Tactical Combat Casualty Care

Journal Article Abstracts

Committee on Tactical Combat Casualty Care

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References

Adams P, Warren K, Guyette F, et al: Implementation of a prehospital air medical thawed plasma program: is it even feasible? J Trauma Acute Care Surg 2019;Epub ahead of a print

Andersen M, De Paoli F, Mærkedahl R, et al: A case of an advance chain of survival in penetrating cardiac injury. Case Rep Emerg Med 2019;doi:10.1155/2019/2895439

Andolfatto G, Innes K, Dick W, et al: Prehospital analgesia with intranasal ketamine (PAIN-K): a randomized double-blind trial in adults. Ann Emerg Med 2019;74:241-250

Bakhshayesh P, Risling D, Enoson A: Three dimensional quality assessment of applied pelvic binders. Bull Emerg Trauma 2019;7:156-161

Baram A, Kakamad F: Bilateral thoracic trauma; presentation and management, a case series. Ann Med Surg 2019;43:25-28

Barr J, Montgomery S: Helicopter medical evacuation in the Korean War: did it matter? J Trauma Acute Care Surg 2019;87:S10-S13

Benov A, Shkolnik I, Glassberg E, et al; Prehospital trauma experience of the Israel defense forces on the Syrian border 2013-2017. J Trauma Acute Care Surg 2019;87:S165-S171

Boutonnet M, Osorio Cajes G, Pasquier P, Ausset S: Tranexamic acid in traumatic hemorrhage: Evidence argues for a prehospital administration. Am J Emerg Med 2019; Epub ahead of print

Caubère A, de Landevoisin E, Schlienger G, et al: Tactical tourniquet: surgical management must be within 3 hours. Trauma Case Rep 2019; doi:10.1016/j.tcr.2019.100217

Chang R, Kerby J, Kalkwarf K, et al: Earlier time to hemostasis in associated with decreased mortality and rate of complications: results from the pragmatic randomized optimal platelet and plasma ratios trial. J Trauma Acute Care Surg 2019;87:342-349

Chen S, Yang J, Zhang L, et al: Progress on combat damage control resuscitation/surgery and its application in the Chinese People's Liberation Army. J Trauma Acute Care Surg 2019;Epub ahead of print

Chen X, Guyette FX, Peitzman AB, Billiar TR, Sperry JL, Brown JB: Identifying patients with time-sensitive injuries: Association of mortality with increasing prehospital time. J Trauma Acute Care Surg 2019 Jun;86(6):1015-1022

Chinn E, Friedman B, Naeem F, et al: Randomized trial of intravenous lidocaine versus hydromorphone for acute abdominal pain in the emergency department. Ann Emerg Med 2019;74:233-240

Derickson M, Kuckelman J, Phillips C, et al: Lifesaving interventions in blackout conditions using night vision technology: come to the dark side. J Trauma Acute Care Surg 2019;S191-S196

Desai S, Zeng D, Chong S: Airway management in inhalation injury: a case series. Singapore Med J 2019;Epub ahead of print

Dhantole L, Dubey A, Sonker A: A study on factors influencing the hemostatic potential fresh frozen plasma. Asian J Transfus Sci 2019;13:23-29

Duchesne J, Costantini T, Khan M, et al: The effect of hemorrhage control adjunct on outcome in severe pelvic fracture: a multi-institutional study. J Trauma Acute Care Surg 2019;87:117-124

Edelman D, Perkins E, Brewster D: Difficult airway management algorithms: a directed review. Anaesthesia 2019;Epub ahead of print

El-Menyar A, Sathian B, Wahlen BM, Abdelrahman H, Peralta R, Al-Thani H, Rizoli S: Prehospital administration of tranexamic acid in trauma patients: A 1:1 matched comparative study from a level 1 trauma center. Am J Emerg Med 2019 Apr 30. Epub ahead of print

Englert Z, Kinard J, Qureshi I, et al: Heterogeneity in military trauma care. Mil Med 2019;Epub ahead of print

Fabich R, Franklin B, Langan N: Definitive management of a traumatic airway; case report. Mil Med 2019;Epub ahead of print

Färkkilä E, Peacock Z, Tannyhill R, et al: Frequency of cervical spine injuries in patients with midface fractures. Int J Oral Maxillofac Surg 2019;Epub ahead of print

Fisher A, Carius B, Corley J, et al: Conducting fresh whole blood transfusion training. J Trauma Acute Care Surg 2019;87:S184-S190

Gupta A, Villegas C, Rosenberg J, et al: Advancing the education of stop the bleed: development of perfused synthetic cadaver model. J Surg Res 2019;244:516-520

Helm M, Hossfeld B, Braun B: Oligoanalgesia in patients with an initial Glasgow Coma Scale score >8 in a physician –staffed helicopter emergency medical service: a multicentric secondary data analysis of >100,000 out-of-hospital emergency missions. Anesth Analg 2019;Epub ahead of print

Highland K, Soumoff A, Spinks E, et al: Ketamine administration during hospitalization is not associated with posttraumatic stress disorder outcomes in military combat casulaties: a matched cohort study. Anesth Analg 2019;Epub ahead of print

Hoops H, Manning J, Graham T, et al: Selective aortic arch perfusion with fresh whole blood or HBOC-201 reverses hemorrhage-induced traumatic cardiac arrest in a lethal model of noncompressible torso hemorrhage. J Trauma Acute Care Surg 2019;87:263-273

How R, Glasser J, Schaub L, et al: Prehospital adenosine, lidocaine, and magnesium has inferior survival compared with tactical combat casualty care resuscitation in a porcine model of prolonged hemorrhagic shock. J Trauma Acute Care Surg 2019;87:68-75

Jimbo I, Uzawa K, Tokumine J, et al: Ultrasonographic identification of the cricothyroid membrane in a patient with a difficult airway as a result of cervical hematoma caused by hemophilia: a case report. BMC Anesthesiol 2019;19:124

Jousi M, Björkman J, Nurmi J: Point-of-care analyses of blood samples from intraosseous access in pre-hospital critical care. Acta Anaesthesiol Scand 2019;Epub ahead of print

Kauvar D, Thomas S, Schechtman D, Walters T: Predictors and timing of amputations in military lower extremity trauma with arterial injury. J Trauma Acute Care Surg 2019;87:S172-S177

Kerr W, Hubbard B, Anderson B, et al: Improvised inguinal junctional tourniquets: recommendations from the Special Operations Combat Medical Combat Skills Sustainment Course. J Spec Oper Med 2019;19:128-133

Kornblith L, Robles A, Conroy A, et al: Predictors of postinjury acute respiratory distress syndrome: lung injury persists in the era of hemostatic resuscitation. J Trauma Acute Care Surg 2019;87:371-378

Kotwal R, Mazuchowski E, Stern C, et al: A descriptive study of US Special Operations Command fatalities, 2001 to 2018. J Trauma Acute Care Surg 2019;87:645-657

Lewis M, Shulman, Hudgins J, et al: Essentials of emergency transfusion- the complement to stop the blood. J Trauma Acute Care Surg 2019;87:420-429

Long B, Hafen L, Koyfman A, Gottlieb M: Resuscitative Endovascular Balloon Occlusion of the Aorta: A Review for Emergency Clinicians. J Emerg Med 2019 Jun;56(6):687-697

Maddry J, Arana A, Perez C, et al: Influence of time to transport to a higher level facility on the clinical outcomes of US combat casualties with TBI: a multicenter 7-year study. Mil Med 2019;Epub ahead of print

Marini C, Petrone P, Soto-Sánchez A, et al: Predictors of mortality in patients with rib fractures. Eur J Trauma Emerg Surg 2019;Epub ahead of print

Marsden M, Rossetto A, Duffield C, et al: Prehospital tranexamic acid shortens the interval to administration by half in major trauma networks: a service evaluation. Emerg Med J 2019;36:395-400

McCarty J, Hashmi Z, Herrera-Escobar j, et al: Effectiveness of the American college of surgeons bleeding control basic training among laypeople applying different tourniquet types: a randomized clinical trial. JAMA Surg 2019;Epub ahead of print

McKenzie N, Wishner C, Sexton M, et al: Active shooter: what would health care students do while caring for their patients? Run? Hide? Or fight? Disaster Med Public Health Prep 2019;24:1-5

Meledeo M, Peltier G, Mcintosh C, et al: Freeze-dried plasma mitigates the dilution effects of a hemoglobin-based oxygen carrier (HBOC-201) in a model of resuscitation for hemorrhage and hemodilution. J Trauma Acute Care Surg 2019;87:S83-S90

Menegozzo C, Artigon E, Meyer-Pflug A, et al: Can ultrasound be used as an adjunct for tube thoracostomy? A systematic review of potential application to reduce procedure-related complications. Int J Surg 2019;68:85-90

Mitra B, Bade-Boon J, Fitzgerald M, et al: Timely completion of multiple life-saving interventions for traumatic haemorrhagic shock: a retrospective cohort study. Burns Trauma 2019;7:22

Özkurtul O, Staab H, Osterhoff G, et al: Technical limitations of REBOA in a patient with exsanguinating pelvic crush trauma: a case report. Patient Saf Surg 2019;doi:10.1186/s13037-019-0204-6

Parker M, Newcomb A, Liu C, Michetti C: Chest tube management practices by trauma surgeons. J Surg Res 2019;244:225-230

Patel K, Mastenbrook J, Pfeifer A, Bauler L: Successful intubation of a difficult airway using a Yankauer suction catheter. J Emerg med 2019;Epub ahead of print

Patzkowski M, Patzkowski J: Perioperative pain management and avoidance of long-term opioid use. Sports Med Arthrosc Rev 2019;27:112-118

Ram K, VaraPrasad K, Krishna M, et al: Prehospital factors associated with discharge outcomes: baseline data from the Andhra Pradesh Traumatic Brain Injury Project. World Neurosurg X 2019;2:doi:10.1016/j.wnsx.2019.100020

Reddy A, Varghese N, Herekar B, Shenoy U: Does prewarming of i-gel improve insertion and ventilation in anaesthetised and paralysed patients? A prospective, randomised, control trial. Saudi J Anaesth 2019;13:215-221

Remley M: Changes are coming to TCCC Training. Infantry 2019;48:47-49

Sachidananda R, Shaikh S, Mitragotri M, et al: Comparison between the Baska Mask® and the I-Gel for minor surgical procedures under general anaesthesia. Turk J Anaesthesiol Reanim 2019;47:2430

Schauer SG, Naylor JF, Chow AL, Maddry JK, Cunningham CW, Blackburn MB, Nawn CD, April MD: Survival of Casualties Undergoing Prehospital Supraglottic Airway Placement Versus Cricothyrotomy. J Spec Oper Med 2019 Fall;19(3):86-89.

Schauer S, April M, Naylor J, et al: Incidence of hyperoxia in combat wounded in Iraq and Afghanistan: a potential opportunity for oxygen conservation. Mil Med 2019;Epub ahead of print

Schauer S, Naylor K, Bellamy M, et al: A descriptive analysis of causalities undergoing CASEVAC from the point-of-injury in the Department of Defense Trauma Registry. Mil Med 2019;184:e225-e229

Schellenberg M, Benjamin E, Bardes J, et al: Undertriage trauma patients: what are we missing? J Trauma Acute Care Surg 2019;Epub ahead of print

Schwartz R, Shiver S, Reynolds B, et al: The use of abdominal aortic and junctional tourniquet versus combat gauze in a porcine hemicorporectomy model. J Spec Oper Med 2019;19:69-72

Shah A, Kothera C, Dheer S: ThoraSite: a device to improve accuracy of lateral decompression needle and chest tube placement. J Trauma Acute Care Surg 2019;87:S128-S131

Sheldon R, Do W, Forte D, et al: An evaluation of a novel medical device versus standard interventions in the treatment of tension pneumothorax in a swine model (sus scrofa). Mil Med 2019;Epub ahead of print

Smith E, Sarani B, Shapiro G, et al: Incidence and Cause of Potentially Preventable Death after Civilian Public Mass Shooting in the US. J Am Coll Surg 2019;229:244-251

Spinella P, Gurney J, Yazer M: Low titer group O whole blood for prehospital hemorrhagic shock: It is an offer we cannot refuse. Transfusion. 2019 Jul;59:2177-2179

Stansfield R, Morris D, Jesulola E: The use of tranexamic acid (TXA) for the management of haemorrhage in trauma patients in the prehospital environment: literature review and descriptive analysis of principle themes. Shock 2019;Epub ahead of print

Suzuki K, Kusunoki S, Sadamori T, et al; Comparison of video and conventional laryngoscopes for simulated difficult emergency tracheal intubations in the presence of liquids in the airway. PLoS One 2019;14:e0220006

Taylor MH, Choi D, Fitzpatrick SM, Gunn KN: Characterisation of aluminium release by the enFlow® fluid-warming system in crystalloids and blood products. 2019 May 7 [Epub ahead of print]

van Leent E, van Wageningen B, Sir Ö, et al: Clinical examination of the pelvic ring in the prehospital phase. Air Med J 2019;38:294-297

Vuoncino M, Soo Hoo A, Patel J, et al: Epidemiology of upper extremity vascular injury in contemporary combat. Ann Vasc Surg 2019;Epub ahead of print

Williams A, Bhatti U, Biesterveld B, et al: Valproic acid improves survival and decreases resuscitation requirements in a swine model of prolonged damage control resuscitation. J Trauma Acute Care Surg 2019;87:393-401

Yelamarthy P, Chhabra H, Vaccaro A, et al; Management and prognosis of acute traumatic cervical central cord syndrome: systematic review and Spinal Cord Society-Spine Trauma Study Group position statement. Eur Spine J 2019;Epub ahead of print

Abstracts

J Trauma Acute Care Surg. 2019 Epub ahead of print

Implementation of a Prehospital Air Medical Thawed Plasma Program: Is It Even Feasible?

Adams P, Warren K, Guyette F, Yazer M, Brown J, Daily B, Miller R, Harbrecht B, Claridge J, Phelan H, Witham W, Putnam A, Zuckerbraun B, Neal M, Sperry J; PAMPer study group.

INTRODUCTION: The PAMPer trial demonstrated a 30-day survival benefit among hypotensive trauma patients treated with prehospital plasma during air medical transport. We characterized resources, costs and feasibility of air medical prehospital plasma program implementation.

METHODS: We performed a secondary analysis using data derived from the recent PAMPer trial. Intervention patients received thawed plasma (5-day shelf-life). Unused plasma units were recycled back to blood bank affiliates, when possible. Distribution method and capability of recycling varied across sites. We determined the status of plasma units deployed, utilized, wasted, and returned. We inventoried thawed plasma use and annualized costs for distribution and recovery.

RESULTS: The PAMPer trial screened 7,275 patients and 5,103 plasma units were deployed across 22 air medical bases over a 42-month time period. Only 368 units (7.2%) of this total thawed plasma pool were provided to plasma randomized PAMPer patients. Of the total plasma pool, 3,716 (72.8%) units of plasma were returned to the blood bank with the potential for transfusion prior to expiration and 1,019 (20.0%) thawed plasma units were deemed wasted for this analysis. The estimated average annual cost of implementation of a thawed plasma program per air medical base at an average courier distance would be between $24,343 and $30,077 depending on the ability to recycle plasma and distance of courier delivery required.

CONCLUSION: A prehospital plasma program utilizing thawed plasma is resource intensive. Plasma waste can be minimized depending on trauma center and blood bank specific logistics. Implementation of a thawed plasma program can occur with financial cost. Products with a longer shelf-life such as liquid plasma or freeze-dried plasma may provide a more cost-effective prehospital product relative to thawed plasma.

STUDY TYPE: Secondary Analysis of Clinical Trial

LEVEL OF EVIDENCE: III.

Case Rep Emerg Med. 2019 Jul 2;2019:2895439

A Case of an Advanced Chain of Survival in Penetrating Cardiac Injury.

Andersen M, De Paoli F, Mærkedahl R, Jepsen S, Dalgaard K, Falstie T, Gerstrøm G

ABSTRACT:
The survival rate of penetrating cardiac trauma is dismal, with only a few patients reaching the hospital with any signs of life. Short transport time and close proximity to the trauma center are positive factors for survival. We report the successful case of a 21-year-old male with penetrating cardiac injury and tension-pneumothorax with long distance to a trauma facility. The patient was stabbed twice in the anterior left side of the thorax. The emergency services found the patient with suspicion of left tension-pneumothorax. Urgent left mini-thoracotomy was established resulting in spontaneous respiration and clinical improvement. Due to rapid clinical deterioration and clinical suspicion of pericardial tamponade, patient was transported to the local regional hospital only minutes away. Echocardiography confirmed tamponade, and urgent ultrasound-guided pericardiocentesis was performed. During the transport blood was intermittently drained from the pericardial sack until arrival at the trauma center where a penetrating injury to the left ventricle was repaired during urgent cardiac surgery. The patient was discharged 8 days after the incident.

Conclusion. Well organized emergency medical transport systems increase the chance of survival in penetrating cardiac injuries. Urgent pericardiocentesis with continuous drainage can help stabilize a patient until arrival at trauma facility.

Ann Emerg Med. 2019 Aug;74(2):241-250

Prehospital Analgesia With Intranasal Ketamine (PAIN-K): A Randomized Double-Blind Trial in Adults.

Andolfatto G, Innes K, Dick W, Jenneson S, Willman E, Stenstrom R, Zed P), Benoit G

STUDY OBJECTIVE: We compare intranasal ketamine with intranasal placebo in providing pain reduction at 30 minutes when added to usual paramedic care with nitrous oxide.

METHODS: This was a randomized double-blind study of out-of-hospital patients with acute pain who reported a verbal numeric rating scale (VNRS) pain score greater than or equal to 5. Exclusion criteria were younger than 18 years, known ketamine intolerance, nontraumatic chest pain, altered mental status, pregnancy, and nasal occlusion. Patients received usual paramedic care and were randomized to receive either intranasal ketamine or intranasal saline solution at 0.75 mg/kg. The primary outcome was the proportion of patients with VNRS score reduction greater than or equal to 2 at 30 minutes. Secondary outcomes were pain reduction at 15 minutes, patient-reported comfort, satisfaction scores, nitrous oxide consumption, and incidence of adverse events.

RESULTS: One hundred twenty subjects were enrolled. Seventy-six percent of intranasal ketamine patients versus 41% of placebo patients reported a greater than or equal to 2-point VNRS reduction at 30 minutes (difference 35%; 95% confidence interval 17% to 51%). Median VNRS reduction at 15 minutes was 2.0 and 1.0 and at 30 minutes was 3.0 and 1.0 for ketamine and placebo, respectively. Improved comfort at 15 and 30 minutes was reported for 75% versus 57% and 61% versus 46% of ketamine and placebo patients, respectively. Sixty-two percent of patients (95% confidence interval 49% to 73%) versus 20% (95% confidence interval 12% to 32%) reported adverse events with ketamine and placebo, respectively. Adverse events were minor, with no patients requiring physical or medical intervention.

CONCLUSION: Added to nitrous oxide, intranasal ketamine provides clinically significant pain reduction and improved comfort compared with intranasal placebo, with more minor adverse events.

Bull Emerg Trauma. 2019 Apr;7(2):156-161

Three Dimensional Quality Assessments of Applied Pelvic Binders.

Bakhshayesh P, Risling D, Enocson A

Objective: To assess the quality of applied pelvic binders using three dimensional computer tomography (3D CT).

Methods: A local trauma registry was used to identify patients with pelvic fractures after high-energy trauma during 2011-2015. A 3D CT reconstruction was made from the initial trauma computer tomography images to assess the level of application, symmetricity of the binder and achieved fracture reduction. An acceptable application of the pelvic binder was deemed if it was at the trochanteric level, symmetric and minimized residual displacement.

Results: We found 73 patients with a pelvic fracture and a pelvic binder on the initial trauma CT-scan. The mean (±SD) age of the patients was 46±17 years and 40% (n=29) were females. The median ISS score was 38 (IQR;29-50), the mean systolic blood pressure on arrival was 106±46 mmHg and the median GCS on arrival was 14 (IQR;7-15). We found that 59% (n=43) of the binders were correctly applied (symmetric at the trochanteric level, symmetrical and with acceptable residual displacement of the fracture). The 30-day mortality was higher in patients with non-correct application 17% (n=5/30) compared to patients with correct application of the pelvic binder 9.3% (n=4/43) however this was not statistically significant (p=0.562).

Conclusion: A substantial number of patients had non-correct application of pelvic binders. Future studies using 3D technique are encouraged to further investigate clinical impacts of non-appropriate application of pelvic binders.

Ann Med Surg (Lond). 2019 May 25;43:25-28

Bilateral thoracic trauma; presentation and management, a case series.

Baram A, Kakamad F

Introduction: Unilateral chest trauma has been perfectly described in the literature while bilateral chest trauma has never been specifically probed, the aim of this study is to highlight the specificities, presentations, the difference in the therapeutic algorithm and outcome of patients with bilateral thoracic trauma.

Patients and methods: A single center, prospective study was carried out in four years. The data were taken directly from the patients, patient's relatives and the medical records. All patients presenting with bilateral chest trauma, admitted to the hospital overnight, were included in this study. The patients were managed according to the Advanced Trauma Life Support (ATLS) protocol which consists of primary and secondary surveys. For those patients who diagnosed to have either haemo or pneumothorax or both, thoracostomy tube was inserted. Descriptive and analytical analyses were calculated.

Results: The study included 107 patients. Bilateral blunt trauma was found in 72 (67.3%) cases while bilateral penetrating trauma was found in 35 (32.7%) patients. The most common mechanism of trauma was road traffic accidents (RTA) accounting for 68 (63.6%) victims. Overall 30-day mortality was 14.9%. In blunt trauma, 3 or more rib fracture, pulmonary contusion, intubation, and intensive care unit admission were among the predictors of increased risk of mortality.

Conclusion: Bilateral thoracic trauma has comparable patterns of presentation, choices of investigation, strategies of management, predictors of the outcome, morbidity and mortality with unilateral chest trauma.

J Trauma Acute Care Surg. 2019 Jul;87(1S Suppl 1):S10-S13

Helicopter medical evacuation in the Korean War: Did it matter?

Barr J, Montgomery S

BACKGROUND: Because of M*A*S*H and other popular portrayals, helicopter evacuation of casualties has been closely linked to the Korean War. We sought to investigate their role in military medicine during this conflict.

METHODS: This study incorporated a thorough review of the original source documents dating to the Korean War that are housed in the National Archives, the Military History Institute, and other repositories.

RESULTS: Medical evacuation helicopters entered the war late, after the United Nations forces had suffered the majority of their casualties. There were relatively few helicopters in the country, and a combination of mechanical and personnel issues kept many grounded. Technological constraints limited their efficacy. Military policy forbade rescues from the front lines, and interhospital transfers comprised a significant percentage of their missions.

CONCLUSION: Helicopters did not appreciably decrease the average time from wounding to surgical care, nor did they evacuate a statistically significant number of casualties, and ultimately, they had minimal effect on military medicine. However, the war did provide helicopters the opportunity to prove themselves conceptually, leading to their widespread usage in Vietnam, in laterconflicts, and ultimately in civilian health care systems.

J Trauma Acute Care Surg. 2019 Jul;87(1S Suppl 1):S165-S171

Prehospital trauma experience of the Israel defense forces on the Syrian border 2013-2017.

Benov A, Shkolnik I, Glassberg E, Nadler R, Gendler S, Antebi B, Chen J, Fink N, Bader T.

BACKGROUND: The Israeli Defense Force Medical Corps (IDF-MC) is routinely collecting prehospital data to establish a prehospital registry. Since February 2013, Israel has been providing medical care to Syrian refugees. This unique humanitarian aid begins in prehospital settings and typically culminates in Israeli civilian hospitals. This report describes the accumulated experience of the IDF-MC to provide Syrian refugees with prehospital treatment.

METHODS: Care provided by IDF-MC medical teams, including prehospital casualty care, is regularly documented and after-action reports are conducted. Records of casualties arriving at the Israeli-Syrian border from February 16, 2013, to December 31, 2017, were prospectively extracted from the IDF Trauma Registry. Patients who did not have a casualty card were excluded. The database included demographic information, injury signature and treatment given.

RESULTS: During the study period, 2,785 Syrian casualties were treated, of whom 2,339 were trauma victims. The most common mechanism of injury was penetrating (60.4%). Prehospital lifesaving interventions included 127 endotracheal intubations, 30 cricothyroidotomies, 55 chest decompressions, and 58 tourniquets for extremity hemorrhage control. Remote Damage Control Resuscitation included reconstituted freeze-dried plasma (n = 75) and tranexamic acid (n = 222 casualties) with no adverse effects.

CONCLUSION: The experience of the IDF-MC teams in caring for civilian casualties along a hostile international border is unique. In this capacity, the IDF-MC has demonstrated effectiveness in providing lifesaving and resuscitative interventions including tranexamic acid and freeze-dried plasma. In this experience, tourniquets have been effective in controlling hemorrhage when applied early and endotracheal intubation and cricothyroidotomy have provided effective airway options in select patients. Prehospital combat casualty care presents a significant challenge both in terms of providing adequate care and in terms of data collection and analysis. The experience described in this article is one example of effective, ongoing prehospital data gathering process. Efforts to provide medical relief to victims of the Syrian civil war continue to this day. While we hope for a better future, as long as these lessons continue to accumulate, it is our obligation to use them to support improvement of trauma care and hopefully save more lives.

LEVEL OF EVIDENCE: Therapeutic, level III.

Am J Emerg Med. 2019 May 31 Epub ahead of print

Tranexamic acid in traumatic hemorrhage: Evidence argues for a prehospital administration.

Boutonnet M, Osorio Cajes G, Pasquier P, Ausset S

QUOTE:
"To conclude, we believe there is sufficient evidence to conclude that early administration of TXA is effective in the management of trauma patients with severe hemorrhage. Further studies on TXA administration in trauma patients should now focus on other indications such as managing severe traumatic brain injury. Thus we look forward to the results of the CRASH-3 study, an international randomized, double-blind, placebo-controlled trial to quantify the effects of the early administration of TXA on death and disability in patients with traumatic brain injury [5]."

Trauma Case Rep. 2019 Jul 3;22:100217. doi: 10.1016/j.tcr.2019.100217. eCollection 2019 Aug.

Tactical tourniquet: Surgical management must be within 3 hours.

Caubère A, de Landevoisin E, Schlienger G, Demoures T, Romanat P

ABSTRACT:
Despite longstanding controversy, tourniquets are widely used in tactical combat casualty care, with undisputed benefits for recent conflicts in Iraq and Afghanistan. Increased time delays are a particular issue in large areas, such as the Sahel-Saharan band. Complications associated with tourniquet use are predominantly related to acute ischemia with risk of amputation and ischaemia-reperfusion injury, as shown in the first clinical case. Often stated but poorly described, misuse of tourniquet and subsequent failure to interrupt arterial blood flow is also a clinical scenario that should be recognized. In the case of misuse of the tourniquet, more significant blood loss may be expected because of venous compression (« venous tourniquet », second clinical case). Early medical re-evaluation of the tourniquet is an essential component in prolonged field care. This includes reassessment of the tourniquet's ability to achieve hemostasis, abolish the downstream pulse and the relevance of the tourniquet altogether. This combat tool requires training to be successful and complications are time dependent. Tourniquet use requires appropriate application, re-evaluation and triage of wounded personnel within 3 h towards more structured surgical management.

J Trauma Acute Care Surg. 2019 Aug;87(2):342-349

Earlier time to hemostasis is associated with decreased mortality and rate of complications: Results from the Pragmatic Randomized Optimal Platelet and Plasma Ratio trial.

Chang R, Kerby J, Kalkwarf K, Van Belle G, Fox E, Cotton B, Cohen M, Schreiber M, Brasel K, Bulger E, Inaba K, Rizoli S, Podbielski J, Wade C, Holcomb J; PROPPR Study Group.

BACKDROP: Clinicians intuitively recognize that faster time to hemostasis is important in bleeding trauma patients, but these times are rarely reported.

METHODS: Prospectively collected data from the Pragmatic Randomized Optimal Platelet and Plasma Ratios trial were analyzed. Hemostasis was predefined as no intraoperative bleeding requiring intervention in the surgical field or resolution of contrast blush on interventional radiology (IR). Patients who underwent an emergent (within 90 minutes) operating room (OR) or IR procedure were included. Mixed-effects Poisson regression with robust error variance (controlling for age, Injury Severity Score, treatment arm, injury mechanism, base excess on admission [missing values estimated by multiple imputation], and time to OR/IR as fixed effects and study site as a random effect) with modified Bonferroni corrections tested the hypothesis that decreased time to hemostasis was associated with decreased mortality and decreased incidence of acute kidney injury (AKI), acute respiratory distress syndrome (ARDS), multiple-organ failure (MOF), sepsis, and venous thromboembolism.

RESULTS: Of 680 enrolled patients, 468 (69%) underwent an emergent procedure. Patients with decreased time to hemostasis were less severely injured, had less deranged base excess on admission, and lower incidence of blunt trauma (all $p < 0.05$). In 408 (87%) patients in whom hemostasis was achieved, every 15-minute decrease in time to hemostasis was associated with decreased 30-day mortality (RR, 0.97; 95% confidence interval [CI], 0.94-0.99), AKI (RR, 0.97; 95% CI, 0.96-0.98), ARDS (RR, 0.98; 95% CI, 0.97-0.99), MOF (RR, 0.94; 95% CI, 0.91-0.97), and sepsis (RR, 0.98; 95% CI, 0.96-0.99), but not venous thromboembolism (RR, 0.99; 95% CI, 0.96-1.03).

CONCLUSION: Earlier time to hemostasis was independently associated with decreased incidence of 30-day mortality, AKI, ARDS, MOF, and sepsis in bleeding trauma patients. Time to hemostasis should be considered as an endpoint in trauma studies and as a potential quality indicator.

LEVEL OF EVIDENCE: Therapeutic/care management, level III.

J Trauma Acute Care Surg 2019 Jun;86(6):1015-1022. doi: 10.1097/TA.0000000000002251.

Identifying patients with time-sensitive injuries: Association of mortality with increasing prehospital time.

Chen X[1], Guyette FX, Peitzman AB, Billiar TR, Sperry JL, Brown JB.

BACKGROUND:
Trauma is a time-sensitive disease. However, recognizing which patients have time-critical injuries in the field is challenging. Many studies failed to identify an association between increasing prehospital time (PHT) and mortality due to evaluation of heterogenous trauma patients, as well as inherent survival bias from missed deaths in patients with long PHT. Our objective was to determine if a subset of existing trauma triage criteria can identify patients in whom mortality is associated with PHT.

METHODS:
Trauma patients 16 years or older transported from the scene in the National Trauma Databank 2007 to 2015 were included. Cubic spline analysis used to identify an inflection where mortality increases to identify a marginal population in which PHT is more likely associated with mortality and exclude biased patients with long PHT. Logistic regression determined the association between mortality and PHT, adjusting for demographics, transport mode, vital signs, operative interventions, and complications. Interaction terms between existing trauma triage criteria and PHT were tested, with model stratification across triage criteria with a significant interaction to determine which criteria identify patients that have increased risk of mortality associated with increasing PHT.

RESULTS:
Mortality risk increased in patients with total PHT of 30 minutes or less, comprising a study population of 517,863 patients. Median total PHT was 26 minutes (interquartile range, 22-28 minutes) with median Injury Severity Score of 9 (interquartile range, 4-14) and 7.4% mortality. Overall, PHT was not associated with mortality (adjusted odd ratio [AOR], 0.984 per 5-minute increase; 95% confidence interval [CI], 0.960-1.009; $p = 0.20$). Interaction analysis demonstrated increased mortality associated with increasing PHT for patients with systolic blood pressure less than 90 mm Hg (AOR, 1.039; 95% CI, 1.003-1.078, $p = 0.04$), Glasgow Coma Scale score of 8 or less (AOR, 1.047; 95% CI, 1.018-1.076; $p < 0.01$), or nonextremity firearm injury (AOR, 1.049; 95% CI, 1.010-1.089; $p < 0.01$).

CONCLUSION:
Patients with prehospital hypotension, Glasgow Coma Scale score of 8 or less, and nonextremity firearm injury have higher mortality with increasing PHT. These patients may have time-sensitive injuries and benefit from rapid transport to definitive care.

LEVEL OF EVIDENCE:
Prognostic/Epidemiologic III; Therapeutic/Care Management IV.

J Trauma Acute Care Surg. 2019 Apr 25;Epub ahead of print

Progress on combat damage control resuscitation/ surgery and its application inmthe Chinese People's Liberation Army.

Chen S, Yang J, Zhang L, Yang L, Qin H, Liu D, Ye Z, Du W, Zhong X, Zong Z

ABSTRACT:
Damage control resuscitation and damage control surgery (DCR/DCS) has now been developed as a well-established standard of care for severely injured civilian patients worldwide. On the other hand, the application of combat DCR/DCS has saved the lives of thousands of severely injured casualty in several wars during the last two decades. This article describes the great progress on DCR/DCS in the last two decades and its application in the Chinese People's Liberation Army (PLA). The main development of the advanced theories of combat DCR/DCS including the global integration of DCR/DCS, application of remote battlefield DCR, balanced hemostatic resuscitation in combat hospitals and enhancement of en route DCR. There are two key factors that determine the feasibility of combat DCR: one is the availability of resources and supplies to implement the advanced theories of combat DCR/DCS, the other is the availability of qualified personnel who master the skills needed for the implementation of DCR/DCS. In the PLA, the advanced theories of combat DCR/DCS have now been widely accepted, and some of related advanced products such as fresh-frozen plasma, packed red blood cells and platelets have been available in level III medical facilities. In conclusion, great progress in combat DCR/DCS has been achieved in recent years, and the Chinese PLA is keeping good pace with this development, although there is still room for improvement. Study type Review article evel of evidence This is a general review article, does not require a level of evidence.

Ann Emerg Med. 2019 Aug;74(2):233-240

Randomized Trial of Intravenous Lidocaine Versus Hydromorphone for Acute Abdominal Pain in the Emergency Department.

Chinn E, Friedman B, Naeem F, Irizarry E, Afrifa F, Zias E, Jones M, Pearlman S, Chertoff A, Wollowitz A, Gallagher E

STUDY OBJECTIVE: We compare the efficacy and safety of intravenous lidocaine with that of hydromorphone for the treatment of acute abdominal pain in the emergency department (ED).

METHODS: This was a randomized, double-blind, clinical trial conducted in 2 EDs in the Bronx, NY. Adults weighing 60 to 120 kg were randomized to receive 120 mg of intravenous lidocaine or 1 mg of intravenous hydromorphone. Thirty minutes after administration of the first dose of the study drug, participants were asked whether they needed a second dose of the investigational medication to which they were randomized. Patients were also stratified according to clinical suspicion of nephrolithiasis. The primary outcome was improvement in pain scores of 0 to 10 between baseline and 90 minutes. An important secondary outcome was need for "off-protocol" parenteral analgesics, including opioids and nonsteroidal anti-inflammatory drugs.

RESULTS: We enrolled 154 patients, of whom 77 received lidocaine and 77 received hydromorphone. By 90 minutes, patients randomized to lidocaine improved by a mean of 3.8 points on the 0-to-10 scale, whereas those randomized to hydromorphone improved by a mean of 5.0 points (mean difference 1.2; 95% confidence interval 0.3 to 2.2). Need for off-protocol "rescue" analgesics occurred for 39 of 77 lidocaine patients (51%) and 20 of 77 hydromorphone patients (26%) (difference 25%; 95% confidence interval 10% to 40%). Adverse events were comparable between groups. Among the subset of 22 patients with nephrolithiasis, lidocaine patients reported a mean improvement of 3.4 points on the pain scale, whereas hydromorphone patients reported a mean improvement of 6.4 points (mean difference 3.0; 95% confidence interval 0.5 to 5.5).

CONCLUSION: Intravenous hydromorphone was superior to intravenous lidocaine both for general abdominal pain and a subset of patients with nephrolithiasis. A majority of patients randomly allocated to lidocaine required additional analgesics.

J Trauma Acute Care Surg. 2019 Jul;87(1S Suppl 1):S191-S196

Lifesaving interventions in blackout conditions using night vision technology: Come to the dark side.

Derickson M, Kuckelman J, Phillips C, Barron M, Marko S, Eckert M, Martin M, Cuadrado D

BACKGROUND: During military combat operations and civilian night-time aeromedical transport, medical providers are frequently required to perform lifesaving interventions (LSIs) in low-light environments. Because definitive surgical care is often delayed until a white light environment is permissible, we sought to determine if night optical device (NOD) technology could enable surgical capabilities in blackout conditions.

METHODS: Using a crossover design, six surgeons performed 11 different procedures on six swine, three in normal light conditions (LC) and 3 in blackout conditions (BC) using two-chamber NODs after familiarization with the procedures in both conditions on manikins. Successful completion and procedural times were compared between groups.

RESULTS: Blackout conditions were confirmed with ambient light reading of 0.2 lux during BC versus 3962.9 lux for LC ($p < 0.001$). There were no significant differences in success rates for any procedure. There were no differences in operative times between BC and LC for extremity tourniquet placement, femoral artery cut-down and clamping, resuscitative thoracotomy, or percutaneous resuscitative endovascular balloon occlusion of the aorta placement. The following procedures took significantly longer in BC vs. LC: Focused Assessment with Sonography for Trauma examination (98 seconds vs. 62 seconds), peripheral IV placement (140 seconds vs. 35 seconds), intraosseous access (51 seconds vs. 26 seconds), jugular vein cut-down and access (237 seconds vs. 104 seconds), laparotomy and packing (71 seconds vs. 51 seconds), stapled splenectomy (137 seconds vs. 74 seconds), resuscitative endovascular balloon occlusion of the aorta placement via cutdown (1,008 seconds vs. 338 seconds), and cricothyroidotomy (177 seconds vs. 109 seconds) (all $p < 0.05$).

CONCLUSION: Lifesaving interventions can be safely and effectively performed in blackout conditions using NODs, although increased difficulty with select procedure types was identified. Focused training and technological improvements to currently available devices are needed.

LEVEL OF EVIDENCE: Basic science.

Singapore Med J. 2019 Jun 14;Epub ahead of print

Airway management in inhalation injury: a case series.

Desai S, Zeng D, Chong S

ABSTRACT:
Inhalation injury is a serious consequence of a fire or an explosion, with potential airway compromise and respiratory complications. We present a case series of five patients with inhalational burns who presented to Singapore General Hospital and discuss our approach to their early management, including early evaluation and planning for the upper and lower airway, coexisting cutaneous burns, and monitoring their ICU (intensive care unit) severity of illness, sepsis and acute respiratory distress syndrome. All five patients suffered various grades of inhalation injury. The patients were initially assessed by nasolaryngoscopy, and three patients were prophylactically intubated before being sent to the emergency operating theatre for definitive airway and burns management with fibreoptic bronchoscopy. All patients were successfully extubated and discharged stable. Various complications can arise as a result of an inhalation injury. Based on our cases and literature review, we propose a standardised workflow for patients with inhalation injury.

Asian J Transfus Sci. 2019 Jan-Jun;13(1):23-29

A study on factors influencing the hemostatic potential of fresh frozen plasma.

Dhantole L, Dubey A, Sonker A

BACKGROUND: Fresh frozen plasma (FFP) is administered to correct deficiencies of various coagulation factors. The level of these factors in FFP varies with donor demographics and ex-vivo processing of plasma. In this study we have compared the quality control parameters of FFP collected from donors of different genders, age groups, ABO blood groups, smoking and alcohol intake habits.

MATERIALS AND METHODS: Four ABO group matched plasma units were pooled, split and further processed by four different freeze-thaw algorithms: frozen by contact shock freezer; thawed at 37°C, frozen by contact shock freezer; thawed at 45°C, frozen by mechanical freezer; thawed at 37°C, frozen by mechanical freezer; thawed at 45°C. The coagulation factor levels in plasma units were compared.

RESULTS: There were no significant differences in the quality parameters with donor age, gender and alcohol intake. Factor VIII levels were significantly lower in O group FFP ($P < 0.05$). Smokers had significantly higher levels of fibrinogen ($P < 0.05$). There were no significant differences in PT, fibrinogen and factor VII levels of FFP processed through various algorithms. Plasma frozen rapidly through contact shock freezer had significantly lower aPTT and higher levels of factor V and VIII compared to mechanical freezing. There were no significant differences between PT, aPTT, fibrinogen, factor V, factor VII and factor VIII levels of FFP thawed at 37°C and 45°C. Mean thawing time was 28 minutes at 37°C and 17 minutes at 45°C.

CONCLUSION: Rapid freezing is recommended for optimum preservation of coagulation factors. Thawing may be done at 45°C in cases of emergency, without compromising hemostatic potential.

J Trauma Acute Care Surg. 2019 Jul;87(1):117-124

The effect of hemorrhage control adjuncts on outcome in severe pelvic fracture: A multi-institutional study.

Duchesne J, Costantini T, Khan M, Taub E, Rhee P, Morse B, Namias N, Schwarz A, Graves J, Kim DY, Howell E, Sperry J, Anto V, Winfield RD, Schreiber M, Behrens B, Martinez B, Raza S, Seamon M, Tatum D.

BACKGROUND: Hemodynamically unstable patients with severe pelvic fracture are a significant challenge to trauma surgeons and have high mortality. Significant variability across institutions in hemorrhage control adjuncts used to quell pelvic bleeding has been demonstrated. However, the effect of these methods on time to definitive bleeding control, type of resuscitation given, and outcomes remains unknown. We sought to elucidate those effects.

METHODS: This was a multicenter retrospective review of severe pelvic fracture patients in shock between 2011 and 2016. Shock was defined as systolic blood pressure less than 90 mm Hg, heart rate greater than 120 beats per minute, or base deficit less than -5. Definitive bleeding control was defined as time to surgical control in the operating room or embolization by interventional radiology. Significance level was at p less than 0.05.

RESULTS: A total of 279 severe pelvic fracture patients with shock on admission from 12 trauma centers were included. The cohort was primarily male (62%) with median (interquartile range) age of 40 years (28-54 years), Injury Severity Score of 38 (29-50), and Glasgow Coma Scale score of 13 (3-15). Overall mortality was 32%. The most common adjunct used was pelvic binder (50%) followed by no adjunct (30.5%); least common was resuscitative balloon occlusion of the aorta (REBOA) (2.5%). Preperitoneal packing alone and REBOA alone/with other adjunct(s) resulted in the fastest times to operating room/interventional radiology but also had the highest blood utilization and mortality rates. Resuscitative balloon occlusion of the aorta was most often used along with pelvic binder (6 of 13; 46%).

CONCLUSION: Marked variation in management of severe pelvic fracture patients in shock indicates the need for a standardized approach to maximize outcomes and minimize transfusion requirements. The use of preperitoneal packing and/or REBOA yielded fastest times to definitive bleeding control. However, REBOA continues to be infrequently used. Future prospective analysis of this combination needs further validation in patients with severe pelvic hemorrhage.

LEVEL OF EVIDENCE: Therapeutic study, level IV.

Anaesthesia. 2019 Sep;74(9):1175-1185

Difficult airway management algorithms: a directed review.

Edelman D, Perkins E, Brewster D

ABSTRACT:
The primary aim of this study was to identify, describe and compare the content of existing difficult airway management algorithms. Secondly, we aimed to describe the literature reporting the implementation of these algorithms. A directed search across three databases (MEDLINE, Embase and Scopus) was performed. All articles were screened for relevance to the research aims and according to pre-determined exclusion criteria. We identified 38 published airway management algorithms. Our results show that most facemask employ a four-step process as represented by a flow chart, with progression from tracheal intubation, facemask ventilation and supraglottic airway device use, to a rescue emergency surgical airway. The identified algorithms are overwhelmingly similar, yet many use differing terminology. The frequency of algorithm publication has increased recently, yet adherence and implementation outcome data remain limited. Our results highlight the lack of a single algorithm that is universally endorsed, recognised and applicable to all difficult airway management situations.

Am J Emerg Med 2019 Apr 30. pii: S0735-6757(19)30293-1. doi: 10.1016/j.ajem.2019.04.051. [Epub ahead of print]

Prehospital administration of tranexamic acid in trauma patients: A 1:1 matched comparative study from a level 1 trauma center.

El-Menyar A, Sathian B, Wahlen BM, Abdelrahman H, Peralta R, Al-Thani H, Rizoli S.

PURPOSE: The purpose of this study was to test the efficacy of prehospital administration of tranexamic acid (TXA) to injured patients on mortality, thromboembolic events and need for blood transfusion in a level 1 trauma center.

METHODS: We conducted a retrospective study comparing adult trauma patients receiving or not receiving prehospital TXA between January 2017 and September 2018. Patients not receiving TXA but transfused within 4 h of admission were 1:1 matched to TXA-treated patients for age, sex, injury severity score, head abbreviated injury score, prehospital heart rate and systolic blood pressure.

RESULTS: In total 204 patients were included (102 TXA and 102 control), with a mean age of 31 years. On admission, shock index ($p = 0.03$) and serum lactate ($p = 0.001$) were greater in the control group, whereas the initial base deficit, hemoglobin levels and EMS time were comparable in both groups. The odd ratio (OR) for shock index ≥0.9 after TXA administration was 0.44 (95% CI 0.23-0.84). The median amount of blood transfusion was greater in the control group [eight units (range 1-40) vs three (range 0-40), $p = 0.01$] as well as the use of massive blood transfusion [OR 0.35 (95% CI 0.19-0.67)]. In the TXA group, VTE was higher [OR 2.0 (95% CI 0.37-11.40)]; whereas the overall mortality was lower [OR 0.78 (95% CI 0.42-1.45)] without reaching statistical significance.

CONCLUSIONS: Prehospital TXA administration is associated with less in-hospital blood transfusion and massive transfusion protocol (MTP). There is no significant increase in the thromboembolic events and mortality, however, further evaluation in larger clinical trials is needed.

Mil Med. 2019 Jun 27. pii: usz158. doi: 10.1093/milmed/usz158

Heterogeneity in Military Trauma Casualty Care.

Englert Z, Kinard J, Qureshi I, Glaser J, Hall A

INTRODUCTION: Military combat casualty care is at the forefront of military medical readiness, but there is little data on current proficiency of deployed personnel. A previous study identified a potential performance gap in military trauma teams. This study aims to evaluate a subsequent team to determine if heterogeneity of teams exists and to determine if this level of efficiency persists or can be improved.

MATERIALS AND METHODS: Military trauma teams at the Role 3 hospital in Bagram, Afghanistan, were evaluated over the course of a single deployment between April and October 2018. Trauma teams were directly observed and performance of the ATLS primary trauma survey timed. These results were compared to previously published times from Kandahar and Bagram Role 3 sites from Oct 2016 to Apr 2017.

RESULTS: Time to completion of the primary survey in 2018 was statistically faster than the times reported from the Role 3 sites from Oct 2016 to Apr 2017 (344.75 s vs. 482.8 s, $p < 0.05$). The greatest improvements of efficiency were in the time periods between assessing the airway and breathing, evaluating the patient's circulation, and completing of the primary survey.

CONCLUSIONS: Trauma teams can vary significantly in their efficiency in evaluating trauma patients. Whether this is clinically significant is currently debatable, but it highlights a possible readiness gap for deploying military personnel and the heterogeneity of military combat casualty care.

Mil Med. 2019 Jul 9. pii: usz167. doi: 10.1093/milmed/usz167. [Epub ahead of print]

Definitive Management of a Traumatic Airway: Case Report.

Fabich R, Franklin B, Langan N

ABSTRACT:
Maxillofacial and neck trauma from penetrating injuries present unique challenges for anesthesia providers and surgeons. In the austere conditions of a combat setting these challenges may be amplified due to limited resources and injury severity. Currently there is a lack of evidence and consensus on how to best manage a traumatized airway in this situation. The authors of this paper present the successful emergency management of a traumatized airway from a severe maxillofacial and neck-penetrating wound. A stepwise team approach using strong communication and a global mental model facilitated definitive airway management in this case allowing for safe transport to definitive care.

Int J Oral Maxillofac Surg. 2019;Epub ahead of print

Frequency of cervical spine injuries in patients with midface fractures.

Färkkilä E, Peacock Z, Tannyhill R, Petrovick L, Gervasini A, Velmahos G, Kaban L

ABSTRACT:
The aim of this retrospective cohort study was to determine the frequency and risk factors for cervical spine injury (CSI) in patients with midface fractures. Patients ≥18 years of age entered in the Massachusetts General Hospital Trauma Registry from 2007 to 2017 were identified. Those with a midface fracture, computed tomography and/or magnetic resonance imaging of the cervical spine, and complete medical records were included. There were 23,394 patients in the registry; 3950 (16.9%) had craniomaxillofacial fractures and 1822 (7.8%) had a CSI. Craniomaxillofacial fractures included fractures of the midface (n=2803, 71.0%), mandible (n=873, 22.1%), and midface plus mandible (n=274, 6.9%). The overall frequency of CSI in patients with midface fractures was 11.4% (350/3077). Patients with midface fractures had a higher risk for CSI compared to patients without a midface fracture (odds ratio 2.4, 95% confidence interval 2.1-2.4, P<0.001). In a multivariate model, nasal and orbital fractures, chest injuries, age, injury severity score, and motor vehicle crash or fall as the etiology were independent risk factors for CSI. Mortality was two times higher in subjects with CSI. Early and accurate diagnosis of CSI is a critical factor when planning the treatment of patients with these fractures.

J Trauma Acute Care Surg. 2019 Jul;87(1S Suppl 1):S184-S190

Conducting fresh whole blood transfusion training.

Fisher A, Carius B, Corley J, Dodge P, Miles E, Taylor A

ABSTRACT:
Fresh whole blood is the optimal resuscitation fluid for casualties in hemorrhagic shock according to the Committee on Tactical Combat Casualty Care and has demonstrated to improve outcomes in severely wounded patients. Like all medical interventions, fresh whole blood transfusions are not without risks, but similarly can be mitigated through increased training to develop provider knowledge and proficiency. To date, no literature has been published regarding the proper technique to conduct fresh whole blood transfusion training. This article provides a structured foundation to establish a standardized fresh whole blood transfusion training program to increase skill and preparedness for fresh whole blood protocol implementation. Using these techniques in a training environment, providers will be able to provide optimal resuscitation in hemorrhagic shock in austere environments.

J Surg Res. 2019 Jul 20;244:516-520

Advancing the Education of Stop the Bleed: Development of a Perfused Synthetic Cadaver Model.

Gupta A, Villegas C, Rosenberg J, Winchell R, Barie P, Narayan M

BACKGROUND: As active shootings and mass casualty incidents have become more prevalent, courses designed to teach basic hemorrhage control to laypersons have proliferated. Participants currently undergo Stop the Bleed (StB) training currently use a synthetic limb mannequin. In a prior survey of 88 participants, there was overwhelming sentiment that the mannequin was limited by its inability to demonstrate cessation of bleeding when hemorrhage control techniques were applied. We hypothesized that simulated bleeding that can be controlled by StB techniques would improve the mannequin and increase confidence of trainees in achieving bleeding control.

METHODS: The mannequin was redesigned to be a self-contained model mimicking bleeding, with fluid flowing from a reservoir into a latex tubing with a laceration mimicking an arterial wound. Fluid was pumped by a rubber bulb attached to the tubing and held in the instructor's hand. Twenty StB trainers conducted beta testing of the perfused mannequin. Forty participants underwent training with both old and new models and completed posttraining surveys.

RESULTS: Beta-testers reported positive feedback regarding both realism of the perfused mannequin and participants' ability to obtain bleeding control using StB techniques. Participants who trialed the mannequin reported increased awareness of the rate of blood flow out of a wound, which in turn increased their sense of urgency to achieve hemostasis.

CONCLUSIONS: In an effort to address shortcomings noted by participants in the current StB mannequin, we developed a novel perfused bleeding mannequin, which responds appropriately to various hemorrhage cessation techniques and is both high fidelity and low cost.

Anesth Analg. 2019 Jul 17;Epub ahead of print

Oligoanalgesia in Patients With an Initial Glasgow Coma Scale Score ≥8 in a Physician-Staffed Helicopter Emergency Medical Service: A Multicentric Secondary Data Analysis of >100,000 Out-of-Hospital Emergency Missions.

Helm M, Hossfeld B, Braun B, Werner D, Peter L, Kulla M

BACKGROUND: Oligoanalgesia, as well as adverse events related to the initiated pain therapy, is prevalent in out-of-hospital emergency medicine, even when a physician is present. We sought to identify factors involved in insufficient pain therapy of patients presenting with an initial Glasgow Coma Scale (GCS) score of ≥8 in the out-of-hospital phase, when therapy is provided by a physician-staffed helicopter emergency medical service (p-HEMS).

METHODS: This was a multicenter, secondary data analysis of conscious patients treated in primary p-HEMS missions between January 1, 2005, and December 31, 2017. Patients with a numeric rating scale (NRS) pain score ≥4, GCS score ≥8 on the scene, without cardiopulmonary resuscitation (CPR), and a National Advisory Committee for Aeronautics (NACA) score <VI were included. Multivariable logistic binary regression analyses were used to identify characteristics of oligoanalgesia (NRS ≥4 at handover or pain reduction <3). Linear regression analysis was used to identify changes in pain treatment within the study period.

RESULTS: We analyzed data from 106,730 patients (3.6% missing data at variable level). Of these patients, 82.9% received some type of analgesic therapy on scene; 79.1% of all patients received analgesic drugs, and 38.6% received nonpharmacological interventions, while 37.4% received both types of intervention. Oligoanalgesia was identified in 18.4% (95% confidence interval [CI], 18.1-18.6) of patients. Factors associated with oligoanalgesia were a low NACA score and a low NRS score, as well as central nervous system or gynecological/obstetric complaints. The use of weak opioids (odds ratio [OR] = 1.05; 95% CI, 0.68-1.57) had no clinically relevant association with oligoanalgesia, in contrast to the use of strong or moderate opioids, nonopioid analgesics, or ketamine. We observed changes in the analgesic drugs used over the 12-year study period, particularly in the use of strong opioids (fentanyl or sufentanil), from 30.3% to 42.3% (P value <.001). Of all patients, 17.1% (95% CI, 16.9-17.3) did not receive any type of pain therapy.

CONCLUSIONS: In the studied p-HEMS cohort, oligoanalgesia was present in 18.4% of all cases. Special presenting complaints, low NACA scores, and low pain scores were associated with the occurrence of oligoanalgesia. However, 17.1% of patients received no type of pain therapy, which suggests a scope for further improvement in prehospital pain therapy. Pharmacological and nonpharmaceutical pain relief should be initiated whenever indicated.

Anesth Analg. 2019 Jul 17;Epub ahead of print

Ketamine Administration During Hospitalization Is Not Associated With Posttraumatic Stress Disorder Outcomes in Military Combat Casualties: A Matched Cohort Study.

Highland K, Soumoff A, Spinks E, Kemezis P, Buckenmaier C

BACKGROUND: Ketamine is routinely used within the context of combat casualty care. Despite early concerns that ketamine administration may be associated with elevated risk of posttraumatic stress disorder (PTSD), more recent evidence suggests no relationship. Because PTSD occurs with regular frequency in Operation Iraqi Freedom/Operation Enduring Freedom (OIF/OEF) Service Members (SMs) and combat-related injuries are associated with higher likelihood of PTSD, it is important to investigate the relationship between ketamine exposure during inpatient medical and surgical care and PTSD symptoms in OIF/OEF SMs.

METHODS: Medical record data from OIF/OEF SMs medically evacuated from combat (N = 1158) included demographic characteristics, injury severity, body areas injured, and PTSD Checklist (PCL) scores. The primary analysis assessed the association between ketamine versus nonketamine exposure on positive PTSD screen (logistic regression) and PCL scores (linear regression) after using 1:1 propensity score matching to adjust for available potential confounding variables. Because there were 2 primary outcomes, the binary positive PTSD screen (yes/no) and continuous PCL score, the significance level was set at $P \leq .025$. In sensitivity analyses, propensity scores were used to match ketamine to nonketamine records in a 1:4 ratio, as well as to conduct inverse probability treatment weighting (IPTW). Regressions examining the relationship between ketamine exposure and outcomes were repeated for unconditional, 1:4 matching, and IPTW models.

RESULTS: In the sample, 107 received ketamine and 1051 did not. In the logistic regression, the probability of a positive PTSD screen was not significantly different between ketamine versus nonketamine patients (odds ratio [OR] = 1.28; 95% confidence interval [CI], 0.48-3.47; P = .62). In the linear regression, PCL scores were not significantly different between ketamine versus nonketamine patients (mean difference = 1.98 [95% CI, -0.99 to 4.96]; P = .19). The results were consistent in the unconditional, 1:4 matching, and IPTW models.

CONCLUSIONS: No differences in PTSD screening risk or symptom levels between ketamine exposed and nonexposed were found. Given the small sample size, wide Cis of the effects, and additional confounds inherent to retrospective studies, future studies are needed to examine the complex relationships between ketamine and psychological symptoms.

J Trauma Acute Care Surg. 2019 Aug;87(2):263-273

Selective aortic arch perfusion with fresh whole blood or HBOC-201 reverses hemorrhage-induced traumatic cardiac arrest in a lethal model of noncompressible torso hemorrhage.

Hoops H, Manning J, Graham T, McCully B, McCurdy S, Ross J

BACKGROUND: Hemorrhage-induced traumatic cardiac arrest (HiTCA) has a dismal survival rate. Previous studies demonstrated selective aortic arch perfusion (SAAP) with fresh whole blood (FWB) improved the rate of return of spontaneous circulation (ROSC) after HiTCA, compared with resuscitative endovascular balloon occlusion of the aorta and cardiopulmonary resuscitation (CPR). Hemoglobin-based oxygen carriers, such as hemoglobin-based oxygen carrier (HBOC)-201, may alleviate the logistical constraints of using FWB in a prehospital setting. It is unknown whether SAAP with HBOC-201 is equivalent in efficacy to FWB, whether conversion from SAAP to extracorporeal life support (ECLS) is feasible, and whether physiologic derangement post-SAAP therapy is reversible.

METHODS: Twenty-six swine (79 ± 4 kg) were anesthetized and underwent HiTCA which was induced via liver injury and controlled hemorrhage. Following arrest, swine were randomly allocated to resuscitation using SAAP with FWB (n = 12) or HBOC-201 (n = 14). After SAAP was initiated, animals were monitored for a 20-minute prehospital period prior to a 40-minute damage control surgery and resuscitation phase, followed by 260 minutes of critical care. Primary outcomes included rate of ROSC, survival, conversion to ECLS, and correction of physiology.

RESULTS: Baseline physiologic measurements were similar between groups. ROSC was achieved in 100% of the FWB animals and 86% of the HBOC-201 animals (p = 0.483). Survival (t = 320 minutes) was 92% (11/12) in the FWB group and 67% (8/12) in the HBOC-201 group (p = 0.120). Conversion to ECLS was successful in 100% of both groups. Lactate peaked at 80 minutes in both groups, and significantly improved by the end of the experiment in the HBOC-201 group (p = 0.001) but not in the FWB group (p = 0.104). There was no significant difference in peak or end lactate between groups.

CONCLUSION: Selective aortic arch perfusion is effective in eliciting ROSC after HiTCA in a swine model, using either FWB or HBOC-201. Transition from SAAP to ECLS after definitive hemorrhage control is feasible, resulting in high overall survival and improvement in lactic acidosis over the study period.

J Trauma Acute Care Surg. 2019 Jul;87(1):68-75

Prehospital adenosine, lidocaine, and magnesium has inferior survival compared with tactical combat casualty care resuscitation in a porcine model of prolonged hemorrhagic shock.

How R, Glaser J, Schaub L, Fryer D, Ozuna K, Morgan C, Sams V, Cardin S

BACKGROUND: Adenosine, lidocaine, and magnesium (ALM) is a cardioplegic agent shown to improve survival by improving cardiac function, tissue perfusion, and coagulopathy in animal models of shock. We hypothesized prehospital ALM treatment in hemorrhagic shock would improve survival compared to current Tactical Combat Casualty Care (TCCC) resuscitation beyond the golden hour.

METHODS: Swine were randomized to: (1) TCCC, (2) 2 mL·kg vehicle control (VC), (3) 2 mL·kg ALM + drip, (4) 4 mL·kg ALM + drip, 5) 4 mL·kg ALM + delayed drip at 0.5 mL·kg·h, 6) 4 mL/kg VC, 7) 4 mL·kg ALM for 15 minutes + delayed drip at 3 mL·kg·h. Animals underwent pressure controlled hemorrhage to mean arterial pressure (MAP) of 30 mm Hg (S = 0). Treatment was administered at T = 0. After 120 minutes of simulated prehospital care (T = 120) blood product resuscitation commenced. Physiologic variables were recorded and laboratories were drawn at specified time points.

RESULTS: Tactical Combat Casualty Care demonstrated superior survival to all other agents. The VC and ALM groups had lower MAPs and systolic blood pressures compared with TCCC. Except for the VC groups, lactate levels remained similar with correction of base deficit after prehospital resuscitation in all groups. Kidney function and liver function remained comparable across all groups. Compared with baseline values, TCCC demonstrated significant hypocoagulability.

CONCLUSION: Adenosine, lidocaine, and magnesium, as administered in this study, are inferior to current Hextend-based resuscitation for survival from prolonged hemorrhagic shock in this model. In survivors, ALM groups had lower systolic blood pressures and MAPs, but provided a protective effect on coagulopathy as compared to TCCC. Adenosine, lidocaine, and magnesium do not appear to be a suitable low volume replacement to current TCCC resuscitation. The reduced coagulopathy compared to TCCC warrants future studies of ALM, perhaps as a therapeutic adjunct.

BMC Anesthesiol. 2019 Jul 9;19(1):124

Ultrasonographic identification of the cricothyroid membrane in a patient with a difficult airway as a result of cervical hematoma caused by hemophilia: a case report.

Jimbo I, Uzawa K, Tokumine J, Mitsuda S, Watanabe K, Yorozu T

BACKGROUND: Surgical cricothyroidotomy is a last resort in patients with an anticipated difficult airway, but without any guarantee of success. Identification of the cricothyroid membrane may be the key to successful cricothyrotomy. Ultrasonographic identification of the cricothyroid membrane has been reported to be more useful than the conventional palpation technique. However, ultrasonographic identification techniques are not yet fully characterized.

CASE PRESENTATION: A 28-year-old man with hemophilia and poor adherence to medication. He was brought to the emergency department with a large cervical hematoma and respiratory difficulty. An otolaryngologist decided to insert a tracheal tube to maintain his airway. However, emergent laryngoscopy indicated an anticipated difficult airway. A backup plan that included awake intubation by the anesthesiologists and surgical cricothyroidotomy by an otolaryngologist was devised. The cricothyroid membrane could not be identified by palpation but was detected by ultrasonographic identification with a longitudinal approach. Awake fiberoptic intubation was successfully performed.

CONCLUSIONS: In this case, the cricothyroid membrane could be identified using the longitudinal approach but not the transverse approach. It may be ideal to know which ultrasound technique can be applied for each patient.

Acta Anaesthesiol Scand. 2019 Jul 10;Epub ahead of print

Point-of-care analyses of blood samples from intraosseous access in pre-hospital critical care.

Jousi M, Björkman J, Nurmi J

BACKGROUND: Intraosseous (IO) access is used for fluid and medication administration in emergency situations when difficulties with vascular access are encountered. IO access would be readily available to take samples for point-of-care (POC) analysis, but there is scarce evidence about the reliability of POC analysis of IO samples among emergency patients. The aim of this study was to evaluate the feasibility and reliability of POC analysis of IO samples in critically ill pre-hospital patients.

METHODS: We performed a prospective, observational study in 35 critically ill pre-hospital patients. After inserting a humeral IO needle, we immediately drew an IO sample. We compared the results to an arterial sample drawn from the same patient within 5 (blood gases) or 15 (other parameters) minutes. Samples were analysed with an i-STAT® POC analyser for blood gases, acid-base balance, electrolytes, glucose and haemoglobin. The agreement between each patient's IO and arterial samples was analysed using the Bland-Altman method. The results were compared to responses about acceptable bias on a questionnaire sent to 16 experienced emergency physicians.

RESULTS: The analysis was successful for 23 patients (70%). Higher age was associated with failed analyses. The average bias was acceptable for base excess, pH, standard bicarbonate, glucose, ionized calcium and sodium. IO potassium values were systematically higher than arterial values. IO haemoglobin values had widely varying agreement.

CONCLUSION: When vascular access is challenging, IO access can be used for emergency POC analyses to help guide clinical decision-making. However, the limitations of IO POC analyses must be carefully considered.

J Trauma Acute Care Surg. 2019 Jul;87(1S Suppl 1):S172-S177

Predictors and timing of amputations in military lower extremity trauma with arterial injury.

Kauvar D, Thomas S, Schechtman D, Walters T

INTRODUCTION: Military lower extremity arterial injuries present threats to life and limb. These injuries are common and limb salvage is a trauma system priority. Understanding the timing and predictors of amputation through the phases of casualty evacuation can help inform future limb salvage efforts. This study characterizes limbs undergoing amputation at different operationally relevant time points.

METHODS: A retrospective cohort study of casualties with lower extremity arterial injuries undergoing initial vascular limb salvage in Iraq and Afghanistan was undertaken. Amputations were grouped as having been performed early (in theater at Role 2 or 3) or late (after evacuation to Role 4 or 5). Further distinction was made between late and delayed (after discharge from initial hospitalization) amputations.

RESULTS: Four hundred fifty-five casualties met inclusion criteria with 103 amputations (23%). Twenty-one (20%) were performed in theater and 82 (80%) were performed following overseas evacuation. Twenty-one (26% of late amputations) were delayed, a median of 359 days from injury (interquartile range, 176-582). Most amputations were performed in the first 4 days following injury. Amputation incidence was highest in popliteal injuries (28%). Overall, amputation was predicted by higher incidence of blast mechanism and fracture and greater limb and casualty injury severity. Early amputations had higher limb injury severity than late amputations. Delayed amputations had greater incidence of motor and sensory loss and contracture than early amputations.

CONCLUSION: Casualty and limb injury severity predict predictors and timing of amputation in military lower extremity arterial injury. Amputation following overseas evacuation was more common than in-theater amputation, and functional loss is associated with delayed amputation. Future limb salvage efforts should focus on postevacuation and rehabilitative care.

LEVEL OF EVIDENCE: Epidemiologic study, level III.

J Spec Oper Med. 2019 Summer;19(2):128-133.

Improvised Inguinal Junctional Tourniquets: Recommendations From the Special Operations Combat Medical Skills Sustainment Course.

Kerr W, Hubbard B, Anderson B, Montgomery HR, Glassberg E, King DR, Hardin RD Jr, Knight RM, Cunningham CW.

ABSTRACT:
Effectively and rapidly controlling significant junctional hemorrhage is an important effort of Tactical Combat Casualty Care (TCCC) and can potentially contribute to greater survival on the battlefield. Although the US Food and Drug Administration (FDA) has approved labeling of four devices for use as junctional tourniquets, many Special Operations Forces (SOF) medics do not carry commercially marketed junctional tourniquets. As part of ongoing educational improvement during Special Operations Combat Medical Skills Sustainment Courses (SOCMSSC), the authors surveyed medics to determine why they do not carry commercial tourniquets and present principles and methods of improvised junctional tourniquet (IJT) application. The authors describe the construction and application of IJTs, including the use of available pressure delivery devices and emphasizing that successful application requires sufficient and repetitive training.

J Trauma Acute Care Surg. 2019 Aug;87(2):371-378

Predictors of postinjury acute respiratory distress syndrome: Lung injury persists in the era of hemostatic resuscitation.

Kornblith L, Robles A, Conroy A, Redick B, Howard B, Hendrickson C, Moore S, Nelson M, Moazed F, Callcut R, Calfee C, Cohen M

BACKGROUND: Acute respiratory distress syndrome (ARDS) following trauma is historically associated with crystalloid and blood product exposure. Advances in resuscitation have occurred over the last decade, but their impact on ARDS is unknown. We sought to investigate predictors of postinjury ARDS in the era of hemostatic resuscitation.

METHODS: Data were prospectively collected from arrival to 28 days for 914 highest-level trauma activations who required intubation and survived more than 6 hours from 2005 to 2016 at a Level I trauma center. Patients with ratio of partial pressure of oxygen to fraction of inspired oxygen of 300 mmHg or less during the first 8 days were identified. Two blinded expert clinicians adjudicated all chest radiographs for bilateral infiltrates in the first 8 days. Those with left-sided heart failure detected were excluded. Multivariate logistic regression was used to define predictors of ARDS.

RESULTS: Of the 914 intubated patients, 63% had a ratio of partial pressure of oxygen to fraction of inspired oxygen of 300 or less, and 22% developed ARDS; among the ARDS cases, 57% were diagnosed early (in the first 24 hours), and 43% later. Patients with ARDS diagnosed later were more severely injured (ISS 32 vs. 20, $p = 0.001$), with higher rates of blunt injury (84% vs. 72%, $p = 0.008$), chest injury (58% vs. 36%, $p < 0.001$), and traumatic brain injury (72% vs. 48%, $p < 0.001$) compared with the no ARDS group. In multivariate analysis, head/chest Abbreviated Injury Score scores, crystalloid from 0 to 6 hours, and platelet transfusion from 0 to 6 hours and 7 to 24 hours were independent predictors of ARDS developing after 24 hours.

CONCLUSIONS: Blood and plasma transfusion were not independently associated with ARDS. However, platelet transfusion was a significant independent risk factor. The role of platelets warrants further investigation but may be mechanistically explained by lung injury models of pulmonary platelet sequestration with peripheral thrombocytopenia.

LEVEL OF EVIDENCE: Prognostic study, level IV.

J Trauma Acute Care Surg. 2019 Sep;87(3):645-657

A descriptive study of US Special Operations Command fatalities, 2001 to 2018.

Kotwal R, Mazuchowski E, Stern C, Montgomery H, Janak J, Howard J, Butler F, Holcomb J, Eastridge B, Gurney J, Shackelford S

BACKGROUND: Studies of fatalities from injury and disease guide prevention and treatment efforts for populations at risk. Findings can inform leadership and direct clinical practice guidelines, research, and personnel, training, and equipment requirements.

METHODS: A retrospective review and descriptive analysis was conducted of United States Special Operations Command (USSOCOM) fatalities who died while performing duties from September 11, 2001, to September 10, 2018. Characteristics analyzed included subcommand, military activity, operational posture, and manner of death.

RESULTS: Of 614 USSOCOM fatalities (median age, 30 years; male, 98.5%) the leading cause of death was injury (97.7%); specifically, multiple/blunt force injury (34.5%), blast injury (30.7%), gunshot wound (GSW; 30.3%), and other (4.5%). Most died outside the United States (87.1%), during combat operations (85.3%), in the prehospital environment (91.5%), and the same day of insult (90.4%). Most fatalities were with the US Army Special Operations Command (67.6%), followed by the Naval Special Warfare Command (16.0%), Air Force Special Operations Command (9.3%), and Marine Corps Forces Special Operations Command (7.2%). Of 54.6% who died of injuries incurred during mounted operations, most were on ground vehicles (53.7%), followed by rotary-wing (37.3%) and fixed-wing (9.0%) aircrafts. The manner of death was primarily homicide (66.0%) and accident (30.5%), followed by natural (2.1%), suicide (0.8%), and undetermined (0.7%). Specific homicide causes of death were GSW (43.7%), blast injury (42.2%), multiple/blunt force injury (13.8%), and other (0.2%). Specific accident causes of death were multiple/blunt force injury (80.7%), blast injury (6.4%), GSW (0.5%), and other (12.3%). Of accident fatalities with multiple/blunt force injury, the mechanism was mostly aircraft mishaps (62.9%), particularly rotary wing (68.4%).

CONCLUSION: Most USSOCOM fatalities died abroad from injury in the prehospital setting. To improve survival from military activities worldwide, leaders must continue to optimize prehospital capability and develop strategies that rapidly connect patients to advanced resuscitative and surgical care.

LEVEL OF EVIDENCE: Epidemiological, level IV; Therapeutic level IV.

J Trauma Acute Care Surg. 2019 Aug;87(2):420-429

Essentials of emergency transfusion-The complement to stop the bleed.

Lewis M, Shulman I, Hudgins J, Moore EE, Inaba K.

ABSTRACT:
Over the past decade, the shift toward damage control surgery for bleeding trauma patients has come with an increased emphasis on optimal resuscitation. Two lifesaving priorities predominate: to quickly stop the bleed and effectively resuscitate the hemorrhagic shock. Blood is separated into components for efficient storage and distribution; however, bleeding patients require all components in a balanced ratio. A variety of blood products are available to surgeons, and these products have evolved over time. This review article describes the current standards for resuscitation of bleeding patients, including characteristics of all available products. The relevant details of blood donation and collection, blood banking, blood components, and future therapies are discussed, with the goal of guiding surgeons in their emergency transfusion practice.

J Emerg Med 2019 Jun;56(6):687-697. doi: 10.1016/j.jemermed.2019.03.030. Epub 2019 Apr 19.

Resuscitative Endovascular Balloon Occlusion of the Aorta: A Review for Emergency Clinicians.

Long B, Hafen L, Koyfman A, Gottlieb M

BACKGROUND:
Non-compressible torso hemorrhage (NCTH) is difficult to control and associated with significant mortality. Resuscitative endovascular balloon occlusion of the aorta (REBOA) utilizes an infra-diaphragmatic approach to control NCTH and is less invasive than resuscitative thoracotomy (RT). This article highlights the evidence for REBOA and provides an overview of the indications, procedural steps, and complications in adults for emergency clinicians.

DISCUSSION:
Traumatic hemorrhage can be life threatening. Patients in extremis, whether from NCTH or exsanguination from other sites, may require RT with aortic cross-clamping. REBOA offers another avenue for proximal hemorrhage control and can be completed by emergency clinicians. The American College of Surgeons Committee on Trauma and the American College of Emergency Physicians recently released a joint statement detailing the indications for REBOA in adults. The evidence behind its use remains controversial, with significant heterogeneity among studies. Most studies demonstrate improved blood pressure without a significant improvement in mortality. Procedural steps include arterial access (most commonly the common femoral artery), positioning the initial sheath, balloon preparation and positioning, balloon inflation, securing the balloon/sheath, subsequent hemorrhage control, balloon deflation, and balloon/sheath removal. Several major complications can occur with REBOA placement. Future studies should evaluate training protocols, the role of simulation, and which target populations would benefit most from REBOA.

CONCLUSIONS:
REBOA can provide proximal hemorrhage control and can be performed by emergency clinicians. This article evaluates the evidence, indications, procedure, and complications for emergency clinicians.

Mil Med. 2019 Jul 23;Epub ahead of print

Influence of Time to Transport to a Higher Level Facility on the Clinical Outcomes of US Combat Casualties with TBI: A Multicenter 7-Year Study.

Maddry J, Arana A, Perez C, Medellin K, Paciocco J, Mora A, Holder W, Davis W, Herson P, Bebarta V

INTRODUCTION: Traumatic brain injury (TBI) is a leading cause of death and disability worldwide and is associated with mortality rates as high as 30%. Patients with TBI are at high risk for secondary injury and need to be transported to definitive care expeditiously. However, the physiologic effects of aeromedical evacuation are not well understood and may compound these risks. Combat TBI patients may benefit from delayed aeromedical evacuation. The goal of this study was to evaluate the impact of transport timing out of theater via Critical Care Air Transport Teams (CCATT) to a higher level facility on the clinical outcomes of combat casualties with TBI.

MATERIALS AND METHODS: We performed a retrospective review of patients with TBI who were evacuated out of theater by CCATT from January 2007 to May 2014. Data abstractors collected flight information, vital signs, procedures, in-flight assessments, and outcomes. Time to transport was defined as the time from injury to CCATT evacuation out of combat theater. We calculated descriptive statistics and constructed regression models to determine the association between time to transport and clinical outcomes. This study was approved by the U.S. Air Force 59th Medical Wing Institutional Review Board.

RESULTS: We analyzed the records of 438 patients evacuated out of theater via CCATT and categorized them into three groups: patients who were transported in one day or less (n = 165), two days (n = 163), and three or more days (n = 110). We used logistic regression models to compare outcomes among patients who were evacuated in two days or three or more days to those who were transported within one day while adjusting for demographics, injury severity, and injury type. Patients who were evacuated in two days or three or more days had 50% lower odds of being discharged on a ventilator and were twice as likely to return to duty or be discharged home than those who were evacuated within one day. Additionally, patients transported in three or more days were 70% less likely to be ventilated at discharge with a GCS of 8 or lower and had 30% lower odds of mortality than those transported within one day.

CONCLUSIONS: In patients with moderate to severe TBI, a delay in aeromedical evacuation out of the combat theater was associated with improved mortality rates and a higher likelihood of discharge to home and return to duty dispositions. This study is correlational in nature and focused on CCATT transports from Role III to Role IV facilities; as such, care must be taken in interpreting our findings and future studies are needed to establish a causal link between delayed evacuation and improved discharge disposition. Our study suggests that delaying aeromedical evacuation of TBI patients when feasible may confer benefit.

Eur J Trauma Emerg Surg. 2019 Jul 19;Epub ahead of print

Predictors of mortality in patients with rib fractures.

Marini C, Petrone P, Soto-Sánchez A, García-Santos E, Stoller C, Verde J

BACKGROUND: The aim of this study was to identify risk factors for morbidity and mortality in patients with rib fractures with focus on identifying a more exact age-dependent cut-off for increased morbidity and mortality.

METHODS: Retrospective study of patients 16 years or older with rib fractures from blunt trauma.

EXCLUSION CRITERIA: patients undergoing rib plating. Initial chest X-ray and Computed Tomography (CT) scans were re-read for the number of rib fractures (NRF) and presence of pulmonary contusion (PC). Data included demographics, mechanism of injury (MOI), NRF, associated injuries, Injury Severity Score (ISS), Glasgow Coma Scale (GCS), Geriatric Trauma Outcome Score (GTOS), presence of pneumothorax, hemothorax, hemo-pneumothorax, PC, Adult Respiratory Distress Syndrome (ARDS), pulmonary complications (ventilator-associated pneumonia, nosocomial pneumonia), and mortality. PC was quantified from CT scans with Mimics. Continuous data were analyzed using Student's t test. Variables significantly different by univariate analysis were analyzed by logistic regression analysis.

RESULTS: The study group consisted of 1188 adult trauma patients admitted during a 2-year period; 800 males and 388 females, with a mean age of 54 ± 21. MOI: MVC, 735 (61.8%); falls, 364 (30.6%); other: 89. Mean NRF, 4 ± 2; GCS, GTOS, and ISS, 15 (15-15), 101 (82-124), and 19 ± 9, respectively. Incidence of PC was 329 (27.7%); PTX, HTX, and HTX/PTX, 264 (20.2%), 57 (4.8%), and 147 (12.4%). Flail chest, in 17 (1.4%); 321 required mechanical ventilation. Age, GCS, male gender, and ISS but not NRF and/or PC were predictive of mortality.

CONCLUSIONS: Increased mortality in patients with rib fractures starts at 65 years of age without a further increase until age ≥ 80. NRF does not predict increased mortality independent of age. Severe TBI is the most common cause of death in patients 16-75 years, as opposed to respiratory complications in patients 80 years-old or greater.

Emerg Med J. 2019 Jul;36(7):395-400

Prehospital tranexamic acid shortens the interval to administration by half in Major Trauma Networks: a service evaluation.

Marsden M, Rossetto A, Duffield C, Woolley T, Buxton W, Steynberg S, Bagga R, Tai N

INTRODUCTION: Tranexamic acid (TXA) reduces bleeding and mortality. Recent trials have demonstrated improved survival with shorter intervals to TXA administration. The aims of this service evaluation were to assess the interval from injury to TXA administration and describe the characteristics of patients who received TXA pre-hospital and in-hospital.

METHODS: We reviewed Trauma and Audit Research Network records and local trauma registries to identify patients of any age that received TXA at all London Major Trauma Centres and Queen's Medical Centre, Nottingham, during 2017. We used the 2016 NICE Guidelines (NG39) which state that TXA should be given within 3 hours of injury.

RESULTS: We identified 1018 patients who received TXA, of whom 661 (65%) had sufficient data to assess the time from injury to TXA administration. The median interval was 74 min (IQR: 47-116). 92% of patients received TXA within 3 hours from injury, and 59% within 1 hour. Half of the patients (54%) received prehospital TXA. The median time to TXA administration when given prehospital was 51 min (IQR: 39-72), and 112 min (IQR: 84-160) if given in-hospital ($p<0.001$). In-hospital TXA patients had less haemodynamic derangement and lower base deficit on admission compared with patients given prehospital TXA.

CONCLUSION: Prehospital administration of TXA is associated with a shorter interval from injury to drug delivery. Identifying a proportion of patients at risk of haemorrhage remains a challenge. However, further reinforcement is needed to empower pre-hospital clinicians to administer TXA to trauma patients without overt signs of shock.

JAMA Surg. 2019 Jul 24;Epub ahead of print

Effectiveness of the American College of Surgeons Bleeding Control Basic Training Among Laypeople Applying Different Tourniquet Types: A Randomized Clinical Trial.

McCarty J, Hashmi Z, Herrera-Escobar J, de Jager E, Chaudhary M, Lipsitz S, Jarman M, Caterson E, Goralnick E

Importance: More than 500 000 laypeople in the United States have been trained in hemorrhage control, including tourniquet application, under the Stop the Bleed campaign. However, it is unclear whether after hemorrhage control training participants become proficient in a specific type of tourniquet or can also use other tourniquets effectively.

Objective: To assess whether participants completing the American College of Surgeons Bleeding Control Basic (B-Con) training with Combat Application Tourniquets (CATs) can effectively apply bleeding control principles using other tourniquet types (commercial and improvised).

Design, Setting, and Participants: This nonblinded, crossover, sequential randomized clinical trial with internal control assessed a volunteer sample of laypeople who attended a B-Con course at Gillette Stadium and the Longwood Medical Area in Boston, Massachusetts, for correct application of each of 5 different tourniquet types immediately after B-Con training from April 4, 2018, to October 9, 2018. The order of application varied for each participant using randomly generated permutated blocks.

Interventions: Full B-Con course, including cognitive and skill sessions, that taught bleeding care, wound pressure and packing, and CAT application.

Main Outcomes and Measures: Correct tourniquet application (applied pressure of ≥250 mm Hg with a 2-minute time cap) in a simulated scenario for 3 commercial tourniquets (Special Operation Forces Tactical Tourniquet, Stretch-Wrap-and-Tuck Tourniquet, and Rapid Application Tourniquet System) and improvised tourniquet compared with correct CAT application as an internal control using 4 pairwise Bonferroni-corrected comparisons with the McNemar test.

Results: A total of 102 participants (50 [49.0%] male; median [interquartile range] age, 37.5 [27.0-53.0] years) were included in the study. Participants correctly applied the CAT at a significantly higher rate (92.2%) than all other commercial tourniquet types (Special Operation Forces Tactical Tourniquet, 68.6%; Stretch-Wrap-and-Tuck Tourniquet, 11.8%; Rapid Application Tourniquet System, 11.8%) and the improvised tourniquet (32.4%) ($P < .001$ for each pairwise comparison). When comparing tourniquets applied correctly, all tourniquet types had higher estimated blood loss, had longer application time, and applied less pressure than the CAT.

Conclusions and Relevance: The B-Con principles for correct CAT application are not fully translatable to other commercial or improvised tourniquet types. This study demonstrates a disconnect between the B-Con course and tourniquet designs available for bystander first aid, potentially stemming from the lack of consensus guidelines. These results suggest that current B-Con trainees may not be prepared to care for bleeding patients as tourniquet design evolves.

Trial Registration: ClinicalTrials.gov identifier:NCT03538379.
Disaster Med Public Health Prep. 2019 Jul 24:1-5

Active Shooter: What Would Health Care Students Do While Caring for Their Patients? Run? Hide? Or Fight?

McKenzie N, Wishner C, Sexton M, Saevig D, Fink B, Rega P

ABSTRACT Objective: The aim of this study was to explore the clinical decisions that health care students would make if faced with an active shooter event while providing patient care.

METHODS: A cross-sectional study design was used to survey 245 students from 6 different professional programs. Participants read 4 case-based scenarios, selected 1 of 4 actions in a multiple-choice format, and responded to an open-ended question. Demographic questions asked whether participants had been a victim of violence and whether they have taken a certified active shooter course. Statistical analysis included descriptive statistics and chi-square testing.

RESULTS: For each case, most students chose "patient-centric" versus" provider-centric" actions (range: 66%-94% and 4%-17%, respectively). The gender of the patient made no difference in actions. Those who attended a certified active shooter course tended to act with more "provider-centric" concerns than those who did not take such a course.

CONCLUSION: A significant majority of interprofessional health care students, when presented with specific case-scenarios, declared they would act to protect themselves and their patients during an active shooter event. This "patient-centric" attitude transcends the oversimplified "Run-Hide-Fight" axiom and must be addressed by all health care educational institutions.

J Trauma Acute Care Surg. 2019 Jul;87(1S Suppl 1):S83-S90

Freeze-dried plasma mitigates the dilution effects of a hemoglobin-based oxygen carrier (HBOC-201) in a model of resuscitation for hemorrhage and hemodilution.

Meledeo M, Peltier G, McIntosh C, Taylor A, Bynum J, Pusateri A, Cap A

BACKGROUND: Hemoglobin-based oxygen carriers (HBOCs) have proven useful for supplementing oxygen delivery when red cells are unavailable; however, HBOCs do not promote hemostasis. The need for prehospital bridges to blood transfusion informed this study which sought to determine the impact of HBOCs on coagulation, with or without cotransfusion of freeze-dried plasma (FDP).

METHODS: Treatment was simulated in vitro by replacing whole blood volume (or whole blood prediluted with 25% plasmalyte A as a hemodilution model) with HBOC-201, FDP, or both at ratios of 10% to 50% of original volume. Prothrombin time (PT), activated partial thromboplastin time (aPTT), fibrinogen, complete blood count, viscosity, thromboelastography (TEG), and platelet adhesion to collagen under flow were evaluated. Subsequently, tissue plasminogen activator was added to model hemorrhagic shock effects on fibrinolysis.

RESULTS: Substituting blood with HBOC resulted in dose-dependent decreases in fibrinogen and cells, which lengthened PT (+61% at highest dose) and aPTT (+40% at highest dose) and produced TEG parameters consistent with dilutional coagulopathy. While substituting blood with FDP decreased cell counts accordingly, fibrinogen, PT, aPTT, and TEG parameters were not statistically changed. When HBOC and FDP were combined 1:1 for volume replacement, observed HBOC-only detriments were mitigated: PT and aPTT were increased by 17% and 11%, respectively, at the highest doses. In prediluted samples, similar trends were seen with exacerbated differences. Platelet adhesion to collagen was directly affected by hematocrit. Samples containing both HBOC and tissue plasminogen activator were highly susceptible to fibrinolysis.

CONCLUSION: A dose equivalent to 1 unit to 2 units each of HBOC-201 and FDP had a modest impact on functional coagulation measures and is reasonable to consider for clinical study as a part of early transfusion intervention. Higher doses may impart hemodilution risks similar to resuscitation with crystalloid or other colloids in coagulation-compromised patients. Further study of HBOC effects on fibrinolysis is also indicated.

Int J Surg. 2019 Aug;68:85-90

Can ultrasound be used as an adjunct for tube thoracostomy? A systematic review of potential application to reduce procedure-related complications.

Menegozzo C, Artifon E, Meyer-Pflug A, Rocha M, Utiyama E

BACKGROUND: chest tube insertions are commonly performed in various scenarios. Although frequent, these procedures result in a significant complication rate, especially in the acute care setting. Ultrasonography has been incorporated to interventional procedures aiming to reduce the incidence of complications. However, little is known about the applications of ultrasound in tube thoracostomies. The aim of this systematic review is to present the potential applications of ultrasonography as an adjunct to the procedure.

METHODS: we searched Medline/Pubmed, EMBASE and Scopus databases. Out of 3012 articles, we selected 19 for further analysis. Thirteen of those were excluded because they did not meet the inclusion criteria. Ultimately, 6 articles were thoroughly evaluated and included in the review.

RESULTS: The included articles show that ultrasound can be used to correctly identify a safe insertion site, to accurately find a vulnerable intercostal artery, and is reliable for timely diagnosis of drain malpositioning.

CONCLUSION: This systematic review highlights the potential benefits of incorporating ultrasonography in tube thoracostomies. No randomized clinical trials are available. However, it is reasonable to assume that proper use of ultrasound may reduce procedure-related complications.

Burns Trauma. 2019 Jul 18;7:22. doi: 10.1186/s41038-019-0160-5

Timely completion of multiple life-saving interventions for traumatic haemorrhagic shock: a retrospective cohort study.

Mitra B, Bade-Boon J, Fitzgerald M, Beck B, Cameron P

Background: Early control of haemorrhage and optimisation of physiology are guiding principles of resuscitation after injury. Improved outcomes have been previously associated with single, timely interventions. The aim of this study was to assess the association between multiple timely life-saving interventions (LSIs) and outcomes of traumatic haemorrhagic shock patients.

Methods: A retrospective cohort study was undertaken of injured patients with haemorrhagic shock who presented to Alfered Emergency & Trauma Centre between July 01, 2010 and July 31, 2014. LSIs studied included chest decompression, control of external haemorrhage, pelvic binder application, transfusion of red cells and coagulation products and surgical control of bleeding through angio-embolisation or operative intervention. The primary exposure variable was timely initiation of ≥ 50% of the indicated interventions. The association between the primary exposure variable and outcome of death at hospital discharge was adjusted for potential confounders using multivariable logistic regression analysis. The association between total pre-hospital times and pre-hospital care times (time from ambulance at scene to trauma centre), in-hospital mortality and timely initiation of ≥ 50% of the indicated interventions were assessed. Results: Of the 168 patients, 54 (32.1%) patients had ≥ 50% of indicated LSI completed within the specified time period. Timely delivery of LSI was independently associated with improved survival to hospital discharge (adjusted odds ratio (OR) for in-hospital death 0.17; 95% confidence interval (CI) 0.03-0.83; p = 0.028). This association was independent of patient age, pre-hospital care time, injury severity score, initial serum lactate levels and coagulopathy. Among patients with pre-hospital time of ≥ 2 h, 2 (3.6%) received timely LSIs. Pre-hospital care times of ≥ 2 h were associated with delayed LSIs and with in-hospital death (unadjusted OR 4.3; 95% CI 1.4-13.0).

Conclusions: Timely completion of LSI when indicated was completed in a small proportion of patients and reflects previous research demonstrating delayed processes and errors even in advanced trauma systems. Timely delivery of a high proportion of LSIs was associated with improved outcomes among patients presenting with haemorrhagic shock after injury. Provision of LSIs in the pre-hospital phase of trauma care has the potential to improve outcomes.

Patient Saf Surg. 2019 Jun 24;13:25

Technical limitations of REBOA in a patient with exsanguinating pelvic crush trauma: a case report.

Özkurtul O, Staab H, Osterhoff G, Ondruschka B, Höch A, Josten C, Fakler J

Background: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an effective adjunct in hemodynamic unstable patients with uncontrolled and non-compressible torso hemorrhage promoting temporary stability during injury repair. The aim of our study was to analyze real life usability of REBOA based on a case report and to review the literature with respect to its possibilities and limitations.

Case presentation: We present the case of a 17-years old female patient who sustained a severe roll-over trauma and pelvic crush injury as a bicyclist by a truck. Upon arrival of the first responders, the patient was awake, alert, and following commands.Subsequent to lifting the truck, the patient became hypotensive and required cardiopulmonary resuscitation, application of a pelvic binder, and endotracheal intubation at the accident scene. She was then admitted by ambulance to our trauma center under ongoing resuscitative measures. After primary survey, it was decided to perform a REBOA with surgical approach to the left femoral artery. Initial insertion of the catheter was successful but could not be advanced beyond the inguinal region. Hence, the patient was transferred to the operating room (OR) but died despite maximum therapy. In the OR and later autopsy, we found a long-distance ruptured and dehiscent external iliac artery with massive bleeding into the pelvis in the context of a bilateral vertical shear fractured pelvic bone.

Conclusion: REBOA can be a useful adjunct but there is a major limitation with potential vascular injury after pelvic trauma. In these situations, cross-clamping the proximal aorta or pre-peritoneal pelvic packing as "traditional" approaches of hemorrhage control during resuscitation may be the most considerable methods for temporary stabilization in severely injured trauma patients. More clinical and cadaveric studies are needed to further understand indications and limitations of REBOA after severe pelvic trauma.

J Surg Res. 2019 Jul 10;244:225-230

Chest Tube Management Practices by Trauma Surgeons.

Parker M, Newcomb A, Liu C, Michetti C

BACKGROUND: Chest tube (CT) placement is among the most common procedures performed by trauma surgeons; evidence guiding CT management is limited and tends toward thoracic surgery patients. The study goal was to identify current CT management practices among trauma providers.

MATERIALS AND METHODS: We designed a Web-based multiple-choice survey to assess CT management practices of trauma providers who were active, senior, or provisional members (n = 1890) of the Eastern Association for the Surgery of Trauma and distributed via e-mail. Descriptive statistics were used.

RESULTS: The response rate was 39% (n = 734). Ninety-one percent of respondents were attending surgeons, the remainder fellows or residents. Regarding experience, 36% of respondents had five or fewer years of practice, 54% 10 y or fewer, and 79% 20 y or fewer. Attendings were more likely than trainees to place pigtail catheters for stable patients with pneumothorax (PTX). Attendings with experience of <5 y were more likely to choose a pigtail than more experienced surgeons for elderly patients with PTX. Respondents preferred standard size CTs for hemothorax and unstable patients with PTX, and larger tubes for unstable patients with hemothorax. Most respondents (53%) perceived the quality of evidence for trauma CT management to be low and cited personal experience and training as the main factors driving their practice.

CONCLUSIONS: Trauma CT management is variable and nonstandardized, depending mostly on clinician training and personal experience. Few surgeons identify their practice as evidence based. We offer compelling justification for the need for trauma CT management research to determine best practices.

J Emerg Med. 2019 Sep;57(3):383-386

Successful Intubation of a Difficult Airway Using a Yankauer Suction Catheter.

Patel K, Mastenbrook J, Pfeifer A, Bauler L

BACKGROUND: Endotracheal intubation (ETI) is used to effectively manage a patient's airway. Failure of ETI may lead to ineffective ventilation or oxygenation, potentially causing organ damage and eventually death. Approximately 8% of ETIs are difficult and 1% are unsuccessful. Tools and techniques to successfully obtain airway access are essential.

CASE REPORT: A patient with chronic obstructive pulmonary disease presented to the emergency department in acute respiratory distress. Noninvasive positive pressure ventilation was unsuccessful in improving the patient's tidal volume and work of breathing. The patient was unable to be intubated by conventional techniques because of a mass obstructing the view of her vocal cords. A cricothyrotomy was considered, but not initially performed because of her distorted anatomy. After multiple intubation attempts from several different physicians, the patient was successfully intubated with the aid of a suction Yankauer, which was used to move the mass peripherally and further served as a conduit through which a bougie was passed.

WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?: The risk for complications rises with each intubation attempt. While there are a variety of tools and aids that can be used to assist in difficult intubations, rapid airway access is essential, and common tools do not always work. We hope that knowledge of this novel, yet simple and effective technique will help physicians successfully intubate patients with distorted oropharyngeal anatomy who cannot be intubated using conventional methods.

Sports Med Arthrosc Rev. 2019 Sep;27(3):112-118

Perioperative Pain Management and Avoidance of Long-term Opioid Use.

Patzkowski M, Patzkowski J.

ABSTRACT:
The opioid epidemic continues to be a problem in the United States and prescription opioid overdose fatalities continue to rise. Chronic opioid use threatens military readiness and puts service members at risk for medical separation from military service. Orthopedic surgeons commonly prescribe opioid medications for postsurgical patients. Long-term opioid use can be the result of acute, postoperative opioid intake. Overprescribing may increase the risk of long-term opioid use, medication diversion and adverse outcomes. Preoperative administration of opioids dramatically increases the risk of continued use up to 1 year after surgery. Strategies to minimize opioid use include opioid-specific preoperative counseling, multimodal analgesia with opioid-sparing oral and intravenous medications, regional anesthesia, minimizing tourniquet use, and preoperative behavioral health evaluation.

World Neurosurg X. 2019 Feb 13;2:100020. doi: 10.1016/j.wnsx.2019.100020. eCollection 2019 Apr.

Prehospital Factors Associated with Discharge Outcomes: Baseline Data from the Andhra Pradesh Traumatic Brain Injury Project.

Ram K, VaraPrasad K, Krishna M, Kannan N, Sundar V, Joseph M, Sinha V, Shukla D, Gururaj G, Narayan R, Pattisapu J, Vavilala M

Objective: Strategies to improve traumatic brain injury (TBI) outcomes in India are ill defined. The objective of this study was to examine baseline prehospital (PH) factors associated with outcomes from the Andhra Pradesh Traumatic Brain Injury Project.

Methods: We conducted a prospective observational cohort study of adult patients with TBI admitted to the primary referral hospital. Modes of injury, prehospital care and transport, and factors associated with increased in-hospital mortality were evaluated. Poisson regression with robust error variance and adjusted attributable risk percent estimates determined factors associated with outcomes.

Results: A total of 447 adults (38% with mild TBI, 30% with moderate TBI, and 32% with severe TBI; 81% men) with isolated TBI (89%) from road traffic accidents (48.1%) or falls (46.5%) were enrolled. Of the patients, 45.7% were transported by ambulance, 61% had scalp/facial bleeding, 11% had respiratory distress, and 7% had cervical spine stabilization. Of these, 25.3% died and 34% had unfavorable outcomes. Among 335 direct admits, 45% traveled more than 50 km and nearly 20% traveled more than 100 km. Bleeding was associated with higher mortality (adjusted relative risk [aRR], 1.56; 95% confidence interval [CI], 1.05-2.31) and unfavorable outcome (aRR, 1.60; 95% CI, 1.18-2.17). Of the patients, 45 (31%) with severe TBI received PH airway management prior to definitive treatment, and respiratory distress was associated with unfavorable discharge outcomes (aRR, 1.23; 95% CI, 1.00-1.51).

Conclusions: Patients with TBI often received treatment far away from injury, bypassing closer hospitals. Scalp/facial bleeding was common and associated with unfavorable outcomes. Ambulance use was infrequent, and few patients received PH airway management, hemorrhage control, or cervical spine stabilization when needed.

Saudi J Anaesth. 2019 Jul-Sep;13(3):215-221

Does prewarming of i-gel improve insertion and ventilation in anaesthetised and paralysed patients? A prospective, randomised, control trial.

Reddy A, Varghese N, Herekar B, Shenoy U

Context: I-gel are supraglottic airway devices with non-inflatable gel-like cuff that is believed to mould to body temperature, to seal the airway. Hence a pre-warmed i-gel may seal faster, provide better ventilation and superior leak pressure.

Aims: To determine if pre-warming i-gel to 40°C improves insertion and efficacy of ventilation.

Methods and Materials: A prospective, randomised, controlled trial was done on 64 patients requiring anaesthesia with muscle relaxation for short duration. For those in group W, i-gel warmed to 40°C for 15 minutes before insertion was used, whereas for those in group C, i-gel kept at room temperature (approximately 23°C) was used. The airway sealing pressure over time, number of attempts and time taken for a successful insertion were noted.

Statistical Analysis: Mean sealing pressure between two groups was compared using independent sample t-test. Repeated Measures ANOVA was used to analyse mean sealing pressure at 0, 15 and 30 min. P value ≤0.05 was considered statistically significant.

Results: Sealing pressure improves over time in both the groups but the mean sealing pressure was higher in group C when compared to group W at all points of time, however this was clinically and statistically insignificant. Ease of insertion, time for successful insertion, insertion attempts, intra-operative manoeuvres were all comparable between the groups with no adverse effects.

Conclusions: Pre-warming of i-gel to 40°C does not improve the success rate of insertion or provide a higher sealing pressure in anaesthetised and paralysed patients when compared to i-gel at room temperature.

Infantry 2019;48:47-49

Changes are coming to TCCC training.

Remley MR

Quote:
"On 18 January 2013, Marine Gen James N. Mattis, then commander of the United States Central Command (CENTCOM), wrote a memorandum to U.S. Military Service Chiefs focusing on the CENTCOM killed in action reduction initiative. He highlighted the outcomes of a November 2012 survey of prehospital medical teams conducted by his command surgeon in coordination with the JTS. This survey's findings identified the difference between the Ranger battlefield trauma care experience and that of the Department of Defense (DoD) at large.

The difference was attributable to the Ranger Casualty Response System, a command-directed program that aggressively teaches TCCC guidelines to all unit personnel, integrates TCCC into small unit tactics and battle drills, and utilizes a unit-based trauma registry for performance improvement and directed procurement. In contrast, most of the DoD did not adopt TCCC until a decade or so after the 75th Ranger Regiment, and other Special Operations units did not implement it with an equivalent amount of command emphasis, contributing to a greater incidence of preventable prehospital deaths in military units that were late adopters of TCCC. Gen Mattis' memorandum outlined that the unprecedented low fatality rate achieved by the Ranger Casualty Response System may serve as a model for improving prehospital trauma care and saving lives on the battlefield.1"

Turk J Anaesthesiol Reanim. 2019 Feb;47(1):24-30

Comparison between the Baska Mask® and I-Gel for Minor Surgical Procedures Under General Anaesthesia.

Sachidananda R, Shaikh S, Mitragotri M, Joshi V, Ladhad D, Mallappa M, Bhat V

Objective: Minor surgical procedures under general anaesthesia require a patent airway without the use of muscle relaxant. Supraglottic airway devices have been widely used for airway management. A study was undertaken to compare first-time insertion success rate, insertion time, sealing pressure and complications between the Baska® mask and I-gel.

Methods: After approval from the institutional ethical committee, a randomised single-blinded study was conducted on 50 American Society of Anesthesiologists' physical status I and II female patients aged 18-40 years who underwent minor surgical procedures under general anaesthesia. Patients were randomly categorized into two groups of 25 each; group Baska® mask and group I-gel, and the first-time success rate, mean insertion time and sealing pressure were measured. The results were analysed using unpaired t-test, Mann-Whitney U test, Chi square test and ANOVA. A p value <0.05 was considered to be statistically significant.

Results: The first-time insertion success rate of the Baska® mask was 21/24 (88%) when compared with the I-gel, which was 23/25 (92%) (p=0.585). The insertion time of the Baska® mask was 14.9±6.2 s, whereas that of the I-gel was 14.7±4.4 s (p=0.877). The mean sealing pressure of the Baska® mask was significantly higher when compared with the I-gel (28.9±3.5 vs. 25.9±2.5 cmH2O) (p=0.001).

Conclusion: The Baska® mask had a similar first-time insertion success rate and insertion time as the I-gel. The sealing pressure of the Baska® mask was significantly greater than that of the I-gel. Both devices had complications that were comparable.

J Spec Oper Med 2019 Fall;19(3):86-89.

Survival of Casualties Undergoing Prehospital Supraglottic Airway Placement Versus Cricothyrotomy.

Schauer SG, Naylor JF, Chow AL, Maddry JK, Cunningham CW, Blackburn MB, Nawn CD, April MD.

BACKGROUND: Airway compromise is the second leading cause of preventable death on the battlefield. Unlike a cricothyrotomy, supraglottic airway (SGA) placement does not require an incision and is less technically challenging. We compare survival of causalities undergoing cricothyrotomy versus SGA placement.

METHODS: We used a series of emergency department (ED) procedure codes to search within the Department of Defense Trauma Registry (DoDTR) from January 2007 to August 2016. This is a subanalysis of that dataset.

RESULTS: During the study period, 194 casualties had a documented cricothyrotomy and 22 had a documented SGA as the sole airway intervention. The two groups had similar proportions of explosive injuries (57.7% versus 63.6%, p = .328), similar composite injury severity scores (25 versus 27.5, p = .168), and similar AIS for the head, face, extremities, and external body regions. The cricothyrotomy group had lower AIS for the thorax (0 versus 3, p = .019) a trend toward lower AIS for the abdomen (0 versus 0, p = .077), more serious injuries to the head (67.5% versus 45.5%, p = .039), and similar rates of serious injuries to the face (4.6% versus 4.6%, p = .984). Glasgow Coma Scale (GCS) scores were similar upon arrival to the ED (3 versus 3, p = .467) as were the proportion of patients surviving to discharge (45.4% versus 40.9%, p = .691). On repeated multivariable analyses, the odds ratios (ORs) for survival were not significantly different between the two groups.

CONCLUSION: We found no difference in short-term outcomes between combat casualties who received an SGA vs cricothyrotomy. Military prehospital personnel rarely used either advanced airway intervention during the recent conflicts in Afghanistan and Iraq.

Mil Med. 2019 May 29 2019;Epub ahead of print

Incidence of Hyperoxia in Combat Wounded in Iraq and Afghanistan: A Potential Opportunity for Oxygen Conservation.

Schauer S, April M, Naylor J, Mould-Millman N, Bebarta V, Becker T, Maddry J, Ginde A

INTRODUCTION: Oxygen supplementation is frequently used in critically injured trauma casualties in the combat setting. Oxygen supplies in the deployed setting are limited so excessive use of oxygen may unnecessarily consume this limited resource. We describe the incidence of supraphysiologic oxygenation (hyperoxia) within casualties in the Department of Defense Trauma Registry (DoDTR).

METHODS: This is a subanalysis of previously published data from the DoDTR – we isolated casualties with a documented arterial blood gas (ABG) and categorized hyperoxia as an arterial oxygen >100 mmHg and extreme hyperoxia > 300 mmHg (a subset of hyperoxia). We defined serious injuries as those with an Abbreviated Injury Score (AIS) of 3 or greater. We defined a probable moderate traumatic brain injury of those with an AIS of 3 or greater for the head region and at least one Glasgow Coma Scale at 8 or less.

RESULTS: Our initial search yielded 28,222 casualties, of which 10,969 had at least one ABG available. Within the 10,969, the proportion of casualties experiencing hyperoxia in this population was 20.6% (2,269) with a subset of 4.1% (452) meeting criteria for extreme hyperoxia. Among those with hyperoxia, the median age was 25 years (IQR 21-30), most were male (96.8%), most frequently US forces (41.4%), injured in Afghanistan (68.3%), injured by explosive (61.1%), with moderate injury scores (median 17, IQR 10-26), and most (93.8%) survived to hospital discharge. A total of 17.8% (1,954) of the casualties underwent endotracheal intubation: 27.5% (538 of 1,954) prior to emergency department (ED) arrival and 72.5% (1,416 of 1,954) within the ED. Among those intubated in the prehospital setting, upon ED arrival 35.1% (189) were hyperoxic, and a subset of 5.6% (30) that were extremely hyperoxic. Among those intubated in the ED, 35.4% (502) were hyperoxic, 7.9% (112) were extremely hyperoxic. Within the 1,277 with a probable TBI, 44.2% (565) experienced hyperoxia and 9.5% (122) met criteria for extreme hyperoxia.

CONCLUSIONS: In our dataset, more than 1 in 5 casualties overall had documented hyperoxia on ABG measurement, 1 in 3 intubated casualties, and almost 1 in 2 TBI casualties. With limited oxygen supplies in theater and logistical challenges with oxygen resupply, efforts to avoid unnecessary oxygen supplementation may have material impact on preserving this scarce resource and avoid potential detrimental clinical effects from supraphysiologic oxygen concentrations.

Mil Med. 2019 Jul 1;184(7-8):e225-e229

A Descriptive Analysis of Causalities Undergoing CASEVAC from the Point-of-Injury in the Department of Defense Trauma Registry.

Schauer S, Naylor J, Bellamy M, Maddry J, April M

INTRODUCTION: The recent conflicts in Iraq and Afghanistan entail an asymmetric battlefield without clearly defined forward lines of troops as seen in previous wars. Accordingly, the United States military medical services have increasingly adopted casualty evacuation (CASEVAC) platforms. We describe CASEVAC events reported within the Department of Defense Trauma Registry (DODTR).

MATERIALS AND METHODS: This is a secondary analysis of previously published data from two datasets spanning from 2007 through 2017. We isolated casualties within our dataset that had a documented evacuation method from the point-of-injury other than dedicated medical evacuation platforms (e.g., MEDEVAC, etc.).

RESULTS: During OPERATION IRAQI FREEDOM, three casualties underwent CASEVAC. The median age was 30 and all were male. Most sustained injuries from explosives (67%) and the median composite injury scores were low (10). The most frequent seriously injured body region was the thorax (67%). All survived to hospital discharge. During operations in Afghanistan (OPERATION ENDURING FREEDOM, OPERATION FREEDOMS SENTINEL, OPERATION NEW DAWN), 248 casualties underwent CASEVAC. The median age was 28 and most (96%) were male. Most sustained injuries from explosives (58%) and the median injury score was low (9). The most frequent seriously injured body region was the extremities (24%). Most (97%) survived to hospital discharge. During OPERATION INHERENT RESOLVE, 247 casualties underwent

CASEVAC. The median age was 21 and most (96%) were male. The majority sustained injuries from explosives (61%) and the median injury score was low (9). The most frequent seriously injury body region was the extremities (27%). Most survived to hospital discharge (94%).

CONCLUSIONS: In our dataset, CASEVAC events most frequently involved US military personnel service members with most surviving to hospital discharge. Developing new terminology that distinguishes different types of CASEVAC would allow for more accurate future analyses of casualty evacuation and outcomes - such as those transports that are truly in a non-medical versus the various medical platforms that do not fall with into the confines of the MEDEVAC platforms.

J Trauma Acute Care Surg. 2019 Jun 12.

Undertriaged Trauma Patients: Who are we Missing?

Schellenberg M, Benjamin E, Bardes J, Inaba K, Demetriades D

INTRODUCTION: Trauma team activation (TTA) criteria, set by the ACS Committee on Trauma (COT), are used to identify patients prehospital who are at highest risk for severe injury and mobilize the optimal resources. Patients are undertriaged if they are severely injured (ISS ≥16) but do not meet TTA criteria. This study examined the epidemiology and injury patterns of undertriaged patients and potential clinical effects.

METHODS: All patients presenting to our Level I trauma center (06/01/2017-05/31/18) were screened for inclusion using modified TTA criteria (mTTA), i.e. age >70 added to the standard ACS COT TTA criteria. Demographics, injury/clinical data, and outcomes of undertriaged patients were analyzed. Undertriaged patients were further subcategorized as 'high risk' if they expired or required emergent intervention.

RESULTS: 233 undertriaged patients were identified from 1423 routine trauma consults (16%). Mean ISS was 20 (range 16-43). Most undertriage occurred following blunt trauma (n=224, 96%), especially MVCs (n=66, 28%) and AVPs (n=57, 24%). Thirty-two patients (14%) were identified as high risk undertriaged patients: 16 (50%) required emergency surgery (mainly craniectomy; n=10, 63%), 5 (16%) required angioembolization, and 14 patients (44%) died. In this high risk group, the cause of death was almost exclusively traumatic brain injury (TBI) (n=13, 93%). Of the patients who died of TBI, the majority had a depressed GCS on presentation to the ED (<11) (n=10, 77%) despite not meeting field criteria for TTA.

CONCLUSIONS: Using mTTA criteria, undertriage rates are relatively low, particularly after penetrating trauma. However, there is a high risk population that is not captured, among whom mortality and need for emergent intervention are high. Most undertriage deaths are secondary to severe TBI. Despite not qualifying for highest level activation, patients with head trauma and GCS <11 on admission are at high risk for adverse outcomes and additional resource mobilization should be considered.

J Spec Oper Med. 2019 Summer;19(2):69-72.

The Use of the Abdominal Aortic and Junctional Tourniquet versus Combat Gauze in a Porcine Hemicorporectomy Model.

Schwartz RB, Shiver SA, Reynolds BZ, Lowry J, Holsten SB, Akers TW, Lyon M.

BACKGROUND: Junctional hemorrhage is a potentially preventable cause of death. The Abdominal Aortic and Junctional Tourniquet (AAJT) compresses major vascular structures and arrests blood flow in exsanguinating hemorrhage. In a human model, the AAJT was effective in stopping blood flow in the femoral arteries via compression of the distal aorta. This study compares the ability of AAJT and Combat Gauze (CG) to stop hemorrhagic bleeding from a hemicorporectomy in a swine model.

METHOD: Six anesthetized swine were used. Carotid arterial catheters were placed for continuous mean arterial pressure (MAP) readings. A hemicorporectomy was accomplished with a blade lever device by cutting the animal through both femoral heads transecting the proximal iliac arteries and veins. Hemorrhage control was attempted with the AAJT and regular Kerlix gauze or CG packing and direct pressure followed by Kerlix gauze placed over the CG. The primary outcome measure was survival at 60 minutes.

RESULTS: The 60-minute survival was 100% for the AAJT and 0% for the CG group. During the 60-minute monitoring period, only one CG animal achieved hemostasis. For the AAJT group, the mean time to hemostasis was 30 seconds. Initial MAP was higher in the AAJT group (mean, 87mmHg) than the CG group (mean, 70mmHg). The mean 60-minute MAP was 73mmHg for the AAJT group. Mean blood loss at 5 minutes and mean total blood loss were greater in the CG group than in the AAJT group.

CONCLUSION: AAJT is superior to CG in controlling hemorrhage in a junctional wound in a swine model.

J Trauma Acute Care Surg. 2019 Jul;87(1S Suppl 1):S128-S131

ThoraSite: A device to improve accuracy of lateral decompression needle and chest tube placement.

Shah A, Kothera C, Dheer S

BACKGROUND: Multiple reports have detailed an unacceptably high error rate in the siting of decompression needles and tubes and describe associated iatrogenic injuries. The objective of the current study was to measure the accuracy of the novel ThoraSite template for identifying an acceptable intercostal space (ICS) for lateral needle or tube thoracostomy.

METHODS: Two trained operators used the ThoraSite to place radiopaque needles in the left and right lateral chests of 12 cadavers. An independent radiologist reviewed fluoroscopy images to determine the primary outcome: the ICS in which each needle was placed. Secondary outcomes were ICS's palpable through ThoraSite's Safe Zone; needle placement relative to the anterior axillary line (AAL) and midaxillary line (MAL); and percent correct placement (defined as the third, fourth, or fifth ICS from 1 cm anterior to the AAL to 1 cm posterior to the MAL).

RESULTS: The six female and six male cadavers spanned 4 ft and 11 inches (150 cm) to 6 ft and 7 inches (201 cm), 80 lb (36 kg) to 350 lb (159 kg), and 16 kg/m to 42 kg/m body mass index. All 24 needles were placed in either the third (4 [17%] of 24 needles), fourth (10 [42%] of 24 needles), or fifth ICS (10 [42%] of 24 needles). In 10 (42%) of 24 assessments, two ICSs were palpable in ThoraSite's Safe Zone. All palpable ICSs were either the third (8 [24%] of 34), fourth (15 [44%] of 34); or fifth ICS (11 [32%] of 34). Twenty-three (96%) of 24 needles were inserted from 1 cm anterior to the AAL to 1 cm posterior to the MAL. Twenty-three (96%) of 24 needle placements were correct.

CONCLUSION: ThoraSite use was associated with needle placement in the third, fourth, or fifth ICS in an area roughly spanning the AAL to MAL in anatomically diverse cadavers. By facilitating appropriate needle/tube placement, ThoraSite use may decrease iatrogenic injuries. Future study involving representative users may be useful to further evaluate ThoraSite accuracy.

LEVEL OF EVIDENCE: Therapeutic and care management, level IV.

Mil Med. 2019 Jun 28;Epub ahead of print

An Evaluation of a Novel Medical Device Versus Standard Interventions in the Treatment of Tension Pneumothorax in a Swine Model (Sus scrofa).

Sheldon R, Do W, Forte D, Weiss J, Derickson M, Eckert M, Martin M

INTRODUCTION: Tension pneumothorax is a common cause of preventable death in trauma. Needle decompression is the traditional first-line intervention but has high failure rates. We sought to evaluate the effectiveness and expedience of needle thoracostomy, surgical tube thoracostomy, and Reactor™ thoracostomy – a novel spring-loaded trocar insertion device.

MATERIALS AND METHODS: Yorkshire swine underwent controlled thoracic insufflation to create tension pneumothorax physiology for device comparison. Additional experiments were performed by increasing insufflation pressures to achieve pulseless electrical activity. Intervention was randomized to needle thoracostomy (14 gauge), tube thoracostomy (32Fr), or Reactor™ thoracostomy (36Fr). Air leak was simulated throughout intervention with 40-80 mL/kg/min insufflation. Intrathoracic pressure monitoring and hemodynamic parameters were obtained at 1 and 5 minutes.

RESULTS: Tension physiology and tension-induced pulseless electrical activity were created in all iterations. Needle thoracostomy ($n = 28$) was faster at 7.04 ± 3.04 seconds than both Reactor thoracostomy ($n = 32$), 11.63 ± 5.30 ($p < 0.05$) and tube thoracostomy ($n = 32$), 27.06 ± 10.73 ($p < 0.01$); however, Reactor™ thoracostomy was faster than tube thoracostomy ($p < 0.001$). Physiological decompression was achieved in all patients treated with Reactor™ and tube thoracostomy, but only 14% of needle thoracostomy. Cardiac recovery to completephysiologic baseline occurred in only 21% (6/28) of those treated with needle thoracostomy whereas Reactor™ or tube thoracostomy demonstrated 88% (28/32) and 94% (30/32) response rates. When combined, needle thoracostomy successfully treated tension pneumothorax in only 4% (1/28) of subjects as compared to 88% (28/32) with Reactor™ thoracostomy and 94% (30/32) with tube thoracostomy ($p < 0.01$).

CONCLUSIONS: Needle thoracostomy provides a rapid intervention for tension pneumothorax, but is associated with unacceptably high failure rates. Reactor™ thoracostomy was effective, expedient, and may provide a useful and technically simpler first-line treatment for tension pneumothorax or tension-induced pulseless electrical activity.

J Am Coll Surg. 2019 Sep;229(3):244-251

Incidence and Cause of Potentially Preventable Death after Civilian Public Mass Shooting in the US.

Smith E, Sarani B, Shapiro G, Gondek S, Rivas L, Ju T, Robinson B, Estroff J, Fudenberg J, Amdur R, Mitchell R

BACKGROUND: The incidence and severity of civilian public mass shooting (CPMS) events continue to rise. Understanding the wounding pattern and incidence of potentially preventable death (PPD) after CPMS is key to updating prehospital response strategy.

METHODS: A retrospective study of autopsy reports after CPMS events identified via the Federal Bureau of Investigation CPMS database from December 1999 to December 31, 2017 was performed. Sites of injury, fatal injury, and incidence of PPD were determined independently by a multidisciplinary panel composed of trauma surgery, emergency medicine, critical care paramedicine, and forensic pathology.

RESULTS: Nineteen events including 213 victims were reviewed. Mean number of gunshot wounds per victim was 4.1. Sixty-four percent of gunshots were to the head and torso. The most common cause of death was brain injury (52%). Only 12% (26 victims) were transported to the hospital and the PPD rate was 15% (32 victims). The most commonly injured organs in those with PPD were the lung (59%) and spinal cord (24%). Only 6% of PPD victims had a gunshot to a vascular structure in an extremity.

CONCLUSIONS: The PPD rate after CPMS is high and is due mostly to non-hemorrhaging chest wounds. Prehospital care strategy should focus on immediate point of wounding care by both laypersons and medical personnel, as well as rapid extrication of victims to definitive medical care.

Transfusion. 2019 Jul;59(7):2177-2179

Low titer group O whole blood for prehospital hemorrhagic shock: It is an offer we cannot refuse.

Spinella P, Gurney J, Yazer M:

QUOTES:

"For military providers the experimental and control groups in this study are interesting, but since practice has changed from when these experiments were initially performed they are less relevant. The Committee on Tactical Combat Casualty Care (CoTCCC), which establishes guidelines for prehospital care in US military combat environments, prioritizes the use of whole blood over all other resuscitation fluids. The CoTCCC's highest priority for non-blood product resuscitation was hetastarch solution prior to 2016, this is why Sheppard et al chose to compare hetastarch to whole blood, but over the last 2 years hetastarch solution (and all clear fluids) have been discouraged and the emphasis has been on bloodbased resuscitation for all combat casualties. While Hetastarch solution is still in the TCCC Guidelines, it is currently under review for removal. The results of the experiments by Sheppard et al indicate, as most military providers would have expected, that warm fresh whole blood resuscitated the rhesus macaque with an improved hemostatic profile and trends toward improved hemodynamics, oxygen delivery, and even survival."

"US military trauma systems in collaboration with the Armed Services Blood Procurement Office have dramatically changed prehospital resuscitation in the past decade from exclusively using crystalloid/colloids to now where blood products are very commonly available prehospital. Trauma systems in the US are also working together with blood suppliers to coordinate donor recruitment and inventory management at all hospitals and emergency medical systems. Teams in San Antonio and south Texas have been incredibly successful at making prehospital LTOWB available with almost no waste.24 The Brothers in Arms program is a case study in collaboration and patient-centered care. It is a program to be emulated.

Emergency medical systems in the US are increasingly starting to incorporate LTOWB for prehospital resuscitation. This is a big change in transfusion medicine. Trauma and transfusion medicine communities need to work together to improve outcomes for patients with severe bleeding in the prehospital setting. Moving forward, we should leave the clear fluids and take the whole blood. It is an offer we cannot refuse our patients."

Shock. 2019 Jun 4;Epub ahead of prin

The Use of Tranexamic acid (TXA) for The Management of Haemorrhage In Trauma Patients In The Prehospital Environment: Literature Review and Descriptive Analysis of Principal Themes.

Stansfield R, Morris D, Jesulola E

ABSTRACT:
Tranexamic acid (TXA) is an anti-fibrinolytic 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 haemophiliacs 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 haemorrhage. Thus, TXA may be well suited for the management of traumatic haemorrhage in the pre-hospital 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 haemorrhage 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 analysed and the and 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, literature supports the use of a loading dose of 1 gram of TXA, followed by 1 gram infusion over 8 hours, given by intravenous administration within a 3 hour window period of traumatic injury. TXA is very effective and safe to use in the pre-hospital setting, and its use is clinically and economically feasible.

PLoS One. 2019 Jul 19;14(7):e0220006

Comparison of video and conventional laryngoscopes for simulated difficult emergency tracheal intubations in the presence of liquids in the airway.

Suzuki K, Kusunoki S, Sadamori T, Tanabe Y, Itai J, Shime N

ABSTRACT:
The presence of vomit, blood, or other foreign liquid materials in the upper airway is a major obstacle in difficult tracheal intubations (TIs) especially in prehospital care. However, the usefulness of video laryngoscopes (VLs) in these situations has not been investigated. The objective of this study was to compare the Airway Scope (AWS) and the Macintosh laryngoscope (ML) for their performance in TIs performed by emergency medical technicians (EMTs) using mannequin models with liquids in the airway. Rice gruel and mock blood were used to fill the upper airways of mannequins to create mock vomit and hematemesis models, respectively. TIs were performed by certified EMTs after visualizing the glottis using an AWS with an 18-Fr suction catheter and a ML with an 18-Fr suction catheter. TIs with AWS and ML were performed in random order in a comparative crossover trial. The TI success rate was evaluated based on the following: (a) the time taken from laryngoscope insertion into the oral cavity to glottis visualization, tracheal tube passage through the glottis, until the initiation of ventilation and (b) the subjective level of difficulty, which was assessed using a visual analog scale (VAS). TIs in vomiting and hematemesis scenarios were performed by 25 and 26 EMTs, respectively. The TI success rates for these scenarios were 100% with both AWS and ML. The median time required until successful ventilation was significantly shorter with AWS than with ML in both the vomiting (42 vs. 58 s) and hematemesis models (33 vs. 39 s), respectively. In the hematemesis scenarios, difficulty assessed using a VAS was lower with AWS than with ML (13 vs. 38 in median), respectively. Compared to the ML, the AWS was capable of faster and easier TIs, in a simulated model of liquid foreign material in the upper airway.

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Characterisation of aluminium release by the enFlow® fluid-warming system in crystalloids and blood products.

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ABSTRACT:
The use of uncoated aluminium-heated plates in an intravenous fluid-warming system has been shown to produce high levels of aluminium in Sterofundin 1/1E, a balanced crystalloid solution. However, the effect of this fluid-warming device on other balanced crystalloid solutions and blood products has not been studied. Using mass spectrometry we measured aluminium levels in Plasma-Lyte 148, compound sodium lactate solution, 4% human albumin solution, expired resuspended packed red cells and fresh frozen plasma that were pumped through an enFlow® fluid-warming system at 2 ml.min-1 . Samples were taken at baseline before heating and then at 10-min intervals up to 60 min with the system set to warm the fluids to 40 °C. High concentrations of aluminium were found for Plasma-Lyte 148 and compound sodium lactate solutions (mean (SD) 223 (0.6) μmol.l-1 and 163 (0.2) μmol.l-1 at 60 min, respectively); both concentrations were significantly greater than the United States Food and Drug Administration recommended maximum limit for aluminium in intravenous nutrition of 25 μg.l-1 (0.9 μmol.l-1). Lower aluminium levels were found in 4% human albumin solutions, expired resuspended red cells and fresh frozen plasma at 60 min (mean (SD) 5.7 (0.1) μmol.l-1 , 2.7 (0.0) μmol.l-1 and 2.3 (0.4) μmol.l-1 , respectively). The process allowing addition of aluminium to be added to Sterofundin 1/1E by the enFlow fluid warmer also occurs in Plasma-Lyte 148 and compound sodium lactate solutions and to a lesser degree in blood products. The exact mechanism facilitating this process and its clinical significance remain unclear.

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Clinical Examination of the Pelvic Ring in the Prehospital Phase.

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INTRODUCTION: Instable pelvic fractures are associated with significant hemorrhage and shock. Instability of the pelvic ring should be tested with the manual compression test (MCT) and instable pelvic ring fractures should prompt mechanical stabilization. However, the accuracy of the prehospital MCT in patients, that sustained a high energetic trauma, is still unknown.

SETTING: Radboudumc Nijmegen, level 1 trauma center, the Netherlands.

METHODS: This prospective blind observational study included all patients after a high impact blunt trauma treated by an experienced Helicopter Emergency Medical Service (HEMS) physician. Nominal arranged questionnaires were filled in by the HEMS physician prior to the radiological examination of the patient.

RESULTS: We included 56 patients of which 11 sustained a pelvic ring fracture. 13 patients were treated with pelvic compression devices, of which only five patients had a pelvic ring fracture. Prehospital performed clinical examination by the HEMS physicians had an overall sensitivity of 0.45 (95% CI 0.16-0.75) and a specificity of 0.93 (95% CI 0.29-0.96).

CONCLUSION: Pelvic ring instability cannot accurately be diagnosed in the prehospital setting, based on the MCT. The use of the pelvic binder should standard in high impact blunt trauma patients, independently of the MCT or trauma mechanism.

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Epidemiology of Upper Extremity Vascular Injury in Contemporary Combat.

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BACKGROUND: The incidence of wartime upper-extremity vascular injury (UEVI) has been stable for the past century. The objective of this study is to provide a contemporary review of wartime UEVI, including epidemiologic characterization and description of early limb loss.

METHODS: The Department of Defense Trauma Registry (DoDTR) was queried to identify US service members who sustained a battle-related UEVI in Afghanistan between January 2009 and December 2015. Anatomic distribution of injury, mechanism of injury (MOI), associated injuries, early management, and early limb loss were analyzed.

RESULTS: Analysis identified 247 casualties who sustained 308 UEVIs. The most common injury was to the vessels distal to the brachial bifurcation (63.3%, n = 195), followed by the brachial vessels (27.3%, n = 84) and the axillary vessels (9.4%, n = 29). The predominant MOIs were penetrating explosive fragments (74.1%, n = 183) and gunshot wounds (25.9%, n = 64). Associated fractures were identified in 151 (61.1%) casualties and nerve injuries in 133 (53.8%). Angiography was performed in 91 (36.8%) casualties, and endovascular treatment was performed 10 (4%) times. Temporary vascular shunts were placed in 39 (15.8%) casualties. Data on surgical management were available for 171 injuries and included repair (48%, n = 82) and ligation (52%, n = 89). The early limb loss rate was 12.1% (n = 30). For all casualties sustaining early limb loss, the MOI was penetrating fragments from an explosion; the average injury severity score (ISS) was 32.3, and the mortality was 6.7% (n = 2). In those without amputation, the ISS and mortality were low at 20 and 4.6% (n = 10), respectively. Overall mortality was 4.9% (n = 12).

CONCLUSIONS: The early limb loss rate was increased compared with initial descriptions from Operation Iraqi Freedom. Amputations are associated with a higher ISS. Improved data capture and fidelity, or differing MOIs, may account for this trend. Proficiency with open and endovascular therapy remains a critical focus for combat casualty care.

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Valproic acid improves survival and decreases resuscitation requirements in a swine model of prolonged damage control resuscitation.

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BACKGROUND: Although damage control resuscitation (DCR) is routinely performed for short durations, prolonged DCR may be required in military conflicts as a component of prolonged field care. Valproic acid (VPA) has been shown to have beneficial properties in lethal hemorrhage/trauma models. We sought to investigate whether the addition of a single dose of VPA to a 72-hour prolonged DCR protocol would improve clinical outcomes.

METHODS: Fifteen Yorkshire swine (40-45 kg) were subjected to lethal (50% estimated total blood volume) hemorrhagic shock (HS) and randomized to three groups: (1) HS, (2) HS-DCR, (3) HS-DCR-VPA (150 mg/kg over 3 hours) (n = 5/cohort). In groups assigned to receive DCR, Tactical Combat Casualty Care guidelines were applied (1 hour into the shock period), targeting a systolic blood pressure of 80 mm Hg. At 72 hours, surviving animals were given transfusion of packed red blood cells, simulating evacuation to higher echelons of care. Survival rates, physiologic parameters, resuscitative fluid requirements, and laboratory profiles were used to compare the clinical outcomes.

RESULTS: This model was 100% lethal in the untreated animals. DCR improved survival to 20%, although this was not statistically significant. The addition of VPA to DCR significantly improved survival to 80% ($p < 0.01$). The VPA-treated animals also had significantly ($p < 0.05$) higher systolic blood pressures, lower fluid resuscitation requirements, higher hemoglobin levels, and lower creatinine and potassium levels.

CONCLUSION: VPA administration improves survival, decreases resuscitation requirements, and improves hemodynamic and laboratory parameters when added to prolonged DCR in a lethal hemorrhage model.

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Management and prognosis of acute traumatic cervical central cord syndrome: systematic review and Spinal Cord Society-Spine Trauma Study Group position statement.

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PURPOSE: Spinal Cord Society (SCS) and Spine Trauma Study Group (STSG) established a panel tasked with reviewing management and prognosis of acute traumatic cervical central cord syndrome (ATCCS) and recommend a consensus statement for its management.

METHODS: A systematic review was performed according to the PRISMA 2009 guidelines. Delphi method was used to identify key research questions and achieve consensus. PubMed, Scopus and Google Scholar were searched for corresponding keywords. The initial search retrieved 770 articles of which 37 articles dealing with management, timing of surgery, complications or prognosis of ATCCS were identified. The literature review and draft position statements were compiled and circulated to panel members. The draft was modified incorporating relevant suggestions to reach consensus.

RESULTS: Out of 37 studies, 15 were regarding management strategy, ten regarding timing of surgery and 12 regarding prognosis of ATCCS.

CONCLUSION: There is reasonable evidence that patients with ATCCS secondary to vertebral fracture, dislocation, traumatic disc herniation or instability have better outcomes with early surgery (< 24 h). In patients of ATCCS secondary to extension injury in stenotic cervical canal without fracture/fracture dislocation/traumatic disc herniation/instability, there is requirement of high-quality prospective randomized controlled trials to resolve controversy regarding early surgery versus conservative management and delayed surgery if recovery plateaus or if there is a neurological deterioration. Until such time decision on surgery and its timing should be left to the judgment of physician, deliberating on pros and cons relevant to the particular patient and involving the well-informed patient and relatives in decision making. These slides can be retrieved under Electronic Supplementary Material.