Tactical Combat Casualty Care

Journal Article Abstracts

Committee on Tactical Combat Casualty Care

August 2018

References

No author: Tactical Combat Casualty Care for medical personnel (TCCC-MP): recommended post-course metrics (24 July 2018). J Spec Oper Med 2018;18:136-146

Allen C, Conner R, Ivester J: Ketamine infusions for outpatients pain management: a policy development project. J Infus Nurs 2018;Epub ahead of print

April M, Arana A, Pallin D, et al: Emergency department intubation success with succinylcholine versus rocuronium: a national emergency airway registry study. Ann Emerg Med 2018;Epub ahead of print.

Aurora A, Rose J, Umoh N, et al: Fresh whole blood resuscitation does not exacerbate skeletal muscle edema and long-term functional deficit after ischemic injury and hemorrhagic shock. J Trauma Acute Care Surg 2018;84:786-794

Bardes J, Inaba K, Schellenberg M, et al: The contemporary timing of trauma deaths. J Trauma Acute Care Surg 2018;84:893-899

Bardes J, Plamer A, Con J et al: Antifibrinolytics in a rural trauma state: assessing the opprotunities. Trauma Surg Acute Care Open 2017;Epub ahead of print

Barr J, Cherry K, Rich N: Vascular surgery in the Pacific theaters of World War II: the persistence of ligation amid unique military medical conditions. Ann Surg 2018;Epub ahead of print

Barron M, Kuckelman J, McCellan J, et al: Mobile forward-looking infrared technology allows rapid assessment of resuscitative endovascular balloon occlusion of the aorta in hemorrhage and blackout conditions. J Trauma Acute Care Surg 2018;85:25-32

Bjerkvig C, Fosse T, Apelseth T, et al: Emergency sternal intraosseous access for warm fresh whole blood transfusion in damage control resuscitation. J Trauma Acute Care Surg 2018;84:S120-S124

Blackburn M, April M, Brown D, et al: Prehospital airway procedures performed in trauma patients by ground forces in Afghanistan. J Trauma Acute Care Surg 2018;85:S154-S160

Boulton A, Lewis C, Naumann D, Midwinter M: Prehospital haemostatic dressings for trauma: a systematic review. Emerg Med J 2018;Epub ahead of print

Boutonnet M, Abback P, Le Saché F, et al: Tranexamic acid in severe trauma patients managed in a mature trauma care system. J Trauma Acute Care Surg 2018;84:S54-S62

Brännström A, Rocksén D, Hartman J, et al: Abdominal Aortic and Junctional Tourniquet release after 240 min is survivable and associated with small intestine and liver ischemia after porcine class II hemorrhage. J Trauma Acute Care Surg 2018;Epub ahead of print

Bribriesco A, Patterson G: Cricothyroid approach for emergency access to the airway. Thorac Surg Clin 2018;28:435-440

Butler F, Holcomb J, Shackelford S, et al: Management of suspected tension pneumothorax in tactical combat casualty care: TCCC Guidelines change 17-02. J Spec Oper Med 2018

Bylund W, Delahanty L, Cooper M: The case of ketamine allergy. Clin Pract Cases Emerg Med 2017;1:323-325

Callaway D: A review of the landscape: challenges and gaps in trauma response to civilian high threat mass casualty incidents. J Trauma Acute Care Surg 2018;84:S21-S27

Cannon J: Prehospital damage-control resuscitation. N Engl J Med 2018;379:387-388

Cannon J, Mason P, Batchinsky A: Past and present role extracorporeal membrane oxygenation in combat casualty care: how far will we go? J Trauma Acute Care Surg 2018;84:S63-S68

Cannon J, Neff L, Pidcoke H: The evolution of pediatric transfusion practice during combat operations 2001-2013. J Trauma Acute Care Surg 2018:84:S69-S76

Cantle P, Hurley M, Swartz M, Holcomb J: Methods for Early Control of Abdominal Hemorrhage: An Assessment of Potential Benefit. J Spec Oper Med 2018;18:98-104

Chakroun-Walha O, Samet A, Jerbi M, et al: Benefits of the tranexamic acid in head trauma with no extracranial bleeding: a prospective follow-up of 180 patients. Eur J Trauma Emerg Surg 2018;Epub ahead of print

Chang S, Tong Q, Beh Z, Quek K: A bench study comparing between scalpel-bougie technique and cannula-to-Melker technique in emergency cricothyroidotomy in a porcine model. Korean J Anesthesiol 2018;Epub ahead of print

Choi M, Tamrakar P, Schuck P, et al: Effect of hypobaria and hyperoxia during sepsis on survival and energy metabolism. J Trauma Acute Care Surg 2018;85:S68-S76

Chow S, Tan Y, Wong T, et al: Direct and indirect low skill fibre-optic intubation: A randomised crossover manikin study of six supraglottic airway devices. Indian J Aaesth 2018;62:350-358

Christian N, Burlew C, Moore E, et al: The focused abdominal sonography for trauma examination can reliably patients with significant intra-abdominal hemorrhage in life-threatening pelvic fractures. J Trauma Acute Care Surg 2018;84:924-928

Chukwu-Lobelu R, Appukuttan A, Edwards S, Patel H: Burn injuries form the London suicide bombings: a new classification of blast-related thermal injuries. Ann Burns Fire Disasters 2017;30:256-260

Clarke B, Williamson T, Gini G, Gupta B: Management of bacterial postoperative endophthalmitis and the role of vitrectomy. Surv Ophthalmol;63:677-693

Coss C, Singh M, Jones J: BET 1: Intravenous tranexamic acid for the treatment of post-partum haemorrhage. Emerg Med J 2018;35:523-524

Curry N, Foley C, Wong H, et al: Early fibrinogen concentrate therapy for major haemorrhage in trauma (E-FIT 1): results from a UK multi-centre, randomised, double blind, placebo-controlled pilot trial. Crit Care 2018;22:164

Davis M, Rasmussen T, Holcomb B: The new reckoning: The Combat Casualty Care Research Program responds to real and present challenges in military operational projections. J Trauma Acute Care Surg. 2018 Jul;85:S1-S3

Derickson M, McClellan J, Marko S, et al: The effects of hemorrhage on the pharmacokinetics of tranexamic acid in a swine model. J Trauma Acute Care Surg 2018;85:S44-S48

Dickson R, Gleisberg G, Aiken M, et al: Emergency medical services simple thoracostomy for traumatic cardiac arrest: postimplementation experience in a ground-based suburban/rural emergency medical services agency. J Emerg Med 2018;Epub ahead of print

Dingley J, Stephenson J, Allender V, et al: Changes in hardness and resilience of i-gel™ cuffs with temperature: a benchtop study. Anaesthesia 2018;Epub ahead of print

Drake S, Holcomb J, Yang Y, et al: Establishing a regional trauma preventable/potentially preventable death rate. Ann Surg 2018;Epub ahead of print

Drake S, Wolf D, Meininger J et al: Methodology to reliably measure preventable trauma death rate. Trauma Surg Acute Care Open. 2017 May 31;2(1):e000106

Dyer M, Hickman D, Haldeman S, et al: Intravenous administration of synthetic of platelets (SynthoPlate) in a mouse liver injury model of uncontrolled hemorrhage improves hemostasis. J Trauma Acute Care Surg 2018;84:917-923

Edwards T, Williams J, Cottee M: Influence of prehospital airway management on neurological outcomes in patients transferred to a heart attack centre following out-of-hospital cardiac arrest. Emerg Med Australas 2018;Epub ahead of print

El-Menyar A, Sathian B, Asim M, et al: Efficacy of prehospital administration of tranexamic acid in trauma patients: a meta-analysis of the randomized controlled trials. Am J Emerg Med 2018;36:1079-1087

Eliassen H, Hervig T, Backlund S, et al: Immediate effects of blood donation on physical and cognitive performance-A randomized controlled double-blinded trial. J Trauma Acute Care Surg 2018;84:S125-S131

Fashola Y, Kaul S, Finefrock D: Bradycardia after tube thoracostomy for spontaneous pneumothorax. Case Rep Emerg Med 2018;Epub ahead of print

Ferguson I, Alkhouri H, Fogg T, Aneman A: Ketamine use for rapid sequence intubation in Australian and New Zealand emergency departments from 2010 to 2015: A registry study. Emerg Med Australas 2018;Epub ahead of print

Fisher A: Stop the bleeding: Educating the public. JAMA 2018;320:589-590

Gendron B, Cronin A, Monti J, Brigg A: Military medic performance with employment of a commercial intraosseous infusion device: a randomized, crossover study. Mil Med 2018;83:e216-e222

Gomez-Builes J, Acuna S, Nascimento B, et al: Harmful or physiologic: diagnosing fibrinolysis shutdown in a trauma cohort with rotational thromboelastometry. Anesth Analg 2018;Epub ahead of print

Goralnick E, Chaudhary M, McCarty J, et al: Effectiveness of instructional interventions for hemorrhage control readiness for laypersons in the public access and tourniquet training study (PATTS): a randomized clinical trial. JAMA Surg 2018;Epub ahead of print

Gottlieb M, Ryan K, Binkley C: Is low-dose ketamine an effective alternative to opioids for the treatment of acute pain in the emergency department? Ann Emerg Med 2018;72:133-134

Grant A, Letson H, Morris J, et al: Tranexamic acid is associated with selective increase in inflammatory markers following total knee arthroplasty (TKA): a pilot study. J Orthop Surg Res 2018;13:149

Grassin-Delyle S, Theusinger O, Albrecht R, et al: Optimisation of the dosage of tranexamic acid in trauma patients with population pharmacokinetic analysis. Anaesthesia 2018;73:719-729

Green S, Roback M, Krauss B: The newest threat to emergency department procedural sedation. Ann Emerg Med 2018;72:115-119

Greene J: Who should perform REBOA technique? Ann Emerg Med 2018;71:A17-A20

Harvin J, Maxim T, Inaba k, et al: Mortality after emergent trauma laparotomy: A multicenter, retrospective study. J Trauma Acute Care Surg 2017;83:464-468

Hilbert-Carius P, Schwarzkopf D, Reinhart K, et al: Synthetic colloid resuscitation in severely injured patients: analysis of a nationwide trauma registry (TraumaRegister DGU). Sci Rep 2018;8:11567

Holcomb J: Transport Time and Preoperating Room Hemostatic Interventions Are Important: Improving Outcomes After Severe Truncal Injury. Crit Care Med 2018;46:447-453

Holcomb J, Jenkins D: Get ready: whole blood is back and it's good for patients. Transfusion 2018;58:1821-1823

Holtenius J, Bakhayesh P, Enocson A: The pelvic factures- indicator of injury severity or lethal fracture? Injury 2018;Epub ahead of print

Howley I, Haut E, Jacobs L, et al: Is thromboelastography (TEG)- based resuscitation better than empirical 1:1 transfusion? Trauma Surg Acute Care Open 2018;3:e000140

Hurwitz J: Can we finally dispense with ketamine's many myths? J Emerg Med 2018;54:697-700

Jaksha A, Justin G, Davies B, et al: Lateral canthotomy and cantholysis in Operations Iraqi Freedom and Enduring Freedom: 2001-2011. Ophthalmic Plast Reconstr Surg 2018;Epub ahead of print

Jennings R, Malbon C, Brock F, et al: A preliminary study into injuries due to non-perforating ballistic impacts into soft body armour over the spine. Injury 2018;Epub ahead of print

Justin G, Baker K, Brooks D, et al: Intraocular foreign body trauma in Operation Iraqi Freedom and Operation Enduring Freedom: 2001 to 2011. Ophthalmology 2018;Epub ahead of print

Kauvar D, Miller D, Walters T: Tourniquet use is not associated with limb loss following military lower extremity arterial trauma. J Trauma Acute Care Surg 2018;Epub ahead of print

Khan M, Rai A, Jain A: A simple and effective scale tourniquet for controlling scalp hemorrhage. J Maxillofac Oral Surg 2018;17:264-265

Kimijima T, Edanaga M, Yamakage M: Superior sealing effect of a three-dimensional printed modified supraglottic airway compared with the i-gel in a three-demensional printed airway model. J Anesth 2018;Epub ahead of print

Kotwal R, Scott L, Janak J, et al: The effect of prehospital transport time, injury severity, and blood transfusion on survival of US military casualties in Iraq. J Trauma Acute Care Surg 2018;85:S112-S121

Kotwal R, Staudt A, Mazuchowski E, et al: A US military role 2 forward surgical team database study of combat mortality in Afghanistan. J Trauma Acute Care Surg 2018;Epub ahead of print

Kragh J, Newton N, Tan A, et al: New and established models of limb tourniquet compared in simulated first aid. J Spec Oper Med 2018;18:36-41

Kuckelman J, Barron M, Moe D, et al: Extending the golden hour for Zone 1 REBOA: improved survival and reperfusion injury with intermittent versus continuous REBOA in a porcine severe truncal hemorrhage model. J Trauma Acute Care Surg 2018;Epub ahead of print

Kuckelman J, Barron M, Moe D, et al: Plasma coadministration improves resuscitation with tranexamic acid or prothrombin complex in a porcine hemorrhagic shock model. J Trauma Acute Care Surg 2018; 85(1):91-100

Lechner R, Küpper T, Tannheimer M: Challenges of military health service support in mountain warfare. Wilderness Environ Med 2018;29:266-274

Leeper C, Yazer M, Cladis F, et al: Use of un-crossmatched cold-stored whole blood in injured children with hemorrhagic shock. JAMA Pediatr 2018;172:491-492

Lehavi A, Yitzhak A, Jarassy R, et al: Comparison of the performance of battery-operated fluid warmers. Emerg Med J 2018;Epub ahead of print

Letson H, Dobson G: 7.5% NaCl resuscitation leads to abnormal clot fibrinolysis after severe hemorrhagic shock and its correction with 7.5% NaCl adenosine, lidocaine, and Mg^2. J Emerg Trauma Shock 2018;11:15-24

Lier H, von Heymann C, Korte W, Schelmbach D: Peripartum haemorrhage: haemostatic aspects of the new German PPH guideline. Transfus Med Hemother 2018;45:127-135

Loftus A, Pynn H, Parker P: Improvised first aid technique for terrorist attack. Emerg Med J 2018;Epub ahead of print

Lopez N, McCoy S, Carroll C, et al: Non-conventional utilization of the Aintree intubation catheter to facilitate exchange between three supraglottic airways and an endotracheal tube: a cadaveric trial. Mil Med 2018;Epub ahead of print

Mannan S, Ali M, Mazur L, et al: The use of tranexamic acid in total elbow replacement to reduce post-operative would infection. J Bone Jt Infect 2018;3:104-107

Manzano-Nunez R, Orlas C, Herrera-Escobar J, et al: A meta-analysis of the incidence of complications associated with groin access after the use of resuscitative endovascular balloon occlusion of the aorta in trauma patients. J Trauma Acute Care Surg 2018;Epub head of print

Manzano-Nunez R, Naranjo M, Foianini E, et al: A meta-analysis of resuscitative endovascular balloon occlusion of the aorta (REBOA) or open aortic cross-clamping by resuscitative thoracotomy in non-compressible torso hemorrhage patients. World J Emerg Surg 2017;12:30

Marsden M, Carden R, Navaratne L, et al: Outcomes following trauma laparotomy for hypotensive trauma patients: a UK military and civilian perspective. J Trauma Acute Care Surg 2018;Epub ahead of print

Matsumura Y, Matsumoto J, Kondo H, et al: Early arterial access for REBOA is related to survival outcome in trauma. J Trauma Acute Care Surg 2018;Epub ahead of print

McGinity A, Zhu C, Greebon L, et al: Prehospital low-titer cold-stored whole blood: Philosophy for ubiquitous utilization of O-positive product for emergency use in hemorrhage due to injury. J Trauma Acute Care Surg 2018;84:S115-S119

Mckee J, Mckee I, Bouclin M, et al: Use of the iTClamp versus standard suturing techniques for securing chest tubes a randomized controlled cadaver study. Turk J Emerg Med 2018; 18:15-19

McKee J, Kirkpatrick A, Bennett B, et al: Worldwide case reports using the iTClamp for external hemorrhage control. J Spec Oper Med 2018;18:39-44

Menegozzo C, Utiyama E: Steering the wheel towards the standard of care: proposal of a step-by-step ultrasound-guided emergency chest tube drainage and literature review. Int J Surg 2018;56:315-319

Moore H, Moore E, Chapman M, et al: Plasma-first resuscitation to treat haemorrhagic shock during emergency ground transportation in an urban area: a randomised trial. Lancet 2018;Epub ahead of print

Motov S, Mann S, Drapkin J, et al: Intravenous sub-dissociative-dose ketamine versus morphine for acute geriatric pain in the Emergency Department: A randomized controlled trial. Am J Emerg Med 2018;Epub ahead of print

Naumann D, Hancox J, Raitt J, et al: What fluids are given during air ambulance treatment of patients with trauma in the UK, and what might this mean for the future? Results from the RESCUER observational cohort study. BMJ Open 2018;8:e019627

Neal M, Reynolds, Nertoty D, et al: Desing and implementation of the western Pennsylvania regional Stop the Bleed initiative. J Trauma Acute Care Surg 2018;Epub ahead of print

Nessen S, Gurney J, Rasmussen T, et al: Unrealized potential of the US Military Battlefield Trauma System: DOW rate is higher in Iraq and Afghanistan that in Vietnam, but CFR and KIA rate are lower. J Trauma Acute Care Surg 2018;Epub ahead of print

Ng M, Perrott J, Burgess S: Evaluation of tranexamic acid in trauma patients: a retrospective quantitative analysis. Am J Emerg Med 2018;Epub ahead of print

Northern D, Manley J, Lyon R, et al; Recent advances in austere combat surgery: use of aortic balloon occlusion as well as blood challenges by special operations medical forces in recent combat operations. J Trauma Acute Care Surg 2018;85:S98-S103

Oh H, Yoon S, Seo M, et al: Utility of the laryngeal handshake method for identifying the cricothyroid membrane. Acta Anaesthesiol Scand 2018;Epub ahead of print

Pace J, Parry N, Vogt K, et al: A clinical prediction model for raised intracranial pressure in patients with traumatic brain injury. J Trauma Acute Care Surg 2018;Epub ahead of print

Patel J, White J, White P, et al: A contemporary, 7-year analysis of vascular injury from the war in Afghanistan. J Vasc Surg 2018;Epub ahead of print

Pati S, Peng Z, Wataha K, et al: Lyophilized plasma attenuates vascular permeability, inflammation and lung injury in hemorrhagic shock. PLoS One 2018;13:e0192363

Price M, Bixby P, Phillips M, et al: Launch of the National Trauma Research Repository coincides with new data sharing requirements. Trauma Surg Acute Care Open 2018;3:e000193

Qasim Z, DuBose J, Rasmussen T, Teeter W: Breaking down silos: the joint statement about the clinical use of resuscitative endovascular balloon occlusion of the aorta (REBOA) warrants revision. Ann Emerg Med 2018;72:225-226

Rall J, Redman T, Ross E, et al: Comparison of zone 3 resuscitative endovascular balloon occlusion of the aorta and the abdominal aortic and junctional tourniquet in a model of junctional hemorrhage in swine. J Surg Res 2018;226:31-39

Redman T, Mayberry K, Mora A, et al: Survey of casualty evacuation missions conducted by the 160th Special Operations Aviation Regiment during the Afghanistan conflict. J Spec Oper Med 2018;18:79-85

Redman T, Ross E: A novel expeditionary perfused cadaver model for trauma training in the out-of-hospital setting. J Emerg Med 2018;Epub ahead of print

Reese J, Sullivan V, Boyer N, Mount C: A non-comparative prospective pilot study of ketamine for sedation in adult septic shock. Mil Med 2018;Epub ahead of print

Remy K, Yazer M, Saini A, et al: Effects of platelet-sparing leukocyte reduction and agitation methods on in vitro measures of hemostatic function in cold-stored whole blood. J Trauma Acute Care Surg 2018;84:S104-S114

Reynolds P: Old tricks for new dogs? John Caddy and the Victorian origins of TCCC. J Spec Oper Med 2018;18:58-62

Romagnoli A, Teeter W, Wasicek P, et al: No wire? No Problem: resuscitative endovascular balloon occlusion of the aorta (REBOA) can be performed effectively and more rapidly with a wire-free device. J Trauma Acute Care Surg 2018;Epub ahead of print

Rosenfeld J, Mitra B, Smit V, et al: Preparedness for treating victims of terrorist attacks in Australia: learning from recent military experience. Emerg Med Australas 2018;Epub ahead of print

Sanders S, Tien H, Callum J, et al: Fibrinogen concentrates in the Special Operations Forces environment. Mil Med 2018;183:e45-e50

Schaeffer C, Galas T, Teruzzi B, et al: Iatrogenic tracheal rupture caused by emergency intubation: a case report. J Emerg Med 2018;Epub ahead of print

Schauer S, Naylor J, Oliver J, et al: An analysis of casualties presenting to military emergency departments in Iraq and Afghanistan. Am J Emerg Med 2018;Epub ahead of print

Schauer S, April M, Fisher A, et al: Junctional tourniquet use of during combat operations Afghanistan: the prehospital trauma registry experience. J Spec Oper Med 2018;18:71-74

Schauer S, Fisher A, April M, et al: Prehospital administration of antibiotic prophylaxis for open combat wounds in Afghanistan 2013-2014. J Spec Oper Med 2018;18:53-56

Schauer S, Naylor J, Brown D, et al: A survey of wilderness medicine analgesia practice patterns. Wilderness Environ Med 2018;29:211-214

Sheppard F, Mitchell T, Macko A, et al: Whole blood and Hextend: Bookends of modern tactical combat casualty care field resuscitation and starting point for multifunctional resuscitation fluid development. J Trauma Acute Care Surg 2018;85:S33-S38

Shiu V, Keller R: The use of Quikclot combat gauze during mohs stages for intra-operative hemostasis. J Am Acad Dermatol 2018;Epub ahead of print

Simons R: Rural accidental injury and death: the neglected disease of modern trauma systems? J Trauma Acute Care Surg 2018;84:972-977

Skube M, Witthuhn S, Mulier K, et al: Assessment of prehospital hemorrhage and airway care using a simulation model. J Trauma Acute Care Surg 2018;85:S27-S32

Sorbello M, Zdravkovic I, Cataldo R, Di Giacinto I: Spring recoil and supraglottic airway devices: lessons from the law of conservation of energy. Rom J Anaesth Intensive Care 2018;25:7-9

Sperry J, Guyette F, Brown J, et al: Prehospital plasma during air medical transport in trauma patients at risk for hemorrhagic shock. N Engl J Med 2018;379:315-326

Sprigg N, Flaherty K, Appleton J, et al: Tranexamic acid for hyperacute primary intracerebral haemorrhage (TICH-2): an international randomised, placebo-controlled, phase 3 superiority trial. Lancet 2018;Epub ahead of print

Strandenes G, Sivertsen J, Eliassen H, et al: Staff officers as blood suppliers: effects of repeated donations and autologous reinfusion of untransfused units. J Trauma Acute Care Surg 2018;84:S89-S92

Struck M, Ewens S, Fakler J, et al: Clinical consequences of chest tube malposition in trauma resuscitation: single-center experience. Eur J Trauma Emerg Surg 2018;Epub ahead of print

Tibbits E, Hoareau G, Simon M, et al: Location is everything: the hemodynamic effects of REBOA in Zone 1 versus Zone 3 of the aorta. J Trauma Acute Care Surg 2018;85:101-107

Valliere M, Wall P, Buising C: From pull to pressure: effects of tourniquet buckles and straps. J Am Coll Surg 2018;Epub ahead of print

Vitalis V, Carfantan C, Montcriol A, et al: Early transfusion on battlefield before admission to role 2: a preliminary observational study during “Barkhane” operations in Sahel. Injury 2018:49:903-910

Vu E, Wan W, Yeung T, Callaway D: Intramuscular tranexamic acid in tactical and combat settings. J Spec Oper Med 2018;18:62-68

Weintrob A, Murray C, Xu J, et al: Early infections complicating the care of combat casualties from Iraq and Afghanistan. Surg Infect 2018;19:286-297

Wenner M, Hinds K, Howard J, et al: Measurement of compensatory reserve predicts racial differences in tolerance to simulated hemorrhage in women. J Trauma Acute Care Surg 2018;85:S77-S83

Yeow C, Greaney L, Foy C, et al: Evaluation of a novel criocthyroidotomy introducer in a simulated obese porcine model: a radomised crossover comparison with scalpel cricothyroidotomy. Anaesthesia 2018;Epub ahead of print

Zhang M, Cowan T, Smiles J, et al: Prehospital analgesic choice in injured patients does not impact on rates of vomiting: experience from a New South Wales primary retrieval service. Emerg Med Australas 2018;30:406-411

Abstracts

J Spec Oper Med. 2018 Fall;18(3):136-146.
Tactical Combat Casualty Care for Medical Personnel (TCCC-MP): Recommended Post-Course Metrics (24 July 2018).
No author

Quotes:

"The recent DoD Instruction 1322.24 has now made TCCC the standard for battlefield trauma care in the US Military."

"As the DoD seeks to ensure that all TCCC training is conducted though high-quality courses, it becomes imperative to have assessment metrics that document that TCCC-MP students have successfully captured the course concepts. The metrics listed here are available now and should be used to ensure that the requisite information has been effectively transferred in TCCC-MP courses and that military medical individuals taking the course are, indeed, ready to save lives on the battlefield."

1. Fund of TCCC Knowledge (Written Post-Course Test)
– JTS-developed test question bank—updated each year
– 60 questions per test
– Randomized order of questions
– 75% is minimum passing score (45 or more correct)

2. TCCC-MP Critical Decision Case Studies (CDCS) Written Test
– All of the TCCC-MP CDCS will be presented as part of the curriculum.
– The case studies will also be included as a separate TCCC-MP question bank.
– The TCCC CDCS written test will be generated by the random test question–generating program.
– The 2018 TCCC-MP CDCS test will have a total of 28 questions.
– 75% or higher is the minimum passing score (21 or more correct)

3. Hands-On Skills (TCCC Skill Sheets)
– There are currently nine TCCC Skills Sheets for the TCCC-MP course.
– A Skill Sheet will be completed for each student for each specified TCCC practical skill.
– The Skill Sheet will be completed throughout the course after practice on that skill with instructor supervision and grading.

J Infus Nurs. 2018 Sep/Oct;41(5):284-292

Ketamine Infusions for Outpatient Pain Management: A Policy Development Project.

Allen C, Conner R, Ivester JR Jr.

ABSTRACT:
Current literature supports using ketamine for both acute and chronic pain management. It is imperative that the development of evidence-based protocols and policies keep pace with health care delivery to ensure patient safety. This project's objective was to formulate an outpatient ketamine infusion policy that promotes consistent and evidence-based care within a specified hospital system. This policy addresses potential side effects and minimization of adverse events by addressing patient selection, level of nursing care required, appropriate monitoring, and staff education.

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Emergency Department Intubation Success with Succinylcholine Versus Rocuronium: A National Emergency Airway Registry Study.

April M, Arana A, Pallin D, Schauer S, Fantegrossi A, Fernandez J, Maddry J, Summers S, Antonacci M, Brown C; NEAR Investigators.

STUDY OBJECTIVE: Although both succinylcholine and rocuronium are used to facilitate emergency department (ED) rapid sequence intubation, the difference in intubation success rate between them is unknown. We compare first-pass intubation success between ED rapid sequence intubation facilitated by succinylcholine versus rocuronium.

METHODS: We analyzed prospectively collected data from the National Emergency Airway Registry, a multicenter registry collecting data on all intubations performed in 22 EDs. We included intubations of patients older than 14 years who received succinylcholine or rocuronium during 2016. We compared the first-pass intubation success between patients receiving succinylcholine and those receiving rocuronium. We also compared the incidence of adverse events (cardiac arrest, dental trauma, direct airway injury, dysrhythmias, epistaxis, esophageal intubation, hypotension, hypoxia, iatrogenic bleeding, laryngoscope failure, laryngospasm, lip laceration, main-stem bronchus intubation, malignant hyperthermia, medication error, pharyngeal laceration, pneumothorax, endotracheal tube cuff failure, and vomiting). We conducted subgroup analyses stratified by paralytic weight-based dose.

RESULTS: There were 2,275 rapid sequence intubations facilitated by succinylcholine and 1,800 by rocuronium. Patients receiving succinylcholine were younger and more likely to undergo intubation with video laryngoscopy and by more experienced providers. First-pass intubation success rate was 87.0% with succinylcholine versus 87.5% with rocuronium (adjusted odds ratio 0.9; 95% confidence interval 0.6 to 1.3). The incidence of any adverse event was also comparable between these agents: 14.7% for succinylcholine versus 14.8% for rocuronium (adjusted odds ratio 1.1; 95% confidence interval 0.9 to 1.3). We observed similar results when they were stratified by paralytic weight-based dose.

CONCLUSION: In this large observational series, we did not detect an association between paralytic choice and first-pass rapid sequence intubation success or peri-intubation adverse events.

J Trauma Acute Care Surg. 2018 May;84(5):786-794

Fresh whole blood resuscitation does not exacerbate skeletal muscle edema and long-term functional deficit after ischemic injury and hemorrhagic shock.

Aurora A, Roe J, Umoh N, Dubick M, Wenke J, Walters TJ

BACKGROUND: Hemorrhagic shock caused by extremity vascular injuries is common in combat injuries. Fluid resuscitation is the standard treatment for severe hemorrhage (HEM). Tourniquets (TKs) used for HEM control cause ischemia-reperfusion (I/R) injury that induces edema formation in the injured muscle. Resuscitation fluids affect edema formation; however, its effect on long-term functional response remains unknown. The objectives of this study are to (1) compare acute muscle damage; (2) determine long-term functional recovery of ischemic muscle; and (3) compare local and systemic inflammatory response including the expression of junctional proteins following early resuscitation with Hextend and fresh whole blood using a rodent model of combined HEM and TK-induced limb I/R.

METHODS: Anesthetized Sprague-Dawley rats underwent 42.5% arterial HEM, followed by 3 hours of TK application. Animals were either not resuscitated or resuscitated with Hextend or fresh whole blood. Two time points were evaluated, 2 and 28 days. Plasma cytokine concentrations were determined at baseline and end resuscitation. At 2 days, edema formation, expression of junctional proteins, and tissue level cytokines concentrations were evaluated. At 28 days, in vivo muscle contractile properties were determined. At both time points, routine histology was performed and graded using a semi-quantitative grading system.

RESULTS: All animals developed hemorrhagic hypovolemia; the mortality rate was 100% in non-resuscitated rats. Hextend resuscitation exacerbated muscle edema (~11%) and muscle strength deficit (~20%). Fresh whole blood resuscitation presented edema and muscle strength akin to TK only. Fresh whole blood resuscitation upregulated expression of junctional proteins including proangiogenic factors and dampened the inflammatory response.

CONCLUSION: Fresh whole blood resuscitation does not exacerbate either TK-induced edema or muscle strength deficit. Fresh whole blood resuscitation may reduce both acute and long-term morbidity associated with extremity trauma. To our knowledge, this is the first study to demonstrate the nature of the resuscitation fluid administered following HEM impacts short- and long-term indices of I/R in skeletal muscle.

J Trauma Acute Care Surg. 2018 Jun;84(6):893-899

The contemporary timing of trauma deaths.

Bardes J, Inaba K, Schellenberg M, Grabo D, Strumwasser A, Matsushima K, Clark D, Brown N, Demetriades D.

BACKGROUND: The distribution of trauma deaths was classically described as trimodal. With advances in both technology and trauma systems, this was reevaluated and found to be bimodal in the early 2000s. Over the last decade there have been continued improvements in trauma and intensive care unit (ICU) care, related to damage control techniques and evidence based ICU pathways. A better understanding of the distribution of trauma deaths may be used to improve trauma systems. This study aimed to evaluate the contemporary distribution of trauma deaths after the widespread implementation of modern trauma and critical care principles.

METHODS: This study included patients entered in the NTDB from 2008 to 2014. For dead patients, hospital length of stay was equated to time until death. Additional data was collected to include demographics, mechanism of injury, Injury Severity Score, and Abbreviated Injury Scale score. Histograms were plotted to demonstrate peaks in deaths. Survival analysis was performed with Kaplan-Meier curves and Gehan-Breslow generalized Wilcoxon tests.

RESULTS: 4,185,009 patients were analyzed. Thirty-four percent of all deaths occurred within the first 24 hours of admission. The factors most associated with death in the first 24 hours were severe abdominal trauma (73%), penetrating trauma (55%), and severe extremity trauma (58%). Among patients with penetrating trauma and an abdominal Abbreviated Injury Scale score of 4 or higher, 83% of deaths occurred within 24 hours. When plotted, the distribution of deaths was seen to fall rapidly after the first 24 hours and continued to be flat for 30 days in all subgroups analyzed.

CONCLUSION: In this study, the distribution of trauma deaths no longer appears to be trimodal. This may reflect advances in trauma and ICU care, and the widespread adaption of damage control principles. Early deaths, however, remains a significant challenge, specifically from non-compressible abdominal hemorrhage and extremity trauma. Primary prevention and early hemorrhage control must continue to be a focus of research and trauma systems.

LEVEL OF EVIDENCE: Epidemiologic, level IV.

Trauma Surg Acute Care Open. 2017 Oct 5;2(1):e000107

Antifibrinolytics in a rural trauma state: assessing the opportunities.

Bardes J, Palmer A, Con J, Wilson A, Schaefer G.

Background: Tranexamic acid (TXA) has demonstrated improved mortality among trauma patients. However, recent evidence from urban US trauma centers has failed to show a benefit among the civilian population. TXA in rural states has not been evaluated. This study aimed to evaluate the current use of TXA in the rural trauma population.

Methods: A retrospective observational review at a level 1 trauma center based in a rural environment. Records were reviewed for TXA indications. TXA indication was defined as: systolic blood pressure <90 mm Hg, blood transfusion, or with a clinical concern for ongoing bleeding. Patients were ineligible if the time since injury was >3 hours.

Results: 400 patients were evaluated. 54% of patients met indications for TXA. 14% of these received TXA. 30.4% with an indication for TXA were ineligible due to arrival beyond 3 hours from time of injury. 135 patients arrived as transfers, 265 from the scene. There was no difference in TXA indications between scene and transfers (73 vs 144, p=1). Transfers were more likely to arrive beyond the 3-hour window (59 vs 7, p=0.001). Mortality for patients treated with TXA was 12.5%. This was not significantly different from patients not treated with TXA (19%).

Discussion: In a rural system, long transfers exclude most patients from treatment with TXA. A multicenter rural trauma center study will be needed to better define the optimal use of TXA in rural populations.

Level of evidence: Level IV data: therapeutic/care management.

Ann Surg. 2018 Epub ahead of print

Vascular Surgery in the Pacific Theaters of World War II: The Persistence of Ligation amid Unique Military Medical Conditions.

Barr J, Cherry K, Rich N

ABSTRACT:
Although multiple sources chronicle the practice of vascular surgery in the North African, Mediterranean, and European theaters of World War II, that of the Pacific campaign remains undescribed. Relying on primary source documents from the war, this article provides the first discussion of the management of vascular injuries in the island-hopping battles of the Pacific. It explains how the particular military, logistic, and geographic conditions of this theater influenced medical and surgical care, prompting a continued emphasis on ligation when surgeons in Europe had already transitioned to repairing arteries.

J Trauma Acute Care Surg. 2018 Jul;85(1):25-32

Mobile forward-looking infrared technology allows rapid assessment of resuscitative endovascular balloon occlusion of the aorta in hemorrhage and blackout conditions.

Barron M, Kuckelman J, McClellan J, Derickson M, Phillips C, Marko S, Sokol K, Eckert M, Martin M.

INTRODUCTION: Objective assessment of final resuscitative endovascular balloon occlusion of the aorta (REBOA) position and adequate distal aortic occlusion is critical in patients with hemorrhagic shock, especially as feasibility is being increasingly investigated in the prehospital setting. We propose that mobile forward-looking infrared (FLIR) thermal imaging is a fast, reliable, and noninvasive method to assess REBOA position and efficacy in scenarios applicable to battlefield and prehospital care.

METHODS: Ten swine were randomized to a 40% hemorrhage group (H, n = 5) or non-hemorrhage group (NH, n = 5). Three experiments were completed after Zone I placement of a REBOA catheter. Resuscitative endovascular balloon occlusion of the aorta was deployed for 30 minutes in all animals followed by randomized continued deployment versus sham in both light and blackout conditions. Forward-looking infrared images and hemodynamic data were obtained. Images were presented to 62 blinded observers for assessment of REBOA inflation status.

RESULTS: There was no difference in hemodynamic or laboratory values at baseline. The H group was significantly more hypotensive (mean arterial pressure 44 vs. 60 mm Hg, $p < 0.01$), vasodilated (systemic vascular resistance 634 vs. 938dyn·s/cm, $p = 0.02$), and anemic (hematocrit 12 vs. 23.2%, $p < 0.01$). Hemorrhage group animals remained more hypotensive, anemic, and acidotic throughout all three experiments. There was a significant difference in the temperature change (ΔTemp) measured by FLIR between animals with REBOA inflated versus not inflated (5.7°C vs. 0.7°C, $p < 0.01$). The H and NH animals exhibited equal magnitudes of ΔTemp in both inflated and deflated states. Blinded observer analysis of FLIR images correctly identified adequate REBOA inflation and aortic occlusion 95.4% at 5 minutes and 98.8% at 10 minutes (positive predictive value at 5 minutes = 99% and positive predictive value at 10 minutes = 100%).

CONCLUSIONS: Mobile thermal imaging is an easy, rapid, and reliable method for assessing distal perfusion after occlusion by REBOA. Smartphone-based FLIR technology allows for confirmation of adequate REBOA placement at the point of care, and performance was not degraded in the setting of major hemorrhage or blackout conditions.

J Trauma Acute Care Surg. 2018 Jun;84(6S Suppl 1):S120-S124

Emergency sternal intraosseous access for warm fresh whole blood transfusion in damage control resuscitation.

Bjerkvig C, Fosse T, Apelseth T, Sivertsen J, Braathen H, Eliassen H, Guttormsen A, Cap A, Strandenes G.

BACKGROUND: Intraosseous (IO) vascular access is increasingly used as an emergency tool for achieving access to the systemic circulation in critically ill patients. The role of IO transfusion of blood in damage control resuscitation is however questionable due to possible inadequate flow rate and hemolysis. Some experts claim that IO transfusion is contraindicated. In this study, we have challenged this statement by looking at flow rates of autologous fresh whole blood reinfusion and hemolysis using two of the commonly used Food and Drug Administration-approved and Conformité Européenne (CE)-marked sternal needles. Additionally, the success rate of sternal access between the two devices is evaluated.

METHODS: Volunteer professional military personnel, were enrolled prospectively in a nonrandomized observational study design. We collected 450 mL of autologous whole blood from each participant. Participants were divided into the following three groups of 10: Tactically Advanced Lifesaving IO Needle (T.A.L.O.N.) IO, FAST1 IO, and intravenous group. The reinfusion was done by gravity only. Blood sampling was performed before blood collection and 30 minutes after reinfusion. Investigation of hemolysis was performed by measurements of haptoglobin and lactate dehydrogenase. Success rate was evaluated by correct aspiration of bone marrow.

RESULTS: Median reinfusion rate was 46.2 mL/min in the FAST1 group, 32.4 mL/min in the T.A.L.O.N. group, and 74.1 mL/min in the intravenous group. Blood samples from all participants were within normal ranges. There was no statistically significant difference in haptoglobin and lactate dehydrogenase between the groups. In the FAST1 group, 1 (9%) of 11 procedures failed. In the T.A.L.O.N. group, 4 (29%) of 14 procedures failed.

CONCLUSION: Although preferable, achieving peripheral venous access in the bleeding patient is a major problem. Our findings suggest that fresh whole-blood transfusion through the IO route is safe, reliable, and provide sufficient flow for resuscitation.

LEVEL OF EVIDENCE: Therapeutic/Care management study, level III.

J Trauma Acute Care Surg. 2018 Jul;85(1S Suppl 2):S154-S160

Prehospital airway procedures performed in trauma patients by ground forces in Afghanistan.

Blackburn M, April M, Brown D, DeLorenzo R, Ryan K, Blackburn A, Schauer S.

BACKGROUND: Airway management is of critical importance in combat trauma patients. Airway compromise is the second leading cause of potentially survivable death on the battlefield and accounts for approximately 1 in 10 preventable deaths. Reports from the Iraq and Afghanistan wars indicate 4% to 7% incidence of airway interventions on casualties transported to combat hospitals. The goal of this study was to describe airway management in the prehospital combat setting and document airway devices used on the battlefield.

METHODS: This study is a retrospective review of casualties that required a prehospital lifesaving airway intervention during combat operations in Afghanistan. We obtained data from the Prehospital Trauma Registry that was linked to the Department of Defense Trauma Registry for outcome data for the time period between January 2013 and September 2014.

RESULTS: Seven hundred five total trauma patients were included, 16.9% required a prehospital airway management procedure. There were 132 total airway procedures performed, including 83 (63.4%) endotracheal intubations and 26 (19.8%) nasopharyngeal airway placements. Combat medics were involved in 48 (36.4%) of airway cases and medical officers in 73 (55.3%). Most (94.2%) patients underwent airway procedures due to battle injuries caused by explosion or gunshot wounds. Casualties requiring airway management were more severely injured and less likely to survive as indicated by Injury Severity Score, responsiveness level, Glascow Coma Scale, and outcome.

CONCLUSION: Percentages of airway interventions more than tripled from previous reports from the wars in Afghanistan and Iraq. These changes are significant, and further study is needed to determine the causes. Casualties requiring airway interventions sustained more severe injuries and experienced lower survival than patients who did not undergo an airway procedure, findings suggested in previous reports.

Emerg Med J. 2018 Jul;35(7):449-457

Prehospital haemostatic dressings for trauma: a systematic review.

Boulton A, Lewis C, Naumann D, Midwinter M

BACKGROUND: Haemorrhage is a major cause of mortality and morbidity following both military and civilian trauma. Haemostatic dressings may offer effective haemorrhage control as part of prehospital treatment.

AIM: To conduct a systematic review of the clinical literature to assess the prehospital use of haemostatic dressings in controlling traumatic haemorrhage, and determine whether any haemostatic dressings are clinically superior.

METHODS: MEDLINE and EMBASE databases were searched using predetermined criteria. The reference lists of all returned review articles were screened for eligible studies. Two authors independently undertook the search, performed data extraction, and risk of bias and Grading of Recommendations, Assessment, Development and Evaluation quality assessments. Meta-analysis could not be undertaken due to study and clinical heterogeneity.

RESULTS: Our search yielded 470 studies, of which 17 met eligibility criteria, and included 809 patients (469 military and 340 civilian). There were 15 observational studies, 1 case report and 1 randomised controlled trial. Indications for prehospital haemostatic dressing use, wound location, mechanism of injury, and source of bleeding were variable. Seven different haemostatic dressings were reported with QuikClot Combat Gauze being the most frequently applied (420 applications). Cessation of bleeding ranged from 67% to 100%, with a median of 90.5%. Adverse events were only reported with QuikClot granules, resulting in burns. No adverse events were reported with QuikClot Combat Gauze use in three studies. Seven of the 17 studies did not report safety data. All studies were at risk of bias and assessed of 'very low' to 'moderate' quality.

CONCLUSIONS: Haemostatic dressings offer effective prehospital treatment for traumatic haemorrhage. QuikClot Combat Gauze may be justified as the optimal agent due to the volume of clinical data and its safety profile, but there is a lack of high-quality clinical evidence, and randomised controlled trials are warranted.

LEVEL OF EVIDENCE: Systematic review, level IV.

J Trauma Acute Care Surg. 2018 Jun;84(6S Suppl 1):S54-S62

Tranexamic acid in severe trauma patients managed in a mature trauma care system.

Boutonnet M(1), Abback P, Le Saché F, Harrois A, Follin A, Imbert N, Cap AP, Trichereau J, Ausset S; Traumabase Group.

BACKGROUND: Tranexamic acid (TXA) use in severe trauma remains controversial notably because of concerns of the applicability of the CRASH-2 study findings in mature trauma systems. The aim of our study was to evaluate the outcomes of TXA administration in severely injured trauma patients managed in a mature trauma care system.

METHODS: We performed a retrospective study of data prospectively collected in the TraumaBase registry (a regional registry collecting the prehospital and hospital data of trauma patients admitted in six Level I trauma centers in Paris Area, France). In hospital mortality was compared between patients having received TXA or not in the early phase of resuscitation among those presenting an unstable hemodynamic state. Propensity score for TXA administration was calculated and results were adjusted for this score. Hemodynamic instability was defined by the need of packed red blood cells (pRBC) transfusion and/or vasopressor administration in the emergency room (ER).

RESULTS: Among patients meeting inclusion criteria (n = 1,476), the propensity score could be calculated in 797, and survival analysis could be achieved in 684 of 797. Four hundred seventy (59%) received TXA, and 327 (41%) did not. The overall hospital mortality rate was 25.7%. There was no effect of TXA use in the whole population but mortality was lowered by the use of TXA in patients requiring pRBC transfusion in the ER (hazard ratio, 0.3; 95% confidence interval, 0.3-0.6).

CONCLUSION: The use of TXA in the management of severely injured trauma patients, in a mature trauma care system, was not associated with reduction in the hospital mortality. An independent association with a better survival was found in a selected population of patients requiring pRBC transfusion in the ER.

LEVEL OF EVIDENCE: Therapeutic study, level III.

J Trauma Acute Care Surg. 2018 Jul 5 Epub ahead of print

Abdominal Aortic and Junctional Tourniquet release after 240 min is survivable and associated with small intestine and liver ischemia after porcine class II hemorrhage.

Brännström A, Rocksén D, Hartman J, Nyman N, BSc J, Arborelius U, Günther M

BACKGROUND: Uncontrolled hemorrhage is a leading cause of tactical trauma related deaths. Hemorrhage from the pelvis and junctional regions are particularly difficult to control due to the inability of focal compression. The Abdominal Aortic and Junctional Tourniquet (AAJT) occludes aortic blood flow by compression of the abdomen. The survivability of tourniquet release beyond 120 min is unknown and fluid requirements to maintain sufficient blood pressure during prolonged application are undetermined. We therefore compared 60 min and 240 min applications and release of the AAJT for 30 min, with crystalloid fluid therapy, after a class II hemorrhage.

METHODS: 60 kg anesthetized pigs were subjected to [SWUNG DASH]900 ml hemorrhage and AAJT application for 60 min (n=5), 240 min (n=5), fluid therapy only for 240 min (n=5) and reperfusion for 30 min.

RESULTS: AAJT application was hemodynamically and respiratory tolerable for 60 min and 240 min. Cumulative fluid requirements decreased by 64%, comparable to 3000 ml of crystalloids. Mechanical ventilation was impaired. AAJT increased the core temperature by 0.9°C compared to fluid therapy. Reperfusion consequences were reversible after 60 min but not after 240 min. 240 min application resulted in small intestine and liver ischemia, persisting hyperkalemia, metabolic acidosis and myoglobinemia, suggesting rhabdomyolysis.

CONCLUSIONS: AAJT application for 240 min with reperfusion was survivable in an intensive care setting and associated with abdominal organ damage. Long time consequences and spinal cord effects were not assessed. We propose an application time limit within 60-240 min, though further studies are needed to increase the temporal resolution. The AAJT may be considered a rescue option to maintain central blood pressure and core temperature in cases of hemorrhagic shock from extremity bleedings, if fluid therapy is unavailable or the supply limited.

Therapeutic study, level II.

Thorac Surg Clin. 2018 Aug;28(3):435-440

Cricothyroid Approach for Emergency Access to the Airway.

Bribriesco A, Patterson G.

ABSTRACT:
Airway emergencies are life-threatening events that face providers of many different backgrounds. In cannot-intubate-cannot-ventilate situations, emergent access to the airway can be obtained through the cricothyroid membrane by cricothyroidotomy. The 3 main techniques are open, percutaneous, and needle cricothyroidotomy. To date, there is no compelling evidence demonstrating superiority of a particular approach. Ultimately, the method used for cricothyroidotomy should be based on the comfort and experience of the provider performing the procedure.

J Spec Oper Med. Summer 2018;18(2):19-35.

Management of Suspected Tension Pneumothorax in Tactical Combat Casualty Care: TCCC Guidelines Change 17-02.

Butler F, Holcomb J, Shackelford S, et al:

ABSTRACT:
This change to the Tactical Combat Casualty Care (TCCC) Guidelines that updates the recommendations for management of suspected tension pneumothorax for combat casualties in the prehospital setting does the following things: (1) Continues the aggressive approach to suspecting and treating tension pneumothorax based on mechanism of injury and respiratory distress that TCCC has advocated for in the past, as opposed to waiting until shock develops as a result of the tension pneumothorax before treating. The new wording does, however, emphasize that shock and cardiac arrest may ensue if the tension pneumothorax is not treated promptly. (2) Adds additional emphasis to the importance of the current TCCC recommendation to perform needle decompression (NDC) on both sides of the chest on a combat casualty with torso trauma who suffers a traumatic cardiac arrest before reaching a medical treatment facility. (3) Adds a 10-gauge, 3.25-in needle/ catheter unit as an alternative to the previously recommended 14-gauge, 3.25-in needle/catheter unit as recommended devices for needle decompression. (4) Designates the location at which NDC should be performed as either the lateral site (fifth intercostal space [ICS] at the anterior axillary line [AAL]) or the anterior site (second ICS at the midclavicular line [MCL]). For the reasons enumerated in the body of the change report, participants on the 14 December 2017 TCCC Working Group teleconference favored including both potential sites for NDC without specifying a preferred site. (5) Adds two key elements to the description of the NDC procedure: insert the needle/ catheter unit at a perpendicular angle to the chest wall all the way to the hub, then hold the needle/catheter unit in place for 5 to 10 seconds before removing the needle in order to allow for full decompression of the pleural space to occur. (6) Defines what constitutes a successful NDC, using specific metrics such as: an observed hiss of air escaping from the chest during the NDC procedure; a decrease in respiratory distress; an increase in hemoglobin oxygen saturation; and/or an improvement in signs of shock that may be present. (7) Recommends that only two needle decompressions be attempted before continuing on to the "Circulation" portion of the TCCC Guidelines. After two NDCs have been performed, the combat medical provider should proceed to the fourth element in the "MARCH" algorithm and evaluate/treat the casualty for shock as outlined in the Circulation section of the TCCC Guidelines. Eastridge's landmark 2012 report documented that noncompressible hemorrhage caused many more combat fatalities than tension pneumothorax.1 Since the manifestations of hemorrhagic shock and shock from tension pneumothorax may be similar, the TCCC Guidelines now recommend proceeding to treatment for hemorrhagic shock (when present) after two NDCs have been performed. (8) Adds a paragraph to the end of the Circulation section of the TCCC Guidelines that calls for consideration of untreated tension pneumothorax as a potential cause for shock that has not responded to fluid resuscitation. This is an important aspect of treating shock in combat casualties that was not presently addressed in the TCCC Guidelines. (9) Adds finger thoracostomy (simple thoracostomy) and chest tubes as additional treatment options to treat suspected tension pneumothorax when further treatment is deemed necessary after two unsuccessful NDC attempts-if the combat medical provider has the skills, experience, and authorizations to perform these advanced interventions and the casualty is in shock. These two more invasive procedures are recommended only when the casualty is in refractory shock, not as the initial treatment.

Clin Pract Cases Emerg Med. 2017 Oct 3;1(4):323-325

The Case of Ketamine Allergy.

Bylund W, Delahanty L, Cooper M

ABSTRACT:
Ketamine is often used for pediatric procedural sedation due to low rates of complications, with allergic reactions being rare. Immediately following intramuscular (IM) ketamine administration, a three-year-old female rapidly developed facial edema and diffuse urticarial rash, with associated wheezing and oxygen desaturation. Symptoms resolved following treatment with epinephrine, dexamethasone and diphenhydramine. This case presents a clinical reaction to ketamine consistent with anaphylaxis due to histamine release, but it is uncertain whether this was immunoglobulin E mediated. This is the only case reported to date of allergic reaction to IM ketamine, without co-administration of other agents.

J Trauma Acute Care Surg. 2018 Jun;84(6S Suppl 1):S21-S27

A review of the landscape: Challenges and gaps in trauma response to civilian high threat mass casualty incidents.

Callaway D

ABSTRACT:
The ultimate goal of the emergency response and trauma system is to reduce potentially preventable death from trauma. Tremendous advances in trauma care emerged from the past 15 years of United States' combat engagements around the globe. Unfortunately, combat and insurgency tactics have also metastasized to the civilian world, resulting in increasingly complex and dynamic acts of intentional mass violence. These high threat active violent incidents (AVIs) pose significant preparedness, response, and clinical care challenges to the civilian healthcare systems. Currently, there are several operational and policy gaps that limit the successful preparedness and response to AVIs and dynamic MCIs in the United States.

N Engl J Med. 2018 Jul 26;379(4):387-388

Prehospital Damage-Control Resuscitation.

Cannon J

Quotes:

“Of course, delivering hemostatic resuscitation to patients who are bleeding as soon as possible after injury makes intuitive sense. During World War II, freeze-dried plasma was administered routinely in the prehospital setting.8 Unfortunately, in many cases, this “field plasma” was the only blood product given, and it proved to be inadequate to save the lives of patients who were in severe hemorrhagic shock. More recently, the concept of “damage-control resuscitation” has emerged, wherein plasma, platelets, and red cells are transfused in nearly equal proportions and administration of nonhemostatic crystalloid solution is minimized. This approach has clearly improved outcomes in patients who survive transport to the trauma center, 9 which begs the question of whether damage-control resuscitation could be started during transport.”

“ recent study of blood products administered in the prehospital setting to combat casualties during helicopter transport showed a survival benefit,10 and now, the investigators of the PAMPer trial7 have confirmed a similar benefit in severely injured civilian patients. In this pragmatic, randomized, controlled trial, 230 patients with unstable vital signs were administered 2 units of plasma before any other resuscitation fluid (plasma group), and 271 patients with unstable vital signs received prehospital crystalloid solution alone or crystalloid solution and red cells (standard-care group) before they arrived at a trauma center. Mortality at 30 days was lower in the plasma group than in the standard-care group (23.2% vs. 33.0%, P = 0.03).”

J Trauma Acute Care Surg. 2018 Jun;84(6S Suppl 1):S63-S68

Past and present role of extracorporeal membrane oxygenation in combat casualty care: How far will we go?

Cannon J, Mason P, Batchinsky A

ABSTRACT:
Advanced extracorporeal therapies have been successfully applied in the austere environment of combat casualty care over the previous decade. In this review, we describe the historic underpinnings of extracorporeal membrane oxygenation, review the recent experience with both partial and full lung support during combat operations, and critically assess both the current status of the Department of Defense extracorporeal membrane oxygenation program and the way forward to establish long-range lung rescue therapy as a routine capability for combat casualty care.

J Trauma Acute Care Surg. 2018 Jun;84(6S Suppl 1):S69-S76

The evolution of pediatric transfusion practice during combat operations 2001-2013.

Cannon J, Neff L, Pidcoke H, Aden J, Spinella P, Johnson M, Cap A, Borgman M

BACKGROUND: Hemostatic resuscitation principles have significantly changed adult trauma resuscitation over the past decade. Practice patterns in pediatric resuscitation likely have changed as well; however, this evolution has not been quantified. We evaluated pediatric resuscitation practices over time within a combat trauma system.

METHODS: The Department of Defense Trauma Registry was queried from 2001 to 2013 for pediatric patients (<18 years). Patients with burns, drowning, and missing injury severity score were excluded. Volumes of crystalloid, packed red blood cells (PRBC), whole blood, plasma, and platelets (PLT) given in the first 24 hours were calculated per kilogram body weight. Tranexamic acid use was also determined. Patients were divided into Early (2001-2005) and Late (2006-2013) cohorts, and subgroups of transfused (TX+) and massively transfused (MT+) patients were created. Intensive care unit and hospital length of stay and 24-hour and in-hospital mortality rates were compared.

RESULTS: A total of 4,358 patients met inclusion criteria. Comparing Early versus Late, injuries from explosions, isolated or predominant head injuries, and injury severity score all increased. The proportion of TX+ patients also increased significantly (13.6% vs 37.4%, $p < 0.001$) as did the number of MT+ patients (2.1% vs 15.5%, $p < 0.001$). Transfusion of high plasma:RBC and PLT:RBC ratios increased in both the TX+ and MT+ subgroups, although overall, PLT and whole blood use was low. After adjusting for differences between groups, the odds of death was no different Early versus Late but decreased significantly in the MT+ patients with time as a continuous variable.

CONCLUSION: Transfusion practice in pediatric combat casualty care shifted toward a more hemostatic approach over time. All-cause mortality was low and remained stable overall and even decreased in MT+ patients despite more injuries due to explosions, more head injuries, and greater injury severity. However, further study is required to determine the optimal resuscitation practices in critically injured children.

LEVEL OF EVIDENCE: Epidemiologic study, level IV.

J Spec Oper Med. Summer 2018;18(2):98-104.

Methods for Early Control of Abdominal Hemorrhage: An Assessment of Potential Benefit.

Cantle P, Hurley M, Swartz M, Holcomb J

BACKGROUND: Noncompressible truncal hemorrhage (NCTH) after injury is associated with a mortality increase that is unchanged during the past 20 years. Current treatment consists of rapid transport and emergent intervention. Three early hemorrhage control interventions that may improve survival are placement of a resuscitative endovascular balloon occlusion of the aorta (REBOA), injection of intracavitary self-expanding foam, and application of the Abdominal Aortic Junctional Tourniquet (AAJT™). The goal of this work was to ascertain whether patients with uncontrolled abdominal or pelvic hemorrhage might benefit by the early or prehospital use of one of these interventions.

METHODS: This was a single-center retrospective study of patients who received a trauma laparotomy from 2013 to 2015. Operative reports were reviewed. The probable benefit of each hemorrhage control method was evaluated for each patient based on the location(s) of injury and the severity of their physiologic derangement. The potential scope of applicability of each control method was then directly compared.

RESULTS: During the study period, 9,608 patients were admitted; 402 patients required an emergent trauma laparotomy. REBOA was potentially beneficial for hemorrhage control in 384 (96%) of patients, foam in 351 (87%), and AAJT in 35 (9%). There was no statistically significant difference in the potential scope of applicability between REBOA and foam ($\rho = .022$). There was a significant difference between REBOA and AAJT ($\rho < .001$) and foam and AAJT™ ($\rho < .001$). The external surface location of signs of injury did not correlate with the internal injury location identified during laparotomy.

CONCLUSION: Early use of REBOA and foam potentially benefits the largest number of patients with abdominal or pelvic bleeding and may have widespread applicability for patients in the preoperative, and potentially the prehospital, setting. AAJT may be useful with specific types of injury. The site of bleeding must be considered before the use of any of these tools.

Eur J Trauma Emerg Surg. 2018 Jun 19. doi: 10.1007/s00068-018-0974-z. [Epub ahead of print]

Benefits of the tranexamic acid in head trauma with no extracranial bleeding: a prospective follow-up of 180 patients.

Chakroun-Walha O, Samet A, Jerbi M, Nasri A, Talbi A, Kanoun H, Souissi B, Chtara K, Bouaziz M, Ksibi H, Rekik N

INTRODUCTION: Tranexamic acid (TXA) is one of the debated therapies in the management of traumatic brain injury (TBI). We conducted this study to evaluate the benefits of TXA in TBI on the mortality and its safety in these patients.

METHODS: This was a prospective randomized open-label trial including all patients, aged at 18 years or older, hospitalized in the emergency room during a 13-month period, for TBI. After the realization of the body CT scan, the patients were included if they had intracranial bleeding, and were then randomized according to their medical file number to receive or not the TXA. The eligibility criteria were based on the uncertainty principle, patients with significant extracranial bleeding were excluded since there was evidence that TXA improve their outcome.

RESULTS: We enrolled 180 patients aged at 42 ± 20 years, with an 88% men-proportion. Subarachnoid haemorrhage was the most frequent lesion in the brain CT-scan (67.5%). After randomization, 96 patients were in the TXA group (53%). Demographic data, clinical, biological and radiological features were statistically comparable in the two groups of patients ('TXA' and 'noTXA'). The needs of transfusion or neurosurgery, the mortality rate, the in-hospital length of stay and the dependency at 28-post-traumatic day were similar in the two groups of patients. However, pulmonary embolism was statistically more frequent in 'TXA' group (11.5 versus 2.4%, $p = 0.02$).

CONCLUSION: TXA is an interesting treatment in haemorrhagic shock. Its efficiency in head trauma is still debated and controversial. Its impact on the mortality and the needs of transfusion or surgery were not demonstrated in this study. Nevertheless, its safety is worth being studied in larger samples as we found a higher rate of pulmonary embolism in the treated group.

Korean J Anesthesiol. 2018 Aug;71(4):289-295. doi: 10.4097/kja.d.18.00025. Epub 2018 May 30.

A bench study comparing between scalpel-bougie technique and cannula-to-Melker technique in emergency cricothyroidotomy in a porcine model.

Chang S, Tong Q, Beh Z, Quek K, Ang B

BACKGROUND: The ideal emergency cricothyroidotomy technique remains a topic of ongoing debate. This study aimed to compare the cannula-to-Melker technique with the scalpel-bougie technique and determine whether yearly training in cricothyroidotomy techniques is sufficient for skill retention.

METHODS: We conducted an observational crossover bench study to compare the cannula-to-Melker with the scalpel-bougie technique in a porcine tracheal model. Twenty-eight anesthetists participated. The primary outcome was time taken for device insertion. Secondary outcomes were first-pass success rate, incidence of tracheal trauma, and technique preference. We also compared the data on outcome measures with the data obtained in a similar workshop a year ago.

RESULTS: The scalpel-bougie technique was significantly faster than the cannula-to-Melker technique for cricothyroidotomy (median time of 45.2 s vs. 101.3 s; P = 0.001). Both techniques had 100% success rate within two attempts; there were no significant differences in the first-pass success rates and incidence of tracheal wall trauma (P > 0.999 and P = 0.727, respectively) between them. The relative risks of inflicting tracheal wall trauma after a failed cricothyroidotomy attempt were 6.9 (95% CI 1.5-31.1), 2.3 (95% CI 0.3-20.7) and 3.0 (95% CI 0.3-25.9) for the scalpel-bougie, cannula-cricothyroidotomy, and Melker-Seldinger airway, respectively. The insertion time and incidence of tracheal wall trauma were lower when the present data were compared with data from a similar workshop conducted the previous year.

CONCLUSIONS: This study supports the use of a scalpel-bougie technique for cricothyroidotomy by anesthetists and advocates a yearly training program for skill retention.

J Trauma Acute Care Surg. 2018 Jul;85(1S Suppl 2):S68-S76

Effect of hypobaria and hyperoxia during sepsis on survival and energy metabolism.

Choi M, Tamrakar P, Schuck P, Proctor J, Moore A, Asbury K, Fiskum G, Coksaygan T, Cross AS.

BACKGROUND: Injured warfighters air evacuated to tertiary medical care facilities are subjected to many stresses that may promote the development of sepsis. In this study, we tested the hypothesis that exposure to "in-flight" hypobaria and/or hyperoxia within 24 hours after onset of intra-abdominal infection in rats accelerates the development and/or severity of sepsis and neurologic injury in survivors.

METHODS: Sprague-Dawley rats underwent cecal ligation/puncture (CLP) or sham procedures. Twenty-four hours later, rats were then placed in hypobaric chambers for 6 hours and assigned to normobaric conditions and maintained at either 21% or 100% O2, or under hypobaric conditions (pressure equivalent to an altitude of 8,000 ft) but maintained under either 28% or 100% O2. Two days after CLP or sham, blood samples were obtained for cytokine levels, and mitochondria were isolated from the brain and heart of a subset of animals for analysis of mitochondrial oxygen consumption. Animals were also evaluated for neuromotor impairment before and 15 days postsurgery.

RESULTS: Among the 70 rats studied, 16.7% of CLP but none of the sham-treated rats died. All of the CLP but none of the sham rats had evidence of peritonitis at 2 days. Twenty percent (6 of 30) CLP rats undergoing hypobaria versus 12.5% (3 of 24) of CLP rats exposed to normobaria died ($p = 0.715$) while 12% (3 of 25) of CLP rats exposed to hyperoxia versus 20.7% (6 of 29) of CLP rats exposed to normoxia died ($p = 0.48$). The ratio of mitochondrial ATP-generating O2 consumption to resting respiration was higher in the CLP plus hypobaria under 100% compared with shams. The only difference in H2O2 production was observed in mitochondria from CLP rats exposed to hyperoxia under normobaric conditions. Composite neurologic scores obtained 15 days postinjury were lower than those at baseline for shams.

CONCLUSION: We conclude that neither "in-flight" hyperoxia nor hypobaria exacerbate sepsis or neurologic injury.

Indian J Anaesth. 2018 May;62(5):350-358

Direct and indirect low skill fibre-optic intubation: A randomised crossover manikin study of six supraglottic airway devices.

Chow S, Tan Y, Wong T, Ho V, Matthews A, Li H, Wong P

Background and Aims: Fibre-optic intubation (FOI) through supraglottic airway devices (SADs) is useful in the management of the difficult airway. We compared two methods of FOI through seven SADs in a randomised crossover manikin study to assess each device's performance and discuss implications on SAD selection.

Methods: Thirty anaesthetsiologists, 15 seniors and 15 juniors, each performed low skill FOI (LSFOI) with seven SADs using both 'direct' and 'indirect' methods. The order of method and device used were randomised. The primary end point was success rate of intubation; secondary end points were time taken for intubation, incidence of difficulties with direct and indirect LSFOI and operator device preference. Statistical analysis was with univariable analysis and comparison of proportions.

Results: Data from six devices were analysed due to a protocol breach with one SAD. There was no difference in intubation success rate across all SADs and intubation methods. Intubation time was significantly shorter in AmbuAuragain than other SADs and shorter with the direct method of LSFOI than the indirect method (mean difference of 6.9 s, P = 0.027). Ambu Auragain had the least SAD and bronchoscope-related difficulties. Seniors had significantly shorter mean intubation times than juniors by 11.6 s (P = 0.0392). The most preferred SAD for both methods was AmbuAuragain.

Conclusion: Low skill FOI consistently achieves a high intubation success rate regardless of experience, choice of method, or SAD used. SAD design features may significantly affect the performance of low skill FOI.

J Trauma Acute Care Surg. 2018 Jun;84(6):924-928

The focused abdominal sonography for trauma examination can reliably identify patients with significant intra-abdominal hemorrhage in life-threatening pelvic fractures.

Christian N, Burlew C, Moore E, Geddes A, Wagenaar A, Fox C, Pieracci F

BACKGROUND: The focused abdominal sonography for trauma (FAST) examination has been reported to be unreliable in pelvic fracture patients. Additionally, given the advent of new therapeutic interventions, such as resuscitative endovascular balloon occlusion of the aorta (REBOA), rapid identification of intra-abdominal hemorrhage compared with Zone III hemorrhage may guide different therapeutic strategies. We hypothesized that FAST is reliable for detecting clinically significant intra-abdominal hemorrhage in the face of complex pelvic fractures.

METHODS: Our pelvic fracture database of all hemodynamically unstable patients requiring intervention from January 1, 2005, to July 1, 2015, was reviewed. The FAST examination was compared with operative and computed tomography (CT) scan findings. Confirmatory evaluation for FAST(-) patients was considered positive if therapeutic intervention was required.

RESULTS: During the study period, 81 patients in refractory shock with FAST imaging in our emergency department (ED) underwent pelvic packing. Mean age was 45 ± 2 years and Injury Severity Score was 50 ± 1.5. The FAST examination was negative in 53 patients; 52 patients did not require operative intervention for abdominal bleeding while one patient required splenectomy. The FAST examination was positive in 28 patients; 26 had findings confirmed by CT or laparotomy while two patients did not have intra-abdominal hemorrhage on further evaluation. The sensitivity and specificity for FAST in this population was 96% and 96%, respectively, positive predictive value was 93%, and negative predictive value was 98%. The false-negative and -positive rates for FAST were 2% and 7%.

CONCLUSION: Focused abdominal sonography for trauma examination reliably identifies clinically significant hemoperitoneum in life-threatening, pelvic fracture related hemorrhage. The incidence of a false-negative FAST in this unstable pelvic fracture population was 2%. FAST results may be used when determining the role of REBOA in these multisystem trauma patients and requires further study. REBOA placement should be considered in hemodynamically unstable pelvic fracture patients who are FAST(-), while laparotomy should be used in FAST(+) patients.

LEVEL OF EVIDENCE: Therapeutic, level IV.

Ann Burns Fire Disasters. 2017 Dec 31;30(4):256-260

Burn injuries from the London suicide bombings: a new classification of blast-related thermal injuries.

Chukwu-Lobelu R, Appukuttan A, Edwards D, Patel H

ABSTRACT:
In July 2005, four suicide bombers detonated explosive improvised high explosive devices (IEDs) in three separate underground carriages and a double decker bus in London, resulting in 56 deaths and 775 injured. This study aims to understand the mechanisms and patterns of burn injuries from high explosives, and the related factors that determine mortality. The types and patterns of burn injuries in survivors and fatalities in the confined underground train carriages and the bus were analysed, evaluating injury severity score and the victims' relative position from the detonation point. The data were sourced from collated police witness statements, hospital records, forensic post mortem examinations and forensic examinations at the scene. The detonation of an explosive device in a confined space causes complex injuries to the human body, resulting in blast-related direct thermal and radiant burns. Injury patterns and mortality were related to crowd density, enclosure design, position of the victims and proximity to the device. Suicide bombings using IEDs will result in direct thermal burns and radiant burns currently categorised in the quaternary (miscellaneous) blast injury group. We propose a classification of these burns following an analysis of the London bombing data with respect to burns in both the fatalities and survivors. Distance from the device, crowd density and environment influences these burns.

Surv Ophthalmol. 2018 Sep - Oct;63(5):677-693. doi:10.1016/j.survophthal.2018.02.003. Epub 2018 Feb 15.

Management of bacterial postoperative endophthalmitis and the role of vitrectomy.

Clarke B, Williamson T, Gini G, Gupta B

ABSTRACT:
Management of postoperative bacterial endophthalmitis was explored in the Endophthalmitis Vitrectomy Study37 in 1995, which has underpinned the core protocols in treatment ever since. While surgical techniques have continued to evolve, little has changed in the overall clinical management as no further large randomized controlled trials have taken place. We review the literature addressing the incidence of endophthalmitis, pathogens, antibiotic therapies, and the role of vitrectomy. We suggest an update to management protocols based on available evidence. While vitreous culture remains the gold standard for diagnosis, new techniques allow bacterial identification after antibiotic administration, so injection should be initiated immediately. Current antibiotic regimes are comprehensive and do not need changing. Intravitreal antibiotics should not be repeated at 48 hours after initial treatment. Vitrectomy should be considered instead if the clinical picture is not improving.

Emerg Med J. 2018 Aug;35(8):523-524. doi: 10.1136/emermed-2018-207944.2.

BET 1: Intravenous tranexamic acid for the treatment of post-partum haemorrhage.

Coss C, Singh M, Jones J

ABSTRACT:
A short-cut review was carried out to see if administering tranexamic acid reduced mortality in patients with postpartum haemorrhage. The author, date and country of publication, patient group studied, study type, relevant outcomes, results, and study weaknesses of these papers are tabulated. Two randomised controlled trials were found, a smaller one suggesting that treatment with tranexamic acid reduced the volume of blood lost and a much larger study that showed a reduction in mortality due to bleeding in this patient group. There were no significant side effects from this treatment found in either study.

Crit Care. 2018 Jun 18;22(1):164.

Early fibrinogen concentrate therapy for major haemorrhage in trauma (E-FIT 1): results from a UK multi-centre, randomised, double blind, placebo-controlled pilot trial.

Curry N, Foley C, Wong H, Mora A, Curnow E, Zarankaite A, Hodge R, Hopkins V, Deary A, Ray J, Moss P, Reed M, Kellett S, Davenport R, Stanworth S

BACKGROUND: There is increasing interest in the timely administration of concentrated sources of fibrinogen to patients with major traumatic bleeding. Following evaluation of early cryoprecipitate in the CRYOSTAT 1 trial, we explored the use of fibrinogen concentrate, which may have advantages of more rapid administration in acute haemorrhage. The aims of this pragmatic study were to assess the feasibility of fibrinogen concentrate administration within 45 minutes of hospital admission and to quantify efficacy in maintaining fibrinogen levels ≥ 2 g/L during active haemorrhage.

METHODS: We conducted a blinded, randomised, placebo-controlled trial at five UK major trauma centres with adult trauma patients with active bleeding who required activation of the major haemorrhage protocol. Participants were randomised to standard major haemorrhage therapy plus 6 g of fibrinogen concentrate or placebo.

RESULTS: Twenty-seven of 39 participants (69%; 95% CI, 52-83%) across both arms received the study intervention within 45 minutes of admission. There was some evidence of a difference in the proportion of participants with fibrinogen levels ≥ 2 g/L between arms ($p = 0.10$). Fibrinogen levels in the fibrinogen concentrate (FgC) arm rose by a mean of 0.9 g/L (SD, 0.5) compared with a reduction of 0.2 g/L (SD, 0.5) in the placebo arm and were significantly higher in the FgC arm ($p < 0.0001$) at 2 hours. Fibrinogen levels were not different at day 7. Transfusion use and thromboembolic events were similar between arms. All-cause mortality at 28 days was 35.5% (95% CI, 23.8-50.8%) overall, with no difference between arms.

CONCLUSIONS: In this trial, early delivery of fibrinogen concentrate within 45 minutes of admission was not feasible. Although evidence points to a key role for fibrinogen in the treatment of major bleeding, researchers need to recognize the challenges of timely delivery in the emergency setting. Future studies must explore barriers to rapid fibrinogen therapy, focusing on methods to reduce time to randomization, using 'off-the-shelf' fibrinogen therapies (such as extended shelf-life cryoprecipitate held in the emergency department or fibrinogen concentrates with very rapid reconstitution times) and limiting the need for coagulation test-based transfusion triggers.

Trauma Acute Care Surg. 2018 Jul;85(1S Suppl 2):S1-S3.
doi:10.1097/TA.0000000000001981.

The new reckoning: The Combat Casualty Care Research Program responds to real and present challenges in military operational projections.

Davis M, Rasmussen T, Holcomb B

ABSTRACT:
This issue of the Journal of Trauma and Acute Care Surgery features topics from the 2017 Military Health System Research Symposium and starts a second decade of partnership between the Combat Casualty Care Research Program (CCCRP) and the journal. This publication comes at a time of significant change for the CCCRP, as it responds to military planning for the future multi-domain battlefield (MDB). The projected MDB portends markedly different operational scenarios than those conducted over the past 17 years. Emerging threats around the globe have the Department of Defense preparing for more complex battlefields that are larger in size and scope and which pit the United States against better equipped and more sophisticated adversaries. As the CCCRP navigates this new reckoning associated with trauma care on the MDB, its research investments will need to be robust and enabled to plan, program, and budget for agile and closer-term solutions. To accomplish this, the program will need to expand on its strong foundation of lessons learned and assets developed over the past 20 years.

J Trauma Acute Care Surg. 2018 Jul;85(1S Suppl 2):S44-S48.
doi:10.1097/TA.0000000000001861.

The effects of hemorrhage on the pharmacokinetics of tranexamic acid in a swine model.

Derickson M, McClellan J, Marko S, Kuckelman J, Phillips C, Barron M, Martin M, Loughren M

BACKGROUND: The early use of tranexamic acid (TXA) is strongly advocated in patients who are likely to require massive transfusion to decrease mortality. This study determines the influence of hemorrhage on the pharmacokinetics of TXA in a porcine model.

METHODS: The investigation was a prospective experimental study in Yucatan minipigs. First, in vitro plasma-cell partitioning of TXA was evaluated by inoculating whole blood with known aliquots, centrifuging, and measuring the supernatant with high-performance liquid chromatography with mass spectrometry (HPLC-MS). Then, using in vivo modeling, normovolemic and hypovolemic (35% reduction in blood volume) swine (n = 4 per group) received 1 g of intravenous TXA and had blood sampled at 14 time points over 4 hours to determine baseline clearance via HPLC-MS. Additional swine (n = 4) were hemorrhaged 35% of their blood volume, and TXA was administered as a 15 mg/kg infusion over 10 minutes followed by infusion of 1.875 mg/kg per hour to simulate massive hemorrhage scenario. During the first hour of TXA administration, one total blood volume was hemorrhaged and simultaneously replaced with TXA free blood. Serial blood samples and the hemorrhaged blood were analyzed by HPLC-MS to determine the percentage of dose lost via hemorrhage.

RESULTS: Clearance of TXA was diminished in the hypovolemic group compared with the normovolemic group (115 ± 4 vs 70 ± 7 mL/min). Percentage of dose lost via hemorrhage averaged 25%. The lowest measured plasma level during the exchange transfusion was 34 μg/mL.

CONCLUSION: Mean 25% of the present 2017 Joint Trauma System Clinical Practice Guideline dosing of TXA can be lost to hemorrhage if a blood volume is transfused within an hour of initiating therapy. In the case of TXA, which has limited distribution and is administered during active hemorrhage and massive blood transfusions, replacement strategies should be developed and tested to find simple methods of adjusting the current dosing guidelines to maintain therapeutic plasma concentrations.

LEVEL OF EVIDENCE: Therapeutic, level II.

J Emerg Med. 2018 Sep;55(3):366-371. doi: 10.1016/j.jemermed.2018.05.027

Emergency Medical Services Simple Thoracostomy for Traumatic Cardiac Arrest: Post-implementation Experience in a Ground-based Suburban/Rural Emergency Medical Services Agency.

Dickson R, Gleisberg G, Aiken M, Crocker K, Patrick C, Nichols T, Mason C, Fioretti J

BACKGROUND: Tube thoracostomy has long been the standard of care for treatment of tension pneumothorax in the hospital setting yet is uncommon in prehospital care apart from helicopter emergency medical services.

OBJECTIVE: We aimed to evaluate the performance of simple thoracostomy (ST) for patients with traumatic cardiac arrest and suspected tension pneumothorax.

METHODS: We conducted a retrospective case series of consecutive patients with traumatic cardiac arrest where simple thoracostomy was used during the resuscitation effort. Data were abstracted from our Zoll emergency medical record (Zoll Medical Corp., Chelmsford, MA) for patients who received the procedure between June 1, 2013 and July 1, 2017. We collected general descriptive characteristics, procedural success, presence of air or blood, and outcomes for each patient.

RESULTS: During the study period we performed ST on 57 patients. The mean age was 41 years old (range 15-81 years old) and 83% were male. Indications included 40 of 57 (70%) blunt trauma and 17 of 57 (30%) penetrating trauma. The presenting rhythm was pulseless electrical activity 65%, asystole 26%, ventricular tachycardia/fibrillation 4%, and nonrecorded 5%. Eighteen of 57 (32%) had air return, 14 of 57 (25%) return of spontaneous circulation, with 6 of 57 (11%) surviving to 24 h and 4 of 57 (7%) discharged from the hospital neurologically intact. Of the survivors, all were blunt trauma mechanism with initial rhythms of pulseless electrical activity. There were no reported medic injuries.

CONCLUSIONS: Our data show that properly trained paramedics in ground-based emergency medical services were able to safely and effectively perform ST in patients with traumatic cardiac arrest. We found a significant (32%) presence of pneumothorax in our sample, which supports previously reported high rates in this patient population.

Anaesthesia. 2018 Jul;73(7):856-862

Changes in hardness and resilience of i-gelTM cuffs with temperature: a benchtop study.

Dingley J, Stephenson J, Allender V, Dawson S, Williams D

ABSTRACT:
The i-gelTM is a supraglottic airway with a gel-like thermoplastic cuff. It has been suggested that the seal around the larynx improves following insertion. Perhaps the most intuitive hypothesis proposed for this is that cuff softening occurs during warming from ambient to body temperature. We investigated this using a food industry texture analyser over a wide temperature range. Size 2 and 3 i-gels were secured to a platform within a temperature-controlled water bath, which was in turn mounted on a texture analyser test stand. Both water and i-gel cuff temperatures were recorded. A spherical probe was advanced 4 mm into the surface of each i-gel at a rate of 1 mm.s-1 , then retracted at the same rate while the upward pressure on the probe was recorded. Three runs made at each of the 11 temperatures (10 °C to 60 °C, 5 °C increments) gave 105,864 data points, from which values for hardness (the peak force on the probe at maximum indentation), and resilience (the rate at which the material recovers its original shape) were calculated. Over 10 to 60 °C, the smallest hardness value expressed as a proportion of the largest was 88.2% and 89.8% for size 2 and 3 i-gels, respectively, and for resilience these were 92.8% and 86.2%, respectively. Over room temperature to body temperature range (21-37.4 °C), hardness decreased by 3.15% and increased by 0.47% for i-gel sizes 2 and 3, respectively, whereas resilience values decreased by 1.85% and 2.68%, respectively. Cuff hardness and resilience did generally reduce with warming, but the effect was minimal over temperature ranges that may be encountered during clinical use.

Ann Surg. 2018 Jul 31. doi: 10.1097/SLA.0000000000002999. [Epub ahead of print]

Establishing a Regional Trauma Preventable/Potentially Preventable Death Rate.

Drake S, Holcomb J, Yang Y, Thetford C, Myers L, Brock M, Wolf D, Cron S, Persse D, McCarthy J, Kao L, Todd S, Naik-Mathuria B, Cox C, Kitagawa R, Sandberg G, Wade C

OBJECTIVE: To establish a trauma preventable/potentially preventable death rate (PPPDR) within a heavily populated county in Texas.

SUMMARY: The National Academies of Sciences estimated the trauma preventable death rate in the United States to be 20%, issued a call for zero preventable deaths, while acknowledging that an accurate preventable death rate was lacking. In this absence, effective strategies to improve quality of care across trauma systems will remain difficult.

METHODS: A retrospective review of death-related records that occurred during 2014 in Harris County, TX, a diverse population of 4.4 million. Patient demographics, mechanism of injury, cause, timing, and location of deaths were assessed. Deaths were categorized using uniform criteria and recorded as preventable, potentially preventable or non-preventable.

RESULTS: Of 1848 deaths, 85% had an autopsy and 99.7% were assigned a level of preventability, resulting in a trauma PPPDR of 36.2%. Sex, age, and race/ethnicity varied across preventability categories ($P < 0.01$). Of 847 prehospital deaths, 758 (89.5%) were non-preventable. Among 89 prehospital preventable/potentially preventable (P/PP) deaths, hemorrhage accounted for 55.1%. Of the 657 initial acute care setting deaths, 292 (44.4%) were P/PP; of these, hemorrhage, sepsis, and traumatic brain injury accounted for 73.3%. Of 339 deaths occurring after initial hospitalization, 287 (84.7%) were P/PP, of these 117 resulted from sepsis and 31 from pulmonary thromboembolism, accounted for 51.6%.

CONCLUSIONS: The trauma PPPDR was almost double that estimated by the National Academies of Sciences. Data regarding P/PP deaths offers opportunity to target research, prevention, intervention, and treatment corresponding to all phases of the trauma system.

Trauma Surg Acute Care Open. 2017 May 31;2(1):e000106. doi: 10.1136/tsaco-2017-000106. eCollection 2017.

Methodology to reliably measure preventable trauma death rate.

Drake S, Wolf D, Meininger J, Cron S, Reynold T, Wade C, Holcomb J.

ABSTRACT:
This article describes a methodology to establish a trauma preventable death rate(PDR) in a densely populated county in the USA. Harris County has >4 million residents, encompasses a geographic area of 1777 square miles and includes the City of Houston, Texas. Although attempts have been made to address a national PDR, these studies had significant methodological flaws. There is no national consensus among varying groups of clinicians for defining preventability or documenting methods by which preventability is determined. Furthermore, although trauma centers routinely evaluate deaths within their hospital for preventability, few centers compare across regions, within the prehospital arena and even fewer have evaluated trauma deaths at non-trauma centers. Comprehensive population-based data on all trauma deaths within a defined region would provide a framework for effective prevention and intervention efforts at the regional and national levels. The authors adapted a military method recently used in Southwest Asia to determine the potential preventability of civilian trauma deaths occurring across a large and diverse population. The project design will allow a data-driven approach to improve services across the entire spectrum of trauma care, from prevention through rehabilitation.

J Trauma Acute Care Surg. 2018 Jun;84(6):917-923

Intravenous administration of synthetic platelets (SynthoPlate) in a mouse liver injury model of uncontrolled hemorrhage improves hemostasis.

Dyer M, Hickman D, Luc N, Haldeman S, Loughran P, Pawlowski C, Sen Gupta A, Neal M

BACKGROUND: Clinical resuscitative treatment of traumatic hemorrhage involves transfusion of RBC, platelets and plasma in controlled ratios. However, use of such blood components, especially platelets, present many challenges including availability, portability, contamination risks, and short shelf-life, which limit the use of platelet transfusions outside of large trauma centers such as remote civilian hospitals and austere prehospital settings. This has prompted significant research in platelet substitutes that may resolve the above issues while providing platelet-mimetic hemostatic action. In this framework, we have developed a synthetic platelet surrogate, SynthoPlate, by integrative decoration of platelet function mimetic peptides on a biocompatible lipid nanovesicle platform. We have previously demonstrated hemostatic capability of SynthoPlate in correcting tail-bleeding time in thrombocytopenic mice. Building on this, we hypothesized that SynthoPlate transfusion would decrease bleeding in a murine model of acute hemorrhagic shock.

METHODS: A validated model of uncontrolled intraperitoneal hemorrhage, via liver laceration was used to induce hemorrhagic shock in mice. SynthoPlate, control (unmodified) particles, and normal saline were administered as pretreatment and recue infusions to mice undergoing liver laceration and evaluated for hemostatic benefit by determining differences in blood loss and monitoring real-time hemodynamic data.

RESULTS: Pretreatment SynthoPlate transfusion resulted in significant reduction of blood loss following hemorrhage, compared with control particles or normal saline treatment (0.86 ± 0.16 g control particles [CP] vs. 0.84 ± 0.13 g normal saline [NS] vs. 0.68 ± 0.09 g SynthoPlate, $p < 0.005$). SynthoPlate transfused mice demonstrated improved hemodynamics taking significantly longer to develop post-injury hypotension (168.3 ± 106.6 seconds CP vs. 137 ± 58 seconds NS vs. 546.7 ± 329.8 seconds SynthoPlate, $p < 0.05$). SynthoPlate infusion following liver laceration, that is, rescue transfusion, also resulted in a significant decrease in blood loss (0.89 ± 0.17 g CP vs. 0.92 ± 0.19 g NS vs. 0.69 ± 0.18 g SynthoPlate, $p < 0.05$).

CONCLUSION: Transfusion of SynthoPlate particles reduces blood loss in a murine model of liver injury, and SynthoPlates may represent a viable transfusion product for the mitigation of blood loss in acute, severe hemorrhagic shock.

Emerg Med Australas. 2018 May 11. doi: 10.1111/1742-6723.13107. [Epub ahead of print]

Influence of prehospital airway management on neurological outcome in patients transferred to a heart attack centre following out-of-hospital cardiac arrest.

Edwards T, Williams J, Cottee M

OBJECTIVE: To describe the association between prehospital airway management and neurological outcomes in patients transferred by the ambulance service directly to a heart attack centre (HAC) post-return of spontaneous circulation (ROSC).

METHODS: A retrospective observational cohort study in which ambulance records were reviewed to determine prehospital airway management strategy and collect physiological and demographic data. HAC notes were obtained to determine in-hospital management and quantify neurological outcome via the cerebral performance category (CPC) scale. Statistical analyses were performed via $\chi 2$ -test, Mann-Whitney U-test, odds ratios and binomial logistic regression.

RESULTS: Two hundred and twenty patients were included between August 2013 and August 2014, with complete outcome data obtained for 209. Median age of patients with complete outcome data was 67 years and 71.3% were male (n = 149). Airway management was provided using a supraglottic airway (SGA) in 72.7% of cases (n = 152) with the remainder undergoing endotracheal intubation (ETI). There was no significant difference in the proportion of patients who had a good neurological outcome (CPC 1 and 2) at discharge between the SGA and ETI groups (P = 0.29). Binomial logistic regression incorporating factors known to influence outcome demonstrated no significant difference in neurological outcomes between the SGA and ETI groups (adjusted OR 0.73, 95% CI 0.34-1.56).

CONCLUSION: In this observational study, there was no significant difference in the proportion of good neurological outcomes in patients managed with SGA versus ETI during cardiac arrest and in the post-ROSC transfer phase. Further research is required to provide more definitive evidence in relation to the optimal airway management strategy in out-of-hospital cardiac arrest.

Am J Emerg Med. 2018 Jun;36(6):1079-1087

Efficacy of prehospital administration of tranexamic acid in trauma patients: A meta-analysis of the randomized controlled trials.

El-Menyar A, Sathian B, Asim M, Latifi R, Al-Thani H

OBJECTIVE: The antifibrinolytic agent tranexamic acid (TXA) has a potential clinical benefit for in-hospital patients with severe bleeding but its effectiveness in pre-hospital settings remains unclear. We conducted a systematic review and meta-analysis to evaluate whether pre-hospital administration of TXA compared to placebo improve patients' outcomes?

METHODS: PubMed, MEDLINE, Cochrane Library, WHO International Clinical Trials Registry Platform, Cochrane Central Register of Controlled Trials (CENTRAL), Scopus, clinicaltrials.gov and Google scholar databases were searched for a retrospective, prospective and randomized (RCT) or quasi-RCT studies that assessed the effect of prehospital administration of TXA versus placebo on the outcomes of trauma patients with significant hemorrhage. The main outcomes of interest were 24hour 30-day mortality and in-hospital thromboembolic complications. Two authors independently abstracted the data using a data collection form. Results from different studies were pooled for the analysis, when appropriate.

RESULTS: Out of 92 references identified through the search, two analytical studies met the inclusion criteria. The effect of TXA on 24-hour mortality had a pooled odds ratio (OR) of 0.49 (95% CI 0.28-0.85), 30-day mortality OR of 0.86 (95% CI, 0.56-1.32), and thromboembolic events OR of 0.74 (95% CI, 0.27-2.07).

CONCLUSION: Prehospital TXA appears to reduce early mortality in trauma patients. The pooled analysis also shows a trend toward lower 30-day mortality and reduced risk of thromboembolic events. Additional randomized controlled clinical trials are needed to determine the significance of these trends.

J Trauma Acute Care Surg. 2018 Jun;84(6S Suppl 1):S125-S131

Immediate effects of blood donation on physical and cognitive performance - A randomized controlled double-blinded trial.

Eliassen H, Hervig T, Backlund S, Sivertsen J, Iversen V, Kristoffersen M, Wengaard E, Gramstad A, Fosse T, Bjerkvig CK, Apelseth T, Doughty H, Strandenes G.

BACKGROUND: The success of implementing damage control resuscitation principles pre-hospital has been at the expense of several logistic burdens including the requirements for resupply, and the question of donor safety during the development of whole blood programs. Previous studies have reported effects on physical performance after blood donation; however, none have investigated the effects of blood donation on cognitive performance.

METHOD: We describe a prospective double-blinded, randomized, controlled study comprised of a battery of tests: three cognitive tests, and VO2max testing on a cycle ergometer. Testing was performed 7 days before blinded donation (baseline day), immediately after donation (Day 0), and 7 days (Day 7) after donation. The inclusion criteria included being active blood donors at the Haukeland University Hospital blood bank, where eligibility requirements were met on the testing days, and providing informed consent. Participants were randomized to either the experimental (n = 26) or control group (n = 31). Control group participants underwent a 'mock donation" in which a phlebotomy needle was placed but blood was not withdrawn.

RESULTS: In the experimental group, mean ± SEM VO2max declined 6% from 41.35 ± 1.7 mLO2/(min·kg) at baseline to 39.0 ± 1.6 mLO2/(min·kg) on Day 0 and increased to 40.51 ± 1.5 mLO2/(min·kg) on Day 7. Comparable values in the control group were 42.1 ± 1.8 mLO2/(min·kg) at baseline, 41.6 ± 1.8 mLO2/(min·kg)) on Day 1 (1% decline from baseline), and 41.8 ± 1.8 mLO2/(min·kg) on Day 7.Comparing scores of all three cognitive tests on Day 0 and Day 7 showed no significant differences ($p > 0.05$).

CONCLUSION: Our main findings are that executive cognitive and physical performances were well maintained after whole blood donation in healthy blood donors. The findings inform post-donation guidance on when donors may be required to return to duty.

LEVEL OF EVIDENCE: Randomized, controlled, double-blinded prospective trial study, level 1.

Case Rep Emerg Med. 2018 Mar 19;2018:6351521. doi: 10.1155/2018/6351521. eCollection 2018.

Bradycardia after Tube Thoracostomy for Spontaneous Pneumothorax.

Fashola Y, Kaul S, Finefrock D

ABSTRACT:
We present the case of an elderly patient who became bradycardic after chest tube insertion for spontaneous pneumothorax. Arrhythmia is a rare complication of tube thoracostomy. Unlike other reported cases of chest tube induced arrhythmias, the bradycardia in our patient responded to resuscitative measures without removal or repositioning of the tube. Our patient, who had COPD, presented with shortness of breath due to spontaneous pneumothorax. Moments after tube insertion, patient developed severe bradycardia that responded to Atropine. In patients requiring chest tube insertion, it is important to be prepared to provide cardiopulmonary resuscitative therapy in case the patient develops a life-threatening arrhythmia.

Emerg Med Australas. 2018 Jun 11. doi: 10.1111/1742-6723.13114. [Epub ahead of print]

Ketamine use for rapid sequence intubation in Australian and New Zealand emergency departments from 2010 to 2015: A registry study.

Ferguson I, Alkhouri H, Fogg T, Aneman A

OBJECTIVE: This study aimed to quantify the proportion of patients undergoing rapid sequence intubation using ketamine in Australian and New Zealand EDs between 2010 and 2015.

METHODS: The Australian and New Zealand Emergency Department Airway Registry is a multicentre airway registry prospectively capturing data from 43 sites. Data on demographics and physiology, the attending staff and indication for intubation were recorded. The primary outcome was the annual percentage of patients intubated with ketamine. A logistic regression analysis was conducted to evaluate the factors associated with ketamine use.

RESULTS: A total of 4658 patients met inclusion criteria. The annual incidence of ketamine use increased from 5% to 28% over the study period ($P < 0.0001$). In the logistic regression analysis, the presence of an emergency physician as a team leader was the strongest predictor of ketamine use (odds ratio [OR] 1.83, 95% confidence interval [CI] 1.44-2.34). The OR for an increase in one point on the Glasgow Coma Scale was 1.10 (95% CI 1.07-1.12), whereas an increase of 1 mmHg of systolic blood pressure had an OR of 0.98 (95% CI 0.98-0.99). Intubation occurring in a major referral hospital had an OR of 0.68 (95% CI 0.56-0.82), while trauma conferred an OR of 1.38 (95% CI 1.25-1.53).

CONCLUSIONS: Ketamine use increased between 2010 and 2015. Lower systolic blood pressure, the presence of an emergency medicine team leader, trauma and a higher Glasgow Coma Scale were associated with increased odds of ketamine use. Intubation occurring in a major referral centre was associated with lower odds of ketamine use.

JAMA. 2018 Aug 14;320(6):589-590

Stop the Bleeding: Educating the Public.

Fisher A, Bulger E, Gestring M

Quotes:

“Before the conflicts, the US military’s approach to out-of-hospital hemorrhage discouraged the use of tourniquets because of fear for limb loss from ischemic injury. More recent experience with battlefield trauma showed that the opposite was true and that the survival benefits with tourniquets far outweighed the risks. 2 In 1996, medical treatment guidelines for special operations forces were published that later evolved into the Tactical Combat Casualty Care (TCCC) curriculum. The TCCC curriculum focused on the most common causes of preventable combat death and emphasized tourniquet use in the control of extremity bleeding. Despite the TCCC guidelines, protocols promoting the widespread use of tourniquets at the start of the conflicts in Iraq and Afghanistan had not yet been developed. Death from extremity hemorrhage during this period accounted for 7.8% of all battlefield fatalities.”

“With the increased availability of tourniquets and the implementation of TCCC guidelines, tourniquet use became more widespread in the US military and mortality decreased significantly. Between 2006 and 2011, mortality from extremity hemorrhage was reduced to 2.6% of all battlefield fatalities.3 The use of commercially developed tourniquets and improved training of all, including nonmedical, combat personnel was credited with this decrease in combat mortality.”

“The lessons learned over a decade of military conflict are helping to guide the civilian response to situations in which uncontrolled hemorrhage is encountered. Basic bleeding control skills are within reach of non-medically trained individuals and the coordinated dissemination of this information to the general public could possibly help to reduce the risk of preventable death due to hemorrhage.”

Mil Med. 2018 May 1;183(5-6):e216-e222

Military Medic Performance with Employment of a Commercial Intraosseous Infusion Device: A Randomized, Crossover Study.

Gendron B, Cronin A, Monti J, Brigg A

Background: Obtaining intraosseous (IO) access remains an invaluable skill in the management and resuscitation of patients on the battlefield. The U.S. Army Combat Medic is currently trained to utilize a sternal IO device (FAST1® Intraosseous Infusion System); however, the Arrow® EZ-IO® Intraosseous Vascular Access System offers unique benefits including ease of use, reload ability, and placement location versatility. Studies have demonstrated high success rates in the operational settings using the EZ-IO® System; however, no prospective studies have been conducted to assess the performance of U.S. Army's conventional Combat Medics using the EZ-IO® System. We hypothesized that EZ-IO® System-naïve medics would have a statistically significant success rate advantage utilizing the proximal tibia approach versus proximal humerus approach.

Methods: A total of 77 U.S. Army Medics (Military Occupational Specialty [MOS] 68 W) volunteer participants were recruited to participate in this randomized, crossover study. Participants received a standardized audio-visual-enhanced lecture on EZ-IO® System use without hands-on training and then randomized into two study groups according to which anatomical approach they would attempt first. Results were analyzed to determine participants' first-attempt mean success rates, mean required time to properly place the needle into simulated humeral head and proximal tibial bone models, and mean survey results measuring the participant's subjective assessment of the two approaches to include, along with training and testing experience. The data of those not naïve to the employment of the EZ-IO® System were excluded.

Results: The primary outcome measurement of overall mean participant success rate with attempted insertions into proximal tibial and humeral head bone models was 88% and 86%, respectively, demonstrating no statistically significant difference by approach, with no significant learning or design confounding effects ($p > 0.05$). Secondary outcomes of mean procedural time and subjective comfort and skill benefit were reported. Successful procedure times between the two anatomical approaches demonstrated a statistically significant mean time advantage of 17.1 s ($p < 0.05$) in proximal tibia IO placement. Overall participant mean subjective comfort level utilizing the EZ-IO® System (0- to 10-point scale with a 0 being not comfortable and a 10 being very comfortable) was 8.2, with no statistically significant difference in comfort discovered when comparing the two approaches. Participants reported a mean subjective score (0-10 scale with a 0 providing no benefit and a 10 providing extreme benefit) of 9.3 when asked how beneficial their newly learned IO system skill was to their overall medical skillset.

Conclusions: The overall first-attempt success rates of U.S. Army Combat Medics employing the EZ-IO® System are similar to the success rates of FAST1® device employment and similar to the success of other provider cohorts using the EZ-IO® device. Coupled with perceived benefit of adding the EZ-IO® System to their combat medic skillset, these data warrant further study and consideration for the incorporation of commercial IO systems into U.S. Army Combat Medic initial, sustainment, and pre-combat training and standard issue equipment.

Anesth Analg. 2018 Oct;127(4):840-849

Harmful or Physiologic: Diagnosing Fibrinolysis Shutdown in a Trauma Cohort With Rotational Thromboelastometry.

Gomez-Builes J, Acuna S, Nascimento B, Madotto F, Rizoli S

BACKGROUND: Despite its central role in early trauma coagulopathy, abnormal fibrinolysis continues to be poorly understood. Excessive fibrinolysis is a known contributor to mortality. Recent studies with thromboelastography (TEG) suggest decreased fibrinolysis (or shutdown) may be just as harmful. Considering the broad use of 2 different viscoelastic assays, which are not interchangeable, we proposed for the first time to define and characterize fibrinolysis shutdown using rotational thromboelastometry (ROTEM).

METHODS: Retrospective cohort study of severely injured patients with admission ROTEM. Shutdown was defined by the best Youden index value of the maximum lysis. Fibrinolysis phenotypes were physiologic, hyperfibrinolysis, and shutdown. Multivariable logistic regression evaluated association between Injury Severity Score and the fibrinolysis phenotypes, and the association among shutdown phenotype with mortality, blood transfusion, and thrombotic events.

RESULTS: Five hundred fifty patients were included. Maximum lysis <3.5% was selected to define shutdown. Predominant phenotype was physiologic (70.7%), followed by shutdown (25.6%) and hyperfibrinolysis (3.6%). Shutdown patients had higher Injury Severity Score, lower base excess, and required more transfusions than physiologic group. Shutdown was associated with acidosis (base excess: odds ratio [OR] for a 1 mEq/L increase, 0.93; 95% confidence interval [CI], 0.88-0.98; P = .0094) and the combination of clotting derangements, higher clot firmness (maximum clot formation: OR for a 2 mm increase, 1.8; 95% CI, 1.5-2.27; P < .0001), lower fibrinogen (OR for a 0.5 g/dL decrease, 1.47; 95% CI, 1.18-1.84; P = .0006), and poor clot formation dynamics (clot formation time: OR for a 5 seconds increase, 1.25; 95% CI, 1.15-1.36; P < .0001). Fibrinolysis shutdown was not independently associated with mortality (OR, 0.61; 95% CI, 0.28-1.33; P = .21), massive transfusion (OR, 2.14; 95% CI, 0.79-5.74; P = .1308), or thrombotic events (OR, 1.08; 95% CI, 0.37-3.15; P = .874). Shutdown was associated with increased 24-hour transfusion (OR, 2.24; 95% CI, 1.24-4.04; P = .007).

CONCLUSIONS: Despite higher injury burden, evidence of shock, and greater need for blood transfusions, early fibrinolysis shutdown was not associated with mortality, suggesting that it could represent an adaptive physiologic response to life-threatening trauma.

JAMA Surg. 2018 Sep 1;153(9):791-799

Effectiveness of Instructional Interventions for Hemorrhage Control Readiness for Laypersons in the Public Access and Tourniquet Training Study (PATTS): A Randomized Clinical Trial.

Goralnick E, Chaudhary M, McCarty J, Caterson E, Goldberg S, Herrera-Escobar J, McDonald M, Lipsitz S, Haider A

Importance: Several national initiatives have emerged to empower laypersons to act as immediate responders to reduce preventable deaths from uncontrolled bleeding. Point-of-care instructional interventions have been developed in response to the scalability challenges associated with in-person training. However, to our knowledge, their effectiveness for hemorrhage control has not been established.

Objective: To evaluate the effectiveness of different instructional point-of-care interventions and in-person training for hemorrhage control compared with no intervention and assess skill retention 3 to 9 months after hemorrhage control training.

Design, Setting, and Participants: This randomized clinical trial of 465 laypersons was conducted at a professional sports stadium in Massachusetts with capacity for 66 000 people and assessed correct tourniquet application by using different point-of-care interventions (audio kits and flashcards) and a Bleeding Control Basic (B-Con) course. Non-B-Con arms received B-Con training after initial testing (conducted from April 2017 to August 2017). Retesting for 303 participants (65%) was performed 3 to 9 months after training (October 2017 to January 2018) to evaluate B-Con retention. A logistic regression for demographic associations was performed for retention testing.

Interventions: Participants were randomized into 4 arms: instructional flashcards, audio kits with embedded flashcards, B-Con, and control. All participants received B-Con training to later assess retention.

Main Outcomes and Measures: Correct tourniquet application in a simulated scenario.

Results: Of the 465 participants, 189 (40.7%) were women and the mean (SD) age was 46.3 (16.1) years. For correct tourniquet application, B-Con (88% correct application [n = 122]; P < .001) was superior to control (n = 104 [16%]) while instructional flashcards (n = 117 [19.6%]) and audio kit (n = 122 [23%]) groups were not. More than half of participants in point-of-care arms did not use the educational prompts as intended. Of 303 participants (65%) who were assessed 3 to 9 months after undergoing B-Con training, 165 (54.5%) could correctly apply a tourniquet. Over this period, there was no further skill decay in the adjusted model that treated time as either linear (odds ratio [OR], 0.98; 95% CI, 0.95-1.03) or quadratic (OR, 1.00; 95% CI, 1.00-1.00). The only demographic that was associated with correct application at retention was age; adults aged 18 to 35 years (n = 58; OR, 2.39; 95% CI, 1.21-4.72) and aged 35 to 55 years (n = 107; OR, 1.77; 95% CI, 1.04-3.02) were more likely to be efficacious than those older than 55 years (n = 138).

Conclusions and Relevance: In-person hemorrhage control training for laypersons is currently the most efficacious means of enabling bystanders to act to control hemorrhage. Laypersons can successfully perform tourniquet application after undergoing a 1-hour course. However, only 54.5% retain this skill after 3 to 9 months, suggesting that investigating refresher training or improved point-of-care instructions is critical.

Ann Emerg Med. 2018 Aug;72(2):133-134

Is Low-Dose Ketamine an Effective Alternative to Opioids for the Treatment of Acute Pain in the Emergency Department?

Gottlieb M, Ryan K, Binkley C

Quotes:

“Although this review provides preliminary evidence that low-dose ketamine may be used as an alternative to opioids for acute pain in the ED setting, studies with larger sample sizes and more rigorous methodology are needed to establish patient selection criteria and the best dosing strategy.”

J Orthop Surg Res. 2018 Jun 18;13(1):149

Tranexamic acid is associated with selective increase in inflammatory markers following total knee arthroplasty (TKA): a pilot study.

Grant A, Letson H, Morris J, McEwen P, Hazratwala K, Wilkinson M, Dobson G

BACKGROUND: Tranexamic acid (TXA) is commonly used in orthopedic surgery to reduce excessive bleeding and transfusion requirements. Our aim was to examine if TXA was required in all osteoarthritis patients undergoing TKA surgery, and its possible effects on systemic inflammation and coagulation properties.

METHODS: Twenty-three patients (Oxford Score 22-29) were recruited consecutively; 12 patients received TXA before (IV, 1.2 g/90 kg) and immediately after surgery (intra-articular, 1.4 g/90 kg). Inflammatory mediators and ROTEM parameters were measured in blood at baseline, after the first bone-cut, immediately after surgery, and postoperative days 1 and 2.

RESULTS: After the bone cut and surgery, TXA significantly increased MCP-1, TNF-α, IL-1β and IL-6 levels compared to non-TXA patients, which was further amplified postoperatively. During surgery, TXA significantly prolonged EXTEM clot times, indicating a thrombin-slowing effect, despite little or no change in clot amplitude or fibrinogen. TXA was associated with three- to fivefold increases in FIBTEM maximum lysis (ML), a finding counter to TXA's antifibrinolytic effect. Maximum lysis for extrinsic and intrinsic pathways was < 8%, indicating little or no hyperfibrinolysis. No significant differences were found in postoperative hemoglobin between the two groups.

CONCLUSIONS: TXA was associated with increased systemic inflammation during surgery compared to non-TXA patients, with further amplification on postoperative days 1 and 2. On the basis of little or no change in viscoelastic clot strength, fibrinogen or clot lysis, there appeared to be no clinical justification for TXA in our group of patients. Larger prospective, randomized trials are required to investigate a possible pro-inflammatory effect in TKA patients.

Anaesthesia. 2018 Jun;73(6):719-729

Optimisation of the dosage of tranexamic acid in trauma patients with population pharmacokinetic analysis.

Grassin-Delyle S, Theusinger O, Albrecht R, Mueller S, Spahn D, Urien S, Stein P

ABSTRACT:
Tranexamic acid is used both pre-hospital and in-hospital as an antifibrinolytic drug to treat or prevent hyperfibrinolysis in trauma patients; dosing, however, remains empirical. We aimed to measure plasma levels of tranexamic acid in patients receiving pre-hospital anti-hyperfibrinolytic therapy and to build a population pharmacokinetic model to propose an optimised dosing regimen. Seventy-three trauma patients were enrolled and each received tranexamic acid 1 g intravenously pre-hospital. A blood sample was drawn after arrival in the emergency department, and we measured the plasma tranexamic acid concentration using liquid chromatography-mass spectrometry, and modelled the data using non-linear mixed effect modelling. Tranexamic acid was administered at a median (IQR [range]) time of 43 (30-55 [5-135]) min after trauma. Plasma tranexamic acid levels were determined on arrival at hospital, 57 (43-70 [20-148]) min after pre-hospital administration of the drug. The measured concentration was 28.7 (21.5-38.5 [8.7-89.0]) μg.ml-1. Our subjects had sustained severe trauma; injury severity score 20 (16-29 [5-75]), including penetrating injury in 2.8% and isolated traumatic brain injury in 19.7%. The pharmacokinetics were ascribed a two-compartment open model with body-weight as the main covariate. As tranexamic acid concentrations may fall below therapeutic levels during initial hospital treatment, we propose additional dosing schemes to maintain a specific target blood concentration for as long as required. This is the first study to investigate plasma level and pharmacokinetics of tranexamic acid after pre-hospital administration in trauma patients. Our proposed dosing regimen could be used in subsequent clinical trials to better study efficacy and tolerance profiles with controlled blood concentrations.

Ann Emerg Med. 2018 Aug;72(2):115-119

The Newest Threat to Emergency Department Procedural Sedation.

Green S, Roback M, Krauss B

Quotes:

“Now the ASA has released updated sedation guidelines that again assert a scope beyond the practice of anesthesiologists, stating that their guidelines “are intended for use by all providers.in any inpatient or outpatient setting.”11 These new guidelines contain vague, confusing, and misleading statements that run contrary to the existing scientific evidence and threaten the well-established sedation practices of emergency physicians and other specialists. Procedural sedation has long been a core competency in emergency medicine and critical care medicine, and our patients depend on us to provide effective sedation and analgesia for procedures that are often extremely painful (eg, cardioversion, abscess incision and drainage, fracture and dislocation reduction) or unduly frightening (eg, facial laceration repair, neuroimaging in a child). These revised ASA guidelines restrict the use of propofol and ketamine—our 2 most commonly administered sedative agents12-17—and any adoption or enforcement of these directives would restrict emergency physician access to these drugs, resulting in widespread use of alternative agents that are less safe and provide much less effective sedation and analgesia.”

CONCLUSION

“In summary, the ASA guideline update contains numerous confusing statements on critical issues relating to ED sedation practice and misleading characterizations in regard to deep sedation, ketamine, and propofol that are contrary to the existing scientific evidence. Key issues such as deep sedation, guideline relationships, skill sets, and specific drugs lack sufficient clarity for meaningful understanding or consistent interpretation. Given the critical need for emergency physicians to advocate on behalf of their patients, and given that each of the vague or omitted areas favors previously asserted adverse ASA positions, we believe that emergency physicians must assume the document to be politically motivated until proven otherwise. Emergency physicians are fully qualified by their training to administer all levels of sedation, and emergency medicine has long been at the forefront of sedation research and safe sedation practice. Non–evidence-based efforts by another specialty to dictate our scope of practice must be vigorously opposed.”

Ann Emerg Med 2018;71:A17-A20

Who should perform REBOA technique?

Greene J

Quotes:

“An endovascular procedure developed in the field by military physicians desperate to find new ways to stop traumatic bleeding is being welcomed by civilian trauma centers, but it is also prompting difficult questions about which medical specialties should perform it. An American College of Surgeons Committee on Trauma (ACS COT) and American College of Emergency Physicians (ACEP) joint guideline requiring that emergency physicians have “added critical care certification” to perform the procedure inspired a rapid backlash that led ACEP to convene a working group to “rework the language.” “Emergency medicine has fought for the last 5 decades to be recognized as a specialty and as experts in emergency care,” said James McCarthy, MD, chairman of the Department of Emergency Medicine at University of Texas Health Science Center in Houston. “This felt like a throwback to other people telling us what we couldn’t do. And that it came with the blessing of our professional organization— There was an absolute feeling of betrayal.”

“For emergency physicians with experience placing catheters, the REBOA technique is not difficult, although a patient in shock may have collapsed arteries that add a degree of difficulty. REBOA carries plenty of risks, though, most notably the need to keep it in place just long enough to restrict blood flow to get the patient to the operating room for surgical repair, but not so long that circulation is restricted to limbs and vital organs, potentially leading to organ failure, spinal cord ischemia, loss of a limb, or death.”

“The key, Dr. McCarthy and others said, is collaboration among the specialists who will likely need to work in concert, without leaving anyone out. “At our institution, we have an incredibly collaborative group of physicians—trauma surgeons, emergency medicine, vascular surgeons, and interventionists,” he said. “I should be trained to do it as part of the trauma response for that institution.”

J Trauma Acute Care Surg. 2017 Sep;83(3):464-468

Mortality after emergent trauma laparotomy: A multicenter, retrospective study.

Harvin J, Maxim T, Inaba K, Martinez-Aguilar M, King D, Choudhry A, Zielinski M, Akinyeye S, Todd S, Griffin R, Kerby J, Bailey J, Livingston D, Cunningham K, Stein D, Cattin L, Bulger E, Wilson A, Undurraga Perl V, Schreiber M, Cherry-Bukowiec J, Alam H, Holcomb J

BACKGROUND: Two decades ago, hypotensive trauma patients requiring emergent laparotomy had a 40% mortality. In the interim, multiple interventions to decrease hemorrhage-related mortality have been implemented but few have any documented evidence of change in outcomes for patients requiring emergent laparotomy. The purpose of this study was to determine current mortality rates for patients undergoing emergent trauma laparotomy.

METHODS: A retrospective cohort of all adult, emergent trauma laparotomies performed in 2012 to 2013 at 12 Level I trauma centers was reviewed. Emergent trauma laparotomy was defined as emergency department (ED) admission to surgical start time in 90 minutes or less. Hypotension was defined as arrival ED systolic blood pressure (SBP) ≤90 mm Hg. Cause and time to death was also determined. Continuous data are presented as median (interquartile range [IQR]).

RESULTS: One thousand seven hundred six patients underwent emergent trauma laparotomy. The cohort was predominately young (31 years; IQR, 24-45), male (84%), sustained blunt trauma (67%), and with moderate injuries (Injury Severity Score, 19; IQR, 10-33). The time in ED was 24 minutes (IQR, 14-39) and time from ED admission to surgical start was 42 minutes (IQR, 30-61). The most common procedures were enterectomy (23%), hepatorrhaphy (20%), enterorrhaphy (16%), and splenectomy (16%). Damage control laparotomy was used in 38% of all patients and 62% of hypotensive patients. The Injury Severity Score for the entire cohort was 19 (IQR, 10-33) and 29 (IQR, 18-41) for the hypotensive group. Mortality for the entire cohort was 21% with 60% of deaths due to hemorrhage. Mortality in the hypotensive group was 46%, with 65% of deaths due to hemorrhage.

CONCLUSION: Overall mortality rate of a trauma laparotomy is substantial (21%) with hemorrhage accounting for 60% of the deaths. The mortality rate for hypotensive patients (46%) appears unchanged over the last two decades and is even more concerning, with almost half of patients presenting with an SBP of 90 mm Hg or less dying.

Sci Rep. 2018 Aug 1;8(1):11567

Synthetic colloid resuscitation in severely injured patients: analysis of a nationwide trauma registry (TraumaRegister DGU).

Hilbert-Carius P, Schwarzkopf D, Reinhart K, Hartog C, Lefering R, Bernhard M, Struck M

ABSTRACT:
The purpose of this study was to investigate the efficacy and safety of synthetic colloid resuscitation among severely injured patients. Fluid resuscitation of trauma patients of a nationwide trauma registry was analysed between 2002 and 2015. Effects of synthetic colloid resuscitation in the pre-hospital setting and emergency department on renal failure, renal replacement therapy and multiple organ failure were analysed among patients with ≥2 days intensive care unit stay, and in-hospital mortality was analysed among all patients. 48,484 patients with mean age of 49 years and mean injury severity score of 23 points were included; 72.3% were male and 95.5% had blunt trauma. Risk-adjusted analyses revealed that patients receiving >1,000 ml synthetic colloids experienced an increase of renal failure and renal replacement therapy rates (OR 1.42 and 1.32, respectively, both $p \leq 0.006$). Any synthetic colloid use was associated with an increased risk of multiple organ failure ($p < 0.001$), but there was no effect on hospital mortality ($p = 0.594$). Between 2002 and 2015 usage of synthetic colloids dropped, likewise did total fluid intake and usage of blood products. The data from this analysis suggests that synthetic colloid resuscitation provides no beneficial effects and might be harmful in patients with severe trauma.

Crit Care Med. 2018 Mar;46(3):447-453

Transport Time and Preoperating Room Hemostatic Interventions Are Important: Improving Outcomes After Severe Truncal Injury.

Holcomb J

OBJECTIVES: Experience in the ongoing wars in Iraq and Afghanistan confirm that faster transport combined with effective prehospital interventions improves the outcomes of patients suffering hemorrhagic shock. Outcomes of patients with hemorrhagic shock and extremity bleeding have improved with widespread use of tourniquets and early balanced transfusion therapy. Conversely, civilian patients suffering truncal bleeding and shock have the same mortality (46%) over the last 20 years. To understand how to decrease this substantial mortality, one must first critically evaluate all phases of care from point of injury to definitive hemorrhage control in the operating room.

DATA SOURCES: Limited literature review.

DATA SYNTHESIS: The peak time to death after severe truncal injury is within 30 minutes of injury. However, when adding prehospital transport time, time spent in the emergency department, followed by the time in the operating room, it currently takes 2.1 hours to achieve definitive truncal hemorrhage control. This disparity in uncontrolled truncal bleeding and time to hemorrhage control needs to be reconciled. Prehospital and emergency department whole blood transfusion and temporary truncal hemorrhage control are now possible.

CONCLUSIONS: The importance of rapid transport, early truncal hemorrhage control and whole blood transfusion is now widely recognized. Prehospital temporary truncal hemorrhage control and whole blood transfusion should offer the best possibility of improving patient outcomes after severe truncal injury.

Transfusion. 2018 Aug;58(8):1821-1823

Get ready: whole blood is back and it's good for patients.

Holcomb J, Jenkins D

Quotes:

“The WB story is a fascinating example of evolution of clinical care. WB was the standard transfusion product for 50 years and obviously was a balanced approach to transfusion. In the early 1970s it essentially disappeared from clinical use, replaced with unbalanced component therapy, in which plasma to RBC ratios often reached 1:10, with platelets given even less often. This drastic change occurred without supporting outcome data in bleeding patients. Interestingly, it was during this era that acute respiratory distress syndrome, multiple organ failure, abdominal compartment syndrome and profound coagulopathy became common. We started caring for patients in the mid -1980s and it was routine to see patients with overt clinical coagulopathy. Over the last decade clinicians around the world have reversed this iatrogenic resuscitation error and are now transfusing bleeding patients in a balanced fashion, with amounts of plasma, platelets, cryoprecipitate and RBCs that attempt to replicate WB. At the same time, the deleterious effects of even small amounts of crystalloid have become widely recognized, and plasma is used as the primary resuscitation fluid.”

“There are approximately 5000 hospitals in the US. While RBCs are widely available, many (most?) cannot meet the standard of infusing RBCs, plasma, platelets and cryoprecipitate immediately upon arrival of a patient in hemorrhagic shock. There are approximately 35,000 ambulances in the US. Today few carry any blood products, although recent data support improved outcomes with prehospital transfusion.22,23 In these situations, every minute really does count. Even if those products are available in the blood bank, it often takes 30-40 minutes to prepare and deliver them to the bedside, during which a substantial percentage of bleeding patients will die.16, 24-26 The standard can be met by providing all hospitals with WB. How many ambulances will carry WB? Some are today, more will tomorrow. Many will say this vision is impossible and entirely unrealistic. What would they say if their loved one was transported or admitted to one of the many hospitals that can’t provide that standard? More than 150,000 patients die after injury every year in the US and bleeding is the leading cause of potentially preventable cause of death. When viewed as a public health crisis, WB is an intervention than can be used to help address those potentially preventable deaths at every level of care. The time is now to make WB widely available.”

Injury. 2018 Aug;49(8):1568-1571

The pelvic fracture - Indicator of injury severity or lethal fracture?

Holtenius J, Bakhshayesh P, Enocson A

BACKGROUND: Presence of pelvic fractures in trauma patients has previously been related to high mortality. However, there are controversies on whether pelvic fractures are the underlying cause of death or if it is rather an indicator of injury severity. We aimed to assess whether the presence of pelvic fracture increased mortality among a cohort of trauma patients or if it was simply an indicator of severe injury.

MATERIAL AND METHODS: Karolinska University Hospital is the largest trauma centre in Sweden. The hospital is linked to the Swedish National Trauma Registry, "SweTrau". Registry data was collected for the period January 2013 until December 2015 with a one year further follow-up regarding mortality. Patients in the pelvic fracture group were compared to the non-pelvic fracture group and regression analysis was performed adjusting for factors that could possibly affect mortality.

RESULTS: Univariable analysis showed that pelvic fracture was associated with an increased mortality, OR 2.4 (CI 1.3-3.4). Multivariable analysis showed that the presence of a pelvic fracture was not associated with an increased 30-day mortality (OR 0.5, CI 0.2-0.9), while factors as Shock (OR 7.1, CI 4.6-10.9), GCS < 9 (OR 6.2, CI 3.9-9.8), ISS > 15 (OR 12.4, CI 8.1-18.9), Age >60 (OR 3.2, CI 2.1-4,9) and ASA 3-4 (OR 4.7, CI 3.1-7.3) were associated with an increased 30-day mortality. Factors affecting 1-year mortality was analysed in the same way and the results were similar.

CONCLUSION: Presence of pelvic fractures in trauma patients is not correlated to increased mortality when adjusted for Age, ISS, ASA, GCS and Shock.

Trauma Surg Acute Care Open. 2018 Jan 8;3(1):e000140. doi: 10.1136/tsaco-2017-000140. eCollection 2018.

Is thromboelastography (TEG)-based resuscitation better than empirical 1:1 transfusion?

Howley I, Haut E, Jacobs L, Morrison J, Scalea T

ABSTRACT:
Thomboelastography (TEG) is a whole blood measure of coagulation which was originally described in the 1950s. However, it has only been in the last few decades that assays have become accessible and viable as a point-of-care test. Following the observation that hemorrhagic shock is associated with an intrinsic coagulopathy, TEG has been used as a method of diagnosing specific coagulation defects in order to direct individualized blood products resuscitation. An alternative transfusion strategy is the administration of fixed ratio products, a paradigm borne out of military experience. It is unknown which strategy is superior and this topic was debated at the 36th Annual Point/Counterpoint Acute Care Surgery Conference. The following article summarizes the discussants points of view along with a summary of the evidence.

Level of evidence: Level III.

Emerg Med. 2018 May;54(5):697-700

Can We Finally Dispense With Ketamine's Many Myths?

Hurwitz J

Quotes:

“The case in question involved an extraordinarily violent patient who, in my estimation, would not tolerate physical restraint without a high risk of injury to himself or others and required paralysis and intubation to permit safe care and further diagnostic studies. Rapid sedation was critical. A single agent capable of chemically restraining the patient within a couple of minutes was essential. I chose ketamine because it is safe to use in this circumstance, generally requires a single dose to be effective, and has a faster onset than most alternatives. The published literature bears this out, demonstrating ketamine’s favorable time to onset as compared to other agents. Cole et al. in particular showed ketamine’s time to adequate sedation (intramuscularly) was 5 min compared to 17 min for haloperidol (16).”

“Ketamine acts quickly, has a wide safety profile over a range of doses, can be used by a variety of routes, generally preserves respiratory drive, and facilitates the care of patients while emergent preintubation measures are implemented. In the combative, head-injured patient who requires immediate sedation, ketamine is a superior alternative to other commonly used sedatives.”

Ophthalmic Plast Reconstr Surg. 2018 Jul 3. doi: 10.1097/IOP.0000000000001168. [Epub ahead of print]

Lateral Canthotomy and Cantholysis in Operations Iraqi Freedom and Enduring Freedom: 2001-2011.

Jaksha A, Justin G, Davies B, Ryan D, Weichel E, Colyer M

PURPOSE: To describe outcomes and associated ocular injuries of lateral canthotomy and cantholysis (LCC) as performed in combat ocular trauma.

METHODS: Data from the Walter Reed Ocular Trauma Database of patients requiring LCC during Operations Iraqi Freedom and Enduring Freedom was reviewed as a retrospective cohort. Primary outcome measures included final visual acuity (VA) and Ocular Trauma Score. Secondary outcome measures were associated injuries and timing of surgery.

RESULTS: Thirty-six LCCs were recorded on a total of 890 eyes (4.04 %) in the Walter Reed Ocular Trauma Database. Eighteen out of 36 eyes (50.00%) had a final VA of the affected eye of 20/200 or worse vision. From the initial available VA measured either at the time of injury or at Walter Reed Army Medical Center, 13 eyes (40.63%) had no change in VA, 15 eyes (46.88%) had improvement, and 4 (12.5%) had a decrease in VA (n = 32, data unavailable for 4 eyes). Ocular Trauma score 0-65 was noted in 14 (38.9%) and 66-100 (61.1%). Retinal detachment (6, 16.67%), optic nerve injuries (7, 19.44%), orbital fractures (20, 55.56%), and retrobulbar hematoma (25, 69.44%) were commonly associated injuries. Of the 36 LCC, 18 (50.00%) were performed as the first surgery performed at the combat support hospital, 13 (36.11%) as the second, 4 (11.11%) as the third, and 1 (2.78%) as the fourth.

CONCLUSIONS: The largest subgroup of patients had an improvement in VA associated with performance of LCC; however, half of patients remained with a final VA of equal to or worse than 20/200 due to severe ocular trauma.

Injury. 2018 May 22. pii: S0020-1383(18)30257-2

A preliminary study into injuries due to non-perforating ballistic impacts into soft body armour over the spine.

Jennings R, Malbon C, Brock F, Harrisson S, Carr D

ABSTRACT:
The UK Home Office test method for ballistic protective police body armours considers anterior torso impacts to be the worst-case scenario and tests rear armour panels to the same standards as front panels. The aim of this paper was to examine the injuries from spinal behind armour blunt trauma (BABT) impacts. This study used a cadaveric 65 kg, female pig barrel and 9 mm Luger ammunition (9 × 19 mm, FMJ Nammo Lapur Oy) into HG1/A + KR1 soft armour panels over the spine. Injuries were inspected and sections removed for x-radiography and micro-CT assessment. All shots over the spine resulted in deep soft tissue injuries from pencilling of the armour and the shirt worn under the armour. The wounds had embedded fabric debris which would require surgery to remove resulting in increased recovery time over injuries usually seen in anterior torso BABT impacts, which are typically haematoma and fractured ribs. The shot with the deepest soft tissue wound (41 mm) also resulted in a fractured spinous process. Shots were also fired at the posterior and anterior rib area of the pig barrel, for comparison to the spine. Similar wounds were seen on the shots to the posterior rib area while shallower, smaller wounds were seen on the anterior and one anterior rib shot resulted in a single, un-displaced rib fracture. The anatomical differences between pigs and humans would most likely mean that injury to a human from these impacts would be more serious.

Ophthalmology. 2018 Jul 20. pii: S0161-6420(18)30179-9

Intraocular Foreign Body Trauma in Operation Iraqi Freedom and Operation Enduring Freedom: 2001 to 2011.

Justin G, Baker K, Brooks D, Ryan D, Weichel E, Colyer M

PURPOSE: We update the incidence of intraocular foreign bodies (IOFB) in soldiers admitted to Walter Reed Army Medical Center from 2001 to 2011 after sustaining combat injuries in Operation Iraqi Freedom and Operation Enduring Freedom.

DESIGN: This consecutive retrospective case series included 890 eyes of 652 patients.

METHODS: Data were collected in the Walter Reed Ocular Trauma Database. Inclusion criteria were any American soldier or Department of Defense civilian with an IOFB injured in Operation Iraqi Freedom/Operation Enduring Freedom. Closed globe injuries with orbital foreign bodies, injury outside of a combat zone, or non-Department of Defense civilian trauma were the exclusion criteria.

MAIN OUTCOME MEASURES: Primary outcome measures were final visual outcome and the number, size, and location of IOFBs. Secondary outcome measures included surgical procedures, use of eye protection, associated complications, source of injury and Ocular Trauma Score.

RESULTS: There were 890 eye injuries in 652 patients evacuated to Walter Reed Army Medical Center between 2001 and 2011. IOFBs were found in 166 eyes of 149 patients (18.6%; 95% confidence interval [CI], 16.2%-21.3%). Most patients had a single IOFB (80.7%). An IOFB was positively associated with Ocular Trauma Score grade 1 or 2 (0-65) injuries (odds ratio [OR], 1.58; 95% CI, 1.07-2.38; P = 0.01). There were 130 eyes (78.33%) that had recorded time from initial visual acuity to final visual acuity and it ranged from 8 to 2421 days (mean, 433.24 days). Thirty-eight (25.16%; 95% CI, 18.89%-32.67%) eyes had no change in visual acuity, 98 (64.90%; 95% CI, 57.00%-72.07%) had improved visual acuity, and 15 (9.93%; 95% CI, 6.01%-15.84%) had decreased visual acuity. IOFB was not found to predict final visual acuity of <20/200 in multivariate analysis when other injury features were known (P = 0.1). Pars plana vitrectomy was completed on 124 eyes (74.70%). Removal of IOFB was performed in 118 eyes (71.08%; average of 31.67 days after initial injury) with a delayed procedure occurring after primary closure and antibiotics owing to a lack of surgical capacity in Iraq and Afghanistan. Retinal detachment occurred in 48 eyes (28.92%) and proliferative vitreoretinopathy in 44 eyes (26.5%).

CONCLUSIONS: IOFBs occur frequently in combat ocular trauma and are significantly associated with more severe injuries. However, IOFBs were not found to be a significant risk factor for visual acuity of <20/200.

J Trauma Acute Care Surg. 2018 Sep;85(3):495-499

Tourniquet use is not associated with limb loss following military lower extremity arterial trauma.

Kauvar D, Miller D, Walters T

BACKGROUND: The effect of battlefield extremity tourniquet (TK) use on limb salvage and long-term complications following vascular repair is unknown. This study explores the influence of TK use on limb outcomes in military lower extremity arterial injury.

METHODS: The study database includes cases of lower extremity vascular injury from 2004 to 2012 with data recorded until discharge from military service. We analyzed all limbs with at least one named arterial injury from the femoral to the tibial level. Tourniquet (TK) and no TK (NTK) groups were identified. Univariate analyses were performed with significance set at $p \leq 0.05$.

RESULTS: A total of 455 cases were included, with 254 (56%) having a TK for a median of 60 minutes (8-270 minutes). Explosive injuries (53%) and gunshot wounds (26%) predominated. No difference between TK and NTK was present in presence of fracture, level of arterial injury, type of arterial repair, or concomitant venous injury. More nerve injuries were present in the TK group, and Abbreviated Injury Scale extremity and Mangled Extremity Severity Score tended toward greater injury severity. Amputation and mortality rates did not differ between groups, but the incidence of severe edema, wound infection, and foot drop was higher in the TK group. Vascular above-knee amputation, arterial repair complication, and severe edema were higher in the TK group also ($p = 0.10$). Tourniquet duration of 60 minutes or longer was not associated with increased amputations, but more rhabdomyolysis was present.

CONCLUSION: Field TK use is associated with wound infection and neurologic compromise but not limb loss. This may be due to a more severe injury profile among TK limbs. Increased TK times may predispose to systemic, but not limb, complications.

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

J Maxillofac Oral Surg. 2018 Jun;17(2):264-265

A Simple and Effective Scalp Tourniquet for Controlling Scalp Hemorrhage.

Khan M, Rai A, Jain A

Quotes:

"We suggest use of sterile surgical glove as a scalp tourniquet which is a simple, less time-consuming technique and provides adequate control of hemorrhage intraoperatively. A sterile glove is cut from its wrist portion (Fig. 1) and is stretched and tied over scalp just above eyebrows, external auricle and just below the external occipital protuberance. The glove is placed over cotton-padded gauge to prevent any injury to underlying tissue. Locking artery forceps is used to hold the stretched glove to maintain adequate pressure (Fig. 2).

We have used this technique in 35 patients, and it successfully provided with hemorrhage control (Fig. 3). The mean time for application of this tourniquet in all cases was 5.68 min, and it can be safely kept for a period of 60–90 min over the scalp during surgery. The advantages of this technique are being inexpensive, simple, less time-consuming, and no additional material or preparation is required. The two main disadvantages of this technique are (a) the pressure applied by the glove cannot be monitored and (b) it cannot be used for surgical procedures performed at the peripheral aspects of scalp."

J Anesth. 2018 Jul 18. doi: 10.1007/s00540-018-2531-7. [Epub ahead of print]

Superior sealing effect of a three-dimensional printed modified supraglottic airway compared with the i-gel in a three-dimensional printed airway model.

Kimijima T, Edanaga M, Yamakage M

PURPOSE: The aim of this study was to compare the force exerted by a three-dimensional (3D) printed modified supraglottic airway (mSGA) vs. that exerted by the i-gel on a 3D printed airway model.

METHODS: After a preliminary experiment in Thiel embalmed cadavers, we created a 3D printed mSGA and five 3D printed airway models based on computed tomography data from five female Japanese patients. We compared the force exerted by the i-gel and mSGA on the larynx of the 3D printed airway models. In addition, tidal volumes with insertion of the airway devices into the 3D printed airway model and administration of different levels of pressure-controlled ventilation (PCV) were compared.

RESULTS: The values below indicate mean values ± SD (p value, 95% confidence interval) for the mSGA and i-gel, respectively. The forces exerted by the cuff parts were as follows: ventral: 12.5 ± 5.4 vs. 20.7 ± 3.7 N (p = 0.0001, - 10.0 to - 6.5), proximal: 1.9 ± 1.4 vs. 1.7 ± 1.3 N (p = 0.322, - 0.26 to 0.74), and dorsal parts: 6.9 ± 2.2 vs. 12.5 ± 4.8 N (p = 0.0001, - 7.9 to - 3.4), respectively. We also found significantly higher tidal volumes with the mSGA under PCV of 10, 15, and 20 cmH2O.

CONCLUSIONS: The method of creating the mSGA that we proposed in this study can be applied to development of novel SGAs that is anatomically more suitable for pharyngolaryngeal structure.

J Trauma Acute Care Surg. 2018 Jul;85(1S Suppl 2):S112-S121

The effect of prehospital transport time, injury severity, and blood transfusion on survival of US military casualties in Iraq.

Kotwal R, Scott L, Janak J, Tarpey B, Howard J, Mazuchowski E, Butler F, Shackelford S, Gurney J, Stockinger Z

BACKGROUND: Reducing time from injury to care can optimize trauma patient outcomes. A previous study of prehospital transport of US military casualties during the Afghanistan conflict demonstrated the importance of time and treatment capability for combat casualty survival.

METHODS: A retrospective descriptive analysis was conducted to analyze battlefield data collected on US military combat casualties during the Iraq conflict from March 19, 2003, to August 31, 2010. All casualties were analyzed by mortality outcome (killed in action, died of wounds, case fatality rate) and compared with Afghanistan conflict. Detailed data for those who underwent prehospital transport were analyzed for effects of transport time, injury severity, and blood transfusion on survival.

RESULTS: For the total population, percent killed in action (16.6% vs. 11.1%), percent died of wounds (5.9% vs. 4.3%), and case fatality rate (10.0 vs. 8.6) were higher for Iraq versus Afghanistan ($p < 0.001$). Among 1,692 casualties (mean New Injury Severity Score, 22.5; mortality, 17.6%) with detailed data, the injury mechanism included 77.7% from explosions and 22.1% from gunshot wounds. For prehospital transport, 67.6% of casualties were transported within 60 minutes, and 32.4% of casualties were transported in greater than 60 minutes. Although 97.0% of deaths occurred in critical casualties (New Injury Severity Score, 25-75), 52.7% of critical casualties survived. Critical casualties were transported more rapidly ($p < 0.01$) and more frequently within 60 minutes ($p < 0.01$) than other casualties. Critical casualties had lower mortality when blood was received ($p < 0.01$). Among critical casualties, blood transfusion was associated with survival irrespective of transport time within or greater than 60 minutes ($p < 0.01$).

CONCLUSION: Although data were limited, early blood transfusion was associated with battlefield survival in Iraq as it was in Afghanistan.

LEVEL OF EVIDENCE: Performance improvement and epidemiological, level IV.

J Trauma Acute Care Surg. 2018 Sep;85(3):603-612

A US military Role 2 forward surgical team database study of combat mortality in Afghanistan.

Kotwal R, Staudt A, Mazuchowski E, Gurney J, Shackelford S, Butler F, Stockinger Z, Holcomb J, Nessen S, Mann-Salinas E

BACKGROUND: Timely and optimal care can reduce mortality among critically injured combat casualties. US military Role 2 surgical teams were deployed to forward positions in Afghanistan on behalf of the battlefield trauma system. They received prehospital casualties, provided early damage control resuscitation and surgery, and rapidly transferred casualties to Role 3 hospitals for definitive care. A database was developed to capture Role 2 data.

METHODS: A retrospective review and descriptive analysis were conducted of battle-injured casualties transported to US Role 2 surgical facilities in Afghanistan from February 2008 to September 2014. Casualties were analyzed by mortality status and location of death (pretransport, intratransport, or posttransport), military affiliation, transport time, injury type and mechanism, combat mortality index-prehospital (CMI-PH), and documented prehospital treatment.

RESULTS: Of 9,557 casualties (median age, 25.0 years; male, 97.4%), most (95.1%) survived to transfer from Role 2 facility care. Military affiliation included US coalition forces (37.4%), Afghanistan National Security Forces (23.8%), civilian/other forces (21.3%), Afghanistan National Police (13.5%), and non-US coalition forces (4.0%). Mortality differed by military affiliation ($p < 0.001$). Among fatalities, most were Afghanistan National Security Forces (30.5%) civilian/other forces (26.0%), or US coalition forces (25.2%). Of those categorized by CMI-PH, 40.0% of critical, 11.2% of severe, 0.8% of moderate, and less than 0.1% of mild casualties died. Most fatalities with CMI-PH were categorized as critical (66.3%) or severe (25.9%), whereas most who lived were mild (56.9%) or moderate (25.4%). Of all fatalities, 14.0% died prehospital (pretransport, 5.8%; intratransport, 8.2%), and 86.0% died at a Role 2 facility (posttransport). Of fatalities with documented transport times (median, 53.0 minutes), most (61.7%) were evacuated within 60 minutes.

CONCLUSIONS: Role 2 surgical team care has been an important early component of the battlefield trauma system in Afghanistan. Combat casualty care must be documented, collected, and analyzed for outcomes and trends to improve performance.

LEVEL OF EVIDENCE: Therapeutic/Care Management, level IV.

Emerg Med Australas. 2018 Jun 11. doi: 10.1111/1742-6723.13114. [Epub ahead of print]

Ketamine use for rapid sequence intubation in Australian and New Zealand emergency departments from 2010 to 2015: A registry study.

Ferguson I, Alkhouri H, Fogg T, Aneman A

OBJECTIVE: This study aimed to quantify the proportion of patients undergoing rapid sequence intubation using ketamine in Australian and New Zealand EDs between 2010 and 2015.

METHODS: The Australian and New Zealand Emergency Department Airway Registry is a multicentre airway registry prospectively capturing data from 43 sites. Data on demographics and physiology, the attending staff and indication for intubation were recorded. The primary outcome was the annual percentage of patients intubated with ketamine. A logistic regression analysis was conducted to evaluate the factors associated with ketamine use.

RESULTS: A total of 4658 patients met inclusion criteria. The annual incidence of ketamine use increased from 5% to 28% over the study period ($P < 0.0001$). In the logistic regression analysis, the presence of an emergency physician as a team leader was the strongest predictor of ketamine use (odds ratio [OR] 1.83, 95% confidence interval [CI] 1.44-2.34). The OR for an increase in one point on the Glasgow Coma Scale was 1.10 (95% CI 1.07-1.12), whereas an increase of 1 mmHg of systolic blood pressure had an OR of 0.98 (95% CI 0.98-0.99). Intubation occurring in a major referral hospital had an OR of 0.68 (95% CI 0.56-0.82), while trauma conferred an OR of 1.38 (95% CI 1.25-1.53).

CONCLUSIONS: Ketamine use increased between 2010 and 2015. Lower systolic blood pressure, the presence of an emergency medicine team leader, trauma and a higher Glasgow Coma Scale were associated with increased odds of ketamine use. Intubation occurring in a major referral centre was associated with lower odds of ketamine use.

J Spec Oper Med. Summer 2018;18(2):36-41.

New and Established Models of Limb Tourniquet Compared in Simulated First Aid.

Kragh JF Jr, Newton NJ, Tan AR, Aden JK 3d, Dubick MA.

BACKGROUND: The performance of a new tourniquet model was compared with that of an established model in simulated first aid.

METHODS: Four users applied the Combat Application Tourniquet (C-A-T), an established model that served as the control tourniquet, and the new SAM Extremity Tourniquet (SXT) model, which was the study tourniquet.

RESULTS: The performance of the C-A-T was better than that of the SXT for seven measured parameters versus two, respectively; metrics were statistically tied 12 times. The degree of difference, when present, was often small. For pretime, a period of uncontrolled bleeding from the start to a time point when the tourniquet first contacts the manikin, the bleeding rate was uncontrolled at approximately 10.4mL/s, and for an overall average of 39 seconds of pretime, 406mL of blood loss was calculated. The mean time to determination of bleeding control (± standard deviation [SD]) was 66 seconds (SXT, 70 ± 30 seconds; C-A-T, 62 ± 18 seconds; $p = .0075$). The mean ease-of-use score was 4 (indicating easy) on a scale of 1 to 5, with 5 indicating very easy (mean ± SD: SXT, 4 ± 1; C-A-T, 5 ± 0; $p < .0001$). C-A-T also performed better for total trial time, manikin damage, blood loss rate, pressure, and composite score. SXT was better for pretime and unwrap time. All users intuitively self-selected the speed at which they applied the tourniquets and that speed was similar in all of the required steps. However, by time segments, one user went slowest in each segment while the other three generally went faster.

CONCLUSIONS: In simulated first aid with tourniquets, better results generally were seen with the C-A-T than with the SXT in terms of performance metrics. However, the degree of difference, when present, was often small.

J Trauma Acute Care Surg. 2018 May 2. doi: 10.1097/TA.0000000000001964. [Epub ahead of print]

Extending the Golden Hour For Zone 1 Reboa: Improved Survival and Reperfusion Injury with Intermittent Versus Continuous Reboa in a Porcine Severe Truncal Hemorrhage Model.

Kuckelman J, Barron M, Moe D, Derickson M, Phillips C, Kononchik J, Lallemand M, Marko S, Eckert M, Martin M

BACKGROUND: Non-compressible hemorrhage can be controlled using resuscitative endovascular occlusion of the aorta (REBOA). Prolonged ischemia limits REBOA application during Zone 1 deployment. Intermittent inflation/deflation may effectively mitigate this problem.

METHODS: A lethal abdominal vascular injury was created in 28 swine. Animals were randomized to controls (n=7), 60min full REBOA (FR, n=5), time-based intermittent REBOA (iRT, n=7), and pressure-based REBOA (iRP, n=9). Intermittent groups had an initial inflation for 15min, followed by 10min inflation: 3min deflation cycles (iRT) or an inflate/deflate schedule based on blood pressure (MAP)<40mmHg (iRP). Experiments were concluded after 120min or death (MAP<20mmHg).

RESULTS: Intermittent REBOA animals all survived to 120min versus 15min for controls and 63min for FR($p<0.001$). After 60min, FR animals were more hypotensive(MAP 20mmHg vs 80mmHg(iRP) and 100mmHg(iRT), $p<0.001$), had lower cardiac output(1.06mL/min vs 5.1L/min(iRP) and 8.2L/min(iRT), $p<0.001$), higher lactate(12.5mg/dL vs 8.5mg/dL(iRP), $p=0.02$), and decreased clot firmness on ROTEM than iRP/T(64mm vs 69mm(iRP) and 69mm(iRT), $p=0.04$). Acidosis was worse in iRT versus iRP at 120min (pH 7.28 vs 7.12, $p=0.02$), improved lactate (11.9mg/dL vs 16.3mg/dL, $p=0.04$), and decreased whole blood resuscitation (452cc vs 646cc, $p=0.05$). Blood loss (clot weight) was higher in controls (2.0kg) versus iRT and iRP(1.16kg and 1.23kg, $p<0.01$) and not different from FR(0.87kg, $p=0.10$).

CONCLUSION: Intermittent REBOA can maintain supraceliac hemorrhage control while decreasing distal ischemia in a swine model. Prolonged survival times, decreased acidosis, and lower resuscitation requirements indicate that this technique could potentially extend Zone 1 REBOA deployment times. Schedules based on MAP may be superior to time-based regimens.

LEVEL OF EVIDENCE: Not applicable as an animal study.

STUDY DESIGN: Original article.

J Trauma Acute Care Surg. 2018 Jul;85(1):91-100

Plasma coadministration improves resuscitation with tranexamic acid or prothrombin complex in a porcine hemorrhagic shock model.

Kuckelman J, Barron M, Moe D, Lallemand M, McClellan J, Marko S, Eckert M, Martin MJ.

BACKGROUND: Traumatic coagulopathy has now been well characterized and carries high rates of mortality owing to bleeding. A 'factor-based' resuscitation strategy using procoagulant drugs and factor concentrates in lieu of plasma is being used by some, but with little evidentiary support. We sought to evaluate and compare resuscitation strategies using combinations of tranexamic acid (TXA), prothrombin complex concentrate (PCC), and fresh frozen plasma (FFP).

METHODS: Sixty adult swine underwent 35% blood volume hemorrhage combined with a truncal ischemia-reperfusion injury to produce uniform shock and coagulopathy. Animals were randomized to control (n = 12), a single-agent group (TXA, n = 10; PCC, n = 8; or FFP, n = 6) or combination groups (TXA-FFP, n = 10; PCC-FFP, n = 8; TXA-PCC, n = 6). Resuscitation was continued to 6 hours. Key outcomes included hemodynamics, laboratory values, and rotational thromboelastometry. Results were compared between all groups, with additional comparisons between FFP and non-FFP groups.

RESULTS: All 60 animals survived to 6 hours. Shock was seen in all animals, with hypotension (mean arterial pressure, 44 mm Hg), tachycardia (heart rate, 145), acidosis (pH 7.18; lactate, 11), anemia (hematocrit, 17), and coagulopathy (fibrinogen, 107). There were clear differences between groups for mean pH ($p = 0.02$), international normalized ratio ($p < 0.01$), clotting time (CT; $p < 0.01$), lactate ($p = 0.01$), creatinine ($p < 0.01$), and fibrinogen ($p = 0.02$). Fresh frozen plasma groups had significantly improved resuscitation and clotting parameters (Figures), with lower lactate at 6.5 versus 8.4 ($p = 0.04$), and increased fibrinogen at 126 versus 95 ($p < 0.01$). Rotational thromboelastometry also demonstrated shortened CT at 60 seconds in the FFP group vs 65 seconds in the non-FFP group ($p = 0.04$).

CONCLUSION: When used to correct traumatic coagulopathy, combinations of FFP with TXA or PCC were superior in improving acidosis, coagulopathy, and CT than when these agents are given alone or in combination without plasma. Further validation of pure factor-based strategies is needed.

Wilderness Environ Med. 2018 Jun;29(2):266-274

Challenges of Military Health Service Support in Mountain Warfare.

Lechner R, Küpper T, Tannheimer M

INTRODUCTION: History is full of examples of the influence of the mountain environment on warfare. The aim of this article is to identify the main environmental hazards and summarize countermeasures to mitigate the impact of this unique environment.

METHODS: A selective PubMed and Internet search was conducted. Additionally, we searched bibliographies for useful supplemental literature and included the recommendations of the leading mountain medicine and wilderness medicine societies.

RESULTS: A definition of mountain warfare mainly derived from environmental influences on body functions is introduced to help identify the main environmental hazards. Cold, rugged terrain, hypoxic exposure, and often a combination and mutual aggravation of these factors are the most important environmental factors of mountain environment. Underestimating this environmental influence has decreased combat strength and caused thousands of casualties during past conflicts. Some marked differences between military and civilian mountaineering further complicate mission planning and operational sustainability.

CONCLUSIONS: To overcome the restrictions of mountain environments, proper planning and preparation, including sustained mountain mobility training, in-depth mountain medicine training with a special emphasize on prolonged field care, knowledge of acclimatization strategies, adapted time calculations, mountain-specific equipment, air rescue strategies and makeshift evacuation strategies, and thorough personnel selection, are vital to guarantee the best possible medical support. The specifics of managing risks in mountain environments are also critical for civilian rescue missions and humanitarian aid.

JAMA Pediatr. 2018 May 1;172(5):491-492. doi: 10.1001/jamapediatrics.2017.5238.

Use of Uncrossmatched Cold-Stored Whole Blood in Injured Children With Hemorrhagic Shock.

Leeper CM, Yazer M, Cladis F, Saladino R, Triulzi D, Gaines B

Quotes:

"Hemorrhagic shock is the most common cause of preventable death in pediatric civilian trauma.1 Balanced resuscitation with blood components has become the standard of care for initial hemostatic resuscitation in adults and children2-4 to mitigate the deleterious effects of trauma-induced coagulopathy.5 Whole blood (WB) contains plasma, red blood cells (RBCs), and platelets and requires less processing and dilution compared with reconstituting WB using components, making it an ideal resuscitative fluid. However, in non–group O recipients, there is a theoretical risk for hemolysis from anti-A and anti-B antibodies in group O WBunits. Recently, the transfusion of WB in bleeding adult male trauma patients has been instituted in a large adult trauma center.6 Whole blood has never been transfused in a pediatric civilian trauma population; the novel use of transfusion of WB in injured children is herein described."

"Discussion | To our knowledge, this is the first cohort of pediatric civilian trauma patients to receive WB during resuscitation. These preliminary data suggest that WB transfusion of up to 20 mL/kg is safe in children with severe injuries; there was no evidence of hemolysis in non–group O recipients, and no transfusion reactions were reported. Based on these data, the transfusion committee of Children's Hospital of Pittsburgh of the University of Pittsburgh Medical Center approved an increase in maximum volume of WB transfusion to 30 mL/kg. Larger cohorts are necessary for further study to determine if WB administration will affect outcomes, including number of donor exposures, cost, total volume transfused, and mortality."

Emerg Med J. 2018 Sep;35(9):564-570

Comparison of the performance of battery-operated fluid warmers.

Lehavi A, Yitzhak A, Jarassy R, Heizler R, Katz Y, Raz A

OBJECTIVES: Warming intravenous fluids is essential to prevent hypothermia in patients with trauma, especially when large volumes are administered. Prehospital and transport settings require fluid warmers to be small, energy efficient and independent of external power supply. We compared the warming properties and resistance to flow of currently available battery-operated fluid warmers.

METHODS: Fluid warming was evaluated at 50, 100 and 200 mL/min at a constant input temperature of 20°C and 10°C using a cardiopulmonary bypass roller pump and cooler. Output temperature was continuously recorded.

RESULTS: Performance of fluid warmers varied with flows and input temperatures. At an input temperature of 20°C and flow of 50 mL/min, the Buddy Lite, enFlow, Thermal Angel and Warrior warmed 3.4, 2.4, 1 and 3.6 L to over 35°C, respectively. However, at an input temperature of 10°C and flow of 200 mL/min, the Buddy Lite failed to warm, the enFlow warmed 3.3 L to 25.7°C, the Thermal Angel warmed 1.5 L to 20.9°C and the Warrior warmed 3.4 L to 34.4°C ($p<0.0001$).

CONCLUSION: We found significant differences between the fluid warmers: the use of the Buddy Lite should be limited to moderate input temperature and low flow rates. The use of the Thermal Angel is limited to low volumes due to battery capacity and low output temperature at extreme conditions. The Warrior provides the best warming performance at high infusion rates, as well as low input temperatures, and was able to warm the largest volumes in these conditions.

J Emerg Trauma Shock. 2018 Jan-Mar;11(1):15-24

7.5% NaCl Resuscitation Leads to Abnormal Clot Fibrinolysis after Severe Hemorrhagic Shock and its Correction with 7.5% NaCl Adenosine, Lidocaine, and Mg2.

Letson H, Dobson G

Background: Hyperfibrinolysis is a common complication of hemorrhagic shock. Our aim was to examine the effect of small-volume 7.5% NaCl adenosine, lidocaine, and Mg2+ (ALM) on fibrinolysis in the rat model of hemorrhagic shock.

Methods: Rats were anesthetized and randomly assigned to one of four groups: (1) baseline, (2) shock, (3) 7.5% NaCl controls, and (4) 7.5% NaCl ALM. Animals were bled for 20 min (42% blood loss) and left in shock for 60 min before resuscitation with 0.3 ml intravenous bolus 7.5% NaCl ± ALM. Rats were sacrificed at 5, 10, 15, 30, and 60 min for rotation thromboelastometry and 15 and 60 min for ELISA analyses.

Results: After hemorrhagic shock, 7.5% NaCl failed to resuscitate and exacerbated coagulopathy and fibrinolysis. At 15 and 60 min, the activation as extrinsically-activated test using tissue factor (EXTEM) with aprotinin to inhibit fibrinolysis (APTEM) test showed little or no correction of fibrinolysis, indicating a plasmin-independent fibrinolysis. Clots also had ~ 60% lower fibrinogen (fibrin-based EXTEM activated test with platelet inhibitor cytochalasin D A10) and 36%-50% reduced fibrinogen-to-platelet ratio (11%-14% vs. 22% baseline). In contrast, 7.5% NaCl ALM resuscitated mean arterial pressure and attenuated hyperfibrinolysis and coagulopathy by 15 min. Correction was associated with lower plasma tissue factor, higher plasminogen activator inhibitor-1, and lower D-dimers (5% of controls at 60 min). Platelet selectin fell to undetectable levels in ALM animals, which may imply improved endothelial and platelet function during resuscitation.

Conclusions: Small-volume 7.5% NaCl resuscitation exacerbated coagulopathy and fibrinolysis that was not corrected by APTEM test. Fibrinolysis appears to be associated with altered fibrin structure during early clot formation and elongation. In contrast, 7.5% NaCl ALM rapidly corrected both coagulopathy and hyperfibrinolysis.

Transfus Med Hemother. 2018 Apr;45(2):127-135Nov 15.

Peripartum Haemorrhage: Haemostatic Aspects of the New German PPH Guideline.

Lier H, von Heymann C, Korte W, Schlembach D

ABSTRACT:
Peripartum haemorrhage remains one of the main causes of maternal mortality world-wide. The German, Austrian and Swiss Societies of Gynaecology and Obstetrics have updated the current guidelines for the treatment of peripartum haemorrhage together with the German Society of Anaesthesiology and Intensive Care Medicine and the Society of Thrombosis and Haemostasis Research. The recommendations have been the result of a thorough review of the available scientific literature and a consensus process involving all members of the guideline group. A key element of the anaesthesiological and haemostatic management is the development of a multidisciplinary standard operating procedure combining surgical as well as medical and haemostatic treatments depending on the severity of bleeding. The guideline underscores the value of clinical and laboratory diagnostics of peripartum haemorrhage as early as possible, even pre-emptively. This allows for an early identification of causes of bleeding and a specific treatment. The guideline comprises evidence-based recommendations for the use of uterotonics, tranexamic acid and blood products such as factor concentrates, fresh frozen plasma, platelet concentrates, packed red blood cells, recombinant activated factor VII and desmopressin. In addition, recommendations for blood conservation strategies involving the use of cell salvage, permissive hypotension and transfusion triggers are given.

Emerg Med J. 2018 Aug;35(8):516-521

Improvised first aid techniques for terrorist attacks.

Loftus A, Pynn H, Parker P

ABSTRACT:
Terrorist acts occur every day around the world. Healthcare professionals are often present as bystander survivors in these situations, with none of the equipment or infrastructure they rely on in their day-to-day practice. Within several countries there has been a move to disseminate the actions to take in the event of such attacks: in the UK, Run, Hide, Tell, and in the USA, Fight Back This paper outlines how a very basic medical knowledge combined with everyday high-street items can render highly effective first aid and save lives. We discuss and summarise modern improvised techniques. These include the C-ABCDE approach of treating catastrophic haemorrhage before airway management, bringing together improvised techniques from the military and wilderness medicine. We explain how improvised tourniquets, wound dressings, splinting and traction devices can be fabricated using items from the high street: nappies, tampons, cling film, duct tape and tablecloths. Cervical spine immobilisation is a labour-intensive protocol that is often practised defensively. With little evidence to support the routine use of triple immobilisation, this should be replaced with a common sense dynamic approach such as the Montana neck brace. Acid or alkali attacks are also examined with simple pragmatic advice. Analgesia is discussed in the context of a prehospital setting. Pharmacy-obtained oral morphine and diclofenac suppositories can be used to treat moderate pain without relying on equipment for intravenous/intraosseous infusion in prolonged hold situations. The differentiation between concealment and cover is summarised: scene safety remains paramount.

Mil Med. 2018 Jun 19. doi: 10.1093/milmed/usy144. [Epub ahead of print]

Non-Conventional Utilization of the Aintree Intubating Catheter to Facilitate Exchangen Between Three Supraglottic Airways and an Endotracheal Tube: A Cadaveric Trial.

Lopez N, McCoy S, Carroll C, Jones E, Miller J

Background: Two studies by Bledsoe et al and Anand et al reported limited efficacy of the Supraglottic Airway Laryngeal Tube (SALT), which is a supraglottic airway (SGA) specifically designed for blind endotracheal intubation. Miller et al reported a 50% success rate using an Eschmann introducer as an adjunct for blind airway exchange via the laryngeal mask airway (LMA) classic. Another study by Ueki et al found that endotracheal tube (ETT) intubation was faster and less damaging to the airway when the Aintree intubating catheter was used in conjunction with a fiberoptic bronchoscope. To date there are no studies utilizing the King laryngeal tube (LT) for blind airway exchange were found.

Methods: This was a prospective crossover study. Participants were recruited from a group of active duty emergency department medical personnel participating in a cadaver training lab. Researchers pre-placed SGA devices in six cadavers with grade I/II airways. Participants attempted airway exchange with each SGA for 2 minutes. The order of SGA devices was alternated for each successive participant. Participants rated the ease or difficulty of placement for each SGA. Success of airway exchange was defined as proper placement of the ETT in the trachea and was confirmed by the same emergency medicine physician via direct laryngoscopy throughout the entire study.

Results: Forty-four emergency department personnel participated in the study. Pairwise McNemar's tests revealed a significantly higher success rate for the LMA unique (LMAU) compared with the King LT ($p = 0.039$) and a significantly higher success rate for the i-gel compared to both the LMAU ($p = 0.007$) and the King LT ($p < 0.001$). Pairwise McNemar's tests also indicated that failure due to placement errors was significantly less prevalent and failure due to running over time was significantly more prevalent with the King LT compared to the i-gel ($p = 0.004$) and the LMAU ($p = 0.002$). There was no significant relationship between blind airway exchange success rates and prior intubation experience.

Conclusion: Considering success rate, ease of use and price, the i-gel was found superior to the King LT and the LMAU for blind airway exchange with an ETT when using an Aintree intubating catheter as an introducer.

J Bone Jt Infect. 2018 May 28;3(2):104-107

The use of Tranexamic Acid in Total Elbow Replacement to Reduce Post-Operative Wound Infection.

Mannan S, Ali M, Mazur L, Chin M, Fadulelmola A

BACKGROUND: Incidence of infection following total elbow replacement (TER) is recognised to be higher compared to hip or knee arthroplasty. Extensive swelling following TER can complicate the wound healing which might lead to infection. Tranexamic Acid (TXA) is proven to reduce blood loss peri-operatively which might contribute to better healing outcomes. Our aim is to assess the effect of TXA in wound healing following TER. Methods: A retrospective review of a single surgeon case series. 10 patients had TER mainly for complicated elbow fractures, four of them were relatively immune-suppressed. All patients had 2 grams of TXA and antibiotics intra-operatively. All were reviewed at two weeks following surgery for wound check and removal of surgical clips.

RESULTS: Seven females and three males with a mean age of 81.5 had TER and TXA. The mean level of pre-operative haemoglobin was 134.40 g/l and the mean post-operative level was 122.70g/l. No patient in this series required blood transfusion. At two weeks and six weeks follow-up, all wound healed up with no signs of infection.

CONCLUSION: TXA has been proven to be safe an effective way of reducing peri-operative bleeding. TXA maintains haemostasis after releasing the tourniquet and therefore reduces the swelling and wound complications post-operatively.

J Trauma Acute Care Surg. 2018 Sep;85(3):626-634

A meta-analysis of the incidence of complications associated with groin access after the use of resuscitative endovascular balloon occlusion of the aorta in trauma patients.

Manzano-Nunez R, Orlas C, Herrera-Escobar J, Galvagno S, DuBose J, Melendez J, Serna JJ Salcedo A, Peña C, Angamarca E, Horer T, Salazar C, Lopez-Castilla V, Ruiz-Yucuma J, Rodriguez F, Parra M, Ordoñez C

BACKGROUND: Serious complications related to groin access have been reported with the use of resuscitative endovascular balloon occlusion of the aorta (REBOA). We performed a systematic review and meta-analysis to estimate the incidence of complications related to groin access from the use of REBOA in adult trauma patients.

METHODS: We identified articles in MEDLINE and EMBASE. We reviewed all studies that involved adult trauma patients who underwent the placement of a REBOA and included only those that reported the incidence of complications related to groin access. A meta-analysis of proportions was performed.

RESULTS: We identified 13 studies with a total of 424 patients. REBOA was inserted most commonly by trauma surgeons or emergency room physicians. Information regarding puncture technique was reported in 12 studies and was available for a total of 414 patients. Percutaneous access and surgical cutdown were performed in 304 (73.4%) and 110 (26.5%) patients, respectively. Overall, complications related to groin access occurred in 5.6% of patients (n = 24/424). Lower limb amputation was required in 2.1% of patients (9/424), of which three cases (3/424 [0.7%]) were directly related to the vascular puncture from the REBOA insertion. A meta-analysis that used the logit transformation showed a 5% (95% CI 3%-9%) incidence of complications without significant heterogeneity (LR test: $\chi = 0.73$, $p = 0.2$, Tau-square = 0.2). In a second meta-analysis, we used the Freeman-Tukey double arcsine transformation and found an incidence of complications of 4% (95% CI 2%-7%) with low heterogeneity ($I = 16.3\%$).

CONCLUSION: We found that the incidence of complications related to groin access was of 4-5% based on a meta-analysis of 13 studies published worldwide. Currently, there are no benchmarks or quality measures as a reference to compare, and thus, further work is required to identify these benchmarks and improve the practice of REBOA in trauma surgery.

LEVEL OF EVIDENCE: Systematic review and meta-analysis, level III.

J Trauma Acute Care Surg. 2018 Sep;85(3):620-625

Outcomes following trauma laparotomy for hypotensive trauma patients: A UK military and civilian perspective.

Marsden M, Carden R, Navaratne L, Smith I, Penn-Barwell J, Kraven L, Brohi K, Tai N, Bowley D

BACKGROUND: The management of trauma patients has changed radically in the last decade, and studies have shown overall improvements in survival. However, reduction in mortality for the many may obscure a lack of progress in some high-risk patients. We sought to examine the outcomes for hypotensive patients requiring laparotomy in UK military and civilian cohorts.

METHODS: We undertook a review of two prospectively maintained trauma databases: the UK Joint Theatre Trauma Registry for the military cohort (February 4, 2003, to September 21, 2014) and the trauma registry of the Royal London Hospital major trauma center (January 1, 2012, to January 1, 2017) for civilian patients. Adults undergoing trauma laparotomy within 90 minutes of arrival at the emergency department (ED) were included.

RESULTS: Hypotension was present on arrival at the ED in 155 (20.4%) of 761military patients. Mortality was higher in hypotensive casualties (25.8% vs. 9.7% in normotensive casualties; $p < 0.001$). Hypotension was present on arrival at the ED in 63 (35.7%) of 176 civilian patients. Mortality was higher in hypotensive patients (47.6% vs. 12.4% in normotensive patients; $p < 0.001$). In both cohorts of hypotensive patients, neither the average injury severity, the prehospital time, the ED arrival systolic blood pressure, nor mortality rate changed significantly during the study period.

CONCLUSIONS: Despite improvements in survival after trauma for patients overall, the mortality for patients undergoing laparotomy who arrive at the ED with hypotension has not changed and appears stubbornly resistant to all efforts. Specific enquiry and research should continue to be directed at this high-risk group of patients.

LEVEL OF EVIDENCE: Prognostic/Epidemiologic, level IV.

J Trauma Acute Care Surg. 2018 Sep;85(3):507-511

Early arterial access for resuscitative endovascular balloon occlusion of the aorta is related to survival outcome in trauma.

Matsumura Y, Matsumoto J, Kondo H, Idoguchi K, Ishida T, Okada Y, Kon Y, OkanK, Ishida K, Toyoda Y, Funabiki T; DIRECT-IABO Investigators.

BACKGROUND: Resuscitative endovascular balloon occlusion of the aorta (REBOA) has been used in refractory hemorrhagic shock patients. Since the optimal timing of arterial access remains unclear, we evaluated the preocclusion status of patients, and elapsed time from the arrival to the hospital is associated with the survival outcomes in the REBOA patients.

METHODS: From August 2011 to December 2016, The Diagnostic and Interventional Radiology in Emergency, Critical care and Trauma-Intra-Aortic Balloon Occlusion (DIRECT-IABO) investigators registered refractory hemorrhagic shock patients undergoing REBOA from 23 hospitals in Japan. Patient characteristics, mechanism of injury, Injury Severity Score (ISS), preocclusion and postocclusion systolic blood pressure, duration of aortic occlusion, clinical time course, and survival outcome were recorded and analyzed. Binary logistic regression analysis was used with mortality and Kaplan-Meier survival analysis was conducted to demonstrate the difference between early and delayed access groups.

RESULTS: Among the enrolled 207 cases, the following patients were excluded from the analysis: five since they were younger than 18 years, nine due to failed attempts at REBOA, 51 nontrauma patients, and 33 who received resuscitative thoracotomy plus REBOA. Thus, the remaining 109 cases were analyzed (30-day survivors, n = 60; nonsurvivors, n = 49). The preocclusion systolic blood pressure was higher, and both hospital arrival to initial arterial access and duration of occlusion were shorter in the survivors. Lower ISS (odds ratio, 0.944; 95% confidence interval, 0.907-0.982; p = 0.0039) and shorter arrival to access (odds ratio, 0.989; 95% confidence interval, 0.979-0.999; p = 0.034) were significantly associated with 30-day survival in the logistic regression analysis. The cutoff point of 21.5 minutes was used in the receiver operating characteristic analysis. The early access group showed a significantly shorter time of arrival to definitive hemostasis and also demonstrated a significantly higher survival in the Kaplan-Meier survival analysis (p = 0.014, Log-rank test).

CONCLUSION: The arrival to access time and ISS were significantly associated with mortality in the REBOA patients in Japan. The early access group demonstrated better survival. The proactive early access in the resuscitation phase might be related to better patient outcomes.

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

J Trauma Acute Care Surg. 2018 Jun;84(6S Suppl 1):S115-S119

Prehospital low-titer cold-stored whole blood: Philosophy for ubiquitous utilization of O-positive product for emergency use in hemorrhage due to injury.

McGinity A, Zhu C, Greebon L, Xenakis E, Waltman E, Epley E, Cobb D, Jonas R, Nicholson S, Eastridge B, Stewart R, Jenkins D

ABSTRACT:
The mortality from hemorrhage in trauma patients remains high. Early balanced resuscitation improves survival. These truths, balanced with the availability of local resources and our goals for positive regional impact, were the foundation for the development of our prehospital whole blood initiative-using low-titer cold-stored O RhD-positive whole blood. The main concern with use of RhD-positive blood is the potential development of isoimmunization in RhD-negative patients. We used our retrospective massive transfusion protocol (MTP) data to analyze the anticipated risk of this change in practice. In 30 months, of 124 total MTP patients, only one female of childbearing age that received an MTP was RhD-negative. With the risk of isoimmunization very low and the benefit of increased resources for the early administration of balanced resuscitation high, we determined that the utilization of low-titer cold-stored O RhD-positive whole blood would be safe and best serve our community.

Turk J Emerg Med. 2018 Mar 9;18(1):15-19

Use of the iTClamp versus standard suturing techniques for securing chest tubes: A randomized controlled cadaver study.

Mckee J, Mckee I Bouclin M, Ball C, McBeth P, Roberts D, Atkinson I, Filips D, Kirkpatrick A

Objectives: Tube thoracostomy (TT) is a common yet potentially life-saving trauma procedure. After successful placement however, securing a TT through suturing is a skillset that requires practice, risking that the TT may become dislodged during prehospital transport. The purpose of this study was to examine if the iTClamp was a simpler technique with equivalent effectiveness for securing TTs.

Materials and methods: In a cadaver model, a 1.5 inch incision was utilized along the upper border of the rib below the 5th intercostal space at the anterior axillary line. TTs (sizes 28Fr, 32Fr, 36Fr and 40Fr) were inserted and secured with both suturing and iTClamp techniques according to the preset randomization. TT were then functionally tested for positive and negative pressure as well as the force required to remove the TT (pull test-up to 5 lbs). Time to secure the TT was also recorded.

Results: When sutured is placed by a trained surgeon, the sutures and iTClamp were functionally equivalent for holding a positive and negative pressure. Mean pull force for both sutures and iTClamp exceeded the 5 lb threshold; there was no significant difference between the groups. Securing the TT with the iTClamp was significantly faster ($p < 0.0001$) with the iTClamp having a mean application time of 37.0 ± 22.8 s and using a suture had a man application time of 96.3 ± 29.0 s.

Conclusion: The iTClamp was effective in securing TTs. The main benefit to the iTClamp is that minimal skill is required to adequately secure a TT to ensure that it does not become dislodged during transport to a trauma center.

J Spec Oper Med. 2018 Fall;18(3):39-44.

Worldwide Case Reports Using the iTClamp for External Hemorrhage Control.

McKee J, Kirkpatrick A, Bennett B, Jenkins D, Logsetty S, Holcomb J

BACKGROUND: Historically, hemorrhage control strategies consisted of manual pressure, pressure dressings, gauze with or without hemostatic ingredients for wound packing, or the use of tourniquets. The iTClamp is a relatively new alternative to stop external bleeding.

METHODS: An anonymous survey was used to evaluate the outcomes of the iTClamp in worldwide cases of external bleeding.

RESULTS: A total of 245 evaluable applications were reported. The iTClamp stopped the bleeding in 81% (n = 198) of the cases. Inadequate bleeding control was documented in 8% (n = 20) and in the remaining 11% (n = 27), bleeding control was not reported. The top three anatomic body regions for iTClamp application were the scalp, 37% (n = 91); arm, 20% (n = 49); and leg, 19% (n = 46). In 26% of the reported cases (direct pressure [23% (n = 63)] and tourniquets [3% (n = 8]), other techniques were abandoned in favor of the iTClamp. Conversely, the iTClamp was abandoned in favor of direct pressure 11 times (4.4%) and abandoned in favor of a tourniquet three times (1%).

CONCLUSION: The iTClamp appears to be a fast and reliable device to stop external bleeding. Because of its function and possible applications, it has potential to lessen the gap between and add to the present selection of devices for treatment of external bleeding.

Int J Surg. 2018 Aug;56:315-319

Steering the wheel towards the standard of care: Proposal of a step-by-step ultrasound-guided emergency chest tube drainage and literature review.

Menegozzo C, Utiyama E

BACKGROUND: Chest tube drainage is a common procedure performed by physicians in the emergency setting. Complications may arise in up to 25% of the cases. These vary from drain misplacement to lethal iatrogenic injuries. Ultrasound provides adequate visualization and correct identification of the insertion site, allows the exclusion of a vulnerable intercostal artery, and enables timely diagnosis of drain malpositioning. Although feasible, ultrasound-guided techniques are underused and seldom applied during chest drainage. One reason for that is the lack of a comprehensive step-by-step description incorporating these techniques. This article aims to describe a standardized ultrasound-guided chest tube drainage technique, and also review the evidence supporting its potential benefits.

MATERIALS AND METHODS: we conducted a thorough literature search on ultrasound techniques regarding the identification of the diaphragm, the neurovascular intercostal bundle, and the position of the chest drain. Also, we analyzed published articles about complications of chest drainage.

RESULTS: we propose a feasible step-by-step ultrasound-guided technique of chest drainage and discuss why this technique should be incorporated in the routine practice.

CONCLUSION: ultrasound guidance should be incorporated in chest drainage in a stepwise fashion. Although intuitively safer, future randomized studies are warranted to support this technique.

Lancet. 2018 Jul 28;392(10144):283-291

Plasma-first resuscitation to treat haemorrhagic shock during emergency groundntransportation in an urban area: a randomised trial.

Moore H, Moore E, Chapman M, McVaney K, Bryskiewicz G, Blechar R, Chin T, Burlew C, Pieracci F, West F, Fleming C, Ghasabyan A, Chandler J, Silliman C, Banerjee A, Sauaia A

BACKGROUND: Plasma is integral to haemostatic resuscitation after injury, but the timing of administration remains controversial. Anticipating approval of lyophilised plasma by the US Food and Drug Administration, the US Department of Defense funded trials of prehospital plasma resuscitation. We investigated use of prehospital plasma during rapid ground rescue of patients with haemorrhagic shock before arrival at an urban level 1 trauma centre.

METHODS: The Control of Major Bleeding After Trauma Trial was a pragmatic, randomised, single-centre trial done at the Denver Health Medical Center (DHMC), which houses the paramedic division for Denver city. Consecutive trauma patients in haemorrhagic shock (defined as systolic blood pressure [SBP] ≤70 mm Hg or 71-90 mm Hg plus heart rate ≥108 beats per min) were assessed for eligibility at the scene of the injury by trained paramedics. Eligible patients were randomly assigned to receive plasma or normal saline (control). Randomisation was achieved by preloading all ambulances with sealed coolers at the start of each shift. Coolers were randomly assigned to groups 1:1 in blocks of 20 according to a schedule generated by the research coordinators. If the coolers contained two units of frozen plasma, they were defrosted in the ambulance and the infusion started. If the coolers contained a dummy load of frozen water, this indicated allocation to the control group and saline was infused. The primary endpoint was mortality within 28 days of injury. Analyses were done in the as-treated population and by intention to treat. This trial is registered with ClinicalTrials.gov, number NCT01838863.

FINDINGS: From April 1, 2014, to March 31, 2017, paramedics randomly assigned 144 patients to study groups. The as-treated analysis included 125 eligible patients, 65 received plasma and 60 received saline. Median age was 33 years (IQR 25-47) and median New Injury Severity Score was 27 (10-38). 70 (56%) patients required blood transfusions within 6 h of injury. The groups were similar at baseline and had similar transport times (plasma group median 19 min [IQR 16-23] vs control 16 min [14-22]). The groups did not differ in mortality at 28 days (15% in the plasma group vs 10% in the control group, p=0·37). In the intention-to-treat analysis, we saw no significant differences between the groups in safety outcomes and adverse events. Due to the consistent lack of differences in the analyses, the study was stopped for futility after 144 of 150 planned enrolments.

INTERPRETATION: During rapid ground rescue to an urban level 1 trauma centre, use of prehospital plasma was not associated with survival benefit. Blood products might be beneficial in settings with longer transport times, but the financial burden would not be justified in an urban environment with short distances to mature trauma centres.

FUNDING: US Department of Defense.

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Intravenous subdissociative-dose ketamine versus morphine for acute geriatric pain in the Emergency Department: A randomized controlled trial.

Motov S, Mann S, Drapkin J, Butt M, Likourezos A, Yetter E, Brady J, Rothberger N, Gohel A, Flom P, Mai M, Fromm C, Marshall J

STUDY OBJECTIVE: We compare the analgesic efficacy and safety of subdissociative intravenous-dose ketamine (SDK) versus morphine in geriatric Emergency Department (ED) patients.

METHODS: This was a prospective, randomized, double-blind trial evaluating ED patients aged 65 and older experiencing moderate to severe acute abdominal, flank, musculoskeletal, or malignant pain. Patients were randomized to receive SDK at 0.3 mg/kg or morphine at 0.1 mg/kg by short intravenous infusion over 15 min. Evaluations occurred at 15, 30, 60, 90, and 120 min. Primary outcome was reduction in pain at 30 min. Secondary outcomes included overall rates of adverse effects and incidence of rescue analgesia.

RESULTS: Thirty patients per group were enrolled in the study. The primary change in mean pain scores was not significantly different in the ketamine and morphine groups: 9.0 versus 8.4 at baseline (mean difference 0.6; 95% CI -0.30 to 1.43) and 4.2 versus 4.4 at 30 min (mean difference -0.2; 95% CI -1.93 to1.46). Patients in the SDK group reported higher rates of psychoperceptual adverse effects at 15, 30, and 60 min post drug administration. Two patients in the ketamine group and one in the morphine group experienced brief desaturation episodes. There were no statistically significant differences with respect to changes in vital signs and need for rescue medication.

CONCLUSION: SDK administered at 0.3 mg/kg over 15 min provides analgesic efficacy comparable to morphine for short-term treatment of acute pain in the geriatric ED patients but results in higher rates of psychoperceptual adverse effects.

ClinicalTrials.gov Registration #: NCT02673372.

BMJ Open. 2018 Jan 23;8(1):e019627. doi: 10.1136/bmjopen-2017-019627.

What fluids are given during air ambulance treatment of patients with trauma in the UK, and what might this mean for the future? Results from the RESCUER observational cohort study.

Naumann D, Hancox J, Raitt J, Smith I, Crombie N, Doughty H, Perkins G, Midwinter M; RESCUER Collaborators.

Collaborators: Evans D, Conway J, Leech C, Lewis S, Church N, Mickwitz C, Pountney A, Bell F, Shewan J, Hyde P, Eddie M, Walker M, Hindson R, Wilson A, Elms S, Hood C, Blackham J, Grier S, Brown V, Irwin R, Clarke N, Corfield A, Cadman A, Evans D, Conway J, Leech C, Lewis S, Church N, Mickwitz C, Pountney A, Bell F, Shewan J, Hyde P, Eddie M, Walker M, Hindson R, Wilson A, Elms S, Hood C, Blackham J, Grier S, Brown V, Irwin R, Clarke N, Corfield A, Cadman A.

OBJECTIVES: We investigated how often intravenous fluids have been delivered during physician-led prehospital treatment of patients with hypotensive trauma in the UK and which fluids were given. These data were used to estimate the potential national requirement for prehospital blood products (PHBP) if evidence from ongoing trials were to report clinical superiority.

SETTING: The Regional Exploration of Standard Care during Evacuation Resuscitation (RESCUER) retrospective observational study was a collaboration between 11 UK air ambulance services. Each was invited to provide up to 5 years of data and total number of taskings during the same period.

PARTICIPANTS: Patients with hypotensive trauma (systolic blood pressure <90 mm Hg or absent radial pulse) attended by a doctor.

PRIMARY AND SECONDARY OUTCOME MEASURES: The primary outcome was the number of patients with hypotensive trauma given prehospital fluids. Secondary outcomes were types and volumes of fluids. These data were combined with published data to estimate potential national eligibility for PHBP.

RESULTS: Of 29 037 taskings, 729 (2.5%) were for patients with hypotensive trauma attended by a physician. Half were aged 21-50 years; 73.4% were male. A total of 537 out of 729 (73.7%) were given fluids. Five hundred and ten patients were given a single type of fluid; 27 received >1 type. The most common fluid was 0.9% saline, given to 486/537 (90.5%) of patients who received fluids, at a median volume of 750 (IQR 300-1500) mL. Three per cent of patients received PHBP. Estimated projections for patients eligible for PHBP at these 11 services and in the whole UK were 313 and 794 patients per year, respectively.

CONCLUSIONS: One in 40 air ambulance taskings were manned by physicians to retrieve patients with hypotensive trauma. The most common fluid delivered was 0.9% saline. If evidence justifies universal provision of PHBP, approximately 800 patients/year would be eligible in the UK, based on our data combined with others published. Prospective investigations are required to confirm or adjust these estimations.

J Trauma Acute Care Surg. 2018 Jul 17. doi: 10.1097/TA.0000000000002027. [Epub ahead of print]

Design and Implementation of the Western Pennsylvania Regional Stop The Bleed Initiative.

Neal M, Reynolds B, Bertoty D, Murray K, Peitzman A, Forsythe R

BACKGROUND: Hemorrhage is the leading cause of preventable death in trauma, and nearly 40% of prehospital deaths can be attributable to blood loss. The Stop The Bleed program provides a structured curriculum for teaching hemorrhage control and the use of bleeding control kits. In order to overcome implementation barriers and to achieve the goal of making education on bleeding control as common as cardiopulmonary resuscitation, widespread implementation with outreach to the public and law enforcement is necessary.

METHODS: We provide a description and analysis of the implementation of a regional Stop The Bleed program which includes a step-by-step guide to the design of this program provided as a template to guide attempts at largescale Stop The Bleed program development.

RESULTS: Combining the efforts of regional trauma and non-trauma centers as a hub-and-spoke design, a region covering four states, 72 counties, and 30,000 square miles was targeted. 27,291 individuals were trained in a 21 month period including 3,172 trainers, 19,310 lay public, and 4,809 law enforcement officers. A total of 436 bleeding control kits were distributed to 102 public schools, and tourniquets were provided to 4,809 law enforcement officers. Program development and community outreach resulted in official recognition of the program by the Pennsylvania State Senate.

CONCLUSIONS: Utilizing a multi-center outreach program design with emphasis on law enforcement and public education while developing a train-the-trainer program, widespread and rapid dissemination of Stop The Bleed teaching is feasible. The general steps described in this manuscript may serve as a template for new or developing programs in other areas to increase the national exposure to Stop The Bleed.

LEVEL OF EVIDENCE: IV STUDY TYPE: economic/decision.

J Trauma Acute Care Surg. 2018 Jul;85(1S Suppl 2):S4-S12

Unrealized potential of the US military battlefield trauma system: DOW rate is higher in Iraq and Afghanistan than in Vietnam, but CFR and KIA rate are lower.

Nessen S, Gurney J, Rasmussen T, Cap A, Mann-Salinas E, Le T, Shackelford S, Remick K, Akers K, Eastridge B, Jenkins D, Stockinger Z, Murray C, Gross K, Seery J, Mabry R, Holcomb J

Quote:

"CONCLUSION: The CFR and %KIA achieved during Afghanistan and Iraq were improved compared to Vietnam and improved during the recent conflicts. The %DOW in Iraq and Afghanistan is higher than in Vietnam. While summary statistics are dependent on multiple medical and non-medical confounders, the increase of % DOW compared to Vietnam as well as the increase in % DOW over time in Iraq is concerning and warrants further investigation. A vital component of any trauma system is continuous performance improvement in order to improve survivability from injury.(25) This analysis indicates that systems should be implemented supporting rapid battlefield performance improvement measures capable of detecting changes in outcome measures like % DOW, % KIA or CFR to enable responsive performance improvement measures. Developing sustainable, robust, accurate and timely performance improvement mechanisms has the potential to not only improve the battlefield trauma system but also the civilian trauma system. These findings should prompt study of the effectiveness and capabilities of the current DOD battlefield trauma system, including individual prehospital and surgical units. Understanding the causal factors of both increases and improvement of the %DOW over time will be critical to effective and sustainable battlefield performance improvement of surgical units."

Am J Emerg Med. 2018 Jun 5. pii: S0735-6757(18)30472-8. doi: 10.1016/j.ajem.2018.06.010. [Epub ahead of print]

Evaluation of tranexamic acid in trauma patients: A retrospective quantitative analysis.

Ng M, Perrott J, Burgess S

INTRODUCTION: Tranexamic acid (TXA) has been shown to decrease mortality in adult trauma patients with or at significant risk of hemorrhage when administered within 3 h of injury. The use and appropriateness of TXA in adult trauma patients presenting to Royal Columbian Hospital (RCH) was investigated.

METHODS: This retrospective chart review utilized the British Columbia Trauma Registry to identify 100 consecutive trauma patients that presented to the emergency department at RCH between April 2012 to June 2015 and met the following indications for TXA: systolic blood pressure <90 mm Hg and/or heart rate >110 bpm and presentation within 8 h of injury. Primary outcomes included: percentage that met indications for TXA, received TXA according to the CRASH-2 protocol, received a pre-hospital dose, and received TXA ≤1, >1 to ≤3, or >3 h from injury.

RESULTS: During the given time period, 117 subjects (2.7%) met indications for TXA. 67 patients (57%) received TXA in any dose, with 10 subjects (8.5%) receiving TXA according to the CRASH-2 protocol. Of the 67 patients who received any TXA, 76% did so ≤3 h. 22 patients (19%) received TXA as a pre-hospital dose.

CONCLUSIONS: <10% of adult trauma patients that met the indication for TXA received it according to the CRASH-2 protocol. Of those patients that received TXA, 76% did so within 3 h. Further inquiry to identify reasons trauma patients are not receiving TXA as well as quality improvement initiatives in trauma care are required.

LEVEL OF EVIDENCE: III STUDY TYPE: Therapeutic.

J Trauma Acute Care Surg. 2018 Jul;85(1S Suppl 2):S98-S103

Recent advances in austere combat surgery: Use of aortic balloon occlusion as well as blood challenges by special operations medical forces in recent combat operations.

Northern D, Manley J, Lyon R, Farber D, Mitchell B, Filak K, Lundy J, DuBose J, Rasmussen T, Holcomb J

BACKGROUND: Resuscitative endovascular balloon occlusion of the aorta (REBOA) for control of noncompressible torso hemorrhage is a technology that is increasingly being utilized in the combat casualty setting. Its use in the resource restricted environment holds potential to improve hemorrhage control, decrease blood product utilization, decrease morbidity, and improve combat mortality. The objective of this report is to present the single largest series of REBOA use on severely injured combat casualties.

METHODS: Over an 18-month period, austere surgical teams comprised of coalition partners provided initial damage control resuscitation (DCR) and surgical stabilization for over 2,300 combat casualties prior to transferring patients to the next level of trauma care.

RESULTS: Twenty patients presented with injuries from explosion and gunshot wounds with mean initial heart rate of 129 bpm and mean initial systolic blood pressure of 71 mm Hg. Femoral cut downs were used in six patients. Aortic occlusion was achieved with REBOA catheter placement in Zone 1 (n = 17) and Zone 3 (n = 2). Systolic blood pressure increased an average of 56 mm Hg with aortic occlusion. There were no access related site complications. All patients survived transport to the next level of care. The majority of blood products transfused in this cohort were whole blood, largely supported by emergent blood drives.

CONCLUSION: This series demonstrates the potential for REBOA as a lifesaving technique for the patient who presents with hemodynamic instability and noncompressible torso hemorrhage. Resuscitative endovascular balloon occlusion of the aorta allows austere surgical teams to rapidly stabilize severely injured combat casualties, expand capability, and provide enhanced DCR while minimizing personnel, resources, and blood product utilization. The use of "whole blood only" strategy for DCR shows potential to be superior to traditional component therapy, and when combined with "proactive" REBOA utilization, provides significant improvements in hemodynamics and hemorrhage control.

LEVEL OF EVIDENCE: Case series, level V.

Acta Anaesthesiol Scand. 2018 Oct;62(9):1223-1228

Utility of the laryngeal handshake method for identifying the cricothyroid membrane.

Oh H, Yoon S, Seo M, Oh E, Yoon H, Lee H, Lee J, Ryu H

BACKGROUND: The cricothyroid membrane is the most commonly accessed location for invasive surgical airway. Although the laryngeal handshake method is recommended for identifying the cricothyroid membrane, there is no clinical data regarding the utility of the laryngeal handshake method in cricothyroid membrane identification. The objective of this study was to compare the accuracy of cricothyroid membrane identification between the laryngeal handshake method and simple palpation.

METHODS: After anaesthesia induction, the otorhinolaryngology resident and anaesthesia resident identified and marked the needle insertion point for cricothyroidotomy using simple palpation and the laryngeal handshake method, respectively. The cricothyroid membrane was confirmed with ultrasonography. Identification was determined successful if the marked point was placed within the longitudinal area of the cricothyroid membrane and within 5 mm from midline transversely. The accuracy of cricothyroid membrane identification using the laryngeal handshake method and simple palpation was compared.

RESULTS: A total of 123 patients were enrolled. The cricothyroid membrane was correctly identified in 87 (70.7%, 95% confidence interval 61.8-78.6%) patients using the laryngeal handshake method compared to 78 (63.4%, 95% confidence interval 54.3-71.9%) patients using simple palpation (P = .188). The time required to identify the cricothyroid membrane was longer when using the laryngeal handshake method (15 [3-48] seconds vs 10.9 [3-55] seconds, P = .003).

CONCLUSION: The success rate of identifying the cricothyroid membrane was similar among the anesthesiologists who performed the laryngeal handshake method and also among otorhinolaryngologists who used simple palpation.

J Trauma Acute Care Surg. 2018 Aug;85(2):380-386

A clinical prediction model for raised intracranial pressure in patients with traumatic brain injuries.

Pace J, Parry N, Vogt K, Hilsden R, Leeper R, Markova Z, Priestap F, Younan J, Ball I.

BACKGROUND: Intracranial hypertension is believed to contribute to secondary brain insult in traumatically brain injured patients. Currently, the diagnosis of intracranial hypertension requires intracranial monitoring or advanced imaging. Unfortunately, prehospital transport times can be prolonged, delaying time to the initial radiographic assessment. The aim of this study was to identify clinical variables associated with raised intracranial pressure (ICP) prior to the completion of neuroimaging.

METHODS: We performed a retrospective cohort study of head injured patients over a 3-year period. Patients were labeled as having increased ICP if they had a single reading of ICP greater than 20 mm Hg within 1 hour of ICP monitor insertion or computed tomography findings suggestive of raised ICP. Patient and clinical characteristics were analyzed using stepwise multivariable logistic regression with ICP as the dependent variable.

RESULTS: Of 701 head injured patients identified, 580 patients met inclusion criteria. Mean age was 48.65 ± 21 years, 73.3% were male. The mean Injury Severity Score was 22.71 ± 12.38, and the mean Abbreviated Injury Scale for body region head was 3.34 ± 1.06. Overall mortality was 14.7%. Only 46 (7.9%) patients had an ICP monitor inserted; however, a total of 107 (18%) patients met the definition of raised ICP. The mortality rate for patients with raised ICP was 50.4%. Independent predictors of raised ICP were as follows: age, older than 55 years (odds ratio [OR], 2.26; 95% confidence interval [CI], 1.35-3.76), pupillary fixation (OR, 5.76; 95% CI, 3.16-10.50), signs of significant head trauma (OR, 2.431; 95% CI, 1.39-4.26), and need for intubation (OR, 3.589; 95% CI, 2.10-6.14).

CONCLUSION: This study identified four independent variables associated with raised ICP and incorporated these findings into a preliminary risk assessment scale that can be implemented at the bedside to identify patients at significant risk of raised ICP. Future work is needed to prospectively validate these findings prior to clinical implementation.

LEVEL OF EVIDENCE: Prognostic, Epidemiological, level III.

J Vasc Surg. 2018 Jun 11. pii: S0741-5214(18)30997-2. doi: 10.1016/j.jvs.2018.04.038. [Epub ahead of print]

A contemporary, 7-year analysis of vascular injury from the war in Afghanistan.

Patel J, White J, White P, Rich N, Rasmussen T

OBJECTIVE: Vascular injury is a leading cause of death and disability in military and civilian trauma. Although a previous interim study defined the distribution of vascular injury during the wars in Iraq and Afghanistan, a contemporary epidemiologic assessment has not been performed. The objective of this study was to provide a current analysis of vascular injury during the final 7 years of the war in Afghanistan, including characterization of anatomic injury patterns, mechanisms of injury, and methods of acute management.

METHODS: The Department of Defense Trauma Registry was analyzed to identify U.S. military service members who sustained a battle-related vascular injury and survived to be treated at a surgical facility in Afghanistan between January 1, 2009, and December 31, 2015. All battle-related injuries (nonreturn to duty) were used as a denominator to establish the injury rate. Mechanism and anatomic distribution of injury as well as the acute management strategies of revascularization, ligation, and use of endovascular techniques were defined.

RESULTS: Of 3900 service members who sustained a battle-related injury, 685 patients (17.6%) had 1105 vascular injuries (1.6 vascular injuries per patient). Extremity trauma accounted for 72% (n = 796) of vascular injuries, followed by the torso (17%; n = 188) and cervical (11%; n = 118) regions. Lower extremity vascular injury was the most prevalent anatomic location (45%; 501/1105). Explosion with fragment penetration accounted for 70% (477/685) of injuries, whereas gunshot wounds accounted for 30% (205/685). Open repair was performed in 559 cases (57%; 554/981), whereas ligation was the initial management strategy in 40% (395/981) of cases. In addition, 374 diagnostic endovascular procedures were completed, 27 therapeutic endovascular interventions to include stent placement and angioplasty were performed and 55 inferior vena cava filters were placed. Mortality of the vascular injury cohort was 5%.

CONCLUSIONS: The rate of vascular injury in modern combat is higher than that reported in previous wars. Open reconstruction is performed in half of cases, although ligation is an important damage control option, especially for minor or distal vessel injuries. Angiographic techniques are increasingly being used and documented within wartime registries more than ever. Proficiency with open and endovascular methods of vascular injury management remains a critical need for the U.S. military and will require partnership with civilian institutions to attain and maintain.

PLoS One. 2018 Feb 2;13(2):e0192363. doi: 10.1371/journal.pone.0192363. eCollection 2018.

Lyophilized plasma attenuates vascular permeability, inflammation and lung injury in hemorrhagic shock.

Pati S, Peng Z, Wataha K, Miyazawa B, Potter D, Kozar R

ABSTRACT:
In severe trauma and hemorrhage the early and empiric use of fresh frozen plasma (FFP) is associated with decreased morbidity and mortality. However, utilization of FFP comes with the significant burden of shipping and storage of frozen blood products. Dried or lyophilized plasma (LP) can be stored at room temperature, transported easily, reconstituted rapidly with ready availability in remote and austere environments. We have previously demonstrated that FFP mitigates the endothelial injury that ensues after hemorrhagic shock (HS). In the current study, we sought to determine whether LP has similar properties to FFP in its ability to modulate endothelial dysfunction in vitro and in vivo. Single donor LP was compared to single donor FFP using the following measures of endothelial cell (EC) function in vitro: permeability and transendothelial monolayer resistance; adherens junction preservation; and leukocyte-EC adhesion. In vivo, using a model of murine HS, LP and FFP were compared in measures of HS- induced pulmonaryvascular inflammation and edema. Both in vitro and in vivo in all measures of EC function, LP demonstrated similar effects to FFP. Both FFP and LP similarly reduced EC permeability, increased transendothelial resistance, decreased leukocyte-EC binding and persevered adherens junctions. In vivo, LP and FFP both comparably reduced pulmonary injury, inflammation and vascular leak. Both FFP and LP have similar potent protective effects on the vascular endothelium in vitro and in lung function in vivo following hemorrhagic shock. These data support the further development of LP as an effective plasma product for human use after trauma and hemorrhagic shock.

Trauma Surg Acute Care Open. 2018 Jun 27;3(1):e000193. doi:10.1136/tsaco-2018-000193. eCollection 2018.

Launch of the National Trauma Research Repository coincides with new data sharing requirements.

Price M, Bixby P, Phillips M, Beilman G, Bulger E, Davis M, McAuliffe M, Rasmussen T, Salinas J, Smith S, Spott M, Weireter L, Jenkins D

Quotes:

“Previous analyses of research data have shown that many trauma studies cannot be replicated or validated due to a variety of factors, including lack of access to study data, lack of access to protocol information, and inability to replicate procedures used in the study. New data sharing rules for federally funded studies have been put in place to address factors associated with this issue. To address these new data sharing requirements, beginning this month, investigators conducting research on trauma and critical care will be able to maximize the utility of the data they produce with the launch of the National Trauma Research Repository (NTRR). The system was developed as a resource to support new and emerging data sharing needs within the trauma research community and is envisioned to be a key piece of the national trauma research infrastructure. It is funded by the Department of Defense (DoD) and developed by the National Trauma Institute (NTI) to promote collaboration, accelerate research, and advance knowledge on the treatment of trauma. When it becomes fully functional, the NTRR will be a comprehensive repository offering thousands of data points from hundreds of studies, enabling investigators to query across studies for their own research objectives.”

“The NTRR was developed by trauma researchers for trauma researchers.”

Ann Emerg Med. 2018 Aug;72(2):225-226

Breaking Down Silos: The Joint Statement About the Clinical Use of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) Warrants Revision.

Qasim Z, DuBose J, Rasmussen T, Teeter W

Quotes:

"Brenner et al1 recently published a joint statement between the American College of Surgeons Committee on Trauma and the American College of Emergency Physicians on the clinical use of resuscitative endovascular balloon occlusion of the aorta (REBOA). The statement created concern in both civilian and military communities by its—in our opinion—overly restrictive message and notable omissions."

"Major resuscitations are team-based endeavors. The entire team should understand REBOA's use and limitations. Excluding appropriately trained emergency physicians without an additional critical care medicine fellowship from using REBOA is incongruent with the observed strong foundation emergency medicine training creates to teach safe use. This has been demonstrated in international systems in which emergency physicians without critical care medicine training use REBOA.2"

"The joint statement did not adequately take into account the US military's experience with REBOA; its comprehensive, evidence-based clinical practice guideline; or its pragmatic approach to skills development.3 The US Air Force's Special Operations Surgical Team's recent multidisciplinary experience with REBOA as an option in mass casualty incidents is relevant to civilian practice.4,5 Any guidance proposed in civilian health systems should not inadvertently restrict the practice of military emergency physicians and surgeons using REBOA to save lives while overseas, or to maintain their skills and train civilian counterparts after returning or after separation from the armed forces."

"The joint statement also seemingly overlooks the capability of some out-of-hospital systems already involved in advanced inter-facility transfers such as extracorporeal membrane oxygenation. Given the burden of preventable out-of-hospital death from torso hemorrhage, the challenge of managing these cases in smaller centers within a trauma network, and the anticipated evolution of REBOA procedural technique (eg, partial REBOA), we recommend a collaborative dialogue between the American College of Surgeons Committee on Trauma, the American College of Emergency Physicians, and the National Association of EMS Physicians. Optimum use in transfer and primary scene response situations should be reviewed, with particular attention on ensuring adequate system support.2"

J Surg Res. 2018 Jun;226:31-39

Comparison of zone 3 Resuscitative Endovascular Balloon Occlusion of the Aorta and the Abdominal Aortic and Junctional Tourniquet in a model of junctional hemorrhage in swine.

Rall J, Redman T, Ross E, Morrison J, Maddry J

BACKGROUND: Traumatic injuries to the pelvis and high junctional injuries are difficult to treat in the field; however, Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) and the Abdominal Aortic and Junctional Tourniquet (AAJT) constitute two promising treatment modalities. The aim of this study is to use a large animal model of pelvic hemorrhage to compare the survival, hemostatic, hemodynamic, and metabolic profile of both techniques.

METHODS: Yorkshire swine (n = 10, 70-90 kg) underwent general anesthesia, instrumentation, and surgical isolation of the femoral artery. Uncontrolled hemorrhage was initiated by an arteriotomy. Animals were randomly allocated to either REBOA or AAJT. Following completion of device application, both groups received a 500 mL Hextend bolus. After 1 hour, the injured femoral artery was ligated to simulate definitive hemostasis followed by a second Hextend bolus and device removal. Animals were observed for two more hours. Physiological data were collected throughout the experiments and compared between groups.

RESULTS: Both techniques achieved 100% hemostasis, and all animals survived the entire experiment except one in the REBOA group. During the hour treatment phase, the AAJT group had a higher mean arterial pressure than the REBOA group (59.9 ± 16.1 versus 44.6 ± 9.8 mm Hg, respectively; $P < 0.05$). The AAJT-treated group had higher lactate levels than the REBOA-treated group (4.5 ± 2.0 versus
3.2 ± 1.3 mg/dL, respectively; $P < 0.05$).

CONCLUSIONS: Despite their mechanistic differences, both techniques achieved a similar hemostatic, hemodynamic, and metabolic profile. Some differences do exist including lactate levels and blood pressure.

J Spec Oper Med. Summer 2018;18(2):79-85.

Survey of Casualty Evacuation Missions Conducted by the 160th Special Operations Aviation Regiment During the Afghanistan Conflict.

Redman T, Mayberry K, Mora A, Benedict B, Ross E, Mapp J, Kotwal R

BACKGROUND: Historically, documentation of prehospital combat casualty care has been relatively nonexistent. Without documentation, performance improvement of prehospital care and evacuation through data collection, consolidation, and scientific analyses cannot be adequately accomplished. During recent conflicts, prehospital documentation has received increased attention for point-of-injury care as well as for care provided en route on medical evacuation platforms. However, documentation on casualty evacuation (CASEVAC) platforms is still lacking. Thus, a CASEVAC dataset was developed and maintained by the 160th Special Operations Aviation Regiment (SOAR), a nonmedical, rotary-wing aviation unit, to evaluate and review CASEVAC missions conducted by their organization.

METHODS: A retrospective review and descriptive analysis were performed on data from all documented CASEVAC missions conducted in Afghanistan by the 160th SOAR from January 2008 to May 2015. Documentation of care was originally performed in a narrative after-action review (AAR) format. Unclassified, nonpersonally identifiable data were extracted and transferred from these AARs into a database for detailed analysis. Data points included demographics, flight time, provider number and type, injury and outcome details, and medical interventions provided by ground forces and CASEVAC personnel.

RESULTS: There were 227 patients transported during 129 CASEVAC missions conducted by the 160th SOAR. Three patients had unavailable data, four had unknown injuries or illnesses, and eight were military working dogs. Remaining were 207 trauma casualties (96%) and five medical patients (2%). The mean and median times of flight from the injury scene to hospital arrival were less than 20 minutes. Of trauma casualties, most were male US and coalition forces (n = 178; 86%). From this population, injuries to the extremities (n = 139; 67%) were seen most commonly. The primary mechanisms of injury were gunshot wound (n = 89; 43%) and blast injury (n = 82; 40%). The survival rate was 85% (n = 176) for those who incurred trauma. Of those who did not survive, most died before reaching surgical care (26 of 31; 84%).

CONCLUSION: Performance improvement efforts directed toward prehospital combat casualty care can ameliorate survival on the battlefield. Because documentation of care is essential for conducting performance improvement, medical and nonmedical units must dedicate time and efforts accordingly. Capturing and analyzing data from combat missions can help refine tactics, techniques, and procedures and more accurately define wartime personnel, training, and equipment requirements. This study is an example of how performance improvement can be initiated by a nonmedical unit conducting CASEVAC missions.

J Emerg Med. 2018 Sep;55(3):383-389

A Novel Expeditionary Perfused Cadaver Model for Trauma Training in the Out-of-Hospital Setting.

Redman T, Ross E

BACKGROUND: Cadaver training for prehospital surgical procedures is a valid training model. The limitation to date has been that perfused cadavers have only been used in wet laboratories in hospitals or university centers. We endeavor to describe a transportable central-perfused cadaver model suitable for training in the battlefield environment. Goals of design were to create a simple, easily reproducible, and realistic model to simulate procedures in field and austere conditions.

METHODS: We conducted a review of the published literature on cadaver models, conducted virtual-reality simulator training, performed interviews with subject matter experts, and visited the laboratories at the Centre for Emergency Health Sciences in Spring Branch, TX, the Basic Endovascular Skills in Trauma laboratory in Baltimore, MD, and the Fresh Tissue Dissection Laboratory at Los Angeles
County and University of Southern California, Keck School of Medicine, Los Angeles, CA.

PROCEDURE: This article will describe a five-step procedure that utilizes extremity tourniquets, right common carotid intra-arterial and distal femur intraosseous (IO) access for perfusion, and oropharynx preparation for airway procedures. The model will then be ready for all tactical combat casualty care procedures, including nasopharyngeal airway, endotracheal intubation, cricothyroidotomy, central-line access, needle decompression, finger and tube thoracostomy, resuscitative endovascular balloon occlusion of the aorta, junctional tourniquets, IO lines, and field amputations.

CONCLUSIONS: This model has been used in the laboratory, field, ground ambulance, and military air ambulance (UH-60) settings with good results. The model described can be used in the field setting with minimal resources and accurately simulates the critical skills for all combat trauma procedures.

Mil Med. 2018 May 24. doi: 10.1093/milmed/usy121. [Epub ahead of print]

A Non-Comparative Prospective Pilot Study of Ketamine for Sedation in Adult Septic Shock.

Reese J, Sullivan V, Boyer N, Mount C

Introduction: Sedation and analgesia in the intensive care unit (ICU) for patients with sepsis can be challenging. Opioids and benzodiazepines can lower blood pressure and decrease respiratory drive. Ketamine is an N-methyl-D-aspartate (NMDA) receptor antagonist that provides both amnesia and analgesia without depressing respiratory drive or blood pressure. The purpose of this pilot study was to assess the effect of ketamine on the vasopressor requirement in adult patients with septic shock requiring mechanical ventilation.

Materials and Methods: We conducted a two-phase study in a multi-disciplinary adult ICU at a tertiary medical center. The first phase was a retrospective chart review of patients admitted with septic shock between July 2010 and July 2011; 29 patients were identified for a historical control group. The second phase was a prospective, non-randomized, open-label pilot study. Patients were eligible for inclusion if they were 18-89 yr of age with a diagnosis of septic shock, who also required mechanical ventilation for at least 24 h, concomitant sedation, and vasopressor therapy. Pregnant patients, patients in the peri-operative timeframe, and patients with acute coronary syndrome were excluded. Patients enrolled in the phase two pilot study received ketamine as the primary sedative. Ketamine was administered as a 1-2 mg/kg IV bolus, then as a continuous infusion starting at 5 mcg/kg/min, titrated 2 mcg/kg/min every 30 min as needed to obtain a Richmond Agitation Sedation Scale (RASS) goal of -1 to -2. If continuous sedation was still required after 48 h, patients were transitioned off ketamine and sedative strategy reverted to usual ICU sedation protocol. The primary outcome was the dose of vasopressor required at 24, 48, 72 and 96 h after enrollment. Secondary outcomes included cumulative ketamine dose, additional sedative and analgesics used, cumulative sedative and analgesic dosing at all time periods, corticosteroid use, days of mechanical ventilation, ICU LOS, hospital LOS, and mortality. Contiguous data were analyzed with unpaired t-tests and categorical data were analyzed with two-tailed, Fisher's exact test. This study was approved by our Institutional Review Board.

Results: From January 2012 to April 2015, a total of 17 patients were enrolled. Patient characteristics were similar in the control and study group. Ketamine was discontinued in one patient due to agitation at 36 h. There was a trend towards decreased norepinephrine and vasopressin use in the study group at all time periods. Regarding secondary outcomes, the study group received less additional analgesia with fentanyl at 24 and 48 h ($p < 0.001$), and less additional sedation with lorazepam, midazolam or dexmedetomidine at 24 h ($p = 0.015$).

Conclusion: This pilot study demonstrated a trend towards decreased vasopressor dose, and decreased benzodiazepine and opiate use when ketamine is used as the sole sedative. The limitations to our study include a small sample size and those inherent in using a retrospective control group. Our findings should be further explored in a large, randomized prospective study.

J Trauma Acute Care Surg. 2018 Jun;84(6S Suppl 1):S104-S114

Effects of platelet-sparing leukocyte reduction and agitation methods on in vitro measures of hemostatic function in cold-stored whole blood.

Remy K, Yazer M, Saini A, Mehanovic-Varmaz A, Rogers S, Cap A, Spinella P

BACKGROUND: Agitation of platelet units stored at room temperature is performed routinely to maintain platelet function, and leukoreduction of blood products is the standard of care in many countries to reduce immune consequences of transfusion. The effect of agitation and leukoreduction on whole blood stored at 4°C requires investigation, as reductions in hemostatic capacity of whole blood may reduce its efficacy in treating trauma-induced coagulopathy and platelet dysfunction. We hypothesize that agitation of whole blood will not affect hemostatic function and that leukoreduction will reduce hemostatic function of whole blood.

METHODS: In this in vitro randomized controlled study, 21 units of leukoreduced and 20 nonleukoreduced whole blood units were each randomly assigned into four agitation groups. Hemostatic parameters were measured using viscoelastic assays (rotational thromboelastometry-Extrinsic Screening Test (ROTEM-EXTEM) and thromboelastography (TEG) platelet mapping), impedance aggregometry (agonists-adenosine phosphate, arachidonic acid, thrombin receptor activating peptide, and collagen), and a thrombin generation assay from these whole blood units before and after filtration and on 0, 5, 10, and 15 days of storage at 4°C.

RESULTS: Leukoreduction compared to nonleukoreduction reduced platelet concentration on Day 0. Viscoelastic measures and thrombin generation parameters revealed significant reduction in hemostatic function between the leukoreduced units and the nonleukoreduced units at a few time points. Leukoreduced units consistently demonstrated reduced platelet aggregation compared to the nonleukoreduced units. Agitation methods did not significantly affect any of the hemostatic parameters examined.

CONCLUSIONS: Leukoreduction of whole blood with a platelet-sparing filter caused a moderate but significant reduction in some measures of whole blood hemostatic function most evident early in storage. The benefits of leukoreduction should be weighed against the potential reduced hemostatic function of leukoreduced units. Agitation of whole blood is not required to maintain hemostatic function.

LEVEL OF EVIDENCE: In vitro randomized controlled trial, level 1.

J Spec Oper Med. Summer 2018;18(2):58-62.

Old Tricks for New Dogs? John Caddy and the Victorian Origins of TCCC.

Reynolds P

ABSTRACT:
The success of Tactical Combat Casualty Care (TCCC) in reducing potentially preventable combat deaths may rely on both specific interventions (such as tourniquets) and the systematized application of immediate care. Essential elements of a combat care system include clear specification of immediate care priorities, standardized methodology, and inclusion and training of all nonmedical personnel in early response. Although TCCC is fairly recent, the construct is similar to that first suggested during the mid-nineteenth century by John Turner Caddy (1822-1902), a British Royal Navy staff surgeon. Although naval warfare engagements at the time were relatively infrequent, casualties could be numerous and severe and often overwhelmed the small medical staff on board. Caddy recognized that nonmedical personnel properly trained in the fundamentals of combat injury management would result in lives saved and greatly improved morale. The novelty was in his attempt to make procedures simple enough to be performed by nonmedical personnel under stress. However, Caddy's guidelines were completely overlooked for nearly two centuries. The principles of best practice for managing combat trauma injuries learned in previous wars have often been lost between conflicts. Understanding the historical roots of combat first responder care may enable us to better understand and overcome barriers to recognition and retention of essential knowledge.

J Trauma Acute Care Surg. 2018 Jun 12. doi: 10.1097/TA.0000000000002003. [Epub ahead of print]

No wire? No problem: Resuscitative endovascular balloon occlusion of the aorta (REBOA) can be performed effectively and more rapidly with a wire-free device.

Romagnoli A, Teeter W, Wasicek P, Gamble W, Hu F, Stein D, Scalea T, Brenner M

INTRODUCTION: A wire-free device is available for REBOA providing aortic occlusion (AO) without lengthy platform guide-wires and large sheaths.

METHODS: This was a retrospective, single-institution review of patients who received REBOA from May 2014-September 2017. Timing of procedural steps was measured in seconds (s) using time-stamped videography.

RESULTS: 74 patients received REBOA; 29 with a platform guidewire, 12F sheath, and balloon catheter (W group), and 45 with a 7F sheath and wire-free device (WF group). Mean age (p=0.22) and ISS (p=0.80) were similar between groups. 59 patients received REBOA at Zone 1; 15 patients at Zone 3. There was no difference in median [IQR] time to common femoral artery (CFA) access between the WF (194[98,313]s) and W (193[126,280]s) groups (p=0.96). Both median time to AO after CFA access (WF:158[109,264]s vs. W:307[222,390]s, p<0.001) and median total procedural time (WF:366[263,596]s vs. W:511[441,597]s; p=0.012) were significantly shorter with the wire-free system. The rates of percutaneous versus open CFA access was not different between groups (p=0.48). Both groups had a similar physiologic response to AO as measured by pre- and post-AO SBP (p=0.86). Overall mortality rate was 74%; 90% in the W group, and 64% in the WF group (p = 0.027). The procedure-related complication rate was not significantly different between groups with regard to compartment syndrome (W:3% vs WF:4%, p=1.0), access-related complications (W:0 vs WF:6%, p=0.28) or systemic complication (W:0 vs WF:9%, p=0.15).

CONCLUSIONS: Once CFA access is obtained, AO with a smaller wire-free device reduces procedural time by approximately 50%. When perfusion to proximal organs is essential, the seconds saved to achieve AO may contribute to improved mortality. Time to obtain CFA access is not dependent on introducer sheath size.

LEVEL OF EVIDENCE: Therapeutic, Level V.

Emerg Med Australas. 2018 Oct;30(5):722-724. doi: 10.1111/1742-6723.13091. Epub 2018 May 9.

Preparedness for treating victims of terrorist attacks in Australia: Learning from recent military experience.

Rosenfeld J, Mitra B, Smit V, Fitzgerald M, Butson B, Stephenson M, Reade M

ABSTRACT:
The Australian health system is generally well prepared for mass casualty events. Fortunately, there have been very few terrorist attacks and these have involved low numbers of casualties compared with events overseas. Nevertheless, Australian health professionals need to be prepared to treat mass casualties with blast and ballistic trauma. The US military and its allies including Australia have had extensive experience with mass casualty management in the Middle East and Afghanistan wars for more than a decade. To define their experience, they developed the Tactical Combat Casualty Care Guidelines that have saved many lives. It is now prudent to incorporate this knowledge and experience into civilian practice in Australia.

Mil Med. 2018 Jan 1;183(1-2):e45-e50

Fibrinogen Concentrate in the Special Operations Forces Environment.

Sanders S, Tien H, Callum J, Nascimento B, Peng H, Funk C, Schmid J, Rizoli S, Rhind S, Beckett A

Introduction: Hemorrhage is the most common cause of death among Special Operations Force (SOF) soldiers. Bringing remote damage control resuscitation into the far-forward combat environment is logistically challenging, as it requires blood products that generally require a robust cold chain. Alternatively, lyophilized products such as fibrinogen concentrate, which does not require thawing or blood group compatibility testing before use, might be advantageous in damage control resuscitation in the battlefield. In this report, we review the evidence for the use of fibrinogen concentrate in the Canadian SOF environment.

Materials and Methods: The literature on the use of fibrinogen concentrate in the trauma setting was reviewed by Canadian Forces Services Working Group, in three separate meetings. Multiple stakeholders were consulted to obtain authoritative perspectives from subject matter experts on the use of fibrinogen concentrate in the Canadian SOF environment. We also conducted a comparison review of fibrinogen content, pathogen risk, shelf life, and methods required for use for fresh frozen plasma, cryoprecipitate, and fibrinogen concentrate relevant to their application in the far-forward combat environment.

Results: Indications and a protocol for the use of fibrinogen as an adjunct to fresh whole blood were formulated based on a literature review and clinical expert opinion. Alternative strategies and other lyophilized blood products were considered before selecting fibrinogen concentrate as the lyophilized blood product of choice. Fibrinogen concentrate is an ABO-universal blood product with an excellent safety profile. Training was conducted by subject matter experts within civilian trauma centers and at military training facilities. The clinical efficacy and safety were confirmed by monitoring the use of fibrinogen concentrate in deployed combat settings.

Conclusion: Fibrinogen concentrate is a useful adjunct to remote damage control resuscitation in the SOF environment. Fibrinogen concentrate was found to be robust for transport into the SOF environment and is widely accepted among SOF operators and medics.

J Emerg Med. 2018 Jul;55(1):e15-e18

Iatrogenic Tracheal Rupture Caused by Emergency Intubation: A Case Report.

Schaeffer C, Galas T, Teruzzi B, Sudrial J, Allou N, Martinet O

BACKGROUND: Iatrogenic tracheal rupture is a rare but life-threatening complication. If suspected by clinical examination or chest radiograph, a computed tomography scan can confirm the diagnosis, but the criterion standard is a bronchoscopy. There is no consensus on its management.

CASE REPORT: A 52-year-old woman was intubated in a prehospital setting after cardiac arrest. A gradual appearance of subcutaneous emphysema was observed after intubation. A computed tomography scan revealed a complicated tracheal rupture, pneumomediastinum, and pneumothorax. The management was surgical.

WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?: Intubation in emergency conditions increases the risk of tracheal rupture and a delay in management is an important prognostic factor.

Am J Emerg Med. 2018 May 2. pii: S0735-6757(18)30363-2. doi: 10.1016/j.ajem.2018.04.068. [Epub ahead of print]

An analysis of casualties presenting to military emergency departments in Iraq and Afghanistan.

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

BACKGROUND: During the past 17 years of conflict the deployed US military health care system has found new and innovative ways to reduce combat mortality down to the lowest case fatality rate in US history. There is currently a data dearth of emergency department (ED) care delivered in this setting. We seek to describe ED interventions in this setting.

METHODS: We used a series of ED procedure codes to identify subjects within the Department of Defense Trauma Registry from January 2007 to August 2016.

RESULTS: During this time, 28,222 met inclusion criteria. The median age of causalities in this dataset was 25 years and most (96.9%) were male, US military (41.3%), and part of Operation Enduring Freedom (66.9%). The majority survived to hospital discharge (95.5%). Most subjects sustained injuries by explosives (55.3%) and gunshot wound (GSW). The majority of subjects had an injury severity score that was considered minor (74.1%), while the preponderance of critically injured casualties sustained injuries by explosive (0.7%). Based on AIS, the most frequently seriously injured body region was the extremities (23.9%). The bulk of administered blood products were packed red blood cells (PRBC, 26.4%). Endotracheal intubation was the most commonly performed critical procedure (11.9%). X-ray (79.9%) was the most frequently performed imaging study.

CONCLUSIONS: US military personnel comprised the largest proportion of combat casualties and most were injured by explosive. Within this dataset, ED providers most frequently performed endotracheal intubation, administered blood products, and obtained diagnostic imaging studies.

J Spec Oper Med. Summer 2018;18(2):71-74.

Junctional Tourniquet Use during Combat Operations in Afghanistan: The Prehospital Trauma Registry Experience.

Schauer SG, April MD, Fisher AD, Cunningham CW, Gurney J.

BACKGROUND: Hemorrhage is the leading cause of potentially preventable death on the battlefield. Although the resurgence of limb tourniquets revolutionized hemorrhage control in combat casualties in the recent conflicts, the mortality rate for patients with junctional hemorrhage is still high. Junctional tourniquets (JTQs) offer a mechanism to address the high mortality rate. The success of these devices in the combat setting is unclear given a dearth of existing data.

METHODS: From the Prehospital Trauma Registry (PHTR) and the Department of Defense Trauma Registry, we extracted cases of JTQ use in Afghanistan.

RESULTS: We identified 13 uses of a JTQ. We excluded one case in which an improvised pelvic binder was used. Of the remaining 12 cases of JTQ use, seven had documented success of hemorrhage control, three failed to control hemorrhage, and two were missing documentation regarding success or failure.

CONCLUSION: We report 12 cases of prehospital use of JTQ in Afghanistan. The findings from this case series suggest these devices may have some utility in achieving hemorrhage control strictly at junctional sites (e.g., inguinal creases). However, they also highlight device limitations. This analysis demonstrates the need for continued improvements in technologies for junctional hemorrhage control, prehospital documentation, data fidelity and collection, as well as training and sustainment of the training for utilization of prehospital hemorrhage control techniques.

J Spec Oper Med. Summer 2018;18(2):53-56.

Prehospital Administration of Antibiotic Prophylaxis for Open Combat Wounds in Afghanistan: 2013-2014.

Schauer SG, Fisher AD, April MD, Stolper KA, Cunningham CW, Carter R 3rd, Fernandez JRD, Pfaff JA.

BACKGROUND: Military operations place injured Service members at high risk for open wounds. Austere environments and initial wound contamination increase the risk for infection. Wound infections continue to cause significant morbidity among injured Service members. Limited evidence suggests that early antibiotic therapy for open wounds reduces infection rates.

METHODS: We obtained data from the Prehospital Trauma Registry (PHTR) from January 2013 through September 2014. This database includes data from Tactical Combat Casualty Care (TCCC) cards, Department of Defense 1380 forms, and after-action reports to provide near-real-time feedback to units on prehospital medical care. We evaluated whether patients with open wounds received antibiotics in accordance with TCCC guidelines. Low adherence was defined at less than 80%.

RESULTS: In this data set, overall, prefixed facility providers administered antibiotics to 54.0% of patients with an open combat wound. Of the antibiotics given, 11.1% were within TCCC guidelines. The relatively low administration and adherence rates persisted across subgroup analyses.

CONCLUSION: Overall, relatively few patients with open combat wounds receive antibiotic administration as recommended by TCCC guidelines. In the group that received antibiotics, few received the specific antibiotics recommended by TCCC guidelines. The development of strategies to improve adherence to these TCCC recommendations is a research priority.

Wilderness Environ Med. 2018 Jun;29(2):211-214. doi: 10.1016/j.wem.2018.01.009. Epub 2018 Mar 22.

A Survey of Wilderness Medicine Analgesia Practice Patterns.

Schauer S, Naylor J, Brown D, Gibbons R, Syndergaard I, Cushing T

INTRODUCTION: In 2014, the Wilderness Medical Society (WMS) published guidelines for the treatment of acute pain in remote settings. We surveyed wilderness medicine providers on self-reported analgesia prescribing practices.

METHODS: We conducted a prospective, anonymous survey. Respondents were recruited from the WMS annual symposium in 2016. All willing attendees were included.

RESULTS: During the symposium, we collected a total of 124 surveys (68% response rate). Respondent age was 42±12 (24-79) years (mean ± SD with range), 58% were male, and 69% reported physician-level training. All respondents had medical training of varying levels. Of the physicians reporting a specialty, emergency medicine (59%, n=51), family medicine (13%, n=11), and internal medicine (8%, n=7) were reported most frequently. Eighty-one (65%) respondents indicated they prefer a standardized pain assessment tool, with the 10-point numerical rating scale being the most common (54%, n=67). Most participants reported preferring oral acetaminophen (81%, n=101) or nonsteroidal anti-inflammatory drugs (NSAID) (91%, n=113). Of those preferring NSAID, most reported administering acetaminophen as an adjunct (82%, n=101). Ibuprofen was the most frequently cited NSAID (71%, n=88). Of respondents who preferred opioids, the most frequently preferred opioid was oxycodone (26%, n=32); a lower proportion of respondents reported preferring oral transmucosal fentanyl citrate (9%, n=11). Twenty-five (20%, n=25) respondents preferred ketamine.

CONCLUSIONS: Wilderness medicine practitioners prefer analgesic agents recommended by the WMS for the treatment of acute pain. Respondents most frequently preferred acetaminophen and NSAIDs.

J Trauma Acute Care Surg. 2018 Jul;85(1S Suppl 2):S33-S38

Whole blood and Hextend: Bookends of modern tactical combat casualty care field resuscitation and starting point for multifunctional resuscitation fluid development.

Sheppard F, Mitchell T, Macko A, Fryer D, Schaub L, Ozuna K, Glaser J

BACKGROUND: Hemorrhage is the leading cause of preventable death in traumatically injured civilian and military populations. Prehospital resuscitation largely relies on crystalloid and colloid intravascular expansion, as whole blood and component blood therapy are logistically arduous. In this experiment, we evaluated the bookends of Tactical Combat Casualty Care Guidelines recommendations of prehospital resuscitation with Hextend and whole blood in a controlled hemorrhagic shock model within non-human primates, as means of a multifunctional resuscitative fluid development.

METHODS: In the nonhuman primate, a multiple injuries model was used, consisting of a musculoskeletal injury (femur fracture), soft tissue injury (15-cm laparotomy), and controlled hemorrhage to a mean arterial pressure of 20 mm Hg, demarcating the beginning of the shock period. Animals were randomized to prehospital interventions of whole blood or Hextend at T = 0 minutes, and at T = 90 minutes definitive surgical interventions and balanced sanguineous damage control resuscitation could be implemented. All animals were euthanized at T = 480 minutes. Data are expressed as mean ± SEM; significance, $p < 0.05$.

RESULTS: No significant differences in survival (83% vs. 100%; $p = 0.3$), tissue perfusion ($EtCO_2$ and StO_2) or endpoints of resuscitation (base deficit, lactate, pH) between Hextend and whole blood were identified. Second, whole blood compared with Hextend demonstrated significantly earlier normalization of clot formation time, maximal clot firmness, and α angle.

CONCLUSION: A future multifunctional resuscitative fluid including an asanguineous, oncotic, non-oxygen-carrying component to facilitate intravascular volume expansion, and a component with synthetic coagulation factors and fibrinogen to deter coagulopathy may show equivalence to whole blood.

LEVEL OF EVIDENCE: N/A: Study type: translational animal model.

J Am Acad Dermatol. 2018 Jun 16. pii: S0190-9622(18)32142-X.
doi:10.1016/j.jaad.2018.06.020. [Epub ahead of print]

The Use of QuikClot Combat Gauze During Mohs Stages for Intra-Operative Hemostasis.

Shiu V, Keller R

Quote:

"We use QuickClot between Mohs stages and have found that less electrocautery is needed which results in less thermal tissue injury. It has drastically improved hemostasis in patients on dialysis, anticoagulation therapy, and during surgical repair of severe rhinophymas. It can be applied to wounds of various depths including intramuscularly. The product comes in 2cm x 2cm or 4cm x 4cm, 6 yard rolls and is cut down to approximately 1.5cm x 1.5cm sterile squares, then stored in sterile urine cups until use. Optimal results are achieved when the dressing is laid in a single layer over the wound and an overlying pressure dressing is applied. On average, about 2-3 minutes of pressure with a dressing is adequate to provide hemostasis. It is not designed to be left in the wound, should not be included in the final dressing, 63 and should be removed with forceps prior to closure. The cost, on average, is about $0.22 per Mohs surgery case. We have seen no side effects or adverse events while using this product. We have found QuikClot to be a cost-effective and useful adjunct to control bleeding intra-operatively during Mohs stages."

J Trauma Acute Care Surg. 2018 Jun;84(6):972-977. doi:10.1097/TA.0000000000001884.

Rural accidental injury and death: The neglected disease of modern trauma systems?

Simons R

Quote:

“Discrepancies in injury death rates are even more dramatic with our own studies demonstrating deaths from motor vehicle crashes nearly five times higher in rural-remote regions of northern BC compared with those in the Metro Vancouver region (Fig. 4).6 Since that publication, although MVC death rates have come down in all regions of the province, it has not done so equitably with the disparity widening even further: death rates due to MVC in Northern BC now being eight times higher than in the Vancouver region (18/100,000 vs 2.3/100,000).7 These data are again mirrored by similar findings reported by other authors for motor vehicle crash deaths and other unintentional injury deaths with the disparity in mortality again related to the degree of rurality of each jurisdiction.5,8 Rural deaths following injury in BC, specifically motor vehicle crashes, occur more rapidly and more often prior to hospitalization compared with more urban jurisdictions (Tables 1 and 2).6 Bottom line, rural remote populations in BC, Canada, North America and all jurisdictions studied to date are being injured more often, are more likely to die from injury, and are more likely to die before reaching hospital than their urban counterparts. For our many aboriginal communities, many of which are in rural or remote jurisdictions, the situation is even worse. 5 These differences are not subtle, they can measured in several orders of magnitude. Our injury prevention efforts and our trauma systems are clearly failing our rural, remote, and aboriginal communities. On the global surgery front, this lesson cannot be lost on those attempting to support trauma system development in low- to middle-income countries (LMIC). Here the 80% to 20%population split is reversed with the majority of people living in the rural jurisdictions. Improving urban trauma center performance in these countries will not mitigate the growing burden of injury in LMIC, which is in large part a rural phenomenon.”

“Military, and now recent civilian experience, has touted the advantages of early initiation of Damage Control Resuscitation (DCR) with more and more prehospital services in North America now equipped with blood products and other hemostatic agents allowing for the initiation of DCR in the prehospital setting. 18 This is particularly valuable in rural settings where local facilities may have very limited transfusion capabilities, and transportation times may be prolonged. Early initiation of DCR may improve early hemostasis and reduce prehospital deaths from hemorrhage.

J Trauma Acute Care Surg. 2018 Jul;85(1S Suppl 2):S27-S32. Doi 10.1097/TA.0000000000001800.

Assessment of prehospital hemorrhage and airway care using a simulation model.

Skube M, Witthuhn S, Mulier K, Boucher B, Lusczek E, Beilman G

BACKGROUND: The quality of prehospital care impacts patient outcomes. Military efforts have focused on training revision and the creation of high-fidelity simulation models to address potentially survivable injuries. We sought to investigate the applicability of models emphasizing hemorrhage control and airway management to a civilian population.

METHODS: Prehospital health care providers (PHPs) undergoing their annual training were enrolled. A trauma scenario was simulated with two modules: hemorrhage control and airway management. Experienced raters used a validated tool to assess performance. Pearson correlation, logistic regression, and χ tests were used for analysis.

RESULTS: Ninety-five PHPs participated with a mean experience of 15.9 ± 8.3 years, and 7.4% reported past military training. The PHPs' overall execution rate of the six hemorrhage control measures varied from 38.9% to 88.4%. The median blood loss was 1,700 mL (interquartile range, 1,043-2,000), and the mean global rater score was 25.0 ± 7.4 (scale, 5-40). There was a significant relationship between PHP profession and past military experience to their consideration of blood transfusion and tranexamic acid. An inverse relationship between blood loss and global rater score was found ($r = -0.59$, $n = 88$, $p = 1.93 \times 10$). After simulated direct laryngoscope failure in the airway module, 58% of PHPs selected video laryngoscopy over placement of a supraglottic airway. Eighty-six percent of participants achieved bilateral chest rise in the manikin regardless of management method. Participants reported improved comfort with skills after simulation.

CONCLUSION: Our data reveal marginal performance in hemorrhage control regardless of the PHP's prior experience. The majority of PHPs were able to secure an advanced airway if direct laryngoscope was unavailable with a predisposition for video laryngoscopy over supraglottic airway. Our findings support the need for continued training for PHPs highlighting hemorrhage control maneuvers and increased familiarity with airway management options. Improved participant confidence post-training gives credence to simulation training.

LEVEL OF EVIDENCE: Prognostic/epidemiological study, level III.

Rom J Anaesth Intensive Care. 2018 Apr;25(1):7-9. doi:10.21454/rjaic.7518.251.sor.

Spring recoil and supraglottic airway devices: lessons from the law of conservation of energy.

Sorbello M, Zdravkovic I, Cataldo R, Di Giacinto I

Quotes:

“Certainly, we are entering a new world, and a new cultural approach to *SAD-anaesthesia*, which is not (and probably cannot be) a simple shift of our habits and techniques from the endotracheal tube to a *simpler* anaesthetic technique. Particularly, avoiding the misleading concept that, SAD being simpler (but not easier) we can downscale our attention and simply make everything easier. We probably rarely see tracheal stenosis as a consequence of an overinflated endotracheal tube cuff, because it does not occur so often and in all patients with a supra-distended cuff; or, maybe better, it is not diagnosed so often [17]. Many patients go missing in follow-ups and many stenosis are clinically insignificant and then probably undiagnosed [18].

Adding this monitoring to our daily practice might also result in further benefits, as suggested by some authors, claiming that a cuff pressure check could also address malposition diagnosis [29]. The use of *continuous* SAD cuff pressure monitoring, relying on Boyle’s law and relative pressure variations due to oropharyngealand cricopharyngeal muscles tone, could also add potentially valuable information on anaesthetic plan adequacy and on our pharmacological choices.
Not forgetting that intra-cuff pressure is not a static value, as it changes because of temperature, exposureto anaesthetic gases such as nitrous oxide, patient position and muscular activity, so that oropharyngealsymptoms might arise also with an initially correctly inflated cuff, but later overinflated or somehowsqueezed by an incorrectly anaesthetized patient [30].”

N Engl J Med. 2018 Jul 26;379(4):315-326. doi: 10.1056/NEJMoa1802345.

Prehospital Plasma during Air Medical Transport in Trauma Patients at Risk for Hemorrhagic Shock.

Sperry J, Guyette F, Brown J, Yazer M, Triulzi D Early-Young B, Adams P, Daley B, Miller R, Harbrecht B, Claridge J,Phelan H, Witham W, Putnam A, Duane T, Alarcon L, Callaway C, Zuckerbraun B, Neal M, Rosengart M, Forsythe R, Billiar T, Yealy D, Peitzman A, Zenati M; PAMPer Study Group.

Collaborators: Buck M, Ryman A, Gimbel E, Gilchrist E, Buhay M, Chang C, Talisa V, Xu T, Kalloway K, Yates A, Rawn S, Jenkins J, Trachtenberg L, Eden R, Fraifogl J, Bates C, Howard C, Stebbins C, McNeill C, Snyder A, Ropp J, Caliman C, Beamon M.

BACKGROUND: After a person has been injured, prehospital administration of plasma in addition to the initiation of standard resuscitation procedures in the prehospital environment may reduce the risk of downstream complications from hemorrhage and shock. Data from large clinical trials are lacking to show either the efficacy or the risks associated with plasma transfusion in the prehospital setting.

METHODS: To determine the efficacy and safety of prehospital administration of thawed plasma in injured patients who are at risk for hemorrhagic shock, we conducted a pragmatic, multicenter, cluster-randomized, phase 3 superiority trial that compared the administration of thawed plasma with standard-care resuscitation during air medical transport. The primary outcome was mortality at 30 days.

RESULTS: A total of 501 patients were evaluated: 230 patients received plasma (plasma group) and 271 received standard-care resuscitation (standard-care group). Mortality at 30 days was significantly lower in the plasma group than in the standard-care group (23.2% vs. 33.0%; difference, -9.8 percentage points; 95% confidence interval, -18.6 to -1.0%; P=0.03). A similar treatment effect was observed across nine prespecified subgroups (heterogeneity chi-square test, 12.21; P=0.79). Kaplan-Meier curves showed an early separation of the two treatment groups that began 3 hours after randomization and persisted until 30 days after randomization (log-rank chi-square test, 5.70; P=0.02). The median prothrombin-time ratio was lower in the plasma group than in the standard-care group (1.2 [interquartile range, 1.1 to 1.4] vs. 1.3 [interquartile range, 1.1 to 1.6], P<0.001) after the patients' arrival at the trauma center. No significant differences between the two groups were noted with respect to multiorgan failure, acute lung injury-acute respiratory distress syndrome, nosocomial infections, or allergic or transfusion-related reactions.

CONCLUSIONS: In injured patients at risk for hemorrhagic shock, the prehospital administration of thawed plasma was safe and resulted in lower 30-day mortality and a lower median prothrombin-time ratio than standard-care resuscitation.

Lancet. 2018 May 26;391(10135):2107-2115

Tranexamic acid for hyperacute primary IntraCerebral Haemorrhage (TICH-2): an international randomised, placebo-controlled, phase 3 superiority trial.

Sprigg N, Flaherty K, Appleton J, Al-Shahi Salman R, Bereczki D, Beridze M, Christensen H, Ciccone A, Collins R, Czlonkowska A, Dineen R, Duley L, Egea-Guerrero J, England T, Krishnan K, Laska A, Law Z, Ozturk S, Pocock S, Roberts I, Robinson T, Roffe C, Seiffge D, Scutt P, Thanabalan J, Werring D, Whynes D, Bath P; TICH-2 Investigators.

BACKGROUND: Tranexamic acid can prevent death due to bleeding after trauma and post-partum haemorrhage. We aimed to assess whether tranexamic acid reduces haematoma expansion and improves outcome in adults with stroke due to intracerebral haemorrhage.

METHODS: We did an international, randomised placebo-controlled trial in adults with intracerebral haemorrhage from acute stroke units at 124 hospital sites in 12 countries. Participants were randomly assigned (1:1) to receive 1 g intravenous tranexamic acid bolus followed by an 8 h infusion of 1 g tranexamic acid or a matching placebo, within 8 h of symptom onset. Randomisation was done centrally in real time via a secure website, with stratification by country and minimisation on key prognostic factors. Treatment allocation was concealed from patients, outcome assessors, and all other health-care workers involved in the trial. The primary outcome was functional status at day 90, measured by shift in the modified Rankin Scale, using ordinal logistic regression with adjustment for stratification and minimisation criteria. All analyses were done on an intention-to-treat basis. This trial is registered with the ISRCTN registry, number ISRCTN93732214.

FINDINGS: We recruited 2325 participants between March 1, 2013, and Sept 30, 2017. 1161 patients received tranexamic acid and 1164 received placebo; the treatment groups were well balanced at baseline. The primary outcome was assessed for 2307 (99%) participants. The primary outcome, functional status at day 90, did not differ significantly between the groups (adjusted odds ratio [aOR] 0·88, 95% CI 0·76-1·03, p=0·11). Although there were fewer deaths by day 7 in the tranexamic acid group (101 [9%] deaths in the tranexamic acid group vs 123 [11%] deaths in the placebo group; aOR 0·73, 0·53-0·99, p=0·0406), there was no difference in case fatality at 90 days (250 [22%] vs 249 [21%]; adjusted hazard ratio 0·92, 95% CI 0·77-1·10, p=0·37). Fewer patients had serious adverse events after tranexamic acid than after placebo by days 2 (379 [33%] patients vs 417 [36%] patients), 7 (456 [39%] vs 497 [43%]), and 90 (521 [45%] vs 556 [48%]).

INTERPRETATION: Functional status 90 days after intracerebral haemorrhage did not differ significantly between patients who received tranexamic acid and those who received placebo, despite a reduction in early deaths and serious adverse events. Larger randomised trials are needed to confirm or refute a clinically significant treatment effect.

J Trauma Acute Care Surg. 2018 Jun;84(6S Suppl 1):S89-S92

Staff officers as blood suppliers: Effects of repeated donations and autologous reinfusions of untransfused units.

Strandenes G, Sivertsen J, Eliassen H, Braathen H, Hervig T

BACKGROUND: Limited blood inventory and resupply chains in combat settings can result in preventable deaths from traumatic hemorrhage. One way of mitigating this could be to establish donor pools where blood is collected in advance of high-risk missions and then reinfused back to the donor if not needed to treat casualties.

METHODS: Four hundred fifty milliliters plus 56 mL of blood was collected, rested for 2 hours in room temperature, and stored at 4°C. The blood was reinfused 22 to 24 hours after donation and the donor observed for adverse reactions. Samples were collected before and 20 minutes after each donation for hematology, immunoglobulin G, ferritin, C-reactive protein, total protein, lactate dehydrogenase, bilirubin, haptoglobin, and activated partial thromboplastin time.

RESULTS: Nine participants went through a total of 36 donation and reinfusion procedures. Four donors participated in five rounds, two in four rounds, two in three rounds, and one in two rounds. A significant drop was seen in hemoglobin (14.6 ± 0.9 to 13.9 ± 0.9) and ferritin (179 ± 70 to 149 ± 78) from before the first donation to after the last reinfusion ($p < 0.05$). Other parameters were unaffected.

CONCLUSION: This small pilot study suggests that repeated donations and reinfusions may be both feasible and safe. Blood collected in this way should be labeled with the donor's full name and social security number (or similar) and the identity visually verified by the donor immediately before both donation and reinfusion. To further reduce risk, this form of donation should be restricted to scenarios where there is no other option for making blood available.

LEVEL OF EVIDENCE: Therapeutic/Care management study, level V.

Eur J Trauma Emerg Surg. 2018 May 31. doi: 10.1007/s00068-018-0966-z. [Epub ahead of print]

Clinical consequences of chest tube malposition in trauma resuscitation: single-center experience.

Struck M, Ewens S, Fakler J, Hempel G, Beilicke A, Bernhard M, Stumpp P, Josten C, Stehr S, Wrigge H, Krämer S

PURPOSE: Evaluation of trauma patients with chest tube malposition using initial emergency computed tomography (CT) and assessment of outcomes and the need for chest tube replacement.

METHODS: Patients with an injury severity score > 15, admitted directly from the scene, and requiring chest tube insertion prior to initial emergency CT were retrospectively reviewed. Injury severity, outcomes, and the positions of chest tubes were analyzed with respect to the need for replacement after CT.

RESULTS: One hundred seven chest tubes of 78 patients met the inclusion criteria. Chest tubes were in the pleural space in 58% of cases. Malposition included intrafissural positions (27%), intraparenchymal positions (11%) and extrapleural positions (4%). Injury severity and outcomes were comparable in patients with and without malposition. Replacement due to malfunction was required at similar rates when comparing intrapleural positions with both intrafissural or intraparenchymal positions (11 vs. 23%, $p = 0.072$). Chest tubes not reaching the target position (e.g., pneumothorax) required replacement more often than targeted tubes (75 vs. 45%, $p = 0.027$). Out-of-hospital insertions required higher replacement rates than resuscitation room insertions (29 vs. 10%, $p = 0.016$). Body mass index, chest wall thickness, injury severity, insertion side and intercostal space did not predict the need for replacement.

CONCLUSIONS: Patients with malposition of emergency chest tubes according to CT were not associated with worse outcomes compared to patients with correctly positioned tubes. Early emergency chest CT in the initial evaluation of severely injured patients allows precise detection of possible malposition of chest tubes that may require immediate intervention.

J Trauma Acute Care Surg. 2018 Jul;85(1):101-10

Location is everything: The hemodynamic effects of REBOA in Zone 1 versus Zone 3 of the aorta.

Tibbits E, Hoareau G, Simon M, Davidson A, DeSoucy E, Faulconer E, DuBose J, Neff L, Grayson J, Williams T, Johnson M

OBJECTIVES: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an emerging technology to augment proximal blood pressure during the resuscitation of patients with noncompressible torso hemorrhage. Currently, placement choice, supraceliac (Zone 1) versus infrarenal (Zone 3) aorta, depends on injury patterns, but remains a highly debated topic. We sought to compare the proximal hemodynamic support provided by Zone 1 versus Zone 3 REBOA placement and the degree of hemodynamic instability upon reperfusion following intervention.

METHODS: Eighteen anesthetized swine underwent controlled hemorrhage of 25% total blood volume, followed by 45 minutes of Zone 1 REBOA, Zone 3 REBOA, or no intervention (control). They were then resuscitated with shed blood, aortic balloons were deflated, and 5 hours of critical care ensued prior to euthanasia. Physiologic parameters were recorded continuously, and blood was drawn for analysis at specified intervals. Significance was defined as $p < 0.05$.

RESULTS: There were no significant differences between groups at baseline or during the initial 30 minutes of hemorrhage. During the intervention period, average proximal MAP was significantly greater in Zone 1 animals when compared with Zone 3 animals (127.9 ± 1.3 vs. 53.4 ± 1.1 mm Hg) and greater in Zone 3 animals when compared with control animals (42.9 ± 0.9 mm Hg). Lactate concentrations were significantly higher in Zone 1 animals (9.6 ± 0.4 mmol/L) when compared with Zone 3 animals (5.1 ± 0.3 mmol/L) and control animals (4.2 ± 0.8 mmol/L).

CONCLUSIONS: In our swine model of hemorrhagic shock, Zone 3 REBOA provided minimal proximal hemodynamic support when compared with Zone 1 REBOA, albeit with less ischemic burden and instability upon reperfusion. In cases of impending hemodynamic collapse, Zone 1 REBOA placement may be more efficacious regardless of injury pattern, whereas Zone 3 should be reserved only for relatively stable patients with ongoing distal hemorrhage.

J Am Coll Surg. 2018 Sep;227(3):332-345

From Pull to Pressure: Effects of Tourniquet Buckles and Straps.

Valliere M, Wall P, Buising C

BACKGROUND: Limb tourniquet pressures > 100 mmHg before tightening system use eases achieving arterial occlusion, minimizes tightening system problems, and probably minimizes discomfort. This study examined effects of buckle and strap features on converting pulling force to strap pressure.

STUDY DESIGN: Twenty-two buckle and strap combinations were evaluated using a thigh-diameter, ballistic gel cylinder and 3 thighs. Weights of 14.11, 27.60, and 41.11 kg provided pulling force. The contribution of buckle movement was evaluated: all buckles on gel and 12 on thighs allowed limited vertical movement, 12 on gel and 4 on thighs held static.

RESULTS: Force conversion patterns per combination were similar on gel and thighs, including greatest force conversion with some buckle movement allowed. Smooth, round redirect buckles without engagement of a strap-securing mechanism had the best conversions of pulling force to tourniquet pressure; 2 achieved arterially occlusive pressures, neither commercially available. Among hook-and-loop secured tourniquets and threaded for self-securing tourniquets, the Generation 7 Combat Application Tourniquet (C-A-T7) and the Tactical Ratcheting Medical Tourniquet (Tac RMT) had the best conversions of pull to pressure (thigh applications/each weight, mean ± SD: C-A-T7 91 ± 11, 164 ± 30, 228 ± 34 mmHg; Tac RMT 82 ± 13, 150 ± 16, 222 ± 17 mmHg). Other Ratcheting Medical Tourniquets with the same buckle but different strap fabrics performed less well. Even lower pressures occurred with the Tactical Mechanical Tourniquet, the Special Operations Forces Tactical Tourniquet, the Parabelt, and the SAM XT Extremity Tourniquet (165 ± 11, 178 ± 13, 131 ± 14, and 106 ± 14 mmHg, all at 41.11 kg, respectively).

CONCLUSIONS: Buckle design and strap fabric affect the conversion of pulling force to tourniquet strap pressure. Low-friction, smooth, round redirects allow the best conversion.

Injury. 2018 May;49(5):903-910

Early transfusion on battlefield before admission to role 2: A preliminary observational study during "Barkhane" operation in Sahel.

Vitalis V, Carfantan C, Montcriol A, Peyrefitte S, Luft A, Pouget T, Sailliol A, Ausset S, Meaudre E, Bordes J

INTRODUCTION: Haemorrage is the leading cause of death after combat related injuries and bleeding management is the cornerstone of management of these casualties. French armed forces are deployed in Barkhane operation in the Sahel-Saharan Strip who represents an immense area. Since this constraint implies evacuation times beyond doctrinal timelines, an institutional decision has been made to deploy blood products on the battlefield and transfuse casualties before role 2 admission if indicated. The purpose of this study was to evaluate the transfusion practices on battlefield during the first year following the implementation of this policy.

MATERIALS AND METHODS: Prospective collection of data about combat related casualties categorized alpha evacuated to a role 2. Battlefield transfusion was defined as any transfusion of blood product (red blood cells, plasma, whole blood) performed by role 1 or Medevac team before admission at a role 2. Patients' characteristics, battlefield transfusions' characteristics and complications were analysed.

RESULTS: During the one year study, a total of 29 alpha casualties were included during the period study. Twenty-eight could be analysed, 7/28 (25%) being transfused on battlefield, representing a total of 22 transfusion episodes. The most frequently blood product transfused was French lyophilized plasma (FLYP). Most of transfusion episodes occurred during medevac. Compared to non-battlefield transfused casualties, battlefield transfused casualties suffered more wounded anatomical regions (median number of 3 versus 2, $p = 0.04$), had a higher injury severity score (median ISS of 45 versus 25, $p = 0,01$) and were more often transfused at role 2, received more plasma units and whole blood units. There was no difference in evacuation time to role 2 between patients transfused on battlefield and non-transfused patients. There was no complication related to battlefield transfusions. Blood products transfusion onset on battlefield ranged from 75 min to 192 min after injury.

CONCLUSION: Battlefield transfusion for combat-related casualties is a logistical challenge. Our study showed that such a program is feasible even in an extended area as Sahel-Saharan Strip operation theatre and reduces time to first blood product transfusion for alpha casualties. FLYP is the first line blood product on the battlefield.

J Spec Oper Med. Spring 2018;18(1):62-68.

Intramuscular Tranexamic Acid in Tactical and Combat Settings.

Vu EN, Wan WCY, Yeung TC, Callaway DW.

BACKGROUND: Uncontrolled hemorrhage remains a leading cause of preventable death in tactical and combat settings. Alternate routes of delivery of tranexamic acid (TXA), an adjunct in the management of hemorrhagic shock, are being studied. A working group for the Committee for Tactical Emergency Casualty Care reviewed the available evidence on the potential role for intramuscular (IM) administration of TXA in nonhospital settings as soon as possible from the point of injury.

METHODS: EMBASE and MEDLINE/PubMed databases were sequentially searched by medical librarians for evidence of TXA use in the following contexts and/or using the following keywords: prehospital, trauma, hemorrhagic shock, optimal timing, optimal dose, safe volume, incidence of venous thromboembolism (VTE), IM bioavailability.

RESULTS: A total of 183 studies were reviewed. The strength of the available data was variable, generally weak in quality, and included laboratory research, case reports, retrospective observational reviews, and few prospective studies. Current volume and concentrations of available formulations of TXA make it, in theory, amenable to IM injection. Current best practice guidelines for large-volume injection (i.e., 5mL) support IM administration in four locations in the adult human body. One case series suggests complete bioavailability of IM TXA in healthy patients. Data are lacking on the efficacy and safety of IM TXA in hemorrhagic shock.

CONCLUSION: There is currently insufficient evidence to support a strong recommendation for or against IM administration of TXA in the combat setting; however, there is an abundance of literature demonstrating efficacy and safety of TXA use in a broad range of patient populations. Balancing the available data and risk- benefit ratio, IM TXA should be considered a viable treatment option for tactical and combat applications. Additional studies should focus on the optimal dose and bioavailability of IM dosing of patients in hemorrhagic shock, with assessment of potential downstream sequelae.

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Early Infections Complicating the Care of Combat Casualties from Iraq and Afghanistan.

Weintrob A, Murray C, Xu J, Krauss M, Bradley W, Warkentien T, Lloyd B, Tribble D

BACKGROUND: During the conflicts in Iraq and Afghanistan, more than 52,000 U.S. military members were wounded in action. The battlefield mortality rate was lower than in past conflicts, however, those surviving often had complex soft tissue and bone injuries requiring multiple surgeries. This report describes the rates, types, and risks of infections complicating the care of combat casualties.

PATIENTS AND METHODS: Infection and microbiology data obtained from the Trauma Infectious Disease Outcomes Study (TIDOS), a prospective observational study of infections complicating deployment-related injuries, were used to determine the proportion of infection, types, and associated organisms. Injury and surgical information were collected from the Department of Defense Trauma Registry. Multivariable Cox proportional hazards and logistic regression models were used to evaluate potential factors associated with infection.

RESULTS: From 2009-2012, 1,807 combat casualties were evacuated to U.S. TIDOS-participating hospitals. Among the 1,807 patients, the proportion of overall infections from time of injury through initial U.S. hospitalization was 34% with half being skin, soft tissue, or bone infections. Infected wounds most commonly grew Enterococcus faecium, Pseudomonas aeruginosa, Acinetobacter spp. Or Escherichia coli. In the multivariable model, amputation, blood transfusions, intensive care unit admission, injury severity scores, mechanical ventilation, and mechanism of injury were associated with risk of infection.

CONCLUSIONS: One-third of combat casualties from Iraq and Afghanistan develop infections during their initial hospitalization. Amputations, blood transfusions, and overall injury severity are associated with risk of infection, whereas more easily modifiable factors such as early operative intervention or antibiotic administration are not.

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Measurement of compensatory reserve predicts racial differences in tolerance to simulated hemorrhage in women.

Wenner M, Hinds K, Howard J, Nawn C, Stachenfeld N, Convertino V

BACKGROUND: The compensatory reserve measurement (CRM) has been established to accurately measure the body's total integrated capacity to compensate for physiologic states of reduced central blood volume and predict hemodynamic decompensation associated with inadequate tissue oxygenation. We previously demonstrated that African American (AA) women have a higher tolerance to reductions in central blood volume. Therefore, we tested the hypothesis that the CRM would identify racial differences during simulated hemorrhage, before the onset of traditional signs/symptoms.

METHODS: We performed a retrospective analysis during simulated hemorrhage using lower-body negative pressure (LBNP) in 23 AA (22 ± 1 years; 24 ± 1 kg/m) and 31 white women (WW) (20 ± 1 years; 23 ± 1 kg/m). Beat-by-beat blood pressure (BP) and heart rate (HR) were recorded during progressive lower body negative pressure to presyncope. The BP waveforms were analyzed using a machine-learning algorithm to derive the CRM at each lower body negative pressure stage.

RESULTS: Resting mean arterial BP (AA, 78 ± 3 mm Hg vs. WW, 74 ± 2 mm Hg) and HR (AA, 68 ± 2 bpm vs. WW, 65 ± 2 bpm) were similar between groups. The CRM progressively decreased during LBNP in both groups; however, the rate of decline in the CRM was less ($p < 0.05$) in AA. The CRM was 4% higher in AA at -15 mm Hg LBNP and progressively increased to 21% higher at -50 mm Hg LBNP ($p < 0.05$). However, changes in BP and HR were not different between groups.

CONCLUSION: These data support the notion that the greater tolerance to simulated hemorrhage induced by LBNP in AA women can be explained by their greater capacity to protect the reserve to compensate for progressive central hypovolemia compared with WW, independent of standard vital signs.

LEVEL OF EVIDENCE: Diagnostic test, level II.

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Evaluation of a novel cricothyroidotomy introducer in a simulated obese porcine model: a randomised crossover comparison with scalpel cricothyroidotomy.

Yeow C, Greaney L, Foy C, King W, Patel B

ABSTRACT:
The Difficult Airway Society 2015 guidelines for management of unanticipated difficulties in tracheal intubation in adults have generated much discussion regarding Plan D: emergency front-of-neck access with a scalpel-bougie cricothyroidotomy technique. There is concern that this technique may not provide an adequate pathway for the bougie and subsequently the tracheal tube, especially in obese patients with deeper airway structures. This could lead to the formation of a false passage, trauma and failure. A novel cricothyroidotomy introducer, 8 mm wide and 170 mm long, with a sharp leading edge and guiding channel to pass a bougie into the trachea, has been designed to complement the scalpel cricothyroidotomy technique. A comparison study of the use of this novel introducer with the scalpel technique in a simulated obese porcine laryngeal model demonstrated shorter insertion times (median (IQR [range]) 85 (65-123 [48-224]) s vs. 84 (72-184 [46-377]) s, p = 0.030). All 26 (100%) participants successfully performed cricothyroidotomy in the introducer group, whereas only 24 (92%) participants were successful in the scalpel group. The introducer group required fewer attempts to access the trachea compared with the scalpel group (p = 0.046). False passages occurred eight (31%) times in the introducer group compared with 17 (65%) times in the scalpel group (p = 0.022). There were no statistical differences in tracheal trauma (p = 0.490), ease of use (p = 0.220) and device preference (p = 0.240). This novel cricothyroidotomy introducer has shown promising results in securing the airway in an emergency front-of-neck access situation. With robust training, this introducer could potentially be complementary to the scalpel-bougie cricothyroidotomy technique.

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Prehospital analgesic choice in injured patients does not impact on rates of vomiting: Experience from a New South Wales primary retrieval service.

Zhang M, Cowan T Smiles J, Morgan M, Armstrong J, Goswami C, Sewell C.

OBJECTIVE: This study aimed to explore the analgesic regimes adopted in our contemporary retrieval practice and the incidence of vomiting in ED after prehospital analgesic use.

METHOD: A retrospective review was conducted on trauma patients retrieved by the Hunter Primary Retrieval Service in the Hunter New England Local Health District, New South Wales, Australia, during 2015.

RESULTS: Of the 379 patients attended by the service in 2015, 196 of them (mean age 38.6, SD 19.68, years) were selected for this review. Morphine was the most commonly used analgesic (mean 68.37%; 95% CI 61.36-74.81%), followed by fentanyl (mean 48.47%; 95% CI 41.29-55.70%) and ketamine (mean 34.18%; 95% CI 27.57-41.28%). Fourteen (7.14%, 95% CI 3.96-11.69%) patients vomited either prehospital or within the ED. Patients in both the emesis and the non-emesis group were comparable in demographics. None of the three studied analgesics were observed to be significantly associated with higher risk of vomiting than the others in this review, although a higher dose of fentanyl was given to the non-emesis group ($P = 0.04$).

CONCLUSIONS: The frequency of vomiting in the retrieved patients observed in our study was less than previously reported in the literature. Opioids still prevailed over ketamine as the preferred initial analgesic, with ketamine most commonly used as an adjunct. Multi-centre trials in this field would be preferable in future in view of the relatively low incidence of vomiting in retrieved trauma patients.