allowed testing on 24 legs. A Combat Application Tourniquet (C-A-T) was applied to all volunteers at the level of the midthigh. 12 legs were tested while wearing CBRN IPE (both operator and simulated casualty), and the control group of 12 legs was tested while wearing conventional combat dress state (both operator and simulated casualty). The order of leg laterality and dress state were sequenced according to a prerandomised system. Efficacy was measured via use of an ultrasound probe at the popliteal artery. Tourniquets were considered effective if arterial flow was completely occluded on ultrasound imaging. Data were collected on time to successful application, failure of tourniquets and pain scores as rated by the visual analogue scale (1-10).

Results: There were no failures of tourniquet application in the CBRN group, and two failures (17%) in the control group. Failures were pain threshold exceeded (n=1) and tourniquet internal strap failure (n=1). The mean application time for the CBRN group was 28.5 s (SD 11.7) and 23.7 s (SD 9.8) for the conventional combat group. There was no statistically significant difference (p=0.27). The median CBRN pain score was 2.0 (IQR 2.0-3.5). The median control pain score was 4.0 (IQR 3-6). This was a statistically significant difference (p=0.002).

Conclusion: C-A-Ts applied to simulated casualties in CBRN IPE at the midthigh are at least as efficacious as those applied to the midthigh in a conventional combat dress state. The pain experienced was less in CBRN IPE than when in a conventional combat dress state.

Intravenous Hydroxocobalamin Versus Hextend Versus Control for Class III Hemorrhage Resuscitation in a Prehospital Swine Model

Vikhyat S Bebarta, Normalynn Garrett , Susan Boudreau , Maria Castaneda

Mil Med 2018 Nov 5;183(11-12):e721-e729

Abstract

Background: Hydroxyethyl starch (Hextend) has been used for hemorrhagic shock resuscitation, however, hydroxyethyl starch may be associated with adverse outcomes.

Objective: To compare systolic blood pressure (sBP) in animals that had 30% of their blood volume removed and treated with intravenous hydroxocobalamin, hydroxyethyl starch, or no fluid.

Methods: Twenty-eight swine (45-55 kg) were anesthetized and instrumented with continuous femoral and pulmonary artery pressure monitoring. Animals were hemorrhaged 20 mL/kg over 20 minutes and then administered 150 mg/kg IV hydroxocobalamin in 180 mL saline, 500 mL hydroxyethyl starch, or no fluid and monitored for 60 minutes. Data were modeled using repeated measures multivariate analysis of variance.

Results: There were no significant differences before treatment. At 20 minutes after hemorrhage, there was no significant difference in mean sBP between treated groups, however, control animals displayed significantly lower mean sBP ($p < 0.001$). Mean arterial pressure and heart rate improved in the treated groups but not in the control group ($p < 0.02$). Prothrombin time was longer and platelet counts were lower in the Hextend group ($p < 0.05$). Moreover, thromboelastography analysis showed longer clotting (K) times ($p < 0.05$) for the hydroxyethyl starch-treated group.

Conclusion: Hydroxocobalamin restored blood pressure more effectively than no treatment and as effectively as hydroxyethyl starch but did not adversely affect coagulation.

Death Ignores the Golden Hour The Argument for Mobile, Farther-Forward Surgery

Brian C. Beldowicz, Michael Bellamy, Robert Modlin

MILITARY REVIEW 2020; March-April 2020: 39-48

Although the footprint of medical resources has significantly contracted in recent years, the geography of ongoing operations has not. As a result, at-risk soldiers find themselves reliant on more tenuous limbs of medical support, far removed from the meticulously orchestrated medical evacuation (medevac) rings once deemed an operational imperative. The first hour after the occurrence of a traumatic injury is considered the most critical for emergency stabilization of a casualty. This “Golden Hour” concept establishes a serviceable standard for the distribution of fixed medical resources supporting areas of operation. However, the Golden Hour paradigm is insufficient for large-scale combat operations (LSCO), specifically when planning medical support for those offensive operations associated with the highest risk to force or those conducted in movement-restricted environments where timely medevac is not guaranteed. In order to provide ground force commanders with options for risk reduction consistent with best medical practice, medical planning will need to recalibrate from the prevailing Golden Hour paradigm to a more deliberate mission support model. Planners must consider operational importance, asymmetric distribution of risk to force, and available surgical assets’ capacity to influence preventable combat mortality and improve the efficiency of the casualty care system.

The Evolution of Blood Transfusion in the Trauma Patient: Whole Blood Has Come Full Circle

Jonathan A Black, Virginia S Pierce, Jeffrey D Kerby, John B Holcomb

Semin Thromb Hemost 2020 Mar;46(2):215-220

Abstract

Whole blood transfusion in the United States dates back to the Civil War, and it was widely used in all major conflicts since World War I. To understand our current civilian transfusion practices and to anticipate future changes in trauma resuscitation, it is important to understand the series of decisions that led trauma surgeons away from whole blood resuscitation and toward component therapy. In this review, we examine the historical basis for blood transfusion in trauma and examine the recent literature and future directions pertaining to blood product resuscitation in hemorrhaging patients.

Outcomes following penetrating neck injury during the Iraq and Afghanistan conflicts: A comparison of treatment at US and United Kingdom medical treatment facilities

John Breeze, Douglas M Bowley, James G Combes, James Baden, Linda Orr, Andrew Beggs, Joseph DuBose, David B Powers

J Trauma Acute Care Surg 2020 May;88(5):696-703

Abstract

Introduction: The United States and United Kingdom (UK) had differing approaches to the surgical skill mix within deployed medical treatment facilities (MTFs) in support of the military campaigns in Iraq and Afghanistan.

Methods: The US and UK combat trauma registries were scrutinized for patients with penetrating neck injury (PNI) at deployed coalition MTF between March 2003 and October 2011. A multivariate mixed effects logistic regression model (threshold, $p < 0.05$) was used stratified by MTF location and year of injury. The dependent variable was fatality on leaving Role 3, and the independent variables were ISS on arrival, nationality, MTF nationality, and presence of head and neck surgeon.

Results: A total of 3,357 (4.9%) of 67,586 patients who arrived alive at deployed military MTF were recorded to have sustained neck injuries; of which 2,186 (83%) were PNIs and the remainder were blunt injuries. When service members killed in action were included, the incidence of neck injury rose from 4.9% to 10%. Seven hundred nine (32%) of 2,186 patients with PNI underwent neck exploration; 555 patients were recorded to have sustained cervical vascular injury, 230 (41%) of 555 underwent vascular ligation or repair. Where it was recorded, PNI directly contributed to death in 64 (28%) of 228 of patients. Fatality status was positively associated with ISS on arrival (odds ratio, 1.05; 95% confidence interval, 1.04-1.06; $p < 0.001$) and the casualty being a local national (odds ratio, 1.74; 95% confidence interval, 1.28-2.38; $p < 0.001$).

Conclusion: Significant differences in the treatment and survival of casualties with PNI were identified between nations in this study; this may reflect differing cervical protection, management protocols, and surgical capability and is worthy of further study. In an era of increasing specialization within surgery, neck exploration remains a skill that must be retained by military surgeons deploying to Role 2 and Role 3 MTF.

Level of evidence: Retrospective cohort study, level III.

Early tranexamic acid in traumatic brain injury: Evidence for an effective therapy

Nuray Sarmad Bukhari, Rashid Jooma

J Pak Med Assoc 2020 Feb;70(Suppl 1)(2):S49-S52.

Abstract

The guidelines for management of traumatic brain injury (TBI) are based largely on measures to maintain an optimum internal milieu for prevention of secondary brain injury and enhancing recovery. One of the most common reasons for worsening outcomes following TBI is expanding intracranial haematoma which is compounded by the fibrinolytic physiology that follows TBI. Tranexamic acid (TXA) has a time tested role in preventing poor outcomes linked to excessive haemorrhage in trauma patients. Historically, patients with isolated head trauma were excluded from TXA use due to a theoretical increased risk of thrombosis. Recent evidence that redefines the beneficial role of early TXA administration in preventing mortality amongst patients with TBI is now at hand and offers a real prospect of a pharmacological intervention that would be adopted as a recommendation based on Class I evidence.

Physiological response to fluid resuscitation with Ringer lactate versus Plasmalyte in critically ill burn patients

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J Appl Physiol (1985) 2020 Mar 1;128(3):709-714

Abstract

The metabolic consequences in vivo of various balanced solutions are poorly known in critically ill patients. The main objective of this study was to describe the metabolic consequences of Plasmalyte versus Ringer lactate (RL) in critically ill burn patients, with a special focus on the plasma clearance of buffer anions (i.e., gluconate, acetate, and lactate). We conducted a randomized trial between August 2017 and October 2018 in a tertiary teaching hospital in Paris, France. Patients with burn total body surface area >30% were randomized to receive Plasmalyte or RL. The primary end point was the base excess 24 h after inclusion. The secondary end points were acetate, gluconate, and lactate plasma concentration, the strong ion difference (SID). Twenty-eight patients were randomized. Twenty-four hours after inclusion, plasma BE was not significantly different in the Plasmalyte and RL groups {-0.9 [95% confidence interval (95% CI): -1.8-0.9] vs. -2.1 [95% CI: -4.6-0.6] mmol/L, respectively, P = 0.26}. Plasma gluconate concentration was higher in the Plasmalyte group (P < 0.001), with a maximum level of 1.86 (95% CI: 0.98-4.0) mmol/L versus 0 (95% CI: 0-0.15) mmol/L. Plasma acetate and lactate were not significantly different. Ionized calcium level was lower in the Plasmalyte group (P = 0.002). Hemodynamics did not differ between groups. To conclude, the alkalinizing effect of Plasmalyte was less important than expected with no difference in base excess compared with RL, in part due to gluconate accumulation. Acetate and lactate did not significantly accumulate. Plasmalyte led to significantly lower ionized calcium levels.NEW & NOTEWORTHY During fluid resuscitation in burns the alkalinizing effect of Plasmalyte was less important than expected, with no difference in base excess compared with Ringer lactate (RL), in part due to gluconate accumulation. Acetate and lactate did not significantly accumulate. Plasmalyte led to significantly lower ionized calcium levels.

Validating Clinical Threshold Values for a Dashboard View of the Compensatory Reserve Measurement for Hemorrhage Detection

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J Trauma Acute Care Surg 2020 Jan 15;Epub ahead of print

Abstract

Background: Compensatory Reserve Measurement (CRM) is a novel noninvasive monitoring technology designed to assess physiologic reserve using feature interrogation of arterial pulse waveforms. This study was conducted to validate clinically relevant CRM values with a simplified color-coded dashboard view.

Methods: We performed a prospective observational study of 300 injured patients admitted to a level I trauma center. CRM was recorded upon ER admission. Data collected to complement the analysis included Patient demographics, vital signs, life-saving interventions (LSI), injury severity score (ISS) and outcomes were recorded. Threshold values of CRM were analyzed for predictive capability of hemorrhage.

Results: 285 patients met inclusion criteria. Mean age of the population was 47 years and 67% were male. Hemorrhage was present in 32 (11%) and LSI was performed in 40 (14%) patients. Transfusion of packed red blood cells (PRBC) was administered in 33 (11.6%) patients, and 21 (7.4%) were taken to the operating room for surgical or endovascular control of hemorrhage. Statistical analyses were performed to identify optimal threshold values for 3 zones of CRM to predict hemorrhage. Optimal levels for red, yellow, and green areas of the dashboard view were stratified as follows: red if CRM<30%, yellow if CRM=30-59%, and green if CRM≥60%. Odds of hemorrhage increased by 12-fold (OR, 12.2; 95%CI, 3.8-38.9) with CRM<30% (red) and 6.5-fold (OR, 6.5; 95%CI, 2.7-15.9) with CRM=30-59% (yellow) when compared to patients with CRM≥60%. ROCAUC for 3-zone CRM was similar to that of continuous CRM (0.77 vs. 0.79), but further increased the ability to predict hemorrhage after adjusting for ISS (ROCAUC = 0.87).

Conclusion: A 3-zone CRM could be a potentially useful predictor of hemorrhage in trauma patients with added capabilities of continuous monitoring and a real-time ISS assessment. These data substantiate easily interpretable threshold dashboard values for triage with potential to improve injury outcomes.

Level of evidence: Diagnostic, Level II.

Perioperative intravenous low-dose ketamine for neuropathic pain after major lower back surgery: A randomized, placebo-controlled study

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Eur J Pain 2020 Mar;24(3):555-567

Abstract

Background: Chronic pain after major lower back surgery is frequent. We investigated in adults the effect of perioperative low-dose ketamine on neuropathic lower back pain, assessed by the DN4 questionnaire, 6 and 12 months after major lower back surgery.

Methods: In this single-centre randomized trial, 80 patients received intravenous ketamine 0.25 mg/kg preoperatively, followed by 0.25 mg kg-1 hr-1 intraoperatively, and 0.1 mg kg-1 hr-1 from 1 hr before the end of surgery until the end of recovery room stay; 80 controls received placebo.

Results: Preoperatively, 47.4% of patients in the ketamine group and 46.3% in the placebo group had neuropathic pain; 10% and 3.8%, respectively, were using strong opioids. At the end of the infusion, the median cumulative dose of ketamine was 84.8 mg (IQR 67.4-106.7) and the median plasma level was 97 ng/ml (IQR 77.9-128.0). At 6 months, 28.8% of patients in the ketamine group and 23.5% in the placebo group had neuropathic pain (absolute difference, 5.2%; 95% CI -10.7 to 21.1; p = .607). At 12 months, 26.4% of patients in the ketamine group and 17.9% in the placebo group had neuropathic pain (absolute difference 8.5%; 95% CI -6.7 to 23.6; p = .319).

Conclusions: In this patient population with a high prevalence of neuropathic lower back pain undergoing major lower back surgery, a perioperative intravenous low-dose ketamine infusion did not have an effect on the prevalence of neuropathic lower back pain at 6 or 12 months postoperatively.

Significance: We were unable to show any analgesic benefit of a short-term perioperative ketamine infusion as an adjuvant to multimodal analgesia in patients with a high prevalence of neuropathic lower back pain undergoing major back surgery. Based on these data, the widespread opinion that ketamine is universally analgesic across different pain conditions must be challenged.

Use of ketamine for prehospital pain control on the battlefield: A systematic review

Gaël de Rocquigny, Christophe Dubecq, Thibault Martinez, John Peffer, Amandine Cauet, Stéphane Travers, Pierre Pasquier

J Trauma Acute Care Surg 2020 Jan;88(1):180-185

Abstract

Background: Intravenous ketamine is commonly used for pain management in the civilian prehospital setting. Several studies have evaluated its effectiveness in the military setting. To date, there has been no report reviewing the published data on the use of ketamine in this context. The objective of this systematic review was to analyze the content and quality of published data on the use of ketamine for prehospital pain management in military trauma.

Methods: The MEDLINE database was searched for studies on ketamine use in combat prehospital settings, at point of injury or during evacuation, published between 2000 and 2019. The systematic review was conducted following PRISMA guidelines, and the protocol was registered on PROSPERO (CRD42019115728). Civilian reports and case series lacking systematic data collection were excluded.

Results: Eight studies were included with 2029 casualties receiving ketamine. All but one were American reports from Afghanistan and Iraq conflicts. Studies implied retrospective cohorts or prospective observational analysis. Ketamine use rose from 3.9% during the period preceding its addition to the Tactical Combat Casualty Care guidelines in 2012 to 19.8% thereafter. It was the most common analgesic administered (up to 52% of casualties) in one of the studies. Ketamine was more likely given during tactical medical evacuation when no analgesic was provided at the point of injury. The median total intravenous dose was 50 mg. Pain intensity decreased from moderate or severe to mild or none, sometimes after only one dose. In one study, ketamine administration during tactical evacuation was associated with increased systolic blood pressure as opposed to morphine. Incoherent speech, extremity movements, and hallucinations were the main adverse events reported.

Conclusion: Published data on ketamine use in military trauma are rare and heterogeneous. Though, all studies tend to strengthen the belief in the efficacy and safety of ketamine when given at 50-mg to 100-mg intravenous for prehospital analgesia in combat casualties.

Level of evidence: Systematic Review, Level IV

Rare Use of Posterolateral Thoracotomy in an Austere Environment

Rebekah J Devasahayam, Robert A Fabich, Currie A Tighe, Tyson E Becker

Mil Med 2020 Mar 2;185(3-4):530-531

Abstract

A 25-year-old local national male presented to a split Forward Surgical Team after impalement of the posterior chest with a metal fragment. The patient was hemodynamically normal, but no imaging was available to determine the depth of penetration or the size of the internal portion of the fragment. This case represents a rare indication for posterolateral thoracotomy in an austere trauma setting.

Best practices for emergency surgical airway: A systematic review

Elliana K DeVore, Andrew Redmann, Rebecca Howell, Sid Khosla

Laryngoscope Investig Otolaryngol 2019 Nov 19;4(6):602-608

Abstract

Objective: In the case of an emergency surgical airway, current guidelines state that surgical cricothyrotomy is preferable to tracheotomy. However, complications associated with emergency cricothyrotomy may be more frequent and severe. We systematically reviewed the English literature on emergency surgical airway to elicit best practices.

Methods: PubMed, Embase, MEDLINE, and the Cochrane Library were searched from inception to January 2019 for studies reporting emergency cricothyrotomy and tracheotomy outcomes. All English-language retrospective analyses, systematic reviews, and meta-analyses were included. Case reports were excluded, as well as studies with pediatric, nonhuman, or nonliving subjects.

Results: We identified 783 articles, and 20 met inclusion criteria. Thirteen evaluated emergency cricothyrotomy and included 1,219 patients (mean age = 39.8 years); 4 evaluated emergency tracheotomy and included 342 patients (mean age = 46.0 years); 2 evaluated both procedures. The rate of complications with both cricothyrotomy and tracheotomy was comparable. The most frequent early complications were failure to obtain an airway (1.6%) and hemorrhage (5.6%) for cricothyrotomy and tracheotomy, respectively. Airway stenosis was the most common long-term complication, occurring at low rates in both procedures (0.22-7.0%).

Conclusions: Complications associated with emergency cricothyrotomy may not occur as frequently as presumed. Tracheotomy is an effective means of securing the airway in an emergent setting, with similar risk for intraoperative and postoperative complications compared to cricothyrotomy. Ultimately, management should depend on clinician experience and patient characteristics.

Level of evidence: IV

Use of the intubating laryngeal mask airway in the emergency department: A ten-year retrospective review

Brian E Driver, Marc Martel, Tarissa Lai, Tracy A Marko, Robert F Reardon

Am J Emerg Med 2020 Jul;38(7):1367-1372

Abstract

Background: Extraglottic devices, such as the intubating laryngeal mask airway (ILMA), facilitate ventilation and oxygenation and are useful for emergency airway management, especially as rescue devices. In the operating room setting the ILMA has been highly successful. However, its performance in the ED has not been described. We sought to describe the indications for and success of the ILMA when used in the ED.

Methods: We performed retrospective, observational study of patients who had an LMA® Fastrach™ (hereafter termed ILMA) placed in a single ED between 2007 and 2017. Patients were identified by keyword search of ED notes in the electronic medical record. Trained abstractors reviewed charts and videos to determine patient characteristics, indication for ILMA placement, success of oxygenation and ventilation, intubation methods and success, and complications related to the device.

Results: During the study period 218 patients had an ILMA placed in the ED. The ILMA was used as a primary device in 118 patients (54%), and as a rescue device in 100 patients (46%). The median number of ILMA uses per faculty physician during the study period was 3. The ILMA oxygenated and ventilated successfully in 212 instances (98%), including 96 times (96%) when used as a rescue airway. Failure of oxygenation was due to tracheal injury (2), abnormal laryngeal inlet anatomy (2), or poor operator technique (1). Intubation through the ILMA was successful in 159 of 192 patients (83%), including a success rate of 81% (112 of 139 patients) with blind intubation.

Conclusion: The ILMA was highly successful in oxygenation, with reasonable intubation success, even when used infrequently by emergency physicians. The ILMA should be considered a valuable primary and rescue intubation device in the ED.

Prehospital Mortality Due to Hemorrhagic Shock Remains High and Unchanged: A Summary of Current Civilian EMS Practices and New Military Changes

Juan Duchesne, Sharven Taghavi, August Houghton, Mansoor Khan, Bruno Perreira, Bryan Cotton, Danielle Tatum, Megan Brenner, Paula Ferrada, Tal Horer, David Kauvar, Andrew Kirkpatrick, Carlos Ordonez, Artai Priouzram, Derek Roberts, Damage Control Resuscitation Committee

Shock 2020 Feb 19; Online ahead of print

Abstract

Mortality secondary to trauma related hemorrhagic shock has not improved for several decades. Underlying the stall in progress is the conundrum of effective pre-hospital interventions for hemorrhage control. As we know, neither pressing hard on the gas nor "Stay and play" have changed mortality over the last 20 years. For this reason, when dealing with effective changes that will improve severe hemorrhage mortality outcomes, there is a need for the creation of a hybrid pre-hospital model. Improvements in mortality outcomes for patients with severe hemorrhage based on evidence for common civilian prehospital procedures such as in-field intubation and immediate fluid resuscitation with crystalloid solution is weak at best. The use of tourniquets, once considered too risky to use, however, has risen dramatically in large part due success seen during their use in the military. Their use in the civilian setting shows promising results. Recently updated military Advanced Resuscitative Care (ARC) guidelines propose the use of prehospital whole blood transfusion as well as in-field use of Zone 1 Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA). Several case studies from Europe suggest these strategies are feasible for use in the civilian population, but could they be implemented in the U.S.?

Traumatic Brain Injuries: Unreported and Untreated in an Army Population

Sandra M Escolas, Margie Luton, Hamid Ferdosi, Bianca D Chavez, Scot D Engel

Mil Med 2020 Jan 7;185(Suppl 1):154-160

Abstract

Introduction: In 2008, it was reported that 19.5% of service members previously deployed experienced a mild traumatic brain injury (mTBI). Fifty-seven percent of those did not seek medical care. It was suggested that concerns with seeking care involved confidentiality and career issues. Objective: This study addressed mTBI history, medical treatment history, and stigmas associated with mTBI/concussion.

Materials and methods: An anonymous questionnaire was developed. Data collection occurred throughout March 2018 in conjunction with Brain Injury Awareness Month activities.

Results: All 5,174 volunteers were Army; 86% male; 87% were between 18 and 34 years old; 89% had <14 years in the military; 35% had a combat deployment; and 10% reported having one or more mTBIs in their military careers. Of the Soldiers who reported a concussion, 52% sought medical care. Of those not seeking care, 64% reported they did not think the injury required care, followed by 18% fearing negative impact on their career. Twenty-eight percent who experienced an mTBI versus 11% who have not reported that there is a stigma associated with an mTBI.

Conclusions: Soldiers sometimes failed to report their suspected concussions and did not seek medical care. Educational efforts may increase reporting of and medical screening for potentially concussive events. Future research to determine the ramifications of unreported and untreated mTBIs/concussions is recommended.

Is fascia iliaca compartment block administered by paramedics for suspected hip fracture acceptable to patients? A qualitative study

Bridie Angela Evans, Alan Brown, Greg Fegan, Simon Ford, Katy Guy, Jenna Jones, Sian Jones, Leigh Keen, Ashrafunnesa Khanom, Mirella Longo, Ian Pallister, Nigel Rees, Ian T Russell, Anne C Seagrove, Alan Watkins, Helen Snooks

BMJ Open 2019 Dec 19;9(12):e033398

Abstract

Objective: To explore patients' experience of receiving pain relief injection for suspected hip fracture from paramedics at the location of the injury.

Design: Qualitative interviews within a feasibility trial about an alternative to routine prehospital pain management for patients with suspected hip fracture.

Setting: Patients treated by paramedics in the catchment area of one emergency department in South Wales.

Participants: Six patients and one carer of a patient who received fascia iliaca compartment block (FICB).

Intervention: FICB administered to patients with suspected hip fracture by trained paramedics. We randomly allocated eligible patients to FICB-a local anaesthetic injection directly into the hip region-or usual care-most commonly morphine-using audited scratch cards.

Outcomes: Acceptability and experience of receiving FICB, assessed through interview data. We audio-recorded, with participants' consent, and conducted thematic analysis of interview transcripts. The analysis team comprised two researchers, one paramedic and one lay member.

Results: Patients had little or no memory of being offered, consenting to or receiving FICB. They recalled the reassuring manner and high quality of care received. They accepted FICB without question. Partial or confused memory characterised experience of subsequent hospital care until surgery. They said their priorities when calling for emergency help were to receive effective care. After hospital treatment, they wanted to regain their health and mobility and resume the quality of life they experienced before their injury.

Conclusions: This study did not raise any concerns about the acceptability of FICB administered at the scene of injury by paramedics to people with suspected hip fracture. It adds to existing evidence about patient and carer experience of on-scene care for people with suspected hip fracture. Further research is needed to assess safety, effectiveness and cost effectiveness of this health technology in a new setting.

Slow and Risky to Safe and Briskly: Modern Implementation of Whole Blood

Andrew D Fisher, Ethan A Miles, Stacy Shackelford

J Spec Oper Med Spring 2020;20(1):21-25.

Saving lives on the battlefield goes beyond eliminating what is currently considered preventable deaths and encompasses the treatment of potentially survivable injuries. Eliminating potentially preventable deaths is a driving force for identifying and implementing advanced treatment strategies. Potentially survivable injuries present a difficult challenge to the combat medic, because noncompressible torso hemorrhage (NCTH) can be particularly complex to treat. Without timely surgical care, many casualties in the potentially survivable category will die because immediate evacuation is not always possible. Therefore, the focus of training and treatment should be on eliminating preventable death and the management of potentially survivable injuries through damage control resuscitation (DCR) and advancing treatment for NCTH.

The lessons learned from prior wars continue to be relevant as we adapt them to today's conflicts. We must seek evolving technological material solutions as well as techniques from the past and future to save lives. As the TCCC community, we must not forget to continue to master the basics and eliminate preventable death while we push on toward saving the potentially survivable.

Prehospital Vasopressor Use Is Associated with Worse Mortality in Combat Wounded

Andrew D Fisher, Michael D April, Cord Cunningham, Steven G Schauer

Prehosp Emerg Care 2020 Mar 20;1-6

Abstract

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

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

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

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

An analysis of the incidence of hypothermia in casualties presenting to emergency departments in Iraq and Afghanistan

Andrew D Fisher, Michael D April, Steven G Schauer

Am J Emerg Med 2019 Dec 9;S0735-6757(19)30792-2

Introduction: Hypothermia on the battlefield has been shown to be associated with severe injury and higher mortality. The incidence of battlefield casualties presenting with hypothermia are described.

Methods: The Department of Defense Trauma Registry (DoDTR) was queried from January 2007 to August 2016. We identified casualties with a documented temperature of <32°Celsius (C) (severe), 32-33.9 °C (moderate), 34-36 °C (mild). We defined serious injuries as those resulting in an AIS of ≥3 by body region.

Results: There were 25,484 records with at least one documented temperature and 2501 (9.8%) casualties with hypothermia within our range. Nineteen (0.75%) casualties presented with severe hypothermia, 225 (9%) with moderate, and 2257 (90%) with mild. The mean injury severity score (ISS) for non-hypothermic, mild, moderate, and severe hypothermic casualties was 8 [4-14], 14 [6-24], 21 [13-29], and 21 [9-25], ($p < 0.001$), respectively. Survival for casualties with severe hypothermia was 57.8%, moderate 80.9%, mild hypothermia 90.9%, and non-hypothermic group 97.6%, $p<0.001$. When adjusting for composite injury score, patient category, mechanism of injury, and location, this finding remained significant (OR 0.27, 0.21-0.34, $p<0.001$). Massive transfusion was more common in hypothermia casualties n = 566 (19%) versus non-hypothermic recipients n = 1734 (6.9%), $p < 0.001$.

Conclusions: Though the number of casualties that presented hypothermic was small, their injuries were more severe, and were more likely to receive massive blood transfusions. This cohort also had a higher mortality rate, a finding which held when adjusting for confounders. There appears to be an opportunity to improve hypothermia prevention for combat.

Management of hypoxaemia in the critically ill patient

Luke Flower, Daniel Martin

Br J Hosp Med (Lond) 2020 Jan 2;81(1):1-10

Abstract

Hypoxaemia is a common presentation in critically ill patients, with the potential for severe harm if not addressed appropriately. This review provides a framework to guide the management of any hypoxaemic patient, regardless of the clinical setting. Key steps in managing such patients include ascertaining the severity of hypoxaemia, the underlying diagnosis and implementing the most appropriate treatment. Oxygen therapy can be delivered by variable or fixed rate devices, and non-invasive ventilation; if patients deteriorate they may require tracheal intubation and mechanical ventilation. Early critical care team involvement is a key part of this pathway. Specialist treatments for severe hypoxaemia can only be undertaken on an intensive care unit and this field is developing rapidly as trial results become available. It is important that each new scenario is approached in a structured manner with an open diagnostic mind and a clear escalation plan.

The utility of the brain trauma evidence to inform paramedic rapid sequence intubation in out-of-hospital stroke

Pieter Francsois Fouche, Paul Andrew Jennings, Malcolm Boyle, Stephen Bernard, Karen Smith

BMC Emerg Med 2020 Jan 28;20(1):5

Abstract

Background: Rapid sequence intubation (RSI) is used to secure the airway of stroke patients. Randomized controlled trial evidence exists to support the use of paramedic RSI for traumatic brain injury (TBI), but cannot necessarily be applied to stroke RSI because of differences between the stroke and TBI patient. To understand if the TBI evidence can be used for stroke RSI, we analysed a retrospective cohort of TBI and strokes to compare how survival is impacted differently by RSI when comparing strokes and TBI.

Methods: This study was a retrospective analysis of 10 years of in-hospital and out-of-hospital data for all stroke and TBI patients attended by Ambulance Victoria, Australia. Logistic regression predicted the survival for ischemic and haemorrhagic strokes as well as TBI. The constituents of RSI, such a medications, intubation success and time intervals were analysed against survival using interactions to asses if RSI impacts survival differently for strokes compared to TBI.

Results: This analysis found significant interactions in the RSI-only group for age, number of intubation attempts, atropine, fentanyl, pulse rate and perhaps scene time and time- to-RSI. Such interactions imply that RSI impact survival differently for TBI versus strokes. Additionally, no significant difference in survival for TBI was found, with a - 0.7% lesser survival for RSI compared to no-RSI; OR 0.86 (95% CI 0.67 to 1.11; p = 0.25). Survival for haemorrhagic stroke was - 14.1% less for RSI versus no-RSI; OR 0.44 (95% CI 0.33 to 0.58; p = 0.01) and was - 4.3%; OR 0.67 (95% CI 0.49 to 0.91; p = 0.01) lesser for ischemic strokes.

Conclusions: Rapid sequence intubation and related factors interact with stroke and TBI, which suggests that RSI effects stroke survival in a different way from TBI. If RSI impact survival differently for strokes compared to TBI, then perhaps the TBI evidence cannot be used for stroke RSI.

Evaluation of helmet and goggle designs by modeling non-penetrating projectile impacts

Rinat Friedman, Ayelet Haimy, Yoram Epstein, Amit Gefen

Comput Methods Biomech Biomed Engin 2019 Feb;22(3):229-242

Abstract

Despite the progress in developing personal combat-protective gear, eye and brain injuries are still widely common and carry fatal or long-term repercussions. The complex nature of the cranial tissues suggests that simple methods (e.g. crash-dummies) for testing the effectiveness of personal protective gear against non-penetrating impacts are both expensive and ineffective, and there are ethical issues in using animal or cadavers. The present work presents a versatile testing framework for quantitatively evaluating protective performances of head and eye combat-protective gear, against non-penetrating impacts. The biomimetic finite element (FE) head model that was developed provides realistic representation of cranial structure and tissue properties. Simulated crash impact results were validated against a former cadaveric study and by using a crash-phantom developed in our lab. The model was then fitted with various helmet and goggle designs onto which a non-penetrating ballistic impact was applied. Example data show that reduction of the elastic and shear moduli by 30% and 80% respectively of the helmet outer Kevlar-29 layer, lowered intracranial pressures by 20%. Our modeling suggests that the level of stresses that develop in brain tissues, which ultimately cause the brain damage, cannot be predicted solely by the properties of the helmet/goggle materials. We further found that a reduced contact area between goggles and face is a key factor in reducing the mechanical loads transmitted to the optic nerve and eye balls following an impact. Overall, this work demonstrates the simplicity, flexibility and usefulness for development, evaluation, and testing of combat-protective equipment using computational modeling. Highlights A finite element head model was developed for testing head gear. Reduced helmet's outer layer elastic and shear moduli lowered intracranial stresses. Gear material properties could not fully predict impact-related stress in the brain. Reduced goggles-face contact lowered transmitted loads to the optic nerve and eyes.

Applying trauma systems concepts to humanitarian battlefield care: a qualitative analysis of the Mosul trauma pathway

Kent Garber, Adam L Kushner, Sherry M Wren, Paul H Wise, Paul B Spiegel

Confl Health 2020 Feb 4;14:5

Abstract

Background: Trauma systems have been shown to save lives in military and civilian settings, but their use by humanitarians in conflict settings has been more limited. During the Battle of Mosul (October 2016-July 2017), trauma care for injured civilians was provided through a novel approach in which humanitarian actors were organized into a trauma pathway involving echelons of care, a key component of military trauma systems. A better understanding of this approach may help inform trauma care delivery in future humanitarian responses in conflicts.

Methodology: A qualitative study design was used to examine the Mosul civilian trauma response. From August-December 2017, in-depth semi-structured interviews were conducted with stakeholders (n = 54) representing nearly two dozen organizations that directly participated in or had first-hand knowledge of the response. Source document reviews were also conducted. Responses were analyzed in accordance with a published framework on civilian battlefield trauma systems, focusing on whether the response functioned as an integrated trauma system. Opportunities for improvement were identified.

Results: The Mosul civilian trauma pathway was implemented as a chain of care for civilian casualties with three successive echelons (trauma stabilization points, field hospitals, and referral hospitals). Coordinated by the World Health Organization, it comprised a variety of actors, including non-governmental organizations, civilian institutions, and at least one private medical company. Stakeholders generally felt that this approach improved access to trauma care for civilians injured near the frontlines compared to what would have been available. Several trauma systems elements such as transportation, data collection, field coordination, and post-operative rehabilitative care might have been further developed to support a more integrated system.

Conclusions: The Mosul trauma pathway evolved to address critical gaps in trauma care during the Battle of Mosul. It adapted the concept of echelons of care from western military practice to push humanitarian actors closer to the frontlines and improve access to care for injured civilians. Although efforts were made to incorporate some of the integrative components (e.g. evidence-based pre-hospital care, transportation, and data collection) that have enabled recent achievements by military trauma systems, many of these proved difficult to implement in the Mosul context. Further discussion and research are needed to determine how trauma systems insights can be adapted in future humanitarian responses given resource, logistical, and security constraints, as well as to clarify the responsibilities of various actors.

Successful endotracheal intubation following a failed first attempt during aeromedical retrieval

John Glasheen, Jeff Hooper, Andrew Donohue, Emmeline Finn, Bronwyn Murray-Smith, Renée Bolot, Mark Edwards

Emerg Med J 2020 May;37(5):314-318

Abstract

Introduction: First attempt intubation success is used by many prehospital services as a marker of quality and safety. An increasing complication rate is associated with repeated intubation attempts. The aim of this study was to identify changes to intubation technique following a failed intubation attempt.

Methods: LifeFlight Retrieval Medicine provides aeromedical retrieval services in Queensland, Australia. This retrospective study identified cases of failed intubation attempts from an electronic database registry over a 41-month period from March 2015 to July 2018. These data were analysed using descriptive statistics.

Results: Of the 762 patients who required intubation 758 (99.5%) were successfully intubated, with 684 intubated at the first attempt (89.8%; 95% CI: 0.87 to 0.92). There was no difference in first attempt success between direct and video laryngoscopy (511/563 (90.8%) vs 172/194 (88.6%) p=0.38), trauma or medical (374/419 (89.3%) vs 310/343 (90.4%), p=0.61), primary or interhospital missions (329/370 (88.7%) vs 355/392 (90.8%), p=0.33). 78 cases of failed first attempt intubations were identified. In 65 of these cases, intubation was successful at the second attempt. A single change was made to the intubation procedure prior to a second successful attempt in 28/78 cases (35.9%), and more than one change was made in 41/78 (52.6%). The changes included the operator, intubation device, patient position, intubating aid and external laryngeal manipulation. No change between attempts was recorded in 9/78 (11.5%). 9 cases were successfully intubated at the third attempt, and changes prior to the third attempt included operator, device and intubating aid.

Conclusion: Although a high overall intubation success was found, one in ten patients who were intubated had a failed first attempt. The majority of successful subsequent attempts were preceded by at least one change to intubating technique. Intubating clinicians need the ability to identify and correct issues leading to a failed first attempt.

Beyond validation: getting health apps into clinical practice

William J Gordon, Adam Landman, Haipeng Zhang, David W Bates

NPJ Digit Med 2020 Feb 3;3:14

Abstract

Fueled by advances in technology, increased access to smartphones, and capital investment, the number of available health "apps" has exploded in recent years. Patients use their smartphones for many things, but not as much as they might for health, especially for managing their chronic conditions. Moreover, while significant work is ongoing to develop, validate, and evaluate these apps, it is less clear how to effectively disseminate apps into routine clinical practice. We propose a framework for prescribing apps and outline the key issues that need to be addressed to enable app dissemination in clinical care. This includes: education and awareness, creating digital formularies, workflow and EHR integration, payment models, and patient/provider support. As work in digital health continues to expand, integrating health apps into clinical care delivery will be critical if digital health is to achieve its potential.

Ultrasound for airway management: An evidence-based review for the emergency clinician

Michael Gottlieb, Dallas Holladay, Katharine M Burns, Damali Nakitende, John Bailitz

Am J Emerg Med 2020 May;38(5):1007-1013

Abstract

Background: Airway management is a common procedure performed in the Emergency Department with significant potential for complications. Many of the traditional physical examination maneuvers have limitations in the assessment and management of difficult airways. Point-of-care ultrasound (POCUS) has been increasingly studied for the evaluation and management of the airway in a variety of settings.

Objective: This article summarizes the current literature on POCUS for airway assessment, intubation confirmation, endotracheal tube (ETT) depth assessment, and performing cricothyroidotomy with an emphasis on those components most relevant for the Emergency Medicine clinician.

Discussion: POCUS can be a useful tool for identifying difficult airways by measuring the distance from the skin to the thyrohyoid membrane, hyoid bone, or epiglottis. It can also predict ETT size better than age-based formulae. POCUS is highly accurate for confirming ETT placement in adult and pediatric patients. The typical approach involves transtracheal visualization but can also include lung sliding and diaphragmatic elevation. ETT depth can be assessed by visualizing the ETT cuff in the trachea, as well as using lung sliding and the lung pulse sign. Finally, POCUS can identify the cricothyroid membrane more quickly and accurately than the landmark-based approach.

Conclusion: Airway management is a core skill in the Emergency Department. POCUS can be a valuable tool with applications ranging from airway assessment to dynamic cricothyroidotomy. This paper summarizes the key literature on POCUS for airway management.

Fixed Wing Tactical Aircraft for Air Medical Evacuation in Sahel

Pierre Guénot, Vincent Beauchamps, Samuel Madec, Cyril Carfantan, Mathieu Boutonnet, Laura Bareau, Hélène Romain, Stéphane Travers

Air Med J Sep-Oct 2019;38(5):350-355

Abstract

Objective: The medical support of military operations over a 5 million km2 area in the Sahel-Saharan strip has justified the use of a medical fixed wing aircraft. Two CASA CN 235 aircraft currently perform medical evacuation (medevac) from the point of injury to forward surgical structures and then to the international airport before strategic medevac to France.

Methods: A retrospective observational study including all flights performed from January 2013 to December 2017 by the medical CASA located in Mali.

Results: Three thousand three flight hours were achieved. Four hundred twenty-four medevacs were performed for 898 patients. Seventy-five percent were evacuated from forward surgical structures. Their initial categorization included 10% Alpha, 23% Bravo, and 67% Charlie. Mechanical ventilation was performed for 5%; 34.5% had common medical or surgical pathologies, 34.2% were combat casualties mostly by explosion, and 18.7% were nonbattle injuries. No difficulties related to the aeronautical environment were reported by the teams.

Conclusion: Tactical medevac with fixed wing aircraft has become a crucial link in the French medical evacuation chain in remote areas. Military emergency medical teams were able to provide in-flight intensive care before and after damage control surgery. Discussions are underway to consider possible doctrinal and logistical evolutions.

Maintaining Surgical Readiness While Deployed to Low-Volume Military Treatment Facilities: A Pilot Program for Clinical and Operational Sustainment Training in the Deployed Environment

Jennifer M Gurney, Will C Cole, John C Graybill, Stacy A Shackelford, Darin K Via

Mil Med 2020 Jan 7;185(Suppl 1):508-512

Introduction: Maintaining readiness among Army surgeons is increasingly challenging because of declining operative experience during certain deployments. Novel solutions should be considered.

Materials and methods: A pilot program was conducted to rotate surgical teams from a military treatment facility with a low volume of combat casualty care to one with a higher volume. Pre- and postrotation surveys were conducted to measure relative operative experience, trauma experience, and perceived readiness among rotators.

Results: Operative volumes and trauma volumes were increased and that perceived readiness among rotators, especially those with the fewest previous deployments, was improved.

Conclusions: Maintaining readiness among Army surgeons is a difficult task, but a combination of increased trauma care while in garrison, as well as increased humanitarian care during deployments, may be helpful. Additionally, rotating providers from facilities caring for few combat casualties to facilities caring for more combat casualties may also be feasible, safe, and helpful.

Tactical Combat Casualty Care Training, Knowledge, and Utilization in the US Army

Jennifer M Gurney, Caryn A Stern, Russ S Kotwal, Cord W Cunningham, Dallas R Burelison, Kirby R Gross, Harold R Montgomery, Edward H Whitt, Clinton K Murray, Zsolt T Stockinger, Frank K Butler, Stacy A Shackelford

Mil Med 2020 Jan 7;185(Suppl 1):500-507

Abstract

Introduction: Tactical Combat Casualty Care (TCCC) is the execution of prehospital trauma skills in the combat environment. TCCC was recognized by the 2018 Department of Defense Instruction on Medical Readiness Training as a critical wartime task. This study examines the training, understanding, and utilization of TCCC principles and guidelines among US Army medical providers and examines provider confidence of medics in performing TCCC skills.

Materials and methods: A cross-sectional survey, developed by members of the Committee on TCCC, was distributed to all US Army Physicians and Physician Assistants via anonymous electronic communication.

Results: A total of 613 completed surveys were included in the analyses. Logistic regression analyses were conducted on: TCCC test score of 80% or higher, confidence with medic utilization of TCCC, and medic utilization of ketamine in accordance with TCCC.

Conclusions: <60% of respondents expressed confidence in the ability of the medics to perform all TCCC skills. Supervising providers who that believed 80 to 100% of their medics had completed TCCC training had more confidence in their medic's TCCC abilities. With TCCC, a recognized lifesaver on the battlefield, continued training and utilization of TCCC concepts are paramount for deploying personnel.

The Prehospital Evaluation and Care of Moderate/Severe TBI in the Austere Environment

Jennifer M Gurney, Paul E Loos, Mayumi Prins, David W Van Wyck, Randall R McCafferty, Donald W Marion

Mil Med 2020 Jan 7;185(Suppl 1):148-153

Abstract

Increased resource constraints secondary to a smaller medical footprint, prolonged evacuation times, or overwhelming casualty volumes all increase the challenges of effective management of traumatic brain injury (TBI) in the austere environment. Prehospital providers are responsible for the battlefield recognition and initial management of TBI. As such, targeted education is critical to efficient injury recognition, promoting both provider readiness and improved patient outcomes. When austere conditions limit or prevent definitive treatment, a comprehensive understanding of TBI pathophysiology can help inform acute care and enhance prevention of secondary brain injury. Field deployable, noninvasive TBI assessment and monitoring devices are urgently needed and are currently undergoing clinical evaluation. Evidence shows that the assessment, monitoring, and treatment in the first few hours and days after injury should focus on the preservation of cerebral perfusion and oxygenation. For cases where medical management is inadequate (eg, evidence of an enlarging intracranial hematoma), guidelines have been developed for the performance of cranial surgery by nonneurosurgeons. TBI management in the austere environment will continue to be a challenge, but research focused on improving evidence-based monitoring and therapeutic interventions can help to mitigate some of these challenges and improve patient outcomes.

A Blended Prehospital Ultrasound Curriculum for Critical Care Paramedics

Andrew Guy, Anthony Bryson, Stephen Wheeler, Neilson McLean, Hussein D Kanji

Air Med J Nov-Dec 2019;38(6):426-430

Abstract

Objective: Point-of-care ultrasound is a nascent and growing area of prehospital care. Most previously described ultrasound curricula for paramedics examine a single type of ultrasound scan. Here, we describe the implementation and evaluation of a prehospital ultrasound curriculum using a blended model of traditional didactics and hands-on experience with online prereading.

Methods: We recruited a prospective convenience sample of critical care paramedics without prior ultrasound experience to take part in a 2-day ultrasound course. All participants completed prereading modules built from online resources followed by a didactic review of the material and hands-on practice. Ultrasound examinations included extended focused abdominal sonography in trauma, cardiac ultrasound, thoracic ultrasound, and vascular ultrasound. A written examination evaluated ultrasound theory and image interpretation, and a practical examination evaluated image acquisition.

Results: Seventeen critical care paramedics completed the course with a mean grade on the written examination of 76%, with 76% of paramedics achieving the predetermined passing mark of 70% or greater. All paramedics passed the practical examination.

Conclusion: The implementation of a prehospital critical care ultrasound program is feasible in our provincial emergency medical services system. Further assessment is necessary to determine future knowledge and skill retention as well as clinical application and utility in real-world settings.

Patient Transportation Delays and Effects on Operation Theatres' Efficiency: A Study for Problem Analysis and Remedial Measures

Rudrashish Haldar, Devendra Gupta, Hemchandra Pandey, Shashi Srivastava, Prabhakar Mishra, Anil Agarwal

Anesth Essays Res Jul-Sep 2019;13(3):554-559

Abstract

Background and aims: Delay in patients' transportation to the operating theater (OT) is a globally recognized phenomenon, leading to delay in the subsequent processes (anesthesia induction, surgery, and patient turnover). This observational study was conducted to evaluate the common reasons for delay in transporting patients to the neurosurgery OT complex and its consequent effects and how the elimination of these reasons by application of feasible measures can influence the after effects.

Settings and design: This was an anesthesiologist-based audit of transportation process of patients to the OT complex of a tertiary care teaching hospital to identify the impediments and effects of delay, suggest and implement remedial measures, and assess the outcomes.

Materials and methods: The movement process of successive 551 patients was studied. In the evaluation phase, common reasons for transportation delays were identified. The incidences of consequent effects such as second-case cancellations and overrunning of OTs beyond scheduled hours were noted. In the implementation phase, corrective measures were instituted and the incidences of delays and the consequent effects were again noted.

Statistical analysis: Statistical analysis was performed using SPSS 17.0.

Results: In the evaluation phase (303 patients), common reasons for delays included porter-associated delays (15), unavailable lifts (7), and pediatric patients (6). The incidences of case cancellation (20) and overrunning of OTs (9) were high. In the implementation phase, after remedial measures were enforced, the incidences of delays due to porter, lifts, and pediatric patients dropped to 1, 6, and 0, respectively. Simultaneously, a decrease in second-case cancellation (2) and overrunning of OTs (7) also reduced. As an additional finding, a significant reduction in OT turnover times was also observed (16.31 ± 9.29 min vs. 11.70 ± 5.78 min).

Conclusions: Analysis of common reasons of patient transportation delays and removal of these impediments can markedly improve the efficiency in OT functioning.

Tranexamic acid for acute traumatic hemorrhage in emergency medicine: why not, but…

Matthieu Heidet

Eur J Emerg Med 2020 Apr;27(2):85-86

Current guidelines broadly recommend using TXA in severely injured patients. While TXA appears to be cheap, easy, well tolerated and efficient, clinicians should remain aware of the limitations of the available results, remind that TXA should be used within precise indications, in accordance with broader key practices in trauma patients, and look forward to answering pending interrogations. Clinicians should adopt a cautious approach in order to limit their use of TXA to the most severe patients and stay aware that many gaps remain unanswered to date. Current strategy of ‘rapid TXA for all’ may improperly lead to overexpose
patients who would not benefit from this practice.

Is prehospital endobronchial intubation a risk factor for subsequent ventilator associated pneumonia? A retrospective analysis

Ana Catalina Hernandez Padilla, Timothée Trampont, Thomas Lafon, Thomas Daix, Dominique Cailloce, Olivier Barraud, François Dalmay, Philippe Vignon, Bruno François

PLoS One 2019 May 23;14(5):e0217466

Abstract

More than half of patients under mechanical ventilation in the intensive care unit (ICU) are field-intubated, which is a known risk factor for ventilator associated pneumonia (VAP). We assessed whether field endobronchial intubation (EBI) is associated with the development of subsequent VAP during the ICU stay. This retrospective, nested case-control study was conducted in a cohort of field-intubated patients admitted to an ICU of a teaching hospital during a three-year period. Cases were defined as field-intubated patients with EBI and controls corresponded to field-intubated patients with proper position of the tracheal tube on admission chest X-ray. Primary endpoint was the development of early VAP. Secondary endpoints included the development of early ventilator associated tracheo-bronchitis, late VAP, duration of mechanical ventilation, length of stay and mortality in the ICU. A total of 145 patients were studied (mean age: 54 ± 19 years; men: 74%). Reasons for field intubation were predominantly multiple trauma (49%) and cardiorespiratory arrest (38%). EBI was identified in 33 patients (23%). Fifty-three patients (37%) developed early or late VAP. EBI after field intubation was associated with a nearly two-fold increase of early VAP, though not statistically significant (30% vs. 17%: p = 0.09). No statistically significant difference was found regarding secondary outcomes. The present study suggests that inadvertent prehospital EBI could be associated with a higher incidence of early-onset VAP. Larger studies are required to confirm this hypothesis. Whether strategies aimed at decreasing the incidence and duration of EBI could reduce the incidence of subsequent VAP remains to be determined.

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

Ian L Hudson, Megan B Blackburn, Amanda M Staudt, Kathy L Ryan, Elizabeth A Mann-Salinas

Mil Med 2020 Jan 7;185(Suppl 1):10-18

Abstract

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

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

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

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

Evaluation and Management of Sports-Related Lacerations of the Head and Neck

Andrew Hyden, Matthew Tennison

Curr Sports Med Rep 2020 Jan;19(1):24-28

Abstract

Soft tissue injuries to the head and neck are a common occurrence in sports. These anatomical regions are somewhat predisposed because of the "athletic stance" that is utilized in many close-contact sports. Although appropriate use of protective equipment, including mouth guards, helmets, and face shields, has reduced the incidence and severity of these injuries, they still occur regularly. To provide appropriate medical care, one must possess adequate knowledge of the superficial and deep anatomical structures, fundamental knowledge and skill in regard to wound care, and awareness of potential poor outcomes related to lacerations of unique structures, such as the mouth, eye, or ear.

Platelet Function: Meloxicam Intravenous in Whole Blood Samples From Healthy Volunteers

Jonathan S Jahr, Shawn Searle, Stewart McCallum, Randall Mack, Kim Minger, Alex Freyer, Wei Du, Sue Hobson

Clin Pharmacol Drug Dev 2020 Jan 21. Online ahead of print.

Abstract

Nonsteroidal anti-inflammatory drugs (NSAIDs) are effective treatments for pain but may induce bleeding events due to platelet dysfunction associated with inhibition of cyclooxygenase (COX)-1 impairing thromboxane production. An intravenous nanocrystal formulation of meloxicam, a COX-2 preferential nonsteroidal anti-inflammatory drug, is under development for the treatment of moderate to severe pain. This single-center ex vivo study evaluated the effect of meloxicam intravenous and ketorolac on platelet function in whole blood samples from healthy volunteers. Each whole blood sample was aliquoted to allow analysis using a platelet function analyzer under negative control (untreated), positive control (2 therapeutic ketorolac concentrations), and meloxicam intravenous (1 therapeutic, 3 supratherapeutic concentrations) using both collagen with epinephrine and collagen with adenosine diphosphate reagent cartridges. The platelet function analyzer determines closure time by simulating platelet adhesion and aggregation following vascular injury. The final analysis set included data from 8 subjects. The collagen with adenosine diphosphate analysis (sensitive to thrombocytopathies) showed no significant differences in closure time for meloxicam- or ketorolac-treated samples and untreated control. The collagen with epinephrine analysis (sensitive to aspirin-induced platelet abnormalities) produced no significant difference in closure time between any meloxicam concentration and untreated control. Ketorolac was associated with significantly longer closure times vs untreated control at both the 2.5- and 5-μg/mL concentrations (P = .003 and .0257, respectively) and vs meloxicam at several concentrations. Similar results were observed when all analyzed samples were included. Meloxicam intravenous had no significant effect on closure times at therapeutic or supratherapeutic concentrations in this ex vivo study.

The effects of QuikClot Combat Gauze and Celox Rapid on hemorrhage control

Don Johnson, Michelle Johnson

Am J Disaster Med 2019 Winter;14(1):17-23

Abstract

Objective: Compare QuikClot Combat Gauze (QCG) and Celox Rapid (CR) for initial hemostasis and over a 1-hour period.

Design: Experimental study.

Setting: Approved animal laboratory.

Subjects: Twenty-one Yorkshire swine.

Interventions: Subjects were randomly assigned to either the QCG (n = 11) or CR (n = 10) group. An arteriotomy was made in the right femoral artery with a 6-mm vascular punch. Bleeding was allowed for 45 seconds. QCG or CR was applied followed by firm pressure for 3 minutes according to Committee on Tactical Combat Casualty Care guidelines. A 10-pound weight simulating a pressure dressing was applied, and the wound was observed for 1 hour. Dressing failure was bleeding > 2 percent of blood volume.

Main outcome measures: Achievement and maintenance of hemostasis and amount of hemorrhage during observation. Odds of successful hemostasis.

Results: QCG was significantly better than CR in initial hemostasis ($p = 0.049$) and maintaining hemostasis over 1 hour ($p = 0.020$). One hundred percent of QCG subjects and 70 percent of CR subjects achieved initial hemostasis. During the 1-hour observation, one additional CR subject failed to maintain hemostasis. CR had significantly more hemorrhage than QCG during the 1-hour observation ($p = 0.027$). QCG had no bleeding compared to CR that had a mean of 162 ± 48 mL (standard error of mean) over 2 minutes. QCG had 15.9 times greater odds of success compared to CR over a period of 1 hour. Over the 1-hour observation time, 100 percent of QCG achieved hemostasis compared to 60 percent of CR.

Prehospital Whole Blood in SOF: Current Use and Future Directions

Thomas B Jones, Virgil L Moore, Akira A Shishido

J Spec Oper Med Winter 2019;19(4):88-90.

Abstract

The US Joint Trauma System (JTS) recommends stored whole blood (SWB) as the preferred product for prehospital resuscitation of battlefield casualties in both their Tactical Combat Casualty Care (TCCC) guidelines and their clinical practice guidelines (CPGs). Clinical data from nearly 2 decades of war during Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) suggest that whole blood (WB) is safe, effective, and far superior to crystalloid and colloid resuscitation fluids. The JTS CPG for whole blood transfusion reflects the most recent clinical evidence but poses unique challenges for execution by Special Operations Forces (SOF) operating in austere environments. Given the limited shelf-life of 35 days, WB requires a constant steady pool of donors. Additionally, the cold-chain requirement for storage poses challenges for SOF on long missions without access to blood refrigerators. SOF operating in less-developed theaters face additional logistical challenges. To mitigate the challenges of WB delivery, US SOF have implemented various protocols to ensure optimal donor pool, awareness/education among medics and specialized equipment for tactical methods of blood-carry and delivery. In general, steps taken include the following: (1) Prior to deployment, soldiers are screened for blood type and titers in order to establish a large donor pool. Support soldiers have been found to be particularly beneficial donors as they typically are in closer proximity to the blood support detachment. (2) In units that operate in smaller teams, such as ODAs, medics are outfitted with "blood kits" to carry blood on missions for point of injury transfusion. In units with larger teams, LTOWB donors are identified on missions and deliver fresh WB in the event of casualties. (3) Medics receive a WB transfusion refresher tabletop exercise and review after action reviews from previous rotations. Additionally, prehospital WB delivery is a required component of scenario-based premission training. The expectation is that medics will administer WB on missions when tactically feasible. Using the prolonged field care framework (ruck, truck, house) as a template, medics now use different methods to store and transport the SWB depending on phase. Medic "truck" and "house" kits include the Dometic CFX™ powered coolers that run on AC, DC, or solar power and allow for constant temperature monitoring. When on foot, medics have been outfitted with tactical blood coolers including the Pelican Biomedical Medic 4™ or Combat Medical Blood Box™ along with a Belmont Buddy-Lite™ intravenous (IV) infusion warmer and IV administration kit with standard micron filter. Presently, SOF medics have the donor support, logistical framework, training, and equipment to deliver WB at the point of injury. However, widespread implementation will require expanded distribution and standardization of "blood kits." Additionally, SOF medical planners must put greater emphasis on education and the importance of WB over crystalloids or colloids-as many medics continue to carry only these products out of convenience. As SOF strive to establish tactics, techniques, and procedures (TTPs) and streamline prehospital WB delivery, we must constantly reassess and refine our procedures, incorporate the latest evidence and technology, and adapt to an evolving battlefield.

BET 1: cervical spine immobilisation in the management of drowning victims

Tom Jones, Alistair Rennie

Emerg Med J 2019 Dec;36(12):766-767

Abstract

A short cut review was carried out to establish whether patients presenting to the emergency department after a near drowning should have cervical spine immobilisation. A search of the literature found only three studies directly relevant to the question. The author, date and country of publication, patient group studied, study type, relevant outcomes, results and study weaknesses of these papers are tabulated. The clinical bottom line is that cervical spine injuries are rare in drowning and near drowning unless there is a history of diving or a fall or signs of trauma. Cervical spine immobilisation should be reserved for cases where there is a reasonable suspicion of a spinal injury.

Improving survival after an emergency resuscitative thoracotomy: a 5-year review of the Trauma Quality Improvement Program

Bellal Joseph, Muhammad Khan, Faisal Jehan, Rifat Latifi, Peter Rhee

Trauma Surg Acute Care Open 2018 Oct 9;3(1):e000201

Abstract

Background: Advancement in trauma care has led to the evolution of emergency resuscitative thoracotomy (ERT) for the revival of trauma patients. We now have more precise understanding of selecting suitable patients for achieving optimal outcomes. The aim of our study was to analyze the utilization and survival trends during the past 5 years, as well as factors that influence survival after ERT.

Methods: A 5-year (2010-2014) analysis of all trauma patients ≥18 years who underwent ERT in the American College of Surgeons Trauma Quality Improvement Program. Outcome measures were utilization rates and survival trends after ERT during the 5-year period. Regression analysis was performed.

Results: 2229 patients underwent ERT, mean age was 37±17 years, 81% were male. Overall 56% patients had penetrating mechanism, location of major injury was thorax in 48, and 71% had signs of life (SOL) on arrival. The overall survival rate was 9.6%. From 2010-2014 ERT utilization has decreased from 331/100 000 to 243/100 000 trauma admissions (p=0.002) and the survival rate has improved from 7.9% to 11.3% (p<0.001). On regression, the independent predictors of survival were penetrating mechanism, age<60 years, SOL on arrival, no prehospital CPR and ISS. No patient aged >60 years with a blunt mechanism of injury (MOI) survived, and there were no survivors above the age of 70 years, regardless of injury mechanism.

Discussion: Utilization of ERT has been decreased during the study period along with improved survival rates. The results of our study demonstrate that performing ERT on patients aged >60 years with a blunt MOI or on any patient aged ≥70 years, regardless of MOI, is futile and should be avoided.

Level of evidence: Level III, prognostic studies.

French lyophilized plasma versus normal saline for post-traumatic coagulopathy prevention and correction: PREHO-PLYO protocol for a multicenter randomized controlled clinical trial

Daniel Jost, Sabine Lemoine, Frederic Lemoine, Vincent Lanoe, Olga Maurin, Clément Derkenne, Marilyn Franchin Frattini, Maëlle Delacote, Edouard Seguineau, Anne Godefroy, Nicolas Hervault, Ludovic Delhaye, Nicolas Pouliquen, Emilie Louis-Delauriere, Julie Trichereau, Florian Roquet, Marina Salomé, Catherine Verret, René Bihannic, Romain Jouffroy, Benoit Frattini, Vivien Hong Tuan Ha, Pascal Dang-Minh, Stéphane Travers, Michel Bignand, Christophe Martinaud, Eliane Garrabe, Sylvain Ausset, Bertrand Prunet, Anne Sailliol, Jean Pierre Tourtier, PREHO-PLYO Study Group

Trials 2020 Jan 22;21(1):106

Abstract

Background: Post-trauma bleeding induces an acute deficiency in clotting factors, which promotes bleeding and hemorrhagic shock. However, early plasma administration may reduce the severity of trauma-induced coagulopathy (TIC). Unlike fresh frozen plasma, which requires specific hospital logistics, French lyophilized plasma (FLYP) is storable at room temperature and compatible with all blood types, supporting its use in prehospital emergency care. We aim to test the hypothesis that by attenuating TIC, FLYP administered by prehospital emergency physicians would benefit the severely injured civilian patient at risk for hemorrhagic shock.

Methods/design: This multicenter randomized clinical trial will include adults severely injured and at risk for hemorrhagic shock, with a systolic blood pressure < 70 mmHg or a Shock Index > 1.1. Two parallel groups of 70 patients will receive either FLYP or normal saline in addition to usual treatment. The primary endpoint is the International Normalized Ratio (INR) at hospital admission. Secondary endpoints are transfusion requirement, length of stay in the intensive care unit, survival rate at day 30, usability and safety related to FLYP use, and other biological coagulation parameters.

Conclusion: With this trial, we aim to confirm the efficacy of FLYP in TIC and its safety in civilian prehospital care. The study results will contribute to optimizing guidelines for treating hemorrhagic shock in civilian settings.

Trial registration: ClinicalTrials.gov, NCT02736812. Registered on 13 April 2016. The trial protocol has been approved by the French ethics committee (CPP 3342) and the French Agency for the Safety of Medicines and Health Products (IDRCB 2015-A00866-43).

Critical Care Transport Time Differences Between Ground, Helicopter VFR, and Helicopter IFR Transports

Tovy H Kamine, Leah Thomas, Collin Davis, Jason Cohen

Aerosp Med Hum Perform 2020 Feb 1;91(2):98-101

Abstract

BACKGROUND: In helicopter critical care and emergency medical services (HEMS) transportation, organizations aim for efficiency of the dispatch process. Most HEMS organizations do not provide transport under instrument flight rules (IFR), due to equipment and training cost. Boston MedFlight (BMF) provides IFR HEMS transport. We set out to determine if response time of IFR transport was superior to ground transport.METHODS: A retrospective analysis of quality improvement data was performed. Data was collected by two observers sitting in the BMF control room in varying shifts. A process map of the dispatch process, from the dispatch call to the vehicle en route was developed. Critical points in the dispatch process were determined and a variety of time differences to determine the length of processes in the dispatch calculated. We compared median time differences between visual flight rules (VFR) flight and IFR flight, between IFR flight and ground transport, and between VFR and Ground for these points using a Mann-Whitney U-test.RESULTS: During the study collection period, 443 transports occurred, of which 109 transports happened while the observers were present: 37 ground, 57 VFR, and 15 IFR. Due to weather, six IFR transports were declined. The overall time from dispatch call to vehicle en route was significantly increased for IFR flights [median: 30 min:8 s (interquartile range 19:06-49:04)] over both VFR flights [11:36 (9:24-17:06); P vs. IFR: 0.001] and ground transports [9:39 (6:59-14.51); P vs. IFR: 0.001]. Most of this increase was accounted for by increases in the time from dispatch to crew acceptance, and from rotor start to vehicle en route.DISCUSSION: IFR conditions resulted in significantly increased dispatch times over both VFR flight and ground transport. The increase is likely a result of weather check, filing an IFR flight plan, and IFR release. Dispatch algorithms should be adjusted for this time delay of IFR transports.Kamine TH, Thomas L, Davis C, Cohen J. Critical care transport time differences between ground, helicopter VFR, and helicopter IFR transports. Aerosp Med Hum Perform. 2020; 91(2):98-101.

Predictors of inhalation burn injury using fire site information

T Kaneko, H Tanaka, S Yamada, M Kitada, T Sakurai, M Harada, F Kimura, T Takahashi, S Kasaoka

Ann Burns Fire Disasters 2017 Dec 31;30(4):275-277

Abstract

Inhalation burn injury (IBI) is a risk factor for mortality in burn patients. However, it is difficult to diagnose IBI using traditional physical examination alone, especially in prehospital settings. Therefore, facial burn patients are usually treated for suspected IBI. In the present study, we investigated whether fire site information could predict IBI as an alternative to traditional physical examination. This retrospective single-centre analysis involved 27 facial burn patients with suspected IBI who were admitted between 2014 and 2016. The patients were divided into two groups (IBI and non-IBI) according to bronchoscopy findings. Fire site information was compared between the two groups. The IBI (n = 13) and non-IBI (n = 14) groups were compared. Domestic fire was more frequent in the IBI group (69% vs. 29%, P = 0.035). The IBI group included one patient with carboxyhemoglobin ≥10% on admission. Prehospitalization fire site information, particularly domestic fires, might predict IBI in facial burn patients.

Management of multiple traumas in emergency medicine department: A review

Parvin Kashani, Amin Saberinia

J Family Med Prim Care 2019 Dec 10;8(12):3789-3797

Abstract

One of the main causes of adults' disability during their working age is multiple trauma. The process of medical care of patients who are injured seriously is still a challenging job. The primary treatment of these patients in the emergency medicine departments is the most required choice after the wilderness first aid and also would be very required before definitive care in the hospital. The main aim of emergency medicine departments is quick recognition and treatment of injuries which pose severe threat to patients' life in appropriate order of priority. The procedure of primary evaluation in emergency medicine department with the help of medical routine examination and ultrasonography is based on the concept of focused assessment with sonography in trauma (FAST) for identifying spontaneous intraperitoneal hemorrhage. Emergency patients who suffer from massive hematothorax, serious lung and heart traumas, and penetrating traumas to the chest would undergo thoracotomy and patients who have few symptoms of perforated hollow viscous will undergo emergency laparotomy. Based on the trauma severity, emergency treatment could be the way to fast recovery of the structure of injured organ and its function. The subsequent goal, in the acute phase, will concentrate on preventing and stopping bleeding and secondary injuries like painful compartment syndrome or intra-abdominal infections (IAIs). However, the main aim of emergency medicine department in taking care of severely injured patients is the management of airway, protecting circulation and breathing, identification of neurologic problems, and whole body clinical examination with the help of healthcare providers.

Exploring Nonbattle Injury in the Deployed Military Environment Using the Department of Defense Trauma Registry

David S Kauvar, Jennifer Gurney

Mil Med 2020 Mar 7; Online ahead of print.

Abstract

Introduction: The impact of disease and nonbattle injury (DNBI) on casualty burden of military operations has historically been greater than that of battle-related injuries. The ratio of battle to DNBI casualties has changed as advances in equipment, hygiene, and infectious diseases have been made; however, during military operations in Iraq and Afghanistan, 30% of serious injuries treated or evacuated from the area of operations were secondary to NBI. Most DoD research and intervention efforts focus on battle injuries; NBI has received much less practical attention. We aimed to explore the potential utility of the largest Department of Defense casualty database in identifying potential intervention targets for preventing NBI events.

Materials and methods: Phase I was a comprehensive NBI literature review from historical and current military operations. Phase II was an IRB exempt initial examination of relevant data contained in the Department of Defense Trauma Registry (DoDTR). Phase I: A MEDLINE search using the terms "military", "injury", and "nonbattle/non battle" was performed, and articles containing useful data points to characterize the unique risks of the modern deployed military environment and identify potentially preventable NBI hazards in the modern deployed military environment were retrieved and reviewed in full-text. Phase II: This information was used to explore data within the DoDTR's and its ability to provide data to inform NBI prevention efforts in the following areas: most prevalent NBI causes, NBI location and timing related to operational tempo, characteristics of the population at risk for NBI.

Results: Phase I: Falls and motor vehicle crashes (MVCs) accounted for most of the serious NBI in Iraq and Afghanistan. No specific epidemiologic data was readily available to guide NBI prevention efforts. Phase II was limited to NBI and falls from Iraq and Afghanistan in the DoDTR. Only aggregate data were available with a total of 1829 falls and 1899 MVCs. Case fatality for falls was 1.1% and for MVCs 6.5%. The greatest frequency of NBI was in Iraq among U.S. Army personnel, but comparison of rates is not possible without reliable denominators for individual variables. Annual NBI incidence seems proportional to overall level of personnel deployed to each theater, but without knowledge of the true denominator of total deployed personnel, it is impossible to conclude definitively. The annual number of falls was stable throughout the period of highest operational tempo in Iraq (2003-2011), although MVCs were more common earlier in the operation (2003-2005), likely corresponding to greater operational maneuver.

Conclusions: The deployed military environment is dangerous and NBI presents a primary prevention target for expeditionary operations. The DoDTR is a database of detailed injury and medical care information and lacks much of the data required to perform a comprehensive epidemiologic NBI analysis. Specific prevention recommendations cannot be made based solely on DoDTR data and integration with other DoD databases that assess operational and tactical data should be considered.

The Role of Exparel Plus Meloxicam for Postoperative Pain Management

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Curr Pain Headache Rep 2020 Jan 30;24(3):6

Abstract

Purpose of review: Acute postoperative pain reduction is a major target against the opioid crisis. While opioids have traditionally been the mainstay for postoperative analgesia, current practice has focused on a multimodal approach to pain control, including ultrasound-guided blocks with longer acting local anesthetic agents.

Recent findings: Non-steroidal anti-inflammatory drugs (NSAIDs), such as meloxicam, are an important class of medications utilized to manage pain in the perioperative period. An additional treatment used in perioperative or postoperative pain relief is Exparel, a bupivacaine (sodium channel blocker) liposomal injectable suspension with a 3-4-day duration of action. The long-acting mechanism and formulation of Exparel consistently has demonstrated decreased opioid use and pain scores in patients undergoing many different surgical procedures. A concern is that pH negatively alters the efficacy of bupivacaine, as in cases of inflamed tissue and acidic fluid pH. For this reason, a combination medication with both meloxicam and bupivacaine has been developed, which normalizes pH and has anti-inflammatory and anti-pain conduction properties. Clinical studies demonstrate that this combination agent can be extremely beneficial in treating postoperative pain. This manuscript summarizes the newest developments with regard to liposomal bupivacaine and the non-steroidal meloxicam, their roles in effective treatment of postoperative pain, contraindications, special considerations of using these medications, and future considerations. HTX-011 pairs up a new extended-release formulation of the local anesthetic bupivacaine with meloxicam, a well-established non-steroidal anti-inflammatory drug (NSAID).

Effectiveness of the combat application tourniquet for arterial occlusion in young children

Joseph R Kelly 1, Matthew J Levy, Jose Reyes, Jennifer Anders

J Trauma Acute Care Surg 2020 May;88(5):644-647

Abstract

Background: Tourniquet use for extremity hemorrhage has become a mainstay in adult trauma care in last 15 years. The efforts of the Stop the Bleed campaign have increased the distribution and use of tourniquets in civilian settings in response to mass shootings and as part of disaster preparedness. Little research or published experience exists regarding the use of tourniquets in the pediatric population. This study sought to determine the minimum patient age on which the combat application tourniquet (CAT) is able to control extremity hemorrhage.

Methods: A convenience sample of pediatric patients, ages 1 year to 8 years, scheduled for elective orthopedic surgery at an academic hospital, were eligible for enrollment. Subject age, weight, height, blood pressure, and arm and leg circumferences were obtained. Once under general anesthesia, the pulse of an upper and a lower limb were obtained by Doppler, a CAT was then placed at the most proximal practical location of the limb until the corresponding pulse was either no longer obtainable by Doppler or until the tourniquet was as tight as its design allows. The tourniquet was removed after 30 seconds of arterial occlusion.

Results: Thirteen children, ages 2 years to 7 years were enrolled. Weights ranged from 12.8 kg to 23.9 kg, with a mean of 16.7 kg. Leg circumferences were 24.5 cm to 34.5 cm, with a mean of 27.9 cm and arm circumferences were 13 cm to 24 cm, with a mean of 16.3 cm. Subject heights were 87 cm to 122 cm, with a mean of 103.4 cm. Twenty-four total extremities were tested, 11 arms and 13 legs. Arterial occlusion was obtained on 100% of limbs tested (95% confidence interval, 85.8-100%).

Conclusion: This study is similar to previous adult tourniquet efficacy studies in design, size and outcomes. It is the first to show successful arterial occlusion on preschool-aged children with a commercial tourniquet in a controlled setting. The results suggest that the CAT can be used in school-aged children with severe extremity hemorrhage with a high likelihood of success.

Level of evidence: Therapeutic, level II.

A Randomized Trial of Mentored vs Nonmentored Military Medics Compared in the Application of a Wound Clamp Without Prior Training: When to Shut Up and Just Watch!

Andrew W Kirkpatrick, Jessica L Mckee, Itamar Netzer, Ian A Mckee, Paul McBeth, Juan P Wachs, Chad G Ball, Elon Glassberg

Mil Med 2020 Jan 7;185(Suppl 1):67-72

Abstract

Introduction: Hemorrhage control is a basic task required of first responders and typically requires technical interventions during stressful circumstances. Remote telementoring (RTM) utilizes information technology to guide inexperienced providers, but when this is useful remains undefined.

Methods: Military medics were randomized to mentoring or not from an experienced subject matter expert during the application of a wound clamp (WC) to a simulated bleed. Inexperienced, nonmentored medics were given a 30-second safety briefing; mentored medics were not. Objective outcomes were time to task completion and success in arresting simulated bleeding.

Results: Thirty-three medics participated (16 mentored and 17 nonmentored). All (100%) successfully applies the WC to arrest the simulated hemorrhage. RTM significantly slowed hemorrhage control (P = 0.000) between the mentored (40.4 ± 12.0 seconds) and nonmentored (15.2 ± 10.3 seconds) groups. On posttask questionnaire, all medics subjectively rated the difficulty of the wound clamping as 1.7/10 (10 being extremely hard). Discussion: WC application appeared to be an easily acquired technique that was effective in controlling simulated extremity exsanguination, such that RTM while feasible did not improve outcomes. Limitations were the lack of true stress and using simulation for the task. Future research should focus on determining when RTM is useful and when it is not required.

Tracking DO2 with Compensatory Reserve During Whole Blood Resuscitation in Baboons

Natalie J Koons, Betty Nguyen, Mithun R Suresh, Carmen Hinojosa-Laborde, Victor A Convertino

Shock 2020 Mar;53(3):327-334

Abstract

Hemorrhagic shock can be mitigated by timely and accurate resuscitation designed to restore adequate delivery of oxygen (DO2) by increasing cardiac output (CO). However, standard care of using systolic blood pressure (SBP) as a guide for resuscitation may be ineffective and can potentially be associated with increased morbidity. We have developed a novel vital sign called the compensatory reserve measurement (CRM) generated from analysis of arterial pulse waveform feature changes that has been validated in experimental and clinical models of hemorrhage. We tested the hypothesis that thresholds of DO2 could be accurately defined by CRM, a noninvasive clinical tool, while avoiding over-resuscitation during whole blood resuscitation following a 25% hemorrhage in nonhuman primates. To accomplish this, adult male baboons (n = 12) were exposed to a progressive controlled hemorrhage while sedated that resulted in an average (± SEM) maximal reduction of 508 ± 18 mL of their estimated circulating blood volume of 2,130 ± 60 mL based on body weight. CRM increased from 6 ± 0.01% at the end of hemorrhage to 70 ± 0.02% at the end of resuscitation. By linear regression, CRM values of 6% (end of hemorrhage), 30%, 60%, and 70% (end of resuscitation) corresponded to calculated DO2 values of 5.9 ± 0.34, 7.5 ± 0.87, 9.3 ± 0.76, and 11.6 ± 1.3 mL O2·kg·min during resuscitation. As such, return of CRM to ~65% during resuscitation required only ~400 mL to restore SBP to 128 ± 6 mmHg, whereas total blood volume replacement resulted in over-resuscitation as indicated by a SBP of 140 ± 7 mmHg compared with an average baseline value of 125 ± 5 mmHg. Consistent with our hypothesis, thresholds of calculated DO2 were associated with specific CRM values. A target resuscitation CRM value of ~65% minimized the requirement for whole blood while avoiding over-resuscitation. Furthermore, 0% CRM provided a noninvasive metric for determining critical DO2 at approximately 5.3 mL O2·kg·min.

Dealing With Burn Patients in War Zones

Antonios Koutras, Athanasios Syllaios, Ioannis Tsilikis, Georgios Kalinterakis, Prokopis-Andreas Zotos, Ifigeneia Zouliati, Adamantios Michalinos, Ioannis Karavokyros, Dimitrios Schizas, Emmanouil Pikoulis

Disaster Med Public Health Prep 2020 Jan 8;1-5

Abstract

Objective: Treating burn patients in the battlefield is one of the biggest challenges that military doctors and medical personnel can face. Wound patterns have been changed over time due to the introduction of new weapons, and many different aspects play a major role in the management of those burns nowadays. There is a potential gap in care of burn patients in war zones.

Methods: A thorough literature search in PubMed, scientific journals, and Internet sites was conducted in regard to burn patients and trauma in war zones.

Results: It is crucial for military surgeons to be able to stabilize burn patients during wartime conflicts, especially those patients who suffer from extreme burn injuries, as specialized treatment should be given. Medical personnel should be aware of all medication types used, the ways to minimize the risk of bacterial infection, and the ways to keep the injured safe.

Conclusions: Injured civilians with burn trauma in the field of battle are deserving care, and special recognition should be given to the non-governmental organizations (NGOs) that strive to ease human suffering in war zones. Proper management of burn patients in war zones is crucial, and military medical staff and NGOs can play a key role in that purpose.

Managing and securing the bleeding upper airway: a narrative review

Michael Seltz Kristensen, Barry McGuire

Can J Anaesth 2020 Jan;67(1):128-140

Abstract

Failure to manage bleeding in the airway is an important cause of airway-related death. The purpose of this narrative review is to identify techniques and strategies that can be employed when severe bleeding in the upper airway may render traditional airway management (e.g., facemask ventilation, intubation via direct/video laryngoscopy, flexible bronchoscopy) impossible because of impeded vision. An extensive literature search was conducted of bibliographic databases, guidelines, and textbooks using search terms related to airway management and bleeding. We identified techniques that establish a definitive airway, even in cases of impeded visibility resulting from severe bleeding in the airway. These include flexible video-/optical- scope-guided intubation via a supraglottic airway device; cricothyroidotomy or tracheotomy; and retrograde-, blind nasal-, oral-digital-, light-, and ultrasound-guided intubation. We provide a structured approach to managing bleeding in the airway that accounts for the source of bleeding and the estimated risk of failure to intubate using direct laryngoscopy or to achieve a front-of-neck access for surgical airway rescue. In situations where these techniques are predicted to be successful, the recommended approach is to identify the cricothyroid membrane (in preparation for rescue cricothyroidotomy), followed by rapid sequence induction. In situations where traditional management of the airway is likely to fail, we recommend an awake approach with one of the aforementioned techniques.

The ABCs of Ocular Trauma: Adapting a Familiar Mnemonic for Rapid Eye Exam in the Pre-Ophthalmic Zone of Care

Christiaan F Kroesen, Matthew Snider, James Bailey, Adam Buchanan, James W Karesh, Frank La Piana, Erin Seefeldt, Jo Ann Egan, Robert A Mazzoli

Mil Med 2020 Jan 7;185(Suppl 1):448-453

Abstract

Evaluation and management of eye trauma is daunting to many practitioners. For general medical emergencies, the familiar ABCs mnemonic serves to both recompose the provider as well as provide a logical order for evaluation and action. We recently adapted an ABCs mnemonic to provide non-ophthalmologists with a familiar method for systematically evaluating and managing eye trauma. A = ACUITY. Visual acuity is the most importance piece of information in eye trauma. B = BEST exam of BOTH eyes. Starting with acuity, examination proceeds from the front to the rear of the eye. Examine the uninjured eye first. C = CONTIGUOUS STRUCTURES and CONTACT LENSES. Examine structures contiguous to the apparent injury. Inspect for contact lens wear. D = DRUGS, DIAGNOSTIC IMAGING, and the DON'TS. Start antibiotics, antiemetics, and analgesics. Administer tetanus. Obtain computerized tomography if available. Do not attempt ocular ultrasound or magnetic resonance imaging. Do not apply pressure to the eye. Do not patch the eye or apply any medication. E = EYE SHIELD and EVACUATE. Shield and ship to ophthalmology. The mnemonic was adapted to reflect current Joint Trauma Services and Tactical Combat Casualty Care practice guidelines. We believe this familiar mnemonic will serve as a useful tool in allowing non-ophthalmologists to comfortably and safely evaluate an eye for trauma.

Ionised calcium levels in major trauma patients who received blood en route to a military medical treatment facility

Tony Kyle, Ian Greaves, Anthony Beynon, Vicky Whittaker, Mike Brewer, Jason Smith

Emerg Med J 2018 Mar;35(3):176-179

Abstract

Background: Hypocalcaemia is a common metabolic derangement in critically ill patients. Blood transfusion can also contribute to depleted calcium levels. The aims of this study were to identify the incidence of hypocalcaemia in military trauma patients receiving blood products en route to a deployed hospital facility and to determine if intravenous calcium, given during the prehospital phase, has an effect on admission calcium levels.

Methods: This was a retrospective review of patients transported by the UK Medical Emergency Response Team in Afghanistan between January 2010 and December 2014 who were treated with blood products in the prehospital setting. Total units of blood products administered, basic demographics, Injury Severity Score and trauma type were collected. Ionised serum calcium levels on admission to hospital were compared between those who received blood products without prehospital intravenous calcium supplemental therapy (non-treatment) and patients who were treated with 10 mL of intravenous calcium chloride (10%) concurrently with blood products (treatment).

Results: The study included 297 patients; 237 did not receive calcium and 60 did. The incidence of hypocalcaemia in the non-treatment group was 70.0% (n=166) compared with 28.3% (n=17) in the treatment group. Serum calcium levels were significantly different between the groups (1.03 mmol/L vs 1.25 mmol/L, difference 0.22 mmol/L, 95% CI 0.15 to 0.27). In the non-treatment group, 26.6% (n=63) had calcium levels within the normal range compared with 41.7% (n=25) in those who received calcium. There was a dose response of calcium level to blood products with a significant decrease in calcium levels as the volume of blood products increased.

Conclusion: Trauma patients who received blood products were at high risk of hypocalcaemia. Aggressive management of these patients with intravenous calcium during transfusion may be required.

Analgesic use in contemporary burn practice: Applications to burn mass casualty incident planning

Sahar T Leazer, Jennifer E Nyland, Sandra M Escolas, James K Aden, Catherine A Rauschendorfer, Leopoldo C Cancio, Kevin K Chung

Burns 2020 Feb;46(1):90-96

Abstract

Background: Determining the amount of analgesics required will help burn centers improve their ability to plan for a burn mass casualty incident (BMCI). We sought to quantify the amount of analgesics needed in an inpatient burn population. We hoped that assessing the analgesic use in daily burn care practice will potentially help estimate opioid needs in a burn mass casualty incident (BMCI).

Methods: We included patients with burns covering equal to or less than 30% total body surface area (TBSA), admitted from spring 2013 to spring 2015. Patient records were reviewed for analgesics and adjuncts, pain scores, age and TBSA. The doses of the different opioids administered were converted into morphine equivalent doses (MED).

Results: We enrolled 141 acute burn survivors with a mean TBSA of 8.2±0.6%. The lowest daily average MED per person was 24.6±2.0mg MED, recorded on the day of injury. The daily average MED per person increased until it peaked at 52.5±5.6mg MED at day 8 post-burn. Then, it declined to 24.6±3.4mg MED by day 14. Bivariate regression analysis of average MED by TBSA showed a significant positive correlation ($p<0.001$). The analysis of average MED by age showed a significant negative correlation ($p<0001$).

Conclusion: Our study quantified opioid requirements in an inpatient burn population and identified TBSA (positively) and age (negatively) as significant predictors.

Tips and tricks: Supraglottic airway device insertion using a tongue depressor

Hyunyoung Lim, Mi Ae Jeong

Eur J Anaesthesiol 2020 Feb;37(2):154-155

Supraglottic airway devices (SADs) have been widely used in general anaesthesia or in difficult tracheal intubation states, but sometimes incomplete insertion still occurs. The authors would like to introduce an
easier method to insert SADs using the tongue depressor used for operations in the mouth. After induction of anaesthesia, press the patient's forehead with the right hand to create neck extension. Then insert the tongue depressor along the tongue with the left hand and lift it upward and forward as in laryngoscope insertion. Then insert the SAD towards the hard palate with the right hand. At the point where resistance occurs during insertion, remove the tongue depressor while pushing the SAD a little more. It can be inserted smoothly.

Challenges of Burn Mass Casualty Incidents in the Prehospital Setting: Lessons From the Formosa Fun Coast Park Color Party

Chien-Hao Lin, Chih-Hao Lin, Chih-Yi Tai, Yu-You Lin, Frank Fuh-Yuan Shih

Prehosp Emerg Care Jan-Feb 2019;23(1):44-48

Abstract

Objective: A burn mass casualty incident (BMCI) involving 499 patients occurred at a "color party" in Taiwan in June 27, 2015. We implemented a study to identify critical challenges regarding the prehospital emergency care in BMCIs. Methods: A 3-stage, mixed methods study was conducted in 2016. First, a statistical analysis of prehospital management using the data retrieved from the Emergency Medical Management System of the Ministry of Health and Welfare, Taiwan was performed. This was followed by a face-to-face, open-ended interview with the emergency medical technicians and the staff of the emergency operations center who responded to the incident; and the transcription of the interview data into constructed themes. Results: Our study indicated that the signs of inhalation injury needed to be incorporated in the field triage protocol for BMCIs; the collaborative utilization of regional emergency medical services may improve the surge capacity in the field; and an "island-hopping" strategy for patient transportation may allow the healthcare systems to manage the surge of burn patients more efficiently. Conclusions: Current field triage protocols may be insufficient for burn patients and should be further investigated. The practices in field triage, transport capacity, and transfer strategy can be considered as a part of an efficient prehospital emergency response to BMCIs.

Implementation of a Prehospital Patella Dislocation Reduction Protocol

Spencer Lord, James Brodell, Heather Lenhardt, Michael Dailey, Jeremy Cushman

Prehosp Emerg Care 2020 Jan 29;1-4

Abstract

Introduction: Acute patella dislocations account for up to 3% of all knee injuries. Prehospital care of patella dislocation often includes knee immobilization and pain management, but in the wilderness environment patella reductions are often performed by basic life support providers. Given the potential benefits of early reduction, the perceived low risk of harm and precedent with which the procedure can be performed, patella reduction was added to the EMT scope of practice in New York State. Our objective is to characterize the mechanism of patella related injuries and describe the success rate and complications experienced with the addition of a prehospital patella reduction protocol.

Methods: This was a retrospective review of a voluntary, preexisting, quality assurance database of cases in which a patella reduction was attempted between October 1, 2016 and June 30, 2018.Results: 90 patients underwent an attempt at patella reduction at one of 52 EMS agencies during the study period. The most common mechanism was a sports-related injury. Patella reduction was successful 83/90 (92.2%). Median pain score was reduced from 10 to 2. There were no reported complications.

Conclusion: While a convenience sample, our results provide preliminary evidence that patella reduction can be performed by EMS providers with infrequent complication and offers significant pain relief.

Comparison of Two Supraglottic Airway Devices: I-gel Airway and ProSeal Laryngeal Mask Airway Following Digital Insertion in Nonparalyzed Anesthetized Patients

Ankur Luthra, Rajeev Chauhan, Amit Jain, Ishwar Bhukal, Shalvi Mahajan, Indu Bala

Anesth Essays Res Oct-Dec 2019;13(4):669-675

Abstract

Aims: The study is aimed to compare the efficacy of I-gel and ProSeal laryngeal mask airway (PLMA) in nonparalysed anesthetized individuals following manufacturer-recommended digital insertion.

In this prospective randomized observational study, 40 American Society of Anesthesiologists I and II patients, aged 18-65 years scheduled for elective surgical procedures were allocated either to PLMA group (Group P, n = 20) or the I-gel group (Group I, n = 20). Following digital insertion of PLMA or I-gel, the following parameters were compared: insertion time, ease of insertion, number of attempts, failed insertion, airway reaction during insertion, oropharyngeal leak (OPL) pressure, and gastric insufflation on auscultation. Fiberoptic view of both the channels of the airway devices and ease of insertion of 12 F Ryle's tube through gastric drain channel were graded. Postoperative complications were also noted.

Results: First attempt and overall insertion success were similar (PLMA, 85% and 100%; I-gel 80% and 100%, respectively). Mean (standard deviation) insertion times were similar (PLMA, 27.40 [11.51] s; I-gel 25.45 [9.03] s). Mean OPL pressure was 3.5 cm H_2O higher with PLMA ($P < 0.012$). The passage of Ryle's tube was easier through I-gel than PLMA. Grade I glottic view (full view of the vocal cords) was visible in 17 (85%) patients who were managed with I-gel whereas only 9 (45%) patients had Grade I view in the PLMA group.

Conclusion: The time required for digital insertion of PLMA and I-gel in nonparalyzed anesthetized patients is similar but PLMA forms a better oropharyngeal seal. I-gel is better positioned over the laryngeal framework and esophagus. I-gel allows easier passage of Ryle's tube through its drain channel than PLMA. The incidence and severity of postoperative sore throat and hoarseness was higher with PLMA.

Prehospital critical care is associated with increased survival in adult trauma patients in Scotland

Alistair Maddock, Alasdair R Corfield, Michael J Donald, Richard M Lyon, Neil Sinclair, David Fitzpatrick, David Carr, Stephen Hearns

Emerg Med J 2020 Mar;37(3):141-145

Abstract

Background: Scotland has three prehospital critical care teams (PHCCTs) providing enhanced care support to a usually paramedic-delivered ambulance service. The effect of the PHCCTs on patient survival following trauma in Scotland is not currently known nationally.

Methods: National registry-based retrospective cohort study using 2011-2016 data from the Scottish Trauma Audit Group. 30-day mortality was compared between groups after multivariate analysis to account for confounding variables.

Results: Our data set comprised 17 157 patients, with a mean age of 54.7 years and 8206 (57.5%) of male gender. 2877 patients in the registry were excluded due to incomplete data on their level of prehospital care, leaving an eligible group of 14 280. 13 504 injured adults who received care from ambulance clinicians (paramedics or technicians) were compared with 776 whose care included input from a PHCCT. The median Injury Severity Score (ISS) across all eligible patients was 9; 3076 patients (21.5%) met the ISS>15 criterion for major trauma. Patients in the PHCCT cohort were statistically significantly (all $p<0.01$) more likely to be male; be transported to a prospective Major Trauma Centre; have suffered major trauma; have suffered a severe head injury; be transported by air and be intubated prior to arrival in hospital. Following multivariate analysis, the OR for 30-day mortality for patients seen by a PHCCT was 0.56 (95% CI 0.36 to 0.86, $p=0.01$).

Conclusion: Prehospital care provided by a physician-led critical care team was associated with an increased chance of survival at 30 days when compared with care provided by ambulance clinicians.

Prehospital blunt traumatic arrest resuscitation augmented by whole blood: a case report

Julian G Mapp, Craig A Manifold, Alberto M Garcia, Jason L Aguilar, Michael L Stringfellow, Christopher J Winckler

Transfusion 2020 May;60(5):1104-1107

Abstract

Background: Prehospital hemorrhagic shock accounts for approximately 25,000 civilian deaths annually in the United States. A balanced, blood-based resuscitation strategy is hypothesized to be the optimal treatment for these patients. Due to logistical constraints, delivering a balanced, blood-based resuscitation is difficult in the prehospital setting. A low titer O+ whole blood (LTO+ WB) ground ambulance initiative, may help alleviate this capability gap.

Case report: A 37-year-old female was involved in a motor vehicle collision at approximately 16:30. While she was trapped inside the vehicle, her mental status deteriorated. The patient was successfully extricated at 17:04 and found to be in cardiac arrest. The paramedics and firefighters quickly secured her airway and applied a mechanical CPR device. The first responder team obtained return of spontaneous circulation, but the patient's blood pressure was 43/27 mmHg. The paramedics transfused one unit of LTO+ WB. Twenty-one minutes after the initial LTO+ WB transfusion, the air ambulance team transfused a second unit of LTO+ WB. Upon hospital arrival, the transfusion was completed, and the patient's shock index improved to 1.0. The trauma team identified a grade 5 splenic injury with active extravasation. Interventional radiology performed an angiogram and successfully embolized the tertiary branches of the inferior splenic pole. She was extubated on postinjury Day one and discharged to her home neurologically intact on postinjury Day 12.

Conclusion: The prehospital availability of LTO+ WB may enhance the resuscitation of critically ill trauma patients.

Mortality review of US Special Operations Command battle-injured fatalities

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J Trauma Acute Care Surg 2020 May;88(5):686-695

Abstract

Background: Comprehensive analyses of battle-injured fatalities, incorporating a multidisciplinary process with a standardized lexicon, is necessary to elucidate opportunities for improvement (OFIs) to increase survivability.

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

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

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

Head-Neck Motion in Prehospital Trauma Patients under Spinal Motion Restriction: A Pilot Study

Neil McDonald, Dean Kriellaars, Erin Weldon, Rob Pryce

Prehosp Emerg Care 2020 Mar 18;1-8; Online ahead of print

Abstract

Background: Spinal precautions are intended to limit motion of potentially unstable spinal segments. The efficacy of various treatment approaches for motion restriction in the cervical spine has been rigorously investigated using healthy volunteers and, to a lesser extent, cadaver samples. No previous studies have objectively measured this motion in trauma patients with potential spine injuries during prehospital care. Objective: The purpose of this study was to characterize head-neck (H-N) kinematics in a sample of trauma patients receiving spinal precautions in the field. Methods: This was a prospective observational study of trauma patients in the prehospital setting. Trauma patients meeting criteria for spinal precautions were eligible for inclusion. Participants received usual care, consisting of either a long backboard, cervical collar, and head blocks (BC) or a cervical collar only (CO), and behavior was categorized as compliant (C) or non-compliant (N). Three inertial measurement units (IMUs), placed on each participant's forehead, sternum, and stretcher, yielded data on H-N motion. Outcomes were described in terms of H-N displacement and acceleration, including single- and multi-planar values, root mean square (RMS), and bouts of continuous motion above pre-determined thresholds. Data were analyzed to compare H-N motion by phase of prehospital care, as well as treatment type and patient behavior.Results: Substantial single- and multi-plane H-N motion was observed among all participants. Maximum single-plane displacements were between 11.3 ± 3.0 degrees (rotation) and 19.0 ± 16.6 degrees (flexion-extension). Maximum multi-plane displacements averaged 31.2 ± 7.2 degrees (range: 7.2 to 82.1 degrees). Maximum multi-plane acceleration averaged 5.8 ± 1.4 m/s2 (range: 1.2 to 19.9 m/s2). There were no significant differences among participants between prehospital phase and treatment type. Non-compliant participants showed significantly more motion than compliant participants. Conclusion: Among actual patients, movement appears to be greater than previously recorded in simulation studies, and to be associated with patient behavior. Miniature IMUs are a feasible approach to field-based measurement of H-N kinematics in trauma patients. Future research should evaluate the effects of patient compliance, treatment, and phase of care using larger samples.

Syrian Civil War: a systematic review of trauma casualty epidemiology

Joshua McIntyre

BMJ Mil Health 2020 Aug;166(4):261-265

Abstract

Background: The Syrian Civil War has caused over 400 000 traumatic deaths. Understanding the nature of war casualties is crucial to deliver healthcare improvement. Historic regional conflicts and Syrian mortality data have been characterised by blast injuries. The aim of this novel review is to assess the trauma epidemiology of Syrian Civil War casualties from the perspective of healthcare facilities.

Methods: This review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses method. Studies addressing Syria, trauma and war were investigated. Eligibility criteria included being conducted from a healthcare facility, published in English and peer reviewed. The outcomes were demography, mechanism of injury and anatomical injury site.

Results: 38 papers satisfied the eligibility criteria. 13 842 casualties were reported across the entire data set. Casualties were 88.8% male (n=4035 of 4544). Children contributed to 16.1% of cases (n=398 of 2469). Mortality rate was 8.6% (n=412 of 4774). Gunshot wound was the most common mechanism of injury representing 66.3% (n=7825 of 11799). Head injury was the most common injured site at 26.6% (n=719 of 2701).

Conclusions: This conflict has a distinct trauma profile compared with regional modern wars. The prevalence of gunshot wounds represents a marked change in mechanism of injury. This may be related to higher mortality rate and proportion of head injuries identified. This review cannot correlate mechanism of injury, demographics or injuries sustained to outcomes. The quality of data from the included studies lacked standardisation; future research and consistent reporting tools are required to enable further analysis.

BET 1: Does inhaled tranexamic acid reduce morbidity in adults with haemoptysis?

Jennifer Mervau, Seamon Jason, Jeffrey S Jones

Emerg Med J 2020 Jan;37(1):45-46

Abstract

A short cut review was carried out to establish whether inhaled tranexamic acid is more effective than placebo at controlling bleeding in patients with haemoptysis. Thirty-four papers were found using the reported searches, of which one presented the best available evidence to answer the clinical question. The author, date and country of publication, patient group studied, study type, relevant outcomes, results and study weaknesses of this paper is tabulated. It is concluded that in patients with non-massive haemoptysis, management with nebulised TXA leads to fast resolution.

Evaluation of pain management in medical transfer of trauma patients by air

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CJEM 2019 Nov;21(6):776-783

Abstract

Objectives: With regionalized trauma care, medical transport times can be prolonged, requiring paramedics to manage patient care and symptoms. Our objective was to evaluate pain management during air transport of trauma patients.

Methods: We conducted a 12-month review of electronic paramedic records from a provincial critical care transport agency. Patients were included if they were ≥18 years old and underwent air transport to a trauma centre, and excluded if they were Glasgow Coma Scale score <14, intubated, or accompanied by a physician or nurse. Demographics, injury description, and transportation parameters were recorded. Outcomes included pain assessment via 11-point numerical rating scale, patterns of analgesia administration, and analgesia-related adverse events. Results were reported as mean ± standard deviation, [range], (percentage).

Results: We included 372 patients: 47.0 years old; 262 males; 361 blunt injuries. Transport duration was 82.4 ± 46.3 minutes. In 232 (62.4%) patients who received analgesia, baseline numerical rating scale was 5.9 ± 2.5. Fentanyl was most commonly administered at 44.3 [25-60] mcg. Numerical rating scale after first analgesia dose decreased by 1.1 [-2-7]. Thereafter, 171 (73.7%) patients received 2.4 [1-18] additional doses. While 44 (23.4%) patients had no change in numerical rating scale after first analgesia dose, subsequent doses resulted in no change in numerical rating scale in over 65% of patients. There were 43 adverse events recorded, with nausea the most commonly reported (39.5%).

Conclusions: Initial and subsequent dose(s) of analgesic had minimal effect on pain as assessed via numerical rating scale, likely due in part to inadequate dosing. Future research is required to determine and address the barriers to proper analgesia.

Characteristics of Open Globe Injuries in the United States From 2006 to 2014

Tahreem A Mir, Joseph K Canner, Sidra Zafar, Divya Srikumaran, David S Friedman, Fasika A Woreta

JAMA Ophthalmol 2020 Jan 23;138(3):268-275

Abstract

Importance: Open globe injuries can lead to substantial visual morbidity and lifelong sequelae. Interventions to reduce the burden of open globe injuries in the United States require a better understanding of these injuries through well-designed epidemiologic investigations.

Objective: To examine the incidence, common injury mechanisms, and economic burden of open globe injuries in the United States.

Design, setting, and participants: This retrospective, cross-sectional study of US nationwide emergency department (ED) data assessed all ED visits of patients with a primary diagnosis of open globe injury in the Nationwide Emergency Department Sample (NEDS) from January 1, 2006, to December 31, 2014. Data analysis was performed from August 29, 2018, to November 11, 2019.

Main outcomes and measures: Annual incidence of open globe injuries by age, sex, mechanism of injury, and concomitant diagnosis, as well as median charges associated with open globe injuries and variables associated with hospitalization.

Results: A total of 124 989 ED visits for open globe injuries were assessed, with an incidence of 4.49 per 100 000 population in the United States from 2006 to 2014 (mean [SD] age of study participants, 37.7 [22.5] years; 94 078 [75.3%] male). The incidence was highest in 2006 (5.88 per 100 000 population) and decreased by 0.3% per month between 2006 and 2014 (incidence rate ratio, 0.99; 95% CI, 0.99-0.99; P < .001). Open globe injuries occurred in 37 060 individuals (30.6%) of low socioeconomic status. The most common injury mechanism was being struck by or against an object or person (40 119 of all 124 989 injury mechanisms [32.1%]). Open globe injuries associated with falls increased 6.6% between 2006-2010 and 2011-2015 (95% CI, 1.04-1.08; P < .001) and were the most common injury mechanism in individuals older than 70 years. The total cost associated with open globe injuries was $793 million. The cost of ED visits increased from $865 during 2006-2010 to $1557 during 2011-2015. Inpatient costs similarly increased from $21 527 during 2006-2010 to $30 243 during 2011-2015.

Conclusions and relevance: The incidence of open globe injuries in the United States decreased from 2006 to 2014. Although the data are from 5 to 13 years ago, these findings appear to provide valuable information for targeting preventive measures toward individuals at highest risk; targeting young men with lower socioeconomic status and individuals 70 years or older at an increased risk of falls may help lower the incidence of open globe injuries.

Are there Field Triage Criteria that Can Predict Low-Yield Air Medical Transports?

Hiroko Miyagi, David C Evans, Howard A Werman

Prehosp Disaster Med 2019 Dec;34(6):596-603

Abstract

Introduction: Air medical transport of trauma patients from the scene of injury plays a critical role in the delivery of severely injured patients to trauma centers. Over-triage of patients to trauma centers reduces the system efficiency and jeopardizes safety of air medical crews.

Hypothesis: The objective of this study was to determine which triage factors utilized by Emergency Medical Services (EMS) providers are strong predictors of early discharge for trauma patients transported by helicopter to a trauma center.

Methods: A retrospective chart review over a two-year period was performed for trauma patients flown from the injury site into a Level I trauma center by an air medical transport program. Demographic and clinical data were collected on each patient. Prehospital factors such as Glasgow Coma Score (GCS), Revised Trauma Score (RTS), intubation status, mechanism of injury, anatomic injuries, physiologic parameters, and any combinations of these factors were investigated to determine which triage criteria accurately predicted early discharge. Hospital factors such as Injury Severity Score (ISS), length-of-stay (LOS), survival, and emergency department disposition were also collected. Early discharge was defined as a hospital stay of less than 24 hours in a patient who survives their injuries. A more stringent definition of appropriate triage was defined as a patient with in-hospital death, an ISS >15, those taken to the operating room (OR) or intensive care unit (ICU), or those receiving blood products. Those patients who failed to meet these criteria were also used to determine over-triage rates.

Results: An overall early discharge rate of 35% was found among the study population. Furthermore, when the more stringent definition was applied, over-triage rates were as high as 85%. Positive predictive values indicated that patients who met at least one anatomic and physiologic criteria were appropriately transported by helicopter as 94% of these patients had stays longer than 24 hours. No other criteria or combination of criteria had a high predictive value for early discharge.

Conclusions: No individual triage criteria or combination of criteria examined demonstrated the ability to uniformly predict an early discharge. Although helicopter transport and subsequent hospital care is costly and resource consuming, it appears that a significant number of patients will be discharged within 24 hours of their transport to a trauma center. Future studies must determine the impact of eliminating "low-yield" triage criteria on under-triage of scene trauma patients.

Ketamine Safety and Use in the Emergency Department for Pain and Agitation/Delirium: A Health System Experience

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West J Emerg Med 2020 Jan 27;21(2):272-281

Abstract

Introduction: Two protocols were developed to guide the use of subdissociative dose ketamine (SDDK) for analgesia and dissociative sedation ketamine for severe agitation/excited delirium in the emergency department (ED). We sought to evaluate the safety of these protocols implemented in 18 EDs within a large health system.

Methods: We conducted a retrospective chart review to evaluate all adult patients who received intravenous (IV) SDDK for analgesia and intramuscular (IM) dissociative sedation ketamine for severe agitation/excited delirium in 12 hospital-based and six freestanding EDs over a one-year period from the protocol implementation. We developed a standardized data collection form and used it to record patient information regarding ketamine use, concomitant medication use, and any comorbidities that could have impacted the incidence of adverse events.

Results: Approximately 570,000 ED visits occurred during the study period. SDDK was used in 210 ED encounters, while dissociative sedation ketamine for severe agitation/excited delirium was used in 37 ED encounters. SDDK was used in 83% (15/18) of sites while dissociative sedation ketamine was used in 50% (9/18) of sites. Endotracheal intubation, non-rebreather mask, and nasal cannula ≥ four liters per minute were identified in one, five, and three patients, respectively. Neuropsychiatric adverse events were identified in 4% (9/210) of patients who received SDDK.

Conclusion: Patients experienced limited neuropsychiatric adverse events from SDDK. Additionally, dissociative sedation ketamine for severe agitation/excited delirium led to less endotracheal intubation than reported in the prehospital literature. The favorable safety profile of ketamine use in the ED may prompt further increases in usage.

Impact of a 4-hour Introductory eFAST Training Intervention Among Ultrasound-Naïve U.S. Military Medics

Jonathan D Monti 1, Michael D Perreault 2

Mil Med 2020 Jun 8;185(5-6):e601-e608

Abstract

Introduction: Advances in the portability of ultrasound have allowed it to be increasingly employed at the point of care in austere settings. Battlefield constraints often limit the availability of medical officers throughout the operational environment, leading to increased interest in whether highly portable ultrasound devices can be employed by military medics to enhance their provision of combat casualty care. Data evaluating optimal training for effective medic employment of ultrasound is limited however. This prospective observational cohort study's primary objective was to assess the impact of a 4-hour introductory training intervention on ultrasound-naïve military medic participants' knowledge/performance of the eFAST application.

Materials and methods: Conventional U.S. Army Medics, all naïve to ultrasound, were recruited from across JBLM. Volunteer participants underwent baseline eFAST knowledge assessment via a 50-question multiple-choice exam. Participants were then randomized to receive either conventional, expert-led classroom didactic training or didactic training via an online, asynchronously available platform. All participants then underwent expert-led, small group hands-on training and practice. Participants' eFAST performance was then assessed with both live and phantom models, followed by a post-course knowledge exam. Concurrently, emergency medicine (EM) resident physician volunteers, serving as standard criterion for trained personnel, underwent the same OSCE assessments, followed by a written exam to assess their baseline eFAST knowledge. Primary outcome measures included (1) post-course knowledge improvement, (2) eFAST exam technical adequacy, and (3) eFAST exam OSCE score. Secondary outcome measures were time to exam completion and diagnostic accuracy rate for hemoperitoneum and hemopericardium. These outcome measures were then compared across medic cohorts and to those of the EM resident physician cohort.

Results: A total of 34 medics completed the study. After 4 hours of ultrasound training, overall eFAST knowledge among the 34 medics improved from a baseline mean of 27% on the pretest to 83% post-test. For eFAST exam performance, the medics scored an average of 20.8 out of a maximum of 22 points on the OSCE. There were no statistically significant differences between the medics who received asynchronous learning versus traditional classroom-based learning, and the medics demonstrated comparable performance to previously trained EM resident physicians.

Conclusions: A 4-hour introductory eFAST training intervention can effectively train conventional military medics to perform the eFAST exam. Online, asynchronously available platforms may effectively mitigate some of the resource requirement burden associated with point-of-care ultrasound training. Future studies evaluating medic eFAST performance on real-world battlefield trauma patients are needed. Skill and knowledge retention must also be assessed for this degradable skill to determine frequency of refresher training when not regularly performed.

Intraosseous access in adults in cardiac arrest: a systematic review and meta-analysis

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Emergencias 2020 Feb;32(1):49-56.

Abstract

Objectives: To evaluate the efficacy of intraosseous access versus venous access in out-of-hospital cardiac arrest in terms of return of spontaneous circulation (ROSC) and survival to hospital discharge with or without favorable neurologic status.

Material and methods: Systematic review and meta-analysis of articles indexed in MEDLINE (PubMed), Embase, the Web of Science, and the Cochrane Library. Other terms adapted to the language of each index were also used. We included observational studies and clinical trials published from January 1, 1950, to May 31, 2019, if the study population included adult patients in cardiac arrest outside the hospital and in whom an intraosseous or intravenous catheter was inserted. Risk of bias was evaluated with the Cochrane and GRADE (Grading of Recommendations Assessment, Development and Evaluation) tools.

Results: We identified 434 papers to include in the qualitative review and 5 studies for meta-analysis. Intraosseous access was related to a lower rate of ROSC (odds ratio [OR], 0.69; 95% CI, 0.57-0.83; P=.02; I2=65%) and worse survival to discharge (OR, 0.65; 95% CI, 0.51-0.83); P<.01, I2=30%).

Conclusion: Intraosseous access in out-of-hospital cardiac arrest is related to poorer outcomes in terms of ROSC and survival at hospital discharge.

Keywords: Circulación espontánea; Alta hospitalaria; Hospital discharge; Intraosseous catheter; Spontaneous circulation; Vía intraósea.

Evaluation of prolonged 'Permissive Hypotension': results from a 6-hour hemorrhage protocol in swine

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Trauma Surg Acute Care Open 2019 Nov 21;4(1):e000369

Abstract

Background: Tactical Combat Casualty Care guidelines for hemorrhage recommend resuscitation to systolic blood pressure (SBP) of 85±5 mm Hg during prehospital care. Success depends on transport to definitive care within the 'golden hour'. As future conflicts may demand longer prehospital/transport times, we sought to determine safety of prolonged permissive hypotension (PH).

Methods: Adult male swine were randomized into three experimental groups. Non-shock (NS)/normotensive underwent anesthesia only. NS/PH was bled to SBP of 85±5 mm Hg for 6 hours of prolonged field care (PFC) with SBP maintained via crystalloid, then recovered. Experimental group underwent controlled hemorrhage to mean arterial pressure 30 mm Hg until decompensation (Decomp/PH), followed by 6 hours of PFC. Hemorrhaged animals were then resuscitated with whole blood and observed for 24 hours. Physiologic variables, blood, tissue samples, and neurologic scores were collected.

Results: Survival of all groups was 100%. Fluid volumes to maintain targeted SBP in PFC were significantly higher in the hemorrhage group than sham groups. After 24 hours' recovery, no significant differences were observed in neurologic scores or cerebrospinal fluid markers of brain injury. No significant changes in organ function related to treatment were observed during PFC through recovery, as assessed by serum chemistry and histological analysis.

Conclusions: After 6 hours, a prolonged PH strategy showed no detrimental effect on survival or neurologic outcome despite the increased ischemic burden of hemorrhage. Significant fluid volume was required to maintain SBP-a potential logistic burden for prehospital care. Further work to define maximum allowable time of PH is needed.

Just the facts: Hypertonic saline is just as good as (and probably better than) mannitol

Laurel Murphy

CJEM 2020 Mar;22(2):152-154

Abstract

A 27-year-old female is brought to the emergency department (ED) by ambulance following a motor vehicle collision at highway speed. She was the belted driver. She has no significant past medical history and is on no medications. Following a prolonged extrication, she is intubated due to decreased level of consciousness before transport.

The good, the bad and the ugly of point-of-care ultrasound

Alistair Murray

Emerg Med Australas 2020 Feb;32(1):158-159

The use of focussed ultrasound (US) or point-of-care ultrasound (POCUS) has changed significantly over the years, as has the way we learn US: from attending workshops to accessing multiple online resources and increasingly realistic simulators. The knowledge and understanding of the ways we learn has developed with it the need for deliberate practice, spaced repetition and meaningful feedback. With these advances there are significant challenges in trying to ascertain what level of proficiency we have attained. We know that self-assessment is deeply unreliable, for example, if you were to ask a room full of people, ‘Please raise your hand if you think you are an above average driver’, it can be practically guaranteed that over 50% of the room will raise their hand. Experience alone is not enough, or else we would award FACEM upon completion of rotations, without the need for examinations or in-training assessments.

Freeze dried plasma for the resuscitation of traumatized pediatric patients: Response

Roy Nadler, Yael Mozer-Glassberg, Barbara Gaines, Elon Glassberg, Jacob Chen

J Trauma Acute Care Surg 2020 Jun;88(6):e152-e153

While the use of shock index was previously considered as a threshold for blood products use in adults, the Israeli Defense Forces (IDF) current clinical practice guidelines (CPGs) refer to blood pressure and heart rate thresholds. These thresholds are also used by other prehospital systems (1,2). We agree that standard pediatric specific-specific thresholds for prehospital resuscitation with blood products are lacking (3), however, it is important to note that reconstituted FDP is the resuscitation fluid of choice in the IDF, obviating the use of crystalloids. Thus, reconstituted FDP is used mainly to restore lost volume, rather than replacing clotting factors.

The importance of simulation education for the management of traumatic cardiac injuries: a case series

Takashi Nagata, Tomohiko Akahoshi, Michiko Sugino, Wataru Ishii, Ryoji Iizuka, Takafumi Shinjo, Yoshimitsu Izawa, Michiaki Hata, Alan Kawarai Lefor

Surg Case Rep 2019 Dec 20;5(1):202

Abstract

Background: The management of cardiac trauma requires rapid intervention in the emergency room, facilitated by a surgeon with prior experience to have good outcomes. Many surgeons have little experience in the requisite procedures. We report here 4 patients who suffered cardiac trauma, and all 4 patients survived with good neurologic outcomes.

Case presentations: Patient 1 suffered blunt cardiac trauma from a motor vehicle accident and presented in shock. Cardiac tamponade was diagnosed and a cardiac rupture repaired with staples through a median sternotomy after rapid transport to the operating room. Patient 2 suffered blunt cardiac trauma and presented in shock with cardiac tamponade. Operating room median sternotomy allowed extraction of pericardial clot with recovery of physiologic stability. Patient 3 presented with self-inflicted stab wounds to the chest and was unstable. She was brought to the operating room and thoracotomy allowed identification of a left ventricle wound which was repaired with a suture. Patient 4 presented in cardiac arrest with multiple self-inflicted stab wounds to the chest. Emergency room thoracotomy allowed repair of a right ventricle laceration with recovery of vital signs.

Conclusions: The management of all 4 patients was according to the principles taught in the ATOM course. Three of the 4 surgeons had no prior experience with management of cardiac trauma and credited the good outcomes to taking the ATOM course. These are uncommon injuries and formal training in their management is beneficial to patients.

Pediatric Prehospital Wound Prophylaxis in Iraq and Afghanistan

Jason F Naylor, Michael D April, Guyon J Hill, Steven G Schauer

Mil Med 2020 Jan 7;185(Suppl 1):73-76

Abstract

Background: Infectious complications of war wounds are a significant source of mortality and morbidity. Tactical Combat Casualty Care (TCCC) guidelines recommend prehospital moxifloxacin, ertapenem, or cefotetan for "all open combat wounds." We describe the prehospital administration of antibiotics to pediatric trauma patients.

Methods: We queried the Department of Defense Trauma Registry for all pediatric subjects admitted to United States and Coalition fixed-facility hospitals in Iraq and Afghanistan from January 2007 to January 2016.

Results: During this time, there were 3,439 pediatric encounters which represented 8.0% of all admissions. Prehospital providers administered a total of 216 antibiotic doses to 210 subjects. Older children received antibiotics more frequently than younger children, were more likely to be male, located in Afghanistan, and injured by explosive with the majority surviving to hospital discharge. Cefazolin and ceftriaxone were the most frequently utilized antibiotics.

Conclusions: The most frequently administered antibiotics were cephalosporins. TCCC recommended agents for adult prehospital wound prophylaxis were infrequently administered to pediatric casualties. Administration rates of pediatric prehospital wound prophylaxis may be improved with pediatric-specific TCCC guidelines recommending cephalosporins as first-line agents, fielding of a TCCC-oriented Broselow tape, and training prehospital providers on administration of antimicrobials.

Prehospital Transfusion of Low-Titer O + Whole Blood for Severe Maternal Hemorrhage: A Case Report

Ryan Newberry, C J Winckler, Ryan Luellwitz, Leslie Greebon, Elly Xenakis, William Bullock, Michael Stringfellow, Julian Mapp

Prehosp Emerg Care Jul-Aug 2020;24(4):566-575

Abstract

Introduction: Beginning in 2017, multiple stakeholders within the Southwest Texas Regional Advisory Council for Trauma collaborated to incorporate cold-stored low-titer O RhD-positive whole blood (LTO + WB) into all phases of their trauma system, including the prehospital phase of care. Although the program was initially focused on trauma resuscitation, it was expanded to included non-traumatic hemorrhagic shock patients that may benefit from whole blood resuscitation.

Case Report: We report the case of a patient with severe maternal hemorrhage secondary to placenta accreta who received a prehospital transfusion of LTO + WB. We believe this to be the first reported case of post-partum hemorrhage resuscitated out of hospital with whole blood.

Discussion: This case highlights the potential benefits of a prehospital whole blood program as well as the controversy surrounding a LTO + WB program that includes females of childbearing age.

Timely access to care for patients with critical burns in India: a prehospital prospective observational study

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Emerg Med J 2019 Mar;36(3):176-182

Abstract

Background: Low/middle-income countries carry a disproportionate burden of the morbidity and mortality from thermal burns. Nearly 70% of burn deaths worldwide are from thermal burns in India. Delays to medical care are commonplace and an important predictor of outcomes. We sought to understand the role of emergency medical services (EMS) as part of the healthcare infrastructure for thermal burns in India.

Methods: We conducted a prospective observational study of patients using EMS for thermal burns across five Indian states from May to August 2015. Our primary outcome was mortality at 2, 7 and 30 days. We compared observed mortality with expected mortality using the revised Baux score. We used X2 analysis for categorical variables and Wilcoxon two-sample test for continuous variables. ORs and 95% CIs are reported for all modelled predictor variables.

Results: We enrolled 439 patients. The 30-day follow-up rate was 85.9% (n=377). The median age was 30 years; 56.7% (n=249) lived in poverty; and 65.6% (n=288) were women. EMS transported 94.3% of patients (n=399) to the hospital within 2 hours of their call. Median total body surface area (TBSA) burned was 60% overall, and 80% in non-accidental burns. Sixty-eight per cent of patients had revised Baux scores greater than 80. Overall 30-day mortality was 64.5%, and highest (90.2%) in women with non-accidental burns. Predictors of mortality by multivariate regression were TBSA (OR 7.9), inhalation injury (OR 5.5), intentionality (OR 4.7) and gender (OR 2.2).

Discussion: Although EMS rapidly connects critically burned patients to care in India, mortality remains high, with women disproportionally suffering self-inflicted burns. To combat the burn epidemic in India, efforts must focus on rapid medical care and critical care services, and on a burn prevention strategy that includes mental health and gender-based violence support services.

Introduction of a mass burn casualty triage system in a hospital during a powder explosion disaster: a retrospective cohort study

Chip-Jin Ng, Shih-Hao You, I-Lin Wu, Yi-Ming Weng, Chung-Hsien Chaou, Cheng-Yu Chien, Chen-June Seak

World J Emerg Surg 2018 Aug 29;13:38

Abstract

Background: The triage system used during an actual mass burn casualty (MBC) incident is a major focus of concern. This study introduces a MBC triage system that was used by a burn center during an actual MBC incident following a powder explosion in New Taipei City, Taiwan.

Methods: This study retrospectively analyzed data from patients who were sent to the study hospital during a MBC incident. The patient list was retrieved from a national online management system. A MBC triage system was developed at the study hospital using the following modifiers: consciousness, breathing, and burn size. Medical records were retrieved from electronic records for analysis. Patient outcomes consisted of emergency department (ED) disposition and intervention.

Results: The patient population was predominantly female (56.3%), with an average age of 24.9 years. Mean burn sizes relative to the TBSA of triage level I, II, and III patients were 57.9%, 40.5%, and 8.7%, respectively. ICU length of stay differed markedly according to triage level (mean days for levels I vs II vs III: 57.9 vs 39.9 vs 2.5 days; $p < 0.001$). Triage system levels I and II indicate ICU admission with a sensitivity of 93.9% (95%CI 80.4-98.3%) and a specificity of 86.7% (62.1-96.3%).Overall, 3 (6.3%) patients were under-triaged. Two (4.2%) patients were over-triaged. Sixteen (48.5%) and 21 (63.6%) patients of triage levels I and II received endotracheal intubation and central venous catheterization, respectively. Sorting of the study population with simple triage and rapid treatment (START) showed great sensitivity (100.0%) but poor specificity (53.3%). The Taiwan Triage and Acuity Scale (TTAS) presented 87.9% sensitivity and 93.9% specificity.

Conclusions: The current MBC triage algorithm served as a good indicator of ED disposition but might have raised excessive immediate attention and had the potential to exhaust the available resources. These findings add to our knowledge of the MBC triage system and should help future researchers in adjusting the triage criteria to fit actual disasters.

Causes of Delay During Interfacility Transports of Injured Patients Transported by Air Ambulance

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Prehosp Emerg Care 2019 Nov 11;1-9 Online ahead of print.

Abstract

Background: Many severely injured patients are initially brought to a non-trauma centers for initial assessment and stabilization. Air ambulance services are commonly used to expedite interfacility transport of injured patients to trauma centers. Little is known of the types of delays experienced during interfacility transports. The purpose of this study was to identify specific causes of modifiable delays and estimate the attributable time associated with each of these delays.

Methods: This was a retrospective cohort study of injured patients undergoing interfacility transfer to a trauma center who were transported by a provincial air ambulance service between January 1, 2014 and December 31, 2016. Electronic patient care records were screened and then manually reviewed to identify causes of delay during the interfacility transport process. The attributable time for each of these delays was also estimated.

Results: There were 932 injured patients emergently transported by air ambulance from a community hospital to a trauma center over the 3-year study period from which 458 unique causes of delay that were identified. The most frequent cause of delays to sending facility were refueling (38%), waiting for land emergency medical services escort (25%) and weather (12%). The most common in-hospital delays included waiting for documentation (32%), delay to intubate (15%), medically unstable patient (13%) and waiting for diagnostic imaging (12%). The most frequent delays to receiving/handover included waiting for land EMS escort (31%), trauma team not assembled (24%) and weather (17%). In-hospital delays with the longest average length of delay included chest tube insertion (53 minutes), intubation (49 minutes) and delays for diagnostic imaging (46 minutes).Conclusions: In conclusion, we identified numerous modifiable causes of delay during interfacility transport. Efforts to reduce these delays can be made at both the air ambulance and hospital levels.

Impact of an Extraglottic Device on Pediatric Airway Management in an Urban Prehospital System

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West J Emerg Med 2019 Oct 21;20(6):962-969

Abstract

Introduction: Prehospital pediatric endotracheal intubation has lower first-pass success rates compared to adult intubations and in general may not offer a survival benefit. Increasingly, emergency medical services (EMS) systems are deploying prehospital extraglottic airways (EGA) for primary pediatric airway management, yet little is known about their efficacy. We evaluated the impact of a pediatric prehospital airway management protocol change, inclusive of EGAs, on airway management and patient outcomes in children in cardiac arrest or respiratory failure.

Methods: Using data from a large, metropolitan, fire-based EMS service, we performed an observational study of pediatric patients with respiratory failure or cardiac arrest who were transported by EMS before and after implementation of an evidence-based airway management protocol inclusive of the addition of the EGA. The primary outcome was change in frequency of intubation attempts when paired with an initial EGA. Secondary outcomes included EGA and intubation success rates and patient survival to hospitalization and discharge.

Results: We included 265 patients age <16 years old, with 142 pre- and 123 post-protocol change. Patient demographics and event characteristics were similar between groups. Intubation attempts declined from 79.6% pre- to 44.7% ($p<0.01$) post-protocol change. In patients with an intubation attempt, overall intubation success declined from 81.4% to 63.6% ($p<0.01$). Post-protocol change, an EGA was attempted in 52.8% of patients with 95.4% success.

Conclusion: Implementation of an evidenced-based airway management algorithm for pediatric patients, inclusive of an EGA device for all age groups, was associated with fewer prehospital intubations. Intubation success may be negatively impacted due to decreases in procedural frequency.

Prehospital treatment of burns in Tanzania: a mini-meta-analysis

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Int J Burns Trauma 2018 Jun 20;8(3):68-76

Abstract

The present study describes initial burn injury care in Tanzania-materials applied, sources of information, reasons for applying the materials, and time to a health centre-in order to suggest ways to optimize initial care. Eight small studies were conducted in which burn-injured patients were interviewed who had been admitted to referral hospitals in four regions in Tanzania. Most burn injuries in Tanzania occur in the home cooking area, and it was found that the first responders were family members, friends, and neighbours. A total of 710 burn victims were interviewed. Twenty-four different materials were applied to the patients' wounds. The most common application was honey. Only 14.3% of the victims received the recommended form of care: application of cool water. It was also found that nothing was applied to the wounds of 17.5% of these patients by first responders. Sources of information on burn treatment were family, friends and neighbours, and, less often, health workers or the media. Most of the burn victims' households had enough water to enable administration of recommended initial care. The main impediment to the provision of appropriate initial treatment of a burn appears to be lack of correct and useful knowledge about what to do immediately after the injury. A two-pronged educational approach should be used to improve care. A national mass media campaign should start immediately to inform ordinary citizens about proper initial treatment of burns. In addition, curricula of all schools that train health workers need to be reviewed for accuracy, and appropriate knowledge about initial care of burn victims should be added if necessary. Measures to improve burn first aid, are relatively easy, even in a low-income country such as Tanzania.

Prehospital care of burn injuries in Africa: A review, 1990-2018

Anne H Outwater, Tanya Van Braekel

Burns 2019 Nov 27;S0305-4179(19)30173-1

Abstract

Purpose: Administration of appropriate first aid immediately after a burn injury is crucial to averting further harm to the victim, physically and psychologically. The aim of this review is to enable the design of better interventions by describing what is known about prehospital care of burn victims in Africa.

Results: This review is based on 17 articles from 5 countries. For the purposes of the review, first responders are defined as those nearest the victim when a burn occurs. First responders include nonclinicians, most typically the mother of a young burn victim. Forty-five different substances, sometimes used in combination, are reported to have been applied to burn injuries: water, 15 food items (especially oils and egg), 14 pharmaceutical products, 9 traditional treatments, 5 minerals (petroleum products being the most common), and charcoal. Appropriate treatment, defined as the application of cool water for 10 min, was achieved about 0.5% of the time, most frequently in Cape Town, South Africa. Most victims do not have their wounds covered while they are transported to a health-care facility. Treatment delays are common. Pain management is hardly addressed.

Conclusions: Appropriate prehospital care for burn injury generally is not practiced in Africa. Yet best practices for prehospital care are affordable, available, and easily understood. The greatest risk factor for poor care is first responders' lack of knowledge. Awareness and education campaigns focusing on the lay public, as well as educational institutions for health workers, are urgently needed throughout the continent.

Efficacy and safety of kaolin-based hemostatic pad vs. standard mechanical compression following transradial and transulnar access for elective coronary angiography and PCI: RAUL trial substudy

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Heart Vessels 2020 Apr;35(4):502-508

Abstract

Hemostatic devices used in the transradial approach (TRA) and transulnar approach (TUA) are limited. This study compared the efficacy and safety of hemostasis using the QuikClot Radial hemostatic pad (QC) vs. standard mechanical compression (SC) after coronary angiography (CAG). This prospective single-center randomized trial included CAG patients. The primary and secondary endpoints were efficacy (successful hemostasis) and safety (total artery occlusion [TAO], pseudoaneurysm, hematoma), respectively. A visual analog scale (VAS) evaluated patient pain during compression. In 2013-2017, 200 patients were randomized 2 × 2 into the: (1) TRA and TUA groups and (2) QC and SC groups. Successful hemostasis was achieved in 92 (92%) patients in the QC group and 100 (100%) patients in the SC group ($p < 0.006$). The TRA SC subgroup showed significantly better results than the TRA QC subgroup (100% vs. 90.0%; $p < 0.03$). Similar results were obtained in the TUA QC and TUA SC subgroups (95% vs. 100%; $p = 0.5$). The secondary endpoint was achieved in the QC and SC groups (8% vs. 9%; $p = 0.8$). Patients reported significantly less pain during QC application than during SC (VAS: 2.6 ± 2.6 vs. 3.4 ± 2.9; $p < 0.03$). In patients undergoing CAG with TRA or TUA, QC was associated with lower efficacy, less discomfort, and similar safety compared to SC.

A Telemedicine Case Series for Acute Medical Emergencies in Greenland: A Model for Austere Environments

Luit Penninga, Anne Kathrine Lorentzen, Christopher Davis

Telemed J E Health 2019 Dec 4. Online ahead of print.

Abstract

Background: Greenland is a vast country, with immense geographical distances and often extreme weather conditions. Specialized health care is limited to larger cities, and qualified medical care is not always immediately available in rural areas. Telemedicine infrastructure is available throughout the country.

Purpose: The purpose of this study was to identify the role of telemedicine in the diagnosis and treatment of acute medical emergencies in remote settlements. Materials and Methods: All medical emergencies were screened from 2015 to 2016 in remote settlements of the Avannaa Health Region in Northwest Greenland, and cases in which telemedicine was utilized were identified.

Results: Three illustrative cases were identified. Diagnoses were severe asthma, bilateral pneumonia, and heart failure. All three patients were accurately diagnosed through a telemedical consultation, and early treatment was initiated. In two out of three patients, acute medical evacuation by air ambulance was avoided, and the third patient was stabilized by the time an air ambulance arrived.

Conclusions: Telemedicine allows for the accurate diagnosis of acute medical emergencies in remote settlements of Greenland and facilitates timely initiation of treatment. This may reduce morbidity and mortality of acute medical illness. In addition, telemedicine may aid in the clinical decision-making on whether or not to arrange for medical evacuation. Avoiding unnecessary medical evacuations reduces cost and risk to air ambulance crews. In addition, telemedicine allows for close monitoring of the patient until the air ambulance arrives. Telemedicine also ensures diagnostic and treatment options when medical evacuation is impossible due to extreme weather conditions. From a global perspective, telemedicine may increase the availability and quality of health care in remote areas and reduce health inequalities between remote and urban areas.

Predictors of Definitive Airway Sans Hypoxia/Hypotension on First Attempt (DASH-1A) Success in Traumatically Injured Patients Undergoing Prehospital Intubation

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Prehosp Emerg Care Jul-Aug 2020;24(4):470-477

Abstract

Background: Prehospital intubation success is routinely treated as a dichotomous outcome based on an endotracheal tube passing through vocal cords regardless of number of attempts or occurrence of hypoxia, or hypotension, which are associated with worse outcomes. We explore patient, provider, and procedure-related variables associated with successful definitive airway sans hypoxia/hypotension on first attempt (DASH-1A) in traumatically injured subjects undergoing endotracheal intubation at the scene of injury by a helicopter EMS system.

Methods: This single-center retrospective chart review included patients with traumatic injuries and at least one attempted intubation by helicopter EMS at the scene of injury. Demographic and clinical variables were tested for association with DASH-1A and overall first-attempt success using univariate comparisons and multivariable logistic regression to produce adjusted odds ratios (aORs) and 95% confidence intervals (CIs). Purposeful backwards stepwise elimination was used to develop logistic regression models for outcomes. Initial inclusion of covariates in multivariable models was based on clinical judgement, known or suspected risk factors and confounders for intubation success, and univariate associations.

Results: Of 419 subjects screened, 263 met inclusion criteria. Median age was 34 years and the majority of subjects were Caucasian (95%), male (76%), and suffered blunt trauma (90%). The endotracheal tube was successfully placed on the first attempt in 198 (75.3%) of patients, but only 142 (55.3%) had a successful DASH-1A, and overall, 246 (94%) had an endotracheal tube passed successfully before hospital arrival. Factors significantly associated with successful DASH-1A were no ground EMS intubation attempt prior to arrival [aOR 2.2 (CI 1.0-4.9)], lack of airway secretions/blood [1.9 (1.0-3.4)], Cormack-Lehane Score of I and II [12.3 (4.5-33.2) & 3.2 (1.2-9.1), respectively], and bougie use [5.4 (1.8-15.8)]. For endotracheal tube passing only, the following were significantly associated with first pass success: grade of view I and II [aORs 87.3 (CI 25.8-295.7) & 6.8 (2.3-19.5), respectively], lack of secretions/blood [4.9 (2.1-11.2), bougie use [7.8 (2.3-26.3)], direct laryngoscopy [5.1 (1.5-17.0)] and not using apneic oxygenation through a nasal cannula [2.5 (1.1-5.6)].Conclusion: In our helicopter EMS system, successful endotracheal intubation on the first attempt and without an episode of hypoxia was associated with no ground EMS intubation attempt prior to flight crew arrival, lack of airway secretions/blood, Cormack-Lehane Score, and bougie use.

Ambulance management of patients with penetrating truncal trauma and hypotension in Melbourne, Australia

Eva Rosenbaum, Shelley Cox, Karen Smith, Mark Fitzgerald, George Braitberg, Anthony Carpenter, Stephen Bernard

Emerg Med Australas 2020 Apr;32(2):336-343

Objective: Penetrating truncal trauma with hypotension is uncommon in Australia. Current pre-hospital clinical practice guidelines based on overseas studies recommend expedited transport to definitive trauma care and that i.v. fluid should only be administered to maintain palpable blood pressure.

Methods: A retrospective review included all adult patients with penetrating truncal trauma and hypotension (systolic blood pressure <90 mmHg) attended by emergency medical services in Victoria between January 2006 and December 2018. Patient pre-hospital characteristics and hospital outcomes are described using descriptive statistics. Predictors of fluid resuscitation and mortality were examined using logistic regression analyses.

Results: Between 2006 and 2018 there were 101 hypotensive, penetrating truncal injury major trauma patients in Melbourne, Victoria transported by road ambulance to a major trauma service. The median age of these patients was 38 years (interquartile range [IQR] 27-50) and 85% were male. Median scene time was 16.6 min (IQR 12-26) and median pre-hospital time was 53.0 min (IQR 38-66). Intravenous fluid resuscitation was given in 54.5% of cases. The mechanism of injury was stabbing in 91.1% and gunshot wound in 8.9%. Urgent surgery was required in 72.3% of cases, 32.7% of patients were admitted to the intensive care unit and there were eight deaths (8.3%).

Conclusion: Penetrating truncal trauma with hypotension is rare in Melbourne, Australia with most patients having the injury caused by stabbing rather than shooting. Compared with outcomes reported in the USA and Europe, the mortality rate is low.

Warming blood prior to transfusion using latent heat

David Roxby, Magdalena Sobieraj-Teague, Jacoba von Wielligh, Romi Sinha, Bryone Kuss, Anne-Louise Smith, Mark McEwen

Emerg Med Australas 2020 Aug;32(4):604-610

Abstract

Objective: Major trauma is associated with blood loss and hypothermia. It is common to replace lost fluid with red cells stored at 2-6°C, and/or colloid/crystalloid fluid stored at ambient temperature, thus increasing hypothermia risk. At trauma and medical retrieval sites, mains electricity powered fluid warmers cannot be generally used. Latent heat provides an alternate practical method of portable temperature-controlled intravenous fluid warming. This work investigates the safety and efficacy of a fluid warmer powered by latent heat.

Methods: Twenty-five haematology patients received red cell transfusions, one through a fluid warmer, using latent heat from a super-cooled liquid and one without warming. Temperature of donor red cell units was measured after passing through fluid warmers. Blood samples were collected from red cell units and patients, prior and after each transfusion. These were tested for haemolysis markers (plasma haemoglobin, potassium, lactate dehydrogenase, bilirubin) and for traces of super-cooled liquid. Patient physiological parameters (oxygen saturation, pulse, temperature, blood pressure, respiration) were monitored during each transfusion.

Results: Patient's physiological signs remained stable and no transfusion reactions were observed during warm transfusions. Latent heat fluid warmers increased the temperature of red cell units to approximately 35°C. There were no significant differences in haemolysis markers following warmed and unwarmed transfusions, and no contamination of red cell units by super-cooled liquid was detected.

Conclusion: The latent heat fluid warmer was shown to safely warm transfused blood in a controlled clinical setting.

Abdominal aortic and junctional tourniquet versus zone III resuscitative endovascular balloon occlusion of the aorta in a swine junctional hemorrhage model

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J Trauma Acute Care Surg 2020 Feb;88(2):292-297

Abstract

Background: Junctional hemorrhage is a leading contributor to battlefield mortality. The Abdominal Aortic and Junctional Tourniquet (AAJT) and infrarenal (zone III) resuscitative endovascular balloon occlusion of the aorta (REBOA) are emerging strategies for controlling junctional hemorrhage, with AAJT currently available in select forward deployed settings and increasing interest in applying REBOA in the military prehospital environment. This study compared the hemostatic, hemodynamic, and metabolic effects of these devices used for junctional hemorrhage control.

Methods: Shock was induced in anesthetized, mechanically ventilated swine with a controlled hemorrhage (20 mL/kg) and closed femur fracture followed by uncontrolled hemorrhage from a partial femoral artery transection (40% total hemorrhage volume). Residual femoral hemorrhage was recorded during 60-minute AAJT (n = 10) or zone III REBOA (n = 10) deployment, and the arterial injury was repaired subsequently. Animals were resuscitated with 15 mL/kg autologous whole blood and observed for 6 hours.

Results: One animal in each group died during observation. Both devices achieved hemostasis with mean residual femoral blood loss in the AAJT and REBOA groups of 0.38 ± 0.59 mL/kg and 0.10 ± 0.07 mL/kg ($p = 0.16$), respectively, during the 60-minute intervention. The AAJT and REBOA augmented proximal blood pressure equally with AAJT allowing higher distal pressure than REBOA during intervention ($p < 0.01$). Following device deflation, AAJT animals had transiently lower mean arterial blood pressure than REBOA pigs (39 ± 6 vs. 54 ± 11 mm Hg $p = 0.01$). Both interventions resulted in similar degrees of lactic acidemia which resolved during observation. Similar cardiac and renal effects were observed between AAJT and REBOA.

Conclusion: The AAJT and REBOA produced similar hemostatic, resuscitative, and metabolic effects in this model of severe shock with junctional hemorrhage. Both interventions may have utility in future military medical operations.

Perceived versus actual cricothyroid membrane landmarking accuracy by emergency medicine residents and staff physicians

Nicholas Schouela, Michael Y Woo, Andy Pan, Warren J Cheung, Jeffery J Perry

CJEM 2020 Jul;22(4):523-527

Abstract

Objectives: Cricothyrotomy is an intervention performed to salvage "can't intubate, can't ventilate" situations. Studies have shown poor accuracy with landmarking the cricothyroid membrane, particularly in female patients by surgeons and anesthesiologists. This study examines the perceived versus actual success rate of landmarking the cricothyroid membrane by resident and staff emergency physicians using obese and non-obese models.

Methods: Five male and female volunteers were models. Each model was placed supine, and a point-of-care ultrasound expert landmarked the borders of each cricothyroid membrane; 20 residents and 15 staff emergency physicians were given one attempt to landmark five models. Overall accuracy and accuracy stratified by sex and obesity status were calculated.

Results: Overall landmarking accuracy amongst all participants was 58% (SD 18%). A difference in accuracy was found for obese males (88%) versus obese females (40%) (difference = 48%, 95% CI = 30-65%, $p < 0.0001$), and non-obese males (77%) versus non-obese females (46%) (difference = 31%, 95% CI = 12-51%, $p = 0.004$). There was no association between perceived difficulty and success (correlation = 0.07, 95% CI = -0.081-0.214, $p = 0.37$). Confidence levels overall were higher amongst staff physicians (3.0) than residents (2.7) (difference = 0.3, 95% CI = 0.1-0.6, $p = 0.02$), but there was no correlation between confidence in an attempt and its success ($p = 0.33$).

Conclusion: We found that physicians demonstrate significantly lower accuracy when landmarking cricothyroid membranes of females. Emergency physicians were unable to predict their own accuracy while landmarking, which can potentially lead to increased failed attempts and a longer time to secure the airway. Improved training techniques may reduce failed attempts and improve the time to secure the airway.

Prehospital Battlefield Casualty Intervention Decision Cognitive Study

Marc A Schweizer, David Wampler, Kevin Lu, Andrew S Oh, Stephen J Rahm, Nicholas M Studer, Cord W Cunningham

Mil Med 2020 Jan 7;185(Suppl 1):274-278

Abstract

Introduction: Airway compromise is the third most common cause of preventable battlefield death. Surgical cricothyroidotomy (SC) is recommended by Tactical Combat Casualty Care (TCCC) guidelines when basic airway maneuvers fail. This is a descriptive analysis of the decision-making process of prehospital emergency providers to perform certain airway interventions.

Methods: We conducted a scenario-based survey using two sequential video clips of an explosive injury event. The answers were used to conduct descriptive analyses and multivariable logistic regression models to estimate the association between the choice of intervention and training factors.

Results: There were 254 respondents in the survey, 176 (69%) of them were civilians and 78 (31%) were military personnel. Military providers were more likely to complete TCCC certification (odds ratio [OR]: 13.1; confidence interval [CI]: 6.4-26.6; P-value < 0.001). The SC was the most frequently chosen intervention after each clip (29.92% and 22.10%, respectively). TCCC-certified providers were more likely to choose SC after viewing the two clips (OR: 1.9; CI: 1.2-3.2; P-value: 0.009), even after controlling for relevant factors (OR: 2.3; CI: 1.1-4.8; P-value: 0.033).

Conclusions: Military providers had a greater propensity to be certified in TCCC, which was found to increase their likelihood to choose the SC in early prehospital emergency airway management.

Efficacy of continuous positive airway pressure in casualties suffering from primary blast lung injury: A modeling study

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Conf Proc IEEE Eng Med Biol Soc 2019 Jul;2019:4965-4968

Abstract

Primary blast lung injury is the most important component of a multisystem syndrome of injury that results from exposure to an explosive shockwave. The majority of such casualties require ventilation in an intensive care unit. We describe the use of a novel primary blast lung injury simulator to evaluate the potential efficacy of continuous positive airway pressure in 6 in silico casualties over 24 hours after injury. Our results suggest that primary blast lung injury is a form of acute lung injury that can be effectively managed with continuous positive airway pressure. In austere environments or in circumstances where medical resources are overwhelmed, continuous positive airway pressure using ambient air may be of benefit.

Ability of Layperson Callers to Apply a Tourniquet Following Protocol-Based Instructions From an Emergency Medical Dispatcher

Greg Scott, Christopher Olola, Marie Isabel Gardett, Daniel Ashwood, Meghan Broadbent, Srilakshmi Sangaraju, Paul Stiegler, Mark Conrad Fivaz, Jeff J Clawson

Prehosp Emerg Care 2020 Mar 3;1-8 Online ahead of print.

Abstract

Introduction: One of the greatest casualty-care improvements resulting from US military operations in Iraq and Afghanistan has been the reduction of preventable death from massive extremity hemorrhage - largely due to the widespread use of limb tourniquets. More recently, tourniquet use in civilian, prehospital settings has shown promise in reducing deaths in cases of catastrophic arterial limb hemorrhage. Telephone instructions by trained emergency medical dispatchers (EMDs) on applying an available tourniquet may help achieve such a benefit.

Objectives: The objective of the study was to determine whether layperson callers can effectively stop simulated bleeding using an improvised or a commercial tourniquet, when provided with scripted instructions via phone from a trained protocol-aided EMD.

Methods: This was a prospective, randomized trial involving layperson volunteers, done at four locations in Salt Lake City, Utah, USA. Volunteers were assigned randomly to three groups: one for each of two commonly available commercial tourniquets and one for an improvised tourniquet.

Results: A total of 246 subjects participated in the study at the four locations between February 11, 2019 and June 22, 2019. The overall median time for all trials (i.e., elapsed time from the start to the end of the simulation) was 3 minutes and 19 seconds. Median time to stop the bleeding (i.e., elapsed time from the start of the simulation to the time the participant was able to successfully stop the bleeding) was 2 minutes and 57 seconds. Median tourniquet pressure was 256 mmHg and median-end blood loss was 1,365 mL. A total of 198 participants (80.49%) were able to completely stop the bleeding while 16 participants (6.5%) had the tourniquet applied with some bleeding still occurring, and 32 participants (13.01%) exceeded the threshold of 2,500 mL of blood loss, resulting in the "patient" not surviving.

Conclusions: The study findings demonstrated that untrained bystanders provided with instructions via phone from a trained Emergency Medical Dispatcher applied a tourniquet and successfully stopped the bleeding completely in most cases.

Is Intranasal Ketamine Safe and Effective as a Prehospital Analgesic?

Brett H Shaw 1, Marshall Ross 1

CJEM 2020 Jan;22(1):31-32

ABSTRACT

Background: Primary care paramedics in British Columbia, Canada, have limited analgesic options other than nitrous oxide when transporting patients. Ketamine can be an effective analgesic when dosed appropriately.

Objective: The aim of this study was to compare the improvement in pain scores between intranasal ketamine and placebo when added to baseline inhaled nitrous oxide.

Design: Single-centre randomized double blind control trial.

Setting: Out-of-hospital patients being cared for by primary care paramedics dispatched from a single station.

Subjects: Out-of-hospital patients with acute pain who reported a verbal numeric rating scale pain score ≥ 5, and who wished to receive analgesia.

Intervention: 0.75 mg/kg intranasal ketamine v. placebo, both in addition to baseline nitrous oxide administration.

Outcomes: Primary outcome was the proportion of patients experiencing a reduction in verbal numeric rating scale score ≥ 2 at 30 minutes.

Synthesis of chitosan iodoacetamides via carbodiimide coupling reaction: Effect of degree of substitution on the hemostatic properties

Jialong Shen, Ahmed Ali Nada, Nabil Yousrie Abou-Zeid, Samuel M Hudson

Carbohydr Polym 2020 Feb 1;229:115522

Abstract

Uncontrolled hemorrhage continues to be the leading cause of death from traumatic injuries both in the battlefield and in the civilian life. Chitosan is among the very few materials that have made the short list of military recommended field-deployable hemostatic dressings. However, the detailed mechanism of its action is still not fully understood. Moreover, in the cases when patients developed coagulopathy, the efficacy of the dressings rely solely on those mechanisms that work outside of the regular blood coagulation cascade. In addition to the well-known erythrocyte agglutination, we proposed to use the reactive N-iodoacetyl group on a new chitosan derivative to accelerate hemostasis. In this paper, we describe the synthesis of chitosan iodoacetamide (CI) with considerations of the stoichiometry among the reagents, the choice of solvent, the pH of the reaction medium, and the reaction time. The reaction was confirmed by FT-IR, 1H and 13C NMR, elemental analysis, iodine content analysis, and SEM-EDS. Water contact angle measurements and Erythrocyte Sedimentation Rate (ESR) method were used to evaluate the hemostatic potential of the newly synthesized CI as a function of their degree of substitution (DS). The range of DS was 5.9% to 27.8% for CI. The mid-range of DS gave the best results for the ESR. CIs exhibit favorable cytocompatibilities up to DS 18.7 compared to the generic unmodified chitosan. In general, the biocompatibility of chitosan iodoacetamide slightly declined with increasing the iodide content up to DS 21.5 owing to its affinity to SH groups of cells.

Massive transfusion and the response to prehospital plasma: It is all in how you define it

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J Trauma Acute Care Surg 2020 Jul;89(1):43-50

Abstract

Background: A recent analysis derived from the Prehospital Air Medical Plasma trial data set demonstrated no significant independent plasma survival benefit in those who required massive transfusion (≥10 units of red cells in 24 hours). The definition of massive transfusion has evolved over time to minimize bias and predict those at highest risk of death. We sought to characterize the definition of massive transfusion, their associated mortality risks and the survival benefit associated with prehospital plasma.

Methods: A secondary analysis was performed using data from a recent prehospital plasma trial. Patients transferred directly from the scene were characterized. We defined historic massive transfusion using ≥10 units red cells in 24 hours and critical administration threshold (CAT) as ≥3 units per hour in the first hour (CAT1hr) or in any of the first 4 hours (CAT4hr) from arrival. The primary outcome was 30-day mortality. Kaplan-Meier analysis and Cox hazard regression were used to characterize the survival benefit of prehospital plasma.

Results: There were a total of 390 enrolled patients who were transferred from the scene and represent the study cohort. Overall, 126 patients were positive for the CAT1hr metric, 183 patients were positive for the CAT4hr metric and 84 patients were positive for historic massive transfusion metric. The overall study mortality rate for those patients who met each transfusion definition was 13.1%, 17.4% and 10.0%, respectively. The CAT4hr metric had the lowest potential for survival bias. Kaplan-Meier survival analysis demonstrated a prehospital plasma survival benefit in the patients who were CAT4hr positive.

Conclusion: The current analysis demonstrates the superior utility of the CAT4hr definition with optimization of survival bias while conserving mortality risk prediction. This transfusion definition was associated with a prehospital plasma survival benefit and may be the most appropriate definition of massive transfusion for pragmatic studies which focus on hemorrhagic shock.

Level of evidence: Epidemiologic, Level II.

The supraglottic airway device as first line of management in anticipated difficult mask ventilation in the morbidly obese

Aparna Sinha, Lakshmi Jayaraman, Dinesh Punhani

J Anaesthesiol Clin Pharmacol Oct-Dec 2019;35(4):540-545

Abstract

Background and aims: Supraglottic airway devices (SGAs) are used to rescue difficult and failed mask ventilation (DMV). We aimed to use the SGA as first-line device, prior to obtaining a definitive airway and to find any predictors of difficulty for the same, in the morbidly obese patients.

Material and methods: Obese surgical patients [body mass index (BMI) >35 kg/m2] were investigated. Difficulties with bag mask ventilation (MV) was graded using the following scale: MV-1, one anesthesiologist unassisted could achieve MV and maintain SpO2>90%; MV-2, one additional anesthesiologist was needed to facilitate MV to achieve SpO2> 90%; MV-3, two additional anesthesiologists were needed for this purpose; and MV-3P, when a supraglottic device was required to ventilate and maintain SpO2 more than 90%. Parameters studied were age, gender, neck circumference (NC), BMI, STOPBANG score, and safe apnea time (SAT).

Results: Logistic regression was performed for predictors of MV-3P; receiver operating characteristic curve was used to locate the best cut-off. Analysis of 834 morbidly obese patients revealed an incidence of MV 1/2/3/3-P as 16%/38%/27%/19%, respectively. DMV was associated with BMI ≥50 kg/m2, NC ≥49.5 cm, and STOPBANG ≥6; $P < 0.001$. The mean SAT for a population with mean BMI 48 ± 8 kg/m2 was 256 ± 66 s. The SAT showed inverse relation to BMI and NC. As per our results, the NC was the single most important predictor of MV-3P, with sensitivity 0.62 and specificity 0.85 at best cut-off 49.5 cm; $P < 0.001$.

Conclusion: NC ≥49.5 cm is strongly associated with low SAT and need for SGA to achieve MV. SGA may provide safety for initial management following induction of anesthesia in this patient population.

Systematic approach to delivering prolonged field care in a prehospital care environment

Michael Smith, K Johnston, R Withnall

BMJ Mil Health 2020 Feb 27; Online ahead of print.

Abstract

Background: This article describes a novel patient care algorithm which provides a Role 1 (R1) medic with a structured approach to delivering prolonged field care (PFC) in a resource-limited environment. PFC is a vital component of the operational patient care pathway providing the continuum of care from completion of a primary survey to the delivery to hospital care. Future operational environments are likely to have more fragile or extended lines of communication, potentially delaying evacuation to hospital care. This delay may lead to increases in patient morbidity and mortality. Effective PFC offers an opportunity to improve patient outcomes and help mitigate against this risk.

Methods: An initial prototype model of a PFC care process was developed using existing hospital-based guidance. A series of medical and trauma vignettes and best available evidence were used to refine the algorithm.

Results: The algorithm has been designed be used in conjunction with patient specific clinical guidance making the approach generalisable for all patient groups. For UK military, clinical guidance is provided by clinical guidelines for operations. The algorithm can be downloaded into a convenient format to be used on mobile devices or printed as an aide memoire.

The Use of Tranexamic Acid (TXA) for the Management of Hemorrhage in Trauma Patients in the Prehospital Environment: Literature Review and Descriptive Analysis of Principal Themes

Rachel Stansfield, Danielle Morris, Emmanuel Jesulola

Shock 2020 Mar;53(3):277-283

Abstract

Tranexamic acid (TXA) is an antifibrinolytic agent used to prevent traumatic exsanguination. It was first introduced to clinical practice for the management of patients with bleeding disorders, especially adapted to reduce bleeding in hemophiliacs undergoing oral surgical interventions. TXA exerts its action on the coagulation process by competitively inhibiting plasminogen activation, thereby reducing conversion of plasminogen into plasmin. This ultimately prevents fibrinolysis and reduces hemorrhage. Thus, TXA may be well suited for the management of traumatic hemorrhage in the prehospital setting.Despite multiplicity of studies on the use of TXA in clinical practice, there is no consensus regarding the use of TXA for the management of hemorrhage in trauma patients in the prehospital environment. Thus, a review on this topic was warranted. An extensive literature search yielded 14 full journal articles which met the inclusion criteria. These articles were thoroughly analyzed and the following themes were identified: "dose of TXA administration," "route of TXA administration," "optimal window of TXA administration," "safety of TXA use," "clinical effectiveness of TXA application," and the "feasibility of TXA use in the prehospital setting."Overall, to achieve the best possible outcomes, the literature supports the use of a loading dose of 1 g of TXA, followed by 1 g infusion over 8 h, given by intravenous administration within a 3-h window period of traumatic injury. TXA is very effective and safe to use in the prehospital setting, and its use is clinically and economically feasible.

Fatal head and neck injuries in military underbody blast casualties

Sarah K Stewart, A P Pearce, Jon C Clasper

J R Army Med Corps 2019 Feb;165(1):18-21

Abstract

Introduction: Death as a consequence of underbody blast (UBB) can most commonly be attributed to central nervous system injury. UBB may be considered a form of tertiary blast injury but is at a higher rate and somewhat more predictable than injury caused by more classical forms of tertiary injury. Recent studies have focused on the transmission of axial load through the cervical spine with clinically relevant injury caused by resultant compression and flexion. This paper seeks to clarify the pattern of head and neck injuries in fatal UBB incidents using a pragmatic anatomical classification.

Methods: This retrospective study investigated fatal UBB incidents in UK triservice members during recent operations in Afghanistan and Iraq. Head and neck injuries were classified by anatomical site into: skull vault fractures, parenchymal brain injuries, base of skull fractures, brain stem injuries and cervical spine fractures. Incidence of all injuries and of each injury type in isolation was compared.

Results: 129 fatalities as a consequence of UBB were identified of whom 94 sustained head or neck injuries. 87 casualties had injuries amenable to analysis. Parenchymal brain injuries (75%) occurred most commonly followed by skull vault (55%) and base of skull fractures (32%). Cervical spine fractures occurred in only 18% of casualties. 62% of casualties had multiple sites of injury with only one casualty sustaining an isolated cervical spine fracture.

Conclusion: Improvement of UBB survivability requires the understanding of fatal injury mechanisms. Although previous biomechanical studies have concentrated on the effect of axial load transmission and resultant injury to the cervical spine, our work demonstrates that cervical spine injuries are of limited clinical relevance for UBB survivability and that research should focus on severe brain injury secondary to direct head impact.

Pilot Study of a Novel Swine Model for Controlling Junctional Hemorrhage Using the iTClamp in Conjunction With Hemostatic Agents

Sean M Stuart, Gregory Zarow, Alexandra Walchak, Julie McLean, Paul Roszko

Mil Med 2019 Mar 1;184(Suppl 1):367-373

Abstract

Exsanguinating hemorrhage is a primary cause of battlefield death. The iTClamp is a relatively new device (FDA approval in 2013) that takes a different approach to hemorrhage control by applying mechanism wound closure. However, no previous studies have explored the feasibility of utilizing the iTClamp in conjunction with hemostatic packing. To fill this important gap in the literature, a novel swine model was developed, and a total of 12 trials were performed using QuikClot Combat Gauze or XSTAT sponges in conjunction with the iTClamp to treat arterial injuries through 5 cm or 10 cm skin incisions in the groin, axilla, or neck. First-attempt application success rate, application time, and blood loss were recorded. Hemostasis was achieved on all wounds, though reapplication was required in one Combat Gauze and three XSTAT applications. Application averaged ~50% slower for Combat Gauze (M = 41 seconds, 95%CI: 22-32 seconds) than for XSTAT (M = 27 seconds, 95%CI: 35-47 seconds). XSTAT application was faster than Combat Gauze for each wound location and size. The 10 cm wounds took ~10 seconds (36%) longer to close (M = 27 seconds, 95%CI: 35-47 seconds) than the 5 cm wounds (M = 27 seconds, 95%CI: 35-47 seconds). Blood loss was similar for Combat Gauze (M = 51 mL, 95%CI: 25-76 mL) and XSTAT (M = 60 mL, 95%CI: 30-90 mL). Blood loss was roughly twice as great for 10 cm wounds (M = 73 mL, 95%CI: 47-100 mL) than for 5 cm wounds (M = 38 mL, 95%CI: 18-57 mL). This pilot study supports the feasibility of a novel model for testing the iTClamp in conjunction with hemostatic packing towards controlling junctional hemorrhage.

Considerations for Development of Exposure Limits for Chemicals Encountered During Aircraft Operation

Lisa M Sweeney, Jeffery M Gearhart, Darrin K Ott, Heather A Pangburn

Mil Med 2020 Jan 7;185(Suppl 1):390-395

Abstract

Background: Military aircrews' health status is critical to their mission readiness, as they perform physically and cognitively demanding tasks in nontraditional work environments. Research Objectives: Our objective is to develop a broad operational risk assessment framework and demonstrate its applicability to health risks to aircrews because of airborne chemical exposure, considering stressors such as heat and exertion.

Methods: Extrapolation of generic exposure standards to military aviation-specific conditions can include computation of risk-relevant internal dosimetry estimates by incorporating changes in breathing patterns and blood flow distribution because of aspects of the in-flight environment. We provide an example of the effects of exertion on peak blood concentrations of 1,2,4-trimethylbenzene computed using a physiologically based pharmacokinetic model.

Results: Existing published collections on the effects of flight-related stressors on breathing patterns and blood flow address only a limited number of stressors. Although data exist that can be used to develop operational exposure limits specific to military aircrew activities, efforts to integrate this information in specific chemical assessments have been limited.

Conclusions: Efforts to develop operational exposure limits would benefit from guidance on how to make use of existing assessments and expanded databases of the impact of environmental stressors on adult human physiology.

Needle Aspiration Versus Closed Thoracostomy in the Treatment of Spontaneous Pneumothorax: A Meta-analysis

Jixiang Tan, Hong Chen, Jin He, Lin Zhao

Lung 2020 Apr;198(2):333-344

Abstract

Purpose: To compare the effectiveness and safety between needle aspiration (NA) and closed thoracostomy (CT) method in adult spontaneous pneumothorax (SP) patients and to explore the most effective and safe protocol by using meta-analysis method.

Materials and methods: This study was based on Cochrane methodology for conducting meta-analysis. Only randomized controlled trials were eligible for this study. The participants were adults who had SP. The Review Manager Database was used to analyze selected studies.

Results: Nine RCTs involving 665 patients were included. Although the initial success rate of CT was higher, the two groups were not statistically significant (RR 0.87 [95% CI 0.76-1.00]; p = 0.05). Compared the NA group, the use of CT method to treat SP significantly increased complications (RR 0.17 [95% CI 0.06-0.45]; p = 0.0003) and operation rate (RR 0.57 [95% CI 0.35-0.95]; p = 0.03). There was no significant difference in the 1-week success rate, admitted rate, 3-month recurrence rate, 1-year recurrence rate, and recurrence time between the two groups. Subgroup analysis of primary spontaneous pneumothorax (PSP) and secondary spontaneous pneumothorax (SSP) patients showed that the initial success rate of the CT method was higher than NA group (RR 0.74 [95% CI 0.60-0.92]; p = 0.007).

Conclusions: For the treatment of SP, NA method could significantly decrease complication rate, operation rate, as well as hospital stay length, compared with the CT method. Subgroup analysis indicated that the use of CT method in SSP and PSP patients might increase the initial success rate.

Comparison of two point of care whole blood coagulation analysis devices and conventional coagulation tests as a predicting tool of perioperative bleeding in adult cardiac surgery-a pilot prospective observational study in Japan

Rui Terada, Toshiyuki Ikeda, Yoshiteru Mori, Sho Yamazaki, Kosuke Kashiwabara, Haruo Yamauchi, Minoru Ono, Yoshitsugu Yamada, Hitoshi Okazaki

Transfusion 2019 Nov;59(11):3525-3535

Abstract

Background: It is widely accepted that Point-of Care Test (PoCT) devices are useful in the detection of coagulopathies in situations of massive bleeding such as major cardiac surgery. These devices contribute to the reduction of blood transfusion. However, their implementation remains limited in Japan because of their cost and lack of health insurance support.

Study design and methods: Conventional coagulation tests and thromboelastography (TEG)/Sonoclot values were measured in 50 consecutive cardiac surgery cases. Clinical background information such as operative procedures was obtained from electronic medical records, and the theoretical perioperative total blood loss was calculated by measuring the hemoglobin content and total red blood cell transfusion volume. The correlation between perioperative total blood loss and the measured laboratory values or clinical parameters was evaluated by a multivariate linear regression analysis. The risk factors of the total amount of platelet transfusion and postoperative drain bleeding volume were similarly evaluated.

Results: No significant association between the estimated perioperative total blood loss (eTBL) and the laboratory measurements including conventional coagulation tests, TEG and Sonoclot was observed. On the other hand, postoperative drain bleeding volume was significantly associated with postoperative Sonoclot CR ($p = 0.039$) as well as preoperative use of oral anticoagulants and cell saver treated blood volume. Platelet transfusion amount was significantly associated with post-CBP PF and time to peak value of Sonoclot ($p = 0.014$ and 0.001, respectively).

Conclusion: Sonoclot measurements may be useful to estimate the risks of postoperative bleeding and platelet transfusion in cardiac surgeries in Japan.

Validation of an evaluation instrument for responders in tactical casualty care simulations

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Rev Lat Am Enfermagem 2020 Apr 17;28:e3251

Objective: to construct and validate a tool for the evaluation of responders in tactical casualty care simulations.

Method: three rubrics for the application of a tourniquet, an emergency bandage and haemostatic agents recommended by the Hartford Consensus were developed and validated. Validity and reliability were studied. Validation was performed by 4 experts in the field and 36 nursing participants who were selected through convenience sampling. Three rubrics with 8 items were evaluated (except for the application of an emergency bandage, for which 7 items were evaluated). Each simulation was evaluated by 3 experts.

Results: an excellent score was obtained for the correlation index for the 3 simulations and 2 levels that were evaluated (competent and expert). The mean score for the application of a tourniquet was 0.897, the mean score for the application of an emergency bandage was 0.982, and the mean score for the application of topical haemostats was 0.805.

Conclusion: this instrument for the evaluation of nurses in tactical casualty care simulations is considered useful, valid and reliable for training in a prehospital setting for both professionals who lack experience in tactical casualty care and those who are considered to be experts.

Hypocalcaemia and traumatic coagulopathy: an observational analysis

Mayank Vasudeva, Joseph K Mathew, Mark C Fitzgerald, Zoe Cheung, Biswadev Mitra

Vox Sang 2020 Feb;115(2):189-195

Abstract

Background and objectives: Haemorrhage-associated calcium loss may lead to disruption of platelet function, intrinsic and extrinsic pathway-mediated haemostasis and cardiac contractility. Among shocked major trauma patients, we aimed to investigate the association between admission hypocalcaemia and adverse outcomes.

Materials and methods: Data were extracted from the Alfred Trauma Registry and the Alfred Applications and Knowledge Management Department for all adult major trauma patients presenting directly from the scene with a shock index ≥1 from 1 July 2014 to 30 June 2018. Patients with pre-hospital blood transfusion were excluded. Ionized hypocalcaemia was defined as <1·11 mmol/l, and acute traumatic coagulopathy was defined as initial INR >1·5. Multivariable logistic regression analysis was used to assess the association between admission hypocalcaemia and acute traumatic coagulopathy that was adjusted for Injury Severity Score, initial GCS, bicarbonate and lactate.

Results: There were 226 patients included in final analysis with 113 (50%) patients recording ionized hypocalcaemia on presentation prior to any blood product transfusion. Ionized hypocalcaemia was associated with coagulopathy in patients with shock index ≥1 (adjusted OR 2·9; 95% CI: 1·01-8·3, P = 0·048). Admission ionized hypocalcaemia was also associated with blood transfusion requirement in the first 24 h post-admission in 62·5% of hypocalcaemic patients as compared to 37·5% of normocalcaemic patients (P < 0·001). Admission ionized hypocalcaemia was associated with death at hospital discharge (25·6% among hypocalcaemic patients compared to 15·0% of normocalcaemic patients (P = 0·047)).

Conclusion: Hypocalcaemia was a common finding in shocked trauma patients and was independently associated with acute traumatic coagulopathy. The early, protocolized administration of calcium to trauma patients in haemorrhagic shock warrants further assessment in randomized controlled trials.

Contributing factors that influence medication errors in the prehospital paramedic environment: a mixed-method systematic review protocol

Dennis Walker, Clint Moloney, Brendan SueSee, Renee Sharples

BMJ Open 2019 Dec 23;9(12):e034094

Abstract

Introduction: There is limited reliable research available on medication errors in relation to paramedic practice, with most evidence-based medication safety guidelines based on research in nursing, operating theatre and pharmacy settings. While similarities exist, evidence suggests that the prehospital environment is distinctly different in many aspects. The prevention of errors requires attention to factors from the organisational and regulatory level down to specific tasks and patient characteristics. The evidence available suggests errors may occur in up to 12.76% of medication administrations in some prehospital settings. With multiple sources stating that the errors are under-reported, this represents significant potential for patient harm. This review will seek to identify the factors influencing the occurrence of medication errors by paramedics in the prehospital environment.

Methods and analysis: The review will include qualitative and quantitative studies involving interventions or phenomena regarding medication errors or medication safety relating to paramedics (including emergency medical technicians and other prehospital care providers) within the prehospital environment. A search will be conducted using MEDLINE (Ovid), EBSCOhost Megafile Search, the International Committee of Medical Journal Editors trial registry, Google Scholar and the OpenGrey database to identify studies meeting this inclusion criteria, with initial searches commencing 30 September 2019. Studies selected will undergo assessment of methodological quality, with data to be extracted from all studies irrespective of quality. Each stage of study selection, appraisal and data extraction will be conducted by two reviewers, with a third reviewer deciding any unresolved conflicts. The review will follow a convergent integrated approach, conducting a single qualitative synthesis of qualitative and 'qualitised' quantitative data.

Ethics and dissemination: No ethical approval was required for this review. Findings from this systematic review will be disseminated via publications, reports and conference presentations.

Non-invasive sensor technology for prehospital stroke diagnosis: Current status and future directions

Kyle B Walsh

Int J Stroke 2019 Aug;14(6):592-602

Abstract

Background: The diagnosis of stroke in the prehospital environment is the subject of intense interest and research. There are a number of non-invasive external brain monitoring devices in development that utilize various technologies to function as sensors for stroke and other neurological conditions. Future increased use of one or more of these devices could result in substantial changes in the current processes for stroke diagnosis and treatment, including transportation of stroke patients by emergency medical services.

Aims: The present review will summarize information about 10 stroke sensor devices currently in development, utilizing various forms of technology, and all of which are external, non-invasive brain monitoring devices.

Summary of review: Ten devices are discussed including the technology utilized, the indications for use (stroke and, when relevant, other neurological conditions), the environment(s) indicated for use (with a focus on the prehospital setting), a description of the physical structure of each instrument, and, when available, findings that have been published in peer-reviewed journals or otherwise reported. The review is organized based on the technology utilized by each device, and seven distinct forms were identified: accelerometers, electroencephalography (EEG), microwaves, near-infrared, radiofrequency, transcranial doppler ultrasound, and volumetric impedance phase shift spectroscopy.

Conclusions: Non-invasive external brain monitoring devices are in various stages of development and have promise as stroke sensors in the prehospital setting. Some of the potential applications include to differentiate stroke from non-stroke, ischemic from hemorrhage stroke, and large vessel occlusion (LVO) from non-LVO ischemic stroke. Successful stroke diagnosis prior to hospital arrival could transform the current diagnostic and treatment paradigm for this disease.

Evaluation of the intensity and management of pain before arrival in hospital among patients with suspected hip fractures

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Int Emerg Nurs 2020 Mar;49: Epub 2020 Feb 3.

Abstract

Background: Pain management needs to be comprehensively investigated in patients with hip fractures, as it represents a fast-growing challenge to emergency care. The purpose of this study was to describe reported pain in patients with suspected hip fractures in a prehospital setting.

Methods: In this observational study, 1,426 patients with a suspected hip fracture were included. Dynamic and static pain were assessed on the arrival of the emergency medical services (EMS) and on hospital admission using the Numerical Rating Scale (NRS), if feasible, and the Behaviour Rating Scale (BRS), if not.

Results: On EMS arrival, the median dynamic NRS pain score was eight and 84% of the patients had severe or moderate dynamic pain according to the BRS. On admission to hospital, the median dynamic NRS pain score was reduced to five and 45% of the patients had reduced dynamic pain according to the BRS. Among all patients, the NRS was judged to be feasible and was therefore used in 36%. Furthermore, there was an association between the decrease in pain and the increase in the number of administered medications, as well as the duration of prehospital care.

Conclusions: Patients with suspected hip fractures suffered substantial pain on EMS arrival. Only half experienced a reduction in pain on hospital admission and only 75% received pain-relieving medication.

Prototype of a Military Medic Smartphone Medical Graphical User Interface for Use by Medics in Deployed Environments

Kenneth H Wong, Shijir Bayarsaikhan, Betty A Levine, Seong K Mun

Mil Med 2020 Jan 7;185(Suppl 1):536-543

Abstract

Introduction: Prompt and effective combat casualty care is essential for decreasing morbidity and mortality during military operations. Similarly, accurate documentation of injuries and treatments enables quality care, both in the immediate postinjury phase and the longer-term recovery. This article describes efforts to prototype a Military Medic Smartphone (MMS) for use by combat medics and other health care providers who work in austere environments.

Materials and methods: The MMS design builds on previous electronic health record systems and is based on observations of medic workflows. It provides several functions including a compact yet efficient physiologic monitor, a communications device for telemedicine, a portable reference library, and a recorder of casualty care data from the point of injury rearward to advanced echelons of care. Apps and devices communicate using an open architecture to support different sensors and future expansions.

Results: The prototype MMS was field tested during live exercises to generate qualitative feedback from potential users, which provided significant guidance for future enhancements.

Conclusions: The widespread deployment of this type of device will enable more effective health care, limit the impact of battlefield injuries, and save lives.

Fentanyl impairs but ketamine preserves the microcirculatory response to hemorrhage

Lusha Xiang, Alfredo S Calderon, Harold G Klemcke, Laura L Scott, Carmen Hinojosa-Laborde, Kathy L Ryan

J Trauma Acute Care Surg 2020 Feb 10; Online ahead of print.

Abstract

Background: Peripheral vasoconstriction is the most critical compensating mechanism following hemorrhage to maintain blood pressure. On the battlefield, ketamine rather than opioids is recommended for pain management in case of hemorrhage but effects of analgesics on compensatory vasoconstriction are not defined. We hypothesized that fentanyl impairs but ketamine preserves the peripheral vasoconstriction and blood pressure compensation following hemorrhage.

Method: Sprague Dawley rats (11-13wk) were randomly assigned to control (saline vehicle), fentanyl, or ketamine-treated groups with or without hemorrhage (n = 8 or 9 for each group). Rats were anesthetized with Inactin (ip. 10mg/100g) and the spinotrapezius muscles were prepared for microcirculatory observation. Arteriolar arcades were observed with a Nikon microscope and vessel images and arteriolar diameters (AD) were recorded by using Nikon NIS Elements Imaging Software. After baseline perimeters were recorded, the arterioles were topically challenged with saline, fentanyl, or ketamine at concentrations relevant to intravenous analgesic doses to determine direct vasoactive effects. After arteriolar diameters returned to baseline, 30% of total blood volume was removed in 25 min. Ten minutes after hemorrhage, rats were intravenously injected with an analgesic dose of fentanyl (0.6μg/100g), ketamine (0.3mg/100g), or a comparable volume of saline. For each drug or vehicle administration, the total volume injected was 0.1 ml/100g. Blood pressure, heart rate, and arteriolar responses were monitored for 40 minutes.

Results: Topical fentanyl induced vasodilation (17 ± 2%) but ketamine caused vasoconstriction (-15 ± 4%, $p < 0.01$). Following hemorrhage, intravenous ketamine did not affect blood pressure or respiratory rate, while fentanyl induced a slight and transient (<5 min, $p = 0.03$ vs saline group) decrease in blood pressure, with a profound and prolonged suppression in respiratory rate (>10 minutes, with a peak inhibition of 57 ± 8% of baseline, $p < 0.01$). The compensatory vasoconstriction observed after hemorrhage was not affected by ketamine treatment. However, after fentanyl injection, although changes in blood pressure were transiently present, arteriolar constriction to hemorrhage was absent and replaced with a sustained vasodilation (78 ± 25% to 36 ± 22% of baseline during the 40 minutes after injection, $p < 0.01$).

Conclusion: Ketamine affects neither systemic nor microcirculatory compensatory responses to hemorrhage, providing preclinical evidence that ketamine may help attenuate adverse physiological consequences associated with opioids following traumatic hemorrhage. Microcirculatory responses are more sensitive than systemic response for evaluation of hemodynamic stability during procedures associated with pain management.

Incidence of injuries and factors related to injuries in combat soldiers

Nirit Yavnai, S Bar-Sela, M Pantanowitz, S Funk, G Waddington, L Simchas, S Svorai-Litvak, N Steinberg

MJ Mil Health 2020 Feb 20; Online ahead of print.

Abstract

Introduction: Musculoskeletal injuries to the lower extremities are major factors contributing to drop out from military tasks. The aim of the present study was to determine the incidence of musculoskeletal injuries and the parameters that differentiate between the soldiers who incurred these injuries and those who did not along 14 weeks of an infantry commanders course.

Methods: One-hundred and sixty-eight participants were recruited from an infantry commanders course. The soldiers were tested before (pre), in the middle (middle) and at the end (last) of the course for anthropometric measurements, proprioceptive ability and dynamic postural balance (DPB), and filled out an ankle stability questionnaire (Cumberland Ankle Instability Tool (CAIT). A physiotherapist followed and recorded all musculoskeletal injuries incurred by the participants during the course.

Results: Fifty-eight participants out of the 168 (34.5%) reported some pain/injury. Time effects were found for body mass index, DPB asymmetry, DPB in posterior-medial (P-M) direction and proprioception ability. Injury effects were found for DPB asymmetry, DPB in P-M direction, CAIT and proprioception ability. An interaction was found for proprioception ability. The Cox regression showed that the variables that are mostly effecting injuries were pretesting proprioception ability, DPB asymmetry and CAIT.

Conclusions: More than one out of three participants incurred musculoskeletal injuries, with deficits in proprioception ability, DPB and ankle stability in pretesting as major factors contributing to injuries. Further studies should look at the effect of specific exercises such as proprioception, DPB and ankle stability exercises for prevention and treatment of musculoskeletal injuries among combat soldiers.

Hydroxyethyl Starch for Fluid Replacement Therapy in High-Risk Surgical Patients: Context and Caution

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Hydroxyethyl starch (HES) solutions have had a turbulent history as resuscitation fluids. There was initial optimism that these products would efficiently expand the intravascular space with a prolonged intravascular half-life and therefore would be “volume sparing,” with less edema. However, enthusiasm was tempered when HES solutions were reported to be harmful when administered to critically ill patients, including those with sepsis. Despite these concerns, HES is still used in surgery under the premise that lower doses infused under strict protocols would be safe. Futier and colleagues report the results of the FLASH multicenter randomized clinical trial, which assessed the effects of HES vs saline for fluid resuscitation in patients undergoing major abdominal surgery. The primary end point was a composite of death and occurrence of renal, respiratory, cardiovascular, infectious, or surgical complications. Several secondary and exploratory end points were also reported. The FLASH clinical trial suggests that a protocolized surgical optimization approach using HES vs saline resulted in minor physiological benefits on day 1 that vanished soon thereafter. However, important morbidity for patients, specifically acute kidney injury, may be related to HES use.

Shock index and pulse pressure as triggers for massive transfusion

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Abstract

Background: Hemorrhage is the most common cause of preventable death in trauma patients. These mortalities might be prevented with prehospital transfusion. We sought to characterize injured patients requiring massive transfusion to determine the potential impact of a prehospital whole blood transfusion program. The primary goal of this analysis was to determine a method to identify patients at risk of massive transfusion in the prehospital environment. Many of the existing predictive models require laboratory values and/or sonographic evaluation of the patient after arrival at the hospital. Development of an algorithm to predict massive transfusion protocol (MTP) activation could lead to an easy-to-use tool for prehospital personnel to determine when a patient needs blood transfusion.

Methods: Using our Level I trauma center's registry, we retrospectively identified all adult trauma patients from January 2015 to August 2017 requiring activation of the MTP. Patients who were younger than 18 years, older than 89 years, prisoners, pregnant women, and/or with nontraumatic hemorrhage were excluded from the study. We retrospectively collected data including demographics, blood utilization, variable outcome data (survival, length of stay, intensive care unit days, ventilator days), prehospital vital signs, prehospital transport times, and Injury Severity Score. The independent-samples t test and χ test were used to compare the group who died to the group who survived. $p < 0.05$ was considered significant. Based on age and mechanism of injury, relative risk of death was calculated. Graphs were generated using Microsoft Excel software to plot patient variables.

Results: Our study population of 102 MTP patients had an average age of 42 years and average Injury Severity Score of 29, consisted of 80% males (82/102), and was 66% blunt trauma (67/102). The all-cause mortality was 67% (68/102). The positive predictive value of death for patients with pulse pressure of less than 45 and shock index of greater than 1 was 0.78 for all patients, but was 0.79 and 0.92 for blunt injury and elderly patients, respectively.

Conclusions: Our data demonstrate a high mortality rate in trauma patients who require MTP despite short transport times, indicating the need for early intervention in the prehospital environment. Given our understanding that the most severely injured patients in hemorrhagic shock require blood resuscitation, this study demonstrates that this subset of trauma patients requiring massive transfusion can be identified in the prehospital setting. We recommend using Emergency Medical Services pulse pressure in combination with shock index to serve as a trigger for initiation of prehospital whole blood transfusion.

Level of evidence: Therapeutic/care management, level V.

Freeze-dried plasma stability under prehospital field conditions

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Abstract

Background: This study evaluated the effect of routine, uncontrolled, Israeli field storage conditions on the stability and efficacy of Lyo-Plas N freeze-dried plasma (FDP). We evaluated clotting factors V, VIII, and XI; proteins S and C; fibrinogen; partial thromboplastin time (PTT); antithrombin III (ATIII); von Willebrand factor (VWF); and international normalized ratio (INR) in FDP stored at 4°C, 25°C, and 40°C for 6 and 12 months, as well as FDP returned from field units after uncontrolled storage for 15 months (manufacturer's shelf life).

Methods and materials: After reconstitution, clotting factor levels were compared to those of freshly supplied FDP doses.

Results: At 4°C for 12 months, factor V decreased slightly. At 25°C, average fibrinogen and factor V content were significantly lower at both periods, and INR was higher after 12 months. At 40°C, all samples were out of normal range in at least one clotting factor after 6 or 12 months. After field storage for 15 months, fibrinogen, factors V and XI, PTT, and protein S were significantly decreased, and INR increased. However, these levels were still within laboratory norms. Statistically significant difference in clotting factors compared to laboratory normal range was found in INR (higher) and factor V (lower).

Conclusions: Our data show minimal decreases in clotting factors in FDP after storage under field conditions, when compared to laboratory normal ranges. Along with the many advantages of FDP, this supports its use at the point of injury under battlefield conditions, despite uncontrolled storage environments. Under controlled storage conditions at 4°C, shelf life could possibly be extended, although further study is required.