Tactical Combat Casualty Care

Journal Article Abstracts

Committee on Tactical Combat Casualty Care

November 2017

Abstracts

J Orthop Trauma. 2017 Oct;31(10):520-525

Efficacy and Safety of Tranexamic Acid in Orthopaedic Fracture Surgery: A Meta-Analysis and Systematic Literature Review.

Amer K, Rehman S, Amer K, Haydel C.

BACKGROUND: Tranexamic acid (TXA) is an antifibrinolytic drug that has been shown to be effective in reducing blood loss and the need for transfusions after several orthopaedic surgeries. However, the effectiveness of TXA use in orthopaedic fracture surgeries still remains unclear. The purpose of this meta-analysis was to review existing literature with interest in the effectiveness and safety of TXA treatment in reducing total blood loss and transfusion rates for patients who underwent surgery for fracture repairs.

METHODS: An electronic literature search of PubMed, Embase, OVID, and the Cochrane Library was conducted to identify studies published before December 2016. All randomized controlled trials and cohort studies evaluating the efficacy of TXA during fracture repair surgeries were identified. Primary outcome measures included the number of patients receiving a blood transfusion and perioperative total blood loss. Data were analyzed using Comprehensive Meta-Analysis (CMA) statistical software.

RESULTS: Seven studies encompassing 559 patients met the inclusion criteria for the meta-analysis. Our meta-analysis indicated that when compared with the placebo control group, the use of TXA in fracture surgeries significantly reduced total blood loss by approximately 330 mL ($P = 0.009$), reduced the transfusion rate with a relative risk of 0.54 ($P < 0.001$), and decreased the drop of hemoglobin by 0.76 g/dL ($P < 0.001$). There was no significant difference between the number of thromboembolic events among the study groups ($P = 0.24$).

CONCLUSIONS: This study demonstrated that tranexamic acid may be used in orthopaedic fracture surgeries to reduce total blood loss, transfusion rates, and the drop in hemoglobin level, without increasing risk of venous thrombo-embolism. A limitation to these findings is the small number of studies available. Further studies need to be conducted to confirm these findings.

LEVEL OF EVIDENCE: Therapeutic Level I. See Instructions for Authors for a complete description of levels of evidence.

Mil Med. 2017 Nov;182(11):1746-1748

Chronic Pain and Suicide: Is There a Role for Ketamine?

Baldwin M, Boilini H, Lamvu G

Quotes:

"Patients with psychiatric conditions and chronic pain were consistently found to be at higher risk for suicide completion than chronic pain patients who did not have any psychiatric diagnoses.6 This data highlights the need for greater awareness of the increased risk for suicide in chronic pain patients but especially in populations that have both chronic pain and a mental health diagnosis."

"Post-traumatic stress disorder (PTSD) and depression diagnoses in patients have been found to have a unique impact on suicidal behavior, especially in patients with a comorbid diagnosis of chronic pain."

"Recently, scientists have identified ketamine as a potential therapeutic option that may have rapid onset, a better side effect profile and perhaps long lasting effects which may make it ideal for acute and long-term use in suicidal patients. Ketamine has also been identified as a possible treatment for chronic pain, MDD, and PTSD as initial studies have demonstrated significant reductions in symptoms for all of these diagnoses."

"While patients with depression and comorbid PTSD who also experience chronic pain are known to have higher suicide rates, we speculate that effective treatment of all conditions may be associated with reductions in suicidal behavior. Until this is confirmed by future research, we believe it is imperative that providers who treat patients for chronic pain screen for suicidality and mental illness. Conversely, providers who treat patients with mental health disorders should screen patients for chronic pain and suicidality. Once these high-risk patients are identified, providers should consider multimodal therapies or pharmacotherapy with drugs that have multiple modes of action such as ketamine. In most of the preliminary research studies involving ketamine for the treatment of TRD, an IV infusion of subanesthetic low dose ketamine (e.g., 0.5 mg/kg) was used and found to rapidly reduce depression and suicidality. Ketamine delivered by infusion was shown to be well tolerated by patients and continued to have a positive impact on depression symptoms and SI for 10 days post infusion."

Emerg Med Australas. 2017 Oct;29(5):570-575. doi: 10.1111/1742-6723.12850.

The emergency surgical airway.

Begley J, Butson B, Kwa P

Quotes:

"Discussions about emergency surgical airway or front of neck access (FONA) can provoke vigorous debate and strike fear into the hearts of airway clinicians. The 'can't intubate, can't oxygenate' (CICO) situation requires prompt and decisive action, and it is important that all clinicians performing advanced airway interventions have a well-considered plan for this rare scenario. Due to the nature and infrequency of CICO events, evidence is largely limited to case series, synthetic models, live animal models and cadaveric human studies. Consensus opinion predominates. In this article, we attempt to draw on the currently available evidence and recently published CICO guidelines to answer common questions that emergency airway practitioners might encounter. Our aim is to provide and justify simple recommendations for this high-stakes emergency situation."

"Jet insufflation via a needle or cannula was the accepted first-line CICO intervention in many guidelines for over a decade.4,11,17,18 This was based on the assumption that this was the quickest and easiest way of providing oxygenation with low complication rates19,20 and that clinicians, particularly anaesthetists, were already experienced with percutaneous needle techniques. 5,11,18,21–23 A 2013 systematic review of synthetic, cadaveric and live animal models found no difference in the success rate or insertion time between cannula and surgical FONA techniques. 16"

"In a CICO emergency, an open surgical cricothyroidotomy is the preferred approach."

National Post; 18 Oct 2017

Keep live pigs for combat first-aid training, medics say as simulators take over trauma instruction. National Post; 18 Oct 2017

Blackwell T

Quotes:

“The authors of the paper published this month in the journal Military Medicine, most of them Canadian Forces members or National Defence Department employees, recommend that live animals be kept as at least part of the combat-care course.”

“Of the 38 medics who responded to the survey, 88 per cent had performed life-saving procedures on troops in Afghanistan, most more than five times. About 90 per cent of those who had been deployed both before and after the pigs were introduced said the change was valuable and urged that it be maintained, a sentiment reflected in their comments.”

“The first time a medic gets blood on their hands and tries a lifesaving procedure should not be on a fellow soldier with their friends looking on.”

Br J Oral Maxillofac Surg. 2017 Sep;55(7):661-665

Contemporary management of maxillofacial ballistic trauma.

Breeze J, Tong D, Gibbons A

Abstract:

Ballistic maxillofacial trauma in the UK is fortunately relatively rare, and generally involves low velocity handguns and shotguns. Civilian terrorist events have, however, shown that all maxillofacial surgeons need to understand how to treat injuries from improvised explosive devices. Maxillofacial surgeons in the UK have also been responsible for the management of soldiers evacuated from Iraq and Afghanistan, and in this review we describe the newer types of treatment that have evolved from these conflicts, particularly that of damage-control maxillofacial surgery.

Mil Med. 2017 Sep;182(9):e1922-e1928

Combat Casualties and Severe Shock: Risk Factors for Death at Role 3 Military Facilities.

Buehner M, Eastridge B, Aden J, DuBose J, Blackbourne L, Cestero R

BACKGROUND: Although significant research has been conducted on combat casualties receiving blood products, there is limited data for the subpopulation presenting in shock. The purpose of this study was to evaluate combat casualties arriving to a role 3 facility with an initial systolic blood pressure (SBP) ≤ 90 in order to identify clinical characteristics and associations between presentation, transfusion therapy, and mortality outcomes.

METHODS: The Department of Defense Trauma Registry was queried from 2001 to 2010 for trauma-related casualties who arrived at a role 3 combat surgical facility with a SBP ≤ 90. Transfers from role 2 facilities were excluded. Data captured included demographics, admission vital signs, laboratory values, blood products, and mortality. Relationships between admission physiology, blood product utilization, and mortality were developed. Independent associations between variables were determined by logistic regression analysis.

RESULTS: 1,703 patients were identified who met our inclusion criteria and composite mortality was 23%. Mortality in those receiving a balanced transfusion ratio was 18% versus 27% ($p < 0.0001$). Hypotensive casualties who survived were significantly more likely to have a higher presenting Glasgow Coma Score (GCS), temperature, SBP, shock index, and pH. In addition, this group was also more likely to have a lower international normalized ratio, pCO_2, and base deficit ($p < 0.001$). Age, heart rate, and pulse pressure were not significantly different between groups. Independent predictors of mortality included Injury Severity Score, presentation GCS, and initial pH value ($p < 0.0001$). In contrast, independent predictors of survival included those with above-knee amputation and a balanced transfusion ($p < 0.0001$).

CONCLUSIONS: Combat casualties hypotensive on arrival to surgical facilities have a significant expected mortality. Those receiving balanced transfusions demonstrated improved survival. Of the five independent risk factors, pH, GCS, and the presence of above-knee amputation are typically available during initial evaluation. These factors may be helpful in determining resource allocation and mortality risk, especially in triage or mass casualty settings.

Prehosp Emerg Care. 2017 Sep 14:1-10.

Sternal Route More Effective than Tibial Route for Intraosseous Amiodarone Administration in a Swine Model of Ventricular Fibrillation.

Burgert JM, Martinez A, O'Sullivan M, Blouin D, Long A, Johnson AD.

OBJECTIVE: The pharmacokinetics of IO administered lipid soluble amiodarone during ventricular fibrillation (VF) with ongoing CPR are unknown. This study measured mean plasma concentration over 5 minutes, maximum plasma concentration (Cmax), and time to maximum concentration (Tmax) of amiodarone administered by the sternal IO (SIO), tibial IO (TIO), and IV routes in a swine model of VF with ongoing CPR.

METHODS: Twenty-one Yorkshire-cross swine were randomly assigned to three groups: SIO, TIO, and IV. Ventricular fibrillation was induced under general anesthesia. After 4 minutes in VF, 300 mg amiodarone was administered as indicated by group assignment. Serial blood specimens collected at 30, 60, 90, 120, 150, 180, 240, and 300 seconds were analyzed using high performance liquid chromatography with tandem mass spectrometry.

RESULTS: The mean plasma concentration of IV amiodarone over 5 minutes was significantly higher than the TIO group at 60 seconds ($P = 0.02$) and 90 seconds ($P = 0.017$) post-injection. No significant differences in Cmax between the groups were found ($P < 0.05$). The Tmax of amiodarone was significantly shorter in the SIO (99 secs) and IV (86 secs) groups compared to the TIO group (215 secs); $P = 0.002$ and $P = 0.002$, respectively.

CONCLUSIONS: The SIO and IV routes of amiodarone administration were comparable. The TIO group took nearly three times longer to reach Tmax than the SIO and IV groups, likely indicating depot of lipid-soluble amiodarone in adipose-rich tibial yellow bone marrow. The SIO route was more effective than the TIO route for amiodarone delivery in a swine model of VF with ongoing CPR. Further investigations are necessary to determine if the kinetic differences found between the SIO and TIO routes in this study affect survival of VF in humans.

Surg Clin North Am. 2017 Oct;97(5):999-1014

Balanced Resuscitation in Trauma Management.

Cantle P, Cotton B

Abstract:

Over the past decade substantial knowledge has been gained in understanding both the coagulopathy of trauma and the complications associated with aggressive crystalloid-based resuscitation. Balanced resuscitation, which includes permissive hypotension, limiting crystalloid use, and the transfusion of blood products in ratios similar to whole blood, has changed the previous standard of care. Prompt initiation of massive transfusion and the protocolled use of 1:1:1 product ratios have improved the morbidity and mortality of patients with trauma in hemorrhagic shock. Balanced resuscitation minimizes the impact of trauma-induced coagulopathy, limits blood product waste, and reduces the complications that occur with aggressive crystalloid resuscitation.

Neurosurgery. 2017 Jan 1;80(1):6-15

Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition.

Carney N, Totten A, O'Reilly C, Ullman J, Hawryluk G, Bell M, Bratton S, Chesnut R, Harris O, Kissoon N, Rubiano A, Shutter L, Tasker R, Vavilala M, Wilberger J, Wright D, Ghajar J

Abstract:

The scope and purpose of this work is 2-fold: to synthesize the available evidence and to translate it into recommendations. This document provides recommendations only when there is evidence to support them. As such, they do not constitute a complete protocol for clinical use. Our intention is that these recommendations be used by others to develop treatment protocols, which necessarily need to incorporate consensus and clinical judgment in areas where current evidence is lacking or insufficient. We think it is important to have evidence-based recommendations to clarify what aspects of practice currently can and cannot be supported by evidence, to encourage use of evidence-based treatments that exist, and to encourage creativity in treatment and research in areas where evidence does not exist. The communities of neurosurgery and neuro-intensive care have been early pioneers and supporters of evidence-based medicine and plan to continue in this endeavor. The complete guideline document, which summarizes and evaluates the literature for each topic, and supplemental appendices (A-I) are available online at https://www.braintrauma.org/coma/guidelines.

J Orthop Trauma. 2017 Oct;31(10):511-512

Tranexamic Acid Should be Considered in Fracture Surgery.

Cornell C

Quotes:

“The introduction of tranexamic acid (TXA) to the field of orthopedic surgery over the past decade has been an unmitigated success. There is no doubt that the administration of TXA can help reduce surgically related blood loss and the need for transfusion during the early postoperative period after elective total joint replacement. There is also no doubt that TXA administration is safe, as it does not seem to promote thromboembolic complications.”

“TXA administration has become routine at my institution for elective total joint and spine surgery, and topical administration is used whenever higher-risk patients present.”

J Emerg Med. 2017 Dec;53(6):885-889

Enhancement of Cricothyroidotomy Education Using a Novel Technique: Cadaver Autografting.

Coughlin R, Chandler I, Binford J, Bonz J, Hile D

BACKGROUND: Cricothyroidotomy is a lifesaving procedure required in up to 2% of emergent airways. Emergency medicine training programs frequently instruct this procedure via cadaver training, but cadaver cost and availability limit the opportunity for all trainees to perform the critical initial skin incision. Cadaver autografting is a novel way to simulate all steps of the procedure.

OBJECTIVE: Our aim was to determine whether the technique of autografting cadaver tissue improves the experience of cricothyroidotomy simulation education for emergency medicine trainees. The investigators hypothesized that autografted cadaver tissue would be a useful adjunct.

METHODS: In this prospective crossover study, volunteers were randomized to first perform cricothyroidotomy on previously incised native neck tissue or on autografted tissue, and then vice versa. The autograft consisted of cadaver iliotibial band covered with lateral thigh skin and subcutaneous tissue to simulate cricothyroid membrane and native anterior neck anatomy. Volunteer emergency medicine residents and sub-interns were included. Twenty-seven residents and nine students participated. Outcomes were evaluated via Likert scale.

RESULTS: Thirty of 36 (83%) participants agreed or strongly agreed that they preferred cadaver autografting to the previously incised native tissue. Thirty-two of 36 (89%) agreed or strongly agreed that cadaver autografting was useful vs. 23 of 36 (64%) who answered similarly regarding previously incised native tissue ($p = 0.001$). Twenty-six of 36 (72%) were more comfortable with cricothyroidotomy in the emergency department after using cadaver autografting vs. 19 of 36 (53%) after using the native tissue ($p = 0.003$).

CONCLUSIONS: Autografted cadaver tissue while simulating cricothyroidotomy was perceived to be a useful adjunct by the majority of participating emergency medicine trainees.

Saudi J Anaesth. 2017 Oct-Dec;11(4):390-395

Comparison of oropharyngeal leak pressure of air-Q™, i-gel™, and laryngeal mask airway supreme™ in adult patients during general anesthesia: A randomized controlled trial.

Damodaran S, Sethi S, Malhotra S, Samra T, Maitra S, Saini V

STUDY OBJECTIVE: Various randomized controlled trials and a meta-analysis have compared i-gel™ and laryngeal mask airway Supreme™ (LMA-S™) in adult patients and found that both the devices provided equivalent oropharyngeal leak pressure (OLP). However, no randomized controlled trial has compared air-Q™ with i-gel™ and LMA-S™ in adult patients. Hence, we designed this study to compare air-Q™ with LMA-S™ and i-gel™ in adult patients.

MATERIALS AND METHODS: A total of 75 adult patients of the American Society of Anesthesiologists physical status I/II of both sexes, between 18 and 60 years, were included in this prospective randomized controlled trial conducted in a tertiary care center. Randomization of patients was done in three equal groups according to the insertion of supraglottic airway device by a computer-generated random number sequence: group air-Q™ (n = 25), group i-gel™ (n = 25), and group LMA-S™ (n = 25). Primary outcome of this study was OLP. We also recorded time for successful placement of device, ease of device insertion, number of attempts to insert device, and ease of gastric tube insertion along with postoperative complications.

RESULTS: The mean ± standard deviation OLP of air-Q™, i-gel™, and LMA-S™ was 26.13 ± 4.957 cm, 23.75 ± 5.439 cm, and 24.80 ± 4.78 cm H2O (P = 0.279). The first insertion success rate for air-Q™, i-gel™, and LMA-S™ was 80%, 76%, and92%, respectively (P = 0.353). The insertion time of air-Q™, i-gel™, and LMA-S™ was 20.6 ± 4.4, 14.8 ± 5.4, and 15.2 ± 4.7 s, respectively (P = 0.000). Time taken for air-Q™ insertion was significantly higher than time taken for i-gel™ (mean difference 5.8 s, P < 0.0001) and LMA-S™ (mean difference 5.4 s, P = 0.0001) insertion. Postoperative complications were similar with all three devices.

CONCLUSIONS: We concluded that air-Q™, i-gel™, and LMA-S™ were equally efficacious in terms of routine airway management in adult patients with normal airway anatomy.

Surg Clin North Am. 2017 Oct;97(5):1047-1064

Thoracic Trauma.

Dennis B, Bellister S, Guillamondegui O

Abstract:

Management of chest trauma is integral to patient outcomes owing to the vital structures held within the thoracic cavity. Understanding traumatic chest injuries and appropriate management plays a pivotal role in the overall well-being of both blunt and penetrating trauma patients. Whether the injury includes rib fractures, associated pulmonary injuries, or tracheobronchial tree injuries, every facet of management may impact the short- and long-term outcomes, including mortality. This article elucidates the workup and management of the thoracic cage, pulmonary and tracheobronchial injuries.

J Spec Oper Med. Spring 2017;17(1):121-129.

Review of 54 Cases of Prolonged Field Care.

DeSoucy E, Shackelford S, DuBose JJ, Zweben S, Rush SC, Kotwal RS, Montgomery HR, Keenan S.

BACKGROUND: Prolonged field care (PFC) is field medical care applied beyond doctrinal planning time-lines. As current and future medical operations must include deliberate and contingency planning for such events, data are lacking to support efforts. A case review was conducted to define the epidemiology, environment, and operational factors that affect PFC outcomes.

METHODS: A survey distributed to US military medical providers solicited details of PFC encounters lasting more than 4 hours and included patient demographics, environmental descriptors, provider training, modes of transportation, injuries, mechanism of injury, vital signs, treatments, equipment and resources used, duration of PFC, and morbidity and mortality status on delivery to the next level of care. Descriptive statistics were used to analyze survey responses.

RESULTS: Surveys from 54 patients treated during 41 missions were analyzed. The PFC provider was on scene at time of injury or illness for 40.7% (22/54) of cases. The environment was described as remote or austere for 96.3% (52/54) of cases. Enemy activity or weather also contributed to need for PFC in 37.0% (20/54) of cases. Care was provided primarily outdoors (37.0%; 20/54) and in hardened nonmedical structures (37.0%; 20/54) with 42.6% (23/54) of cases managed in two or more locations or transport platforms. Teleconsultation was obtained in 14.8% (8/54) of cases. The prehospital time of care ranged from 4 to 120 hours (median 10 hours), and five (9.3%) patients died prior to transport to next level of care.

CONCLUSION: PFC in the prehospital setting is a vital area of military medicine about which data are sparse. This review was a novel initial analysis of recent US military PFC experiences, with descriptive findings that should prove helpful for future efforts to include defining unique skillsets and capabilities needed to effectively respond to a variety of PFC contingencies.

Trauma Surg Acute Care Open 2017;Epub on line

Methodology to reliably measure preventable trauma death rate.

Drake S, Wolf D, Meininger J, et al.

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.

Lancet 2017; Epub ahead of print

Tranexamic acid: is it about time?

Dries D

Quote:

“Angele Gayet-Ageron and colleagues 4 did a metaanalysis of individual patient-level data involving more than 40 000 patients from these two randomised trials of tranexamic acid in acute severe bleeding (traumatic and post-partum haemorrhage). Absence of death from bleeding was the primary measure of treatment benefit. From this dataset, the investigators examined the effect of treatment delay on mortality benefit by use of logistic regression models. Delaying tranexamic acid administration reduced treatment benefit, while immediate treatment improved survival from bleeding by more than 70% (odds ratio 1・72, 95% CI 1・42–2・10; p<0・0001) compared with later treatment. The benefit of tranexamic acid administration decreased by 10% for every 15 min of treatment delay until 3 h after the onset of haemorrhage, when there was no benefit. 4,5”

Ann Emerg Med. 2017 Oct;70(4):473-478.e1

The Bougie and First-Pass Success in the Emergency Department.

Driver B, Dodd K, Klein L, Buckley R, Robinson A, McGill J, Reardon R, Prekker M

STUDY OBJECTIVE: The bougie may improve first-pass intubation success in operating room patients. We seek to determine whether bougie use is associated with emergency department (ED) first-pass intubation success.

METHODS: We studied consecutive adult ED intubations at an urban, academic medical center during 2013. Intubation events were identified by motion-activated video recording. We determined the association between bougie use and first-pass intubation success, adjusting for neuromuscular blockade, video laryngoscopy, abnormal airway anatomy, and whether the patient was placed in the sniffing position or the head was lifted off the bed during intubation.

RESULTS: Intubation with a Macintosh blade was attempted in 543 cases; a bougie was used on the majority of initial attempts (80%; n=435). First-pass success was greater with than without bougie use (95% versus 86%; absolute difference 9% [95% confidence interval {CI} 2% to 16%]). The median first-attempt duration was higher with than without bougie (40 versus 27 seconds; difference 14 seconds [95% CI 11 to 16 seconds]). Bougie use was independently associated with greater first-pass success (adjusted odds ratio 2.83 [95% CI 1.35 to 5.92]).

CONCLUSION: Bougie was associated with increased first-pass intubation success. Bougie use may be helpful in ED intubation.

South Med J. 2017 Aug;110(8):554-558

Transfusion Practice in Trauma Resuscitation.

Eckel A, Hess J

Abstract:

Recognition of the acute coagulopathy of trauma and the limits of reconstituting whole blood with conventional blood components has led to a radical change in the way trauma patients with severe injuries are resuscitated. Massive transfusion protocols (MTP) have evolved toward the administration of conventional blood components in fixed ratios. Administration of a 1:1:1 unit ratio of fresh frozen plasma to whole-blood-derived platelets to packed red blood cells is now the most common strategy and the stated goal of directors of >80% of the level I trauma centers in the United States. Various physiologic scoring systems exist to guide early activation of an MTP. After activation of an MTP, more goal-directed therapy follows as soon as laboratory results are available. Hemostatic resuscitation using defined blood component ratios modified by early laboratory results can lead to more efficient blood product usage and improved patient outcomes.

JAMA. 2017 Oct 24;318(16):1548-1549

Prehospital Blood Transfusion for Combat Casualties.

Elster E, Bailey J

Quote:

"….the results reported by Shackelford et al (10) suggest that prehospital transfusion is an important factor in survival among combat patients. Attempts to replicate this approach and determine the transferability of prehospital transfusion for severely injured civilian patients have so far been unsuccessful. This inability to demonstrate a benefit in civilian patients is related more to the variability of treatment in the prehospital system rather than the heterogeneity of civilian vs military patient populations. This suggests the need for a broader strategy that allows for adoption and dissemination of best practices (as was done with prehospital blood transfusion in combat zones) to bring these military advances into the larger civilian trauma care model. (11,12)

This study also highlights 2 additional issues: the ongoing need for accurate data collection in combat zones to support the military's efforts to continuously improve outcomes by assessing the effectiveness of previous care processes; and the imperative to bring this strategy home by developing a national trauma system that promotes bilateral exchange of information and expertise between military and civilian trauma and injury care systems. (2) Systematic data collection through the military Joint Trauma System was a decisive force in transforming combat casualty care in Iraq and Afghanistan. A similarly systematic and pragmatic approach could yield comparable benefits in the United States. The report by Shackelford et al10 also highlights the critical need for a national system to exist as a partner with the Joint Trauma System; one that leverages the lessons learned from combat and is able to validate and apply them when appropriate to civilian settings. Only such a systems-based approach will enable the large multicenter studies and interconnected data systems required to rapidly advance trauma care in the United States. (11,12) With such a system in place, both civilian and military personnel involved in trauma care from the point of injury to postoperative recovery will have the insights, information, and skills to provide optimal care to every patient they encounter."

JAMA Surg. 2017 Oct 25. [Epub ahead of print]

Does Tranexamic Acid Cause Venous Thromboembolism After Trauma?: Who Cares, If It Saves Lives?

Etchill E, Fang R, Haut ER

Quotes:

" Early tranexamic acid (TXA) administration following an injury has decreased mortality rates in both military and civilian populations. (1,2) Consequently, TXA is now incorporated as an adjunct to blood product–based "damage control resuscitation" protocols in not only civilian trauma centers, but also in deployed combat casualty care in which the early adoption of TXA was driven by limitations of blood component availability in austere settings. (3-7) This study by Johnston et al (8) examined the relationship between TXA administration, use, and venous thromboembolic (VTE) events. (8) They demonstrated an association between TXA and VTE and suggested that overuse, defined as use without massive transfusion, resulted in an increased rate of VTE. This is a valuable study; however, there are limitations to be considered."

"First, while this study demonstrates a potential association between TXA and VTE in combat casualties, the generalizability of these findings to civilian patients is unknown. As the authors acknowledge, the incidence of VTE is consistently higher in military comparedwith civilian trauma populations."

"Second, the definition of massive transfusion that the authors use included total units of all blood components that were administered within 24 hours rather than the more common definition of packed red blood cells only."

" Third, the authors claim patients who experience hemorrhaging who do not require a massive transfusion may not benefit from TXA despite a survival benefit having been demonstrated in previous randomized clinical trials. By minimizing the potential benefits of TXA and overemphasizing the negative VTE events, the authors promoted a decreased use of a product that has been shown to improve survival rates when used appropriately."

"The relative mortality benefit of TXA compared with the potential risk of VTE events must be considered. We would clearly prefer a live patient with a VTE to a deceased patient."

Spine Deform. 2017 Sep;5(5):310-313

Hemostasis and Safety of a Novel Fibrin Dressing Versus Standard Gauze in Bleeding Cancellous Bone in a Caprine Spine Surgery Model.

Floyd C, Padua R, Olson C

BACKGROUND: Decorticated bone is a significant source of blood loss in scoliosis surgery. Current hemostatic methods include packed gauze (GS), physical barriers such as bone wax, and xenograft collagen-based materials. We assessed the safety and efficacy of a novel fibrin dressing (dextran-thrombin-fibrinogen [DTF]) compared to GS. This dressing comprises lyophilized thrombin and fibrinogen embedded in an elastic electrospun nanofiber dextran matrix.

PURPOSE: The study tests the hypothesis that DTF is more efficacious than GS in control of bleeding from cancellous bone.

STUDY DESIGN: A preclinical Good Laboratory Practices (GLP) study.

METHODS: We enrolled 10 goats that were followed for 28 ± 1 days. Each animal was randomly assigned to the test or control group. Both test and control animals had 4 cancellous bone injuries. Test animal injuries were treated with DTF, whereas standard GS was used to control bleeding in the control animals. Bleeding at the bone injury site was characterized as either none, oozing, flowing, or pulsatile and was assessed at 4 and 8 minutes after dressing application. Goats were survived 28 ± 1 days and then necropsied.

RESULTS: Application of the fibrin dressing to bleeding cancellous bone, both posterior spinal lamina, and iliac crest graft sites, resulted in control of bleeding within 4 minutes at all injury sites. Eighty percent of control injury sites continued to bleed after 8 minutes and required application of bone wax to control bleeding. There were no differences in prothrombin time, partial thromboplastin time, or fibrinogen levels between test and control animals at 1 or 28 days. We observed no adverse histologic reactions at 28 days.

CONCLUSION: The fibrin dressing is an efficacious and safe method of controlling blood loss from cancellous bone in a spine surgery model.

Ann Emerg Med. 2017 Oct;70(4):449-459

Nonphysician Out-of-Hospital Rapid Sequence Intubation Success and Adverse Events: A Systematic Review and Meta-Analysis.

Fouche P, Stein C, Simpson P, Carlson J, Doi S

STUDY OBJECTIVE: Rapid sequence intubation performed by non-physicians such as paramedics or nurses has become increasingly common in many countries; however, concerns have been stated in regard to the safe use and appropriateness of rapid sequence intubation when performed by these health care providers. The aim of our study is to compare rapid sequence intubation success and adverse events between non-physician and physician in the out-of-hospital setting.

METHODS: A systematic literature search of key databases including MEDLINE, EMBASE, and the Cochrane Library was conducted. Eligibility, data extraction, and assessment of risk of bias were assessed independently by 2 reviewers. A bias-adjusted meta-analysis using a quality-effects model was conducted for the primary outcomes of overall intubation success and first-pass intubation success and for adverse events when possible.

RESULTS: Eighty-three studies were included in the meta-analysis. There was a 2% difference in successful intubation proportion for physicians versus non-physicians, 99% (95% confidence interval [CI] 98% to 99%) versus 97% (95% CI 95% to 99%). A 10% difference in first-pass rapid sequence intubation success was noted between physicians versus non-physicians, 88% (95% CI 83% to 93%) versus 78% (95% CI 65% to 89%). For airway trauma, bradycardia, cardiac arrest, endobronchial intubation, hypertension, and hypotension, lower prevalences of adverse events were noted for physicians. However, non-physicians had a lower prevalence of hypoxia and esophageal intubations. Similar proportions were noted for pulmonary aspiration and emesis. Nine adverse events estimates lacked precision, except for endobronchial intubation, and 4 adverse event analyses showed evidence of possible publication bias. Consequently, no reliable evidence exists for differences between physicians and non-physicians for adverse events.

CONCLUSION: This analysis shows that physicians have a higher rapid sequence intubation first-pass and overall success, as well as mostly lower rates of adverse events for rapid sequence intubation in the out-of-hospital setting. Nevertheless, for all success and adverse events no firm conclusion for a difference could be drawn because of lack of precision of meta-analytic estimates or selective reporting. First-pass success could be an area in which to focus quality improvement strategies for non-physicians.

J Trauma Acute Care Surg. 2017 Oct;83(4):668-674

Outcomes after concomitant traumatic brain injury and hemorrhagic shock: A secondary analysis from the Pragmatic, Randomized Optimal Platelets and Plasma Ratios trial.

Galvagno S, Fox E, Appana S, Baraniuk S, Bosarge P, Bulger E, Callcut R, Cotton B, Goodman M, Inaba K, O'Keeffe T, Schreiber M, Wade C, Scalea T, Holcomb J, Stein D; PROPPR Study Group.

BACKGROUND: Often the clinician is faced with a diagnostic and therapeutic dilemma in patients with concomitant traumatic brain injury (TBI) and hemorrhagic shock (HS), as rapid deterioration from either can be fatal. Knowledge about outcomes after concomitant TBI and HS may help prioritize the emergent management of these patients. We hypothesized that patients with concomitant TBI and HS (TBI + HS) had worse outcomes and required more intensive care compared with patients with only one of these injuries.

METHODS: This is a post hoc analysis of the Pragmatic, Randomized Optimal Platelets and Plasma Ratios (PROPPR) trial. TBI was defined by a head Abbreviated Injury Scale score greater than 2. HS was defined as a base excess of -4 or less and/or shock index of 0.9 or greater. The primary outcome for this analysis was mortality at 30 days. Logistic regression, using generalized estimating equations, was used to model categorical outcomes.

RESULTS: Six hundred seventy patients were included. Patients with TBI + HS had significantly higher lactate (median, 6.3; interquartile range, 4.7-9.2) compared with the TBI group (median, 3.3; interquartile range, 2.3-4). TBI + HS patients had higher activated prothrombin times and lower platelet counts. Unadjusted mortality was higher in the TBI + HS (51.6%) and TBI (50%) groups compared with the HS (17.5%) and neither group (7.7%). Adjusted odds of death in the TBI and TBI + HS groups were 8.2 (95% confidence interval, 3.4-19.5) and 10.6 (95% confidence interval, 4.8-23.2) times higher, respectively. Ventilator, intensive care unit-free and hospital-free days were lower in the TBI and TBI + HS groups compared with the other groups. Patients with TBI + HS or TBI had significantly greater odds of developing a respiratory complication compared with the neither group.

CONCLUSION: The addition of TBI to HS is associated with worse coagulopathy before resuscitation and increased mortality. When controlling for multiple known confounders, the diagnosis of TBI alone or TBI+HS was associated with significantly greater odds of developing respiratory complications.

LEVEL OF EVIDENCE: Prognostic study, level II.

J Orthop Trauma. 2017 Oct;31(10):513-519

Tranexamic Acid in Orthopaedic Trauma Surgery: A Meta-Analysis.

Gausden E, Qudsi R, Boone M, O'Gara B, Ruzbarsky J, Lorich D

AIM: To systematically review and quantify the efficacy of tranexamic acid (TXA) use in reducing the risk of receiving a blood transfusion in patients undergoing orthopaedic trauma surgery, in reducing blood loss, and risk of thromboembolic events.

METHODS: A systematic literature search was performed using MEDLINE, Embase, ClinicalTrials.gov, and conference proceeding abstracts from 2014 to 2016. A minimum of 2 reviewers screened each study and graded quality. The primary outcome measure was the risk of receiving a blood transfusion in the TXA group versus control. A meta-analysis was performed to construct a combined odds ratio (OR) of receiving a blood transfusion, mean difference (MD) of blood loss, and OR of thromboembolic events.

RESULTS: Twelve studies were included in the quantitative analysis (1,333 patients). The risk of blood transfusion was significantly less in patients who were administered TXA compared with controls [OR 0.407; 95% confidence interval (CI) 0.278-0.594, I = 34, Q = 17, P ≤ 0.001]. There was significantly less blood loss in the TXA group compared with controls, as the mean difference was 304 mL (95% CI, 142-467 mL) (I = 94, Q value = 103, P < 0.001). There was no significant difference in risk of symptomatic thromboembolic events (OR 0.968; 95% CI, 0.530-1.766, I = 0, Q value = 5, P = 0.684).

CONCLUSIONS: In patients with orthopaedic trauma, TXA reduces the risk of blood transfusion, reduces perioperative blood loss, and has no significant effect on the risk of symptomatic thromboembolic events. More high-quality studies are needed to ensure the safety of the drug in these patients.

LEVEL OF EVIDENCE: Therapeutic Level I. See Instructions for Authors for a **complete** description of levels of evidence.

Lancet 2017;Epub ahead of print

Effect of treatment delay on the effectiveness and safety of antifibrinolytics in acute sever haemorrhage: a meta-analysis of individual patient-level data from 40138 bleeding patients.

Gayet-Ageron A, Prieto-Merino D, Ker K, et al

Background: Antifibrinolytics reduce death from bleeding in trauma and post-partum haemorrhage. We examined the effect of treatment delay on the effectiveness of antifibrinolytics.

Methods: We did an individual patient-level data meta-analysis of randomised trials done with more than 1000 patients that assessed antifibrinolytics in acute severe bleeding. We identified trials done between Jan 1, 1946, and April 7, 2017, from MEDLINE, Embase, the Cochrane Central Register of Controlled Trials (CENTRAL), Web of Science, PubMed, Popline, and the WHO International Clinical Trials Registry Platform. The primary measure of treatment benefit was absence of death from bleeding. We examined the effect of treatment delay on treatment effectiveness using logistic regression models. We investigated the effect of measurement error (misclassification) in sensitivity analyses. This study is registered with PROSPERO, number 42016052155.

Findings: We obtained data for 40,138 patients from two randomised trials of tranexamic acid in acute severe bleeding (traumatic and post-partum haemorrhage). Overall, there were 3558 deaths, of which 1408 (40%) were from bleeding. Most (884 [63%] of 1408) bleeding deaths occurred within 12 h of onset. Deaths from post-partum haemorrhage peaked 2–3 h after childbirth. Tranexamic acid significantly increased overall survival from bleeding (odds ratio [OR] 1·20, 95% CI 1·08–1·33; p=0·001), with no heterogeneity by site of bleeding (interaction p=0·7243). Treatment delay reduced the treatment benefit (p<0·0001). Immediate treatment improved survival by more than 70% (OR 1·72, 95% CI 1·42–2·10; p<0·0001). Thereafter, the survival benefit decreased by 10% for every 15 min of treatment delay until 3 h, after which there was no benefit. There was no increase in vascular occlusive events with tranexamic acid, with no heterogeneity by site of bleeding (p=0·5956). Treatment delay did not modify the effect of tranexamic acid on vascular occlusive events.

Interpretation: Death from bleeding occurs soon after onset and even a short delay in treatment reduces the benefit of tranexamic acid administration. Patients must be treated immediately. Further research is needed to deepen our understanding of the mechanism of action of tranexamic acid.

Eur J Trauma Emerg Surg. 2017 Oct 3

Decompression of tension pneumothoraces in Asian trauma patients: greater success with lateral approach and longer catheter lengths based on computed tomography chest wall measurements.

Goh S, Xu W, Teo L

INTRODUCTION: Our study aims to compare the anterior and lateral approaches for needle thoracostomy (NT) and determine the adequacy of catheter lengths used for NT in Asian trauma patients based on computed tomography chest wall measurements.

METHODOLOGY: A retrospective review of chest computed tomography scans of 583 Singaporean trauma patients during period of 2011-2015 was conducted. Four measurements of chest wall thickness (CWT) were taken at the second intercostal space, midclavicular line and fifth intercostal space, midaxillary line bilaterally. Measurements were from the superficial skin layer of the chest wall to the pleural space. Successful NT was defined radiologically as CWT ≤ 5 cm.

RESULTS: There were 593 eligible subjects. Mean age was 49.1 years (49.1 ± 21.0). Majority were males (77.0%) and Chinese (70.2%). Mean CWT for the anterior approach was 4.04 cm (CI 3.19-4.68) on the left and 3.92 cm (CI 3.17-4.63) on the right. Mean CWT for the lateral approach was 3.52 cm (CI 2.52-4.36) on the left, and 3.62 cm (CI 3.65-4.48) on the right. Mean CWT was shorter in the lateral approach by 0.52 cm on the left and 0.30 cm on the right ($p = 0.001$). With a 5.0 cm catheter in the anterior approach, 925 out of 1186 sites (78.8%) will have adequate NT as compared to 98.2% with a 7.0 cm catheter. Similarly, in the lateral approach 1046 out of 1186 (88.2%) will have adequate NT as compared to 98.5% with a 7.0 cm catheter. Obese subjects had significantly higher mean CWT in both approaches ($p = 0.001$). There was moderate correlation between BMI and CWT in the anterior approach, $r^2 = 0.529$ as compared to the lateral approach, $r^2 = 0.244$.

CONCLUSION: Needle decompression using the lateral approach or a longer catheter is more likely to succeed in Asian trauma patients. A high BMI is an independent predictor of failure of NT, especially for the anterior as compared to lateral approach.

J Trauma Acute Care Surg. 2017 Nov;83(5):911-916

Trauma to the heart: A review of presentation, diagnosis, and treatment.

Goldstein A, Soffer D

Quote:

“The specific diagnostic workup with penetrating trauma to the heart starts with determining whether the patient is hemodynamically stable. Only 15% of the unstable patients presenting to Kings County Hospital after penetrating mediastinal trauma were found to have cardiac injury.13 For the extremis patients, there is little controversy regarding their care; the diagnostic workup is rapidly incorporated into aggressive surgical intervention with immediate therapeutic intent such as an emergency room thoracotomy or expedient exploration in the operating room directly from the trauma bay. For the hemodynamically stable patient with penetrating chest injury, the increase in use of chest computer tomography (CCT) during the initial evaluation has changed the diagnostic algorithms despite inconclusive evidence. Over the past two decades, algorithms for the stable patient with penetrating chest trauma have included at minimum a chest x-ray (CXR) and ultrasound (US), with further intervention or diagnostic modalities depending on the findings. 3,13,21,22 Most recently, the use of CCT in this stable patient population has increased up to 3.5-fold without a clear benefit.”

CONCLUSIONS

Despite an understandable lack of data and clinical trial on cardiac trauma, certain principles of management, expert opinions, and studies published from high-volume centers have been vital in educating treating physicians. This has significantly decreased the mortality and morbidity of traumatic cardiac injury. In the unstable patient, there is little debate about the necessity for immediate surgical intervention. In the stable patient, especially the majority of patients with multitrauma, a high suspicion of cardiac trauma must be maintained until completely ruled out. A strong understanding of the differences between penetrating and blunt cardiac trauma is crucial for rapid and accurate diagnoses, appropriate observation, and any necessary treatments in order to prevent the often fatal, missed cardiac injury.

Surg Clin North Am. 2017 Oct;97(5):985-998

Assessment and Resuscitation in Trauma Management.

Gondek S, Schroeder M, Sarani B

Abstract:

The golden hour of trauma represents a crucial period in the management of acute injury. In an efficient trauma resuscitation, the primary survey is viewed as more than simple ABCs with multiple processes running in parallel. Resuscitation efforts should be goal oriented with defined endpoints for airway management, access, and hemodynamic parameters. In tandem with resuscitation, early identification of life-threatening injuries is critical for determining the disposition of patients when they leave the trauma bay. Salvage strategies for profoundly hypotensive or pulseless patients include retrograde balloon occlusion of the aorta and resuscitative thoracotomy, with differing populations benefiting from each.

Mil Med. 2017 Sep;182(9):e1824-e1833

Systematic Review of Live Tissue Versus Simulation Education for Prehospital Trauma Providers.

Goolsby C, Branting A, Ausman J, Williams D, Ausman C, David J, Allard R

BACKGROUND: Advanced simulation capabilities have provided medical educators novel approaches for learners. Simulation has successfully replaced many aspects of medical education that previously used animal live-tissue training (LTT) for physician education. However, prehospital trauma providers, such as combat medics, currently used LTT to prepare for patient care. This use of LTT has sparked a debate about the optimal educational modality for this unique learner population. At this time, there is no clear evidence-based recommendation available to recommend either LTT or simulation as a superior modality.

METHODS: The authors performed a systematic review of observational studies and randomized control trials (RCTs) to examine the use of LTT versus simulation in the trauma education of prehospital providers. The authors judged studies for inclusion and data abstraction independently and in duplicate, while also assessing quality and risk of bias. Since the literature demonstrated a heterogeneous background, no meta-analysis was performed.

RESULTS: 12 studies met inclusion criteria: seven RCTs, four prospective cohorts, one cross-sectional study. Two of seven RCTs were presented as abstracts only. Ten of 12 studies were performed in a military setting, whereas two occurred in a civilian setting. Four studies used swine, two used goats, one used swine and goats, one used canines, and four did not specify the animal type. The authors used the Cochrane Collaboration tool to assess RCTs and found a considerable risk of bias. They used the Newcastle-Ottawa score to assess prospective cohorts (mean score of 5.75 ± 0.5, range 1-9), and the cross-sectional study (score 4, range 1-9).

CONCLUSION: The existing literature provides limited, low-to-moderate quality outcome data. Evidence does not exist at this time to recommend either LTT or simulation as a superior educational modality for prehospital trauma care providers.

Shock. 2017 Sep 29. [Epub ahead of print]

2017 Military Supplement: Hemoglobin-based Oxygen Carriers: Current State-of-the-Art and Novel Molecules.

Gupta A

Abstract:

In blood, the primary role of RBCs is to transport oxygen via highly regulated mechanisms involving hemoglobin (Hb). Hb is a tetrameric porphyrin protein comprising of two α- and two β-polypeptide chains, each containing an iron-containing heme group capable of binding one oxygen molecule. In military as well as civilian traumatic exsanguinating hemorrhage, rapid loss of RBCs can lead to sub-optimal tissue oxygenation and subsequent morbidity and mortality. In such cases, transfusion of whole blood or RBCs can significantly improve survival. However, blood products including RBCs present issues of limited availability and portability, need for type matching, pathogenic contamination risks, and short shelf-life, causing substantial logistical barriers to their pre-hospital use in austere battlefield and remote civilian conditions. While robust research is being directed to resolve these issues, parallel research efforts have emerged towards bioengineering of semi-synthetic and synthetic surrogates of RBCs, using various cross-linked, polymeric and encapsulated forms of Hb. These Hb-based oxygen carriers (HBOCs) can potentially provide therapeutic oxygenation when blood or RBC are not available. Several of these HBOCs have undergone rigorous pre-clinical and clinical evaluation, but have not yet received clinical approval in the USA for human use. While these designs are being optimized for clinical translations, several new HBOC designs and molecules have been reported in recent years, with unique properties. The current article will provide a comprehensive review of such HBOC designs, including current state-of-the-art and novel molecules in development, along with a critical discussion of successes and challenges in this field.

Ulus Travma Acil Cerrahi Derg. 2017 Sep;23(5):357-361

Topical hemostatics for bleeding control in pre-hospital setting: Then and now.

Güven H

Abstract:

Massive hemorrhage causes instant and early deaths because of hypovolemia. However, even if the victim makes it to the hospital, hypothermia, metabolic acidosis, and coagulation impairments caused by bleeding pose a great risk for survival. Many topical hemostatic agents are developed for neck, armpit, or groin injuries that are not amenable to tourniquet application and for extremity wounds to be used in conjunction with tourniquets. This paper focuses on those hemostatics that differ based on the action mechanism and are suitable for pre-hospital setting and summarizes the latest recommendations regarding their usage.

Acad Emerg Med. 2017 Oct 27 [Epub ahead of print]

Training and Assessing Critical Airway, Breathing and Hemorrhage Control Procedures for Trauma Care: Live Tissue versus Synthetic Models.

Hart D, Rush R, Rule G, Clinton J, Beilman G, Anders S, Brown R, McNeil M), Reihsen T, Chipman J, Sweet R; University of Minnesota Combat Casualty Training Consortium (UMN CCTC)

INTRODUCTION: Optimal teaching and assessment methods and models for emergency airway, breathing and hemorrhage interventions are not currently known. The University of Minnesota Combat Casualty Training consortium (UMN CCTC) was formed to explore the strengths and weaknesses of synthetic training models (STMs) versus Live tissue (LT) models. In this study, we compare the effectiveness of best in class STMs versus an anesthetized caprine (goat) model for training and assessing 7 procedures: Junctional hemorrhage control, Tourniquet (TQ) placement, Chest seal, Needle thoracostomy (NCD), Nasopharyngeal airway (NPA), Tube thoracostomy, and Cricothyrotomy (Cric).

METHODS: Army combat medics were randomized to one of four groups: 1) Live tissue trained - live tissue tested (LT-LT), 2) live tissue trained - synthetic training model tested (LT-STM), 3) synthetic training model trained - live tissue tested (STM-LT), 4) synthetic training model trained - synthetic training model tested (STM-STM). Participants trained in small groups for 3-4 hours and were evaluated individually. LT-LT was the "control" to which other groups were compared, as this is the current military pre-deployment standard. The mean procedural scores (PS) were compared using a pairwise t-test with a Dunnett's correction. Logistic regression was used to compare critical fails (CF) and skipped tasks.

RESULTS: There were 559 subjects included. Junctional hemorrhage control revealed no difference in CFs, but LT tested subjects (LT-LT and STM-LT) skipped this task more than STM tested subjects (LT-STM and STM-STM) ($p<0.05$), and STM-STM had higher PS than LT-LT ($p<0.001$). For TQ, both STM tested groups (LT-STM and STM-STM) had more CFs than LT-LT ($p<0.001$) and LT-STM had lower PS than LT-LT ($p<0.05$). No differences were seen for chest seal. For NCD, LT-STM had greater CFs than LT-LT ($p=0.001$), and lower PSs ($p=0.001$). There was no difference in CFs for NPA, but all groups had worse PS versus LT-LT ($p<0.05$). For Cric, we were underpowered; STM-LT trended towards more CFs ($p=0.08$), and STM-STM had higher PSs than LT-LT ($p<0.01$). Tube thoracostomy revealed STM-LT had higher CFs than LT-LT ($p<0.05$), but LT-STM had lower PS ($p<0.05$). An interaction effect (making the subjects who trained and tested on different models more likely to CF) was only found for Tourniquet, chest seal and Cric, however, of these 3 procedures, only TQ demonstrated any significant difference in CF rates.

CONCLUSION: Training on STM or LT did not demonstrate a difference in subsequent performance for 5 of 7 procedures (junctional hemorrhage, TQ, chest seal, NPA and NCD). Until synthetic training models are developed with improved anthropomorphic and tissue fidelity, there may still be a role for LT for training tube thoracostomy and potentially cricothyrotomy. For assessment, our STM appears more challenging for TQ and potentially for NCD than LT. For junctional hemorrhage, the increased "skips" with LT may be explained by the differences in anatomicfidelity. While these results begin to uncover the effects of training and assessing these procedures on various models, further study is needed to ascertain how well performance on an STM or LT model translates to the human model.

Crit Care. 2017 Aug 23;21(1):222

Hyperfibrinolysis in severe isolated traumatic brain injury may occur without tissue hypoperfusion: a retrospective observational multicentre study.

Hayakawa M, Maekawa K, Kushimoto S, Kato H, Sasaki J, Ogura H, Matsuoka T, Uejima T, Morimura N, Ishikura H, Hagiwara A, Takeda M, Kaneko N, Saitoh D, Kudo D, Kanemura T, Shibusawa T, Furugori S, Nakamura Y, Shiraishi A, Murata K, Mayama G, Yaguchi A, Kim S, Takasu O, Nishiyama K

BACKGROUND: Hyperfibrinolysis is a critical complication in severe trauma. Hyperfibrinolysis is traditionally diagnosed via elevated D-dimer or fibrin/fibrinogen degradation product levels, and recently, using thromboelastometry. Although hyperfibrinolysis is observed in patients with severe isolated traumatic brain injury (TBI) on arrival at the emergency department (ED), it is unclear which factors induce hyperfibrinolysis. The present study aimed to investigate the factors associated with hyperfibrinolysis in patients with isolated severe TBI.

METHODS: We conducted a multicentre retrospective review of data for adult trauma patients with an injury severity score ≥ 16, and selected patients with isolated TBI (TBI group) and extra-cranial trauma (non-TBI group). The TBI group included patients with an abbreviated injury score (AIS) for the head ≥ 4 and an extra-cranial AIS < 2. The non-TBI group included patients with an extra-cranial AIS ≥ 3 and head AIS < 2. Hyperfibrinolysis was defined as a D-dimer level ≥ 38 mg/L on arrival at the ED. We evaluated the relationships between hyperfibrinolysis and injury severity/tissue injury/tissue perfusion in TBI patients by comparing them with non-TBI patients.

RESULTS: We enrolled 111 patients in the TBI group and 126 in the non-TBI group. In both groups, patients with hyperfibrinolysis had more severe injuries and received transfusion more frequently than patients without hyperfibrinolysis. Tissue injury, evaluated on the basis of lactate dehydrogenase and creatine kinase levels, was associated with hyperfibrinolysis in both groups. Among patients with TBI, the mortality rate was higher in those with hyperfibrinolysis than in those without hyperfibrinolysis. Tissue hypoperfusion, evaluated on the basis of lactate level, was associated with hyperfibrinolysis in only the non-TBI group. Although the increase in lactate level was correlated with the deterioration of coagulofibrinolytic variables (prolonged prothrombin time and activated partial thromboplastin time, decreased fibrinogen levels, and increased D-dimer levels) in the non-TBI group, no such correlation was observed in the TBI group.

CONCLUSIONS: Hyperfibrinolysis is associated with tissue injury and trauma severity in TBI and non-TBI patients. However, tissue hypoperfusion is associated with hyperfibrinolysis in non-TBI patients, but not in TBI patients. Tissue hypoperfusion may not be a prerequisite for the occurrence of hyperfibrinolysis in patients with isolated TBI.

J Trauma Acute Care Surg. 2017 Oct;83(4):617-621

Implications of the Trauma Quality Improvement Project inclusion of nonsurvivable injuries in performance benchmarking.

Heaney J, Schroll R, Turney J, Stuke L, Marr AB, Greiffenstein P, Robledo R, Theriot A, Duchesne J, Hunt J.

BACKGROUND: The Trauma Quality Improvement Project (TQIP) uses an injury prediction model for performance benchmarking. We hypothesize that at a Level I high-volume penetrating trauma center, performance outcomes will be biased due to inclusion of patients with non-survivable injuries.

METHODS: Retrospective chart review was conducted for all patients included in the institutional TQIP analysis from 2013 to 2014 with length of stay (LOS) less than 1 day to determine survivability of the injuries. Observed (O)/expected (E) mortality ratios were calculated before and after exclusion of these patients. Completeness of data reported to TQIP was examined.

RESULTS: Eight hundred twenty-six patients were reported to TQIP including 119 deaths. Non-survivable injuries accounted 90.9% of the deaths in patients with an LOS of 1 day or less. The O/E mortality ratio for all patients was 1.061, and the O/E ratio after excluding all patients with LOS less than 1 day found to have non-survivable injuries was 0.895. Data for key variables were missing in 63.3% of patients who died in the emergency department, 50% of those taken to the operating room and 0% of those admitted to the intensive care unit. Charts for patients who died with LOS less than 1 day were significantly more likely than those who lived to be missing crucial.

CONCLUSION: This study shows TQIP inclusion of patients with non-survivable injuries biases outcomes at an urban trauma center. Missing data results in imputation of values, increasing inaccuracy. Further investigation is needed to determine if these findings exist at other institutions, and whether the current TQIP model needs revision to accurately identify and exclude patients with non-survivable injuries.

LEVEL OF EVIDENCE: Prognostic and epidemiological, level III.

Am J Emerg Med. 2017 Sep 16 [Epub ahead of print]

Definitive airway management after pre-hospital supraglottic airway insertion: Outcomes and a management algorithm for trauma patients.

Hernandez M, Aho J, Zielinski M, Zietlow S, Kim B, Morris D

BACKGROUND: Prehospital airway management increasingly involves supraglottic airway insertion and a paucity of data evaluates outcomes in trauma populations. We aim to describe definitive airway management in traumatically injured patients who necessitated prehospital supraglottic airway insertion.

METHODS: We performed a single institution retrospective review of multisystem injured patients (≥15years) that received prehospital supraglottic airway insertion during 2009 to 2016. Baseline demographics, number and type of: supraglottic airway insertion attempts, definitive airway and complications were recorded. Primary outcome was need for tracheostomy. Univariate and multivariable statistics were performed.

RESULTS: 56 patients met inclusion criteria and were reviewed, 78% were male. Median age [IQR] was 36 [24-56] years. Injuries comprised blunt (94%), penetrating (4%) and burns (2%). Median ISS was 26 [22-41]. Median number of prehospital endotracheal intubation (PETI) attempts was 2 [1-3]. Definitive airway management included: (n=20, 36%, tracheostomy), (n=10, 18%, direct laryngoscopy), (n=6, 11%, bougie), (n=9, 15%, Glidescope), (n=11, 20%, bronchoscopic assistance). 24-hour mortality was 41%. Increasing number of PETI was associated with increasing facial injury. On regression, increasing cervical and facial injury patterns as well as number of PETI were associated with definitive airway control via surgical tracheostomy.

CONCLUSIONS: After supraglottic airway insertion, operative or non-operative approaches can be utilized to obtain a definitive airway. Patients with increased craniofacial injuries have an increased risk for airway complications and need for tracheostomy. We used these factors to generate an evidence based algorithm that requires prospective validation.

LEVEL OF EVIDENCE: Level IV - Retrospective study.

STUDY TYPE: Retrospective single institution study.

Prehosp Emerg Care. 2017 Sep 28: [Epub ahead of print]

Prehospital Pain Management: Disparity By Age and Race.

Hewes HA, Dai M, Mann NC, Baca T, Taillac P.

IMPORTANCE: Historically, pain management in the prehospital setting, specifically pediatric pain management, has been inadequate despite many EMS (emergency medical services) transports related to traumatic injury with pain noted as a symptom. The National Emergency Services Information System (NEMSIS) database offers the largest national repository of prehospital data, and can be used to assess current patterns of EMS pain management across the country.

OBJECTIVES: To analyze prehospital management of pain using NEMSIS data, and to assess if variables such as patient age and/or race/ethnicity are associated with disparity in pain treatment.

DESIGN/SETTING/PARTICIPANTS: A retrospective descriptive study over a three-year period (2012-2014) of the NEMSIS database for patients evaluated for three potentially painful medical impressions (fracture, burn, penetrating injury) to assess the presence of documented pain as a symptom, and if patients received treatment with analgesic medications. Results were analyzed according to type of pain medication given, age categories, and race/ethnicity of the patients.

MAIN OUTCOMES: Percentage of EMS transports documenting the three painful impressions that had pain documented as a symptom, received any of the six pain medications, and the disparity in documentation and treatment by age and race/ethnicity.

RESULTS: There were 276,925 EMS records in the NEMSIS database that met inclusion criteria. Pain was listed as a primary or associated symptom for 29.5% of patients, and the youngest children (0-3 years) were least likely to have pain documented as a symptom (14.6%). Only 15.6% of all activations documented the receipt of prehospital pain medications. Children (<15 years) received pain medication 14.8% [95% CI 14.33, 15.34] of the time versus adults (≥15 years) 15.6% [95% CI 15.48, 15.76, p = 0.004]. Morphine and fentanyl were the most commonly administered medications to all age groups. Black patients were less likely to receive pain medication than other racial groups.

CONCLUSIONS: Documentation of pain as a symptom and pain treatment continue to be infrequent in the prehospital setting in all age groups, especially young children. There appears to be a racial disparity with Black patients less often treated with analgesics. The broad incorporation of national NEMSIS data suggests that these inadequacies are a widespread challenge deserving further attention.

Accepted for publication in Critical Care Medicine

Transport Time and Pre-Operating Room Hemostatic Interventions are Important: Improving Outcomes after Severe Truncal Injury

John B Holcomb, MD, FACS

Objective: 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 is now possible.

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

J Trauma Acute Care Surg. 2017 Oct;83(4):579-588

Military use of tranexamic acid in combat trauma: Does it matter?

Howard JT1, Stockinger ZT, Cap AP, Bailey JA, Gross KR.

BACKGROUND: Tranexamic acid (TXA) has been previously reported to have a mortality benefit in civilian and combat-related trauma, and was thus added to the Joint Theater Trauma System Damage Control Resuscitation Clinical Practice Guideline. As part of ongoing system-wide performance improvement, the use of TXA has been closely monitored. The goal was to evaluate the efficacy and safety of TXA use in military casualties and provide additional guidance for continued use.

METHODS: A total of 3,773 casualties were included in this retrospective, observational study of data gathered from a trauma registry. The total sample, along with three subsamples for massive transfusion patients (n = 784), propensity-matched sample (n = 1,030), and US/North Atlantic Treaty Organization (NATO) military (n = 1,262), was assessed for administration of TXA and time from injury to administration of TXA. Outcomes included mortality and occurrence of pulmonary embolism and deep vein thrombosis. Multivariable proportional hazards regression models with robust standard error estimates were used to estimate hazard ratios (HR) for assessment of outcomes while controlling for covariates.

RESULTS: Results of univariate and multivariate analyses of the total sample (HR, 0.97; 95% confidence interval [CI], 0.62-1.53; p = 0.86), massive transfusion sample (HR, 0.84; 95% CI, 0.46-1.56; p = 0.51), propensity-matched sample (HR, 0.68; 95% CI, 0.27-1.73; p = 0.34), and US/NATO military sample (HR, 0.76; 95% CI, 0.30-1.92; p = 0.48) indicate no statistically significant association between TXA use and mortality. Use of TXA was associated with increased risk of pulmonary embolism in the total sample (HR, 2.82; 95% CI, 2.08-3.81; p < 0.001), massive transfusion sample (HR, 3.64; 95% CI, 1.96-6.78; p = 0.003), US/NATO military sample (HR, 2.55; 95% CI, 1.73-3.69; p = 0.002), but not the propensity-matched sample (HR, 3.36; 95% CI, 0.80-14.10; p = 0.10). TXA was also associated with increased risk of deep vein thrombosis in the total sample (HR, 2.00; 95% CI, 1.21-3.30; p = 0.02) and US/NATO military sample (HR, 2.18; 95% CI, 1.20-3.96; p = 0.02).

CONCLUSION: In the largest study on TXA use in a combat trauma population, TXA was not significantly associated with mortality, due to lack of statistical power. However, our HR estimates for mortality among patients who received TXA are consistent with previous findings from the CRASH-2 trial. At the same time, continued scrutiny and surveillance of TXA use in military trauma, specifically for prevention of thromboembolic events, is warranted.

Int J Environ Res Public Health. 2017 Oct 12;14(10). pii: E1217

Effect of Early Pelvic Binder Use in the Emergency Management of Suspected Pelvic Trauma: A Retrospective Cohort Study.

Hsu S, Chen C, Chou Y, Wang S, Chan D

BACKGROUND: We aimed to evaluate the effect of early pelvic binder use in the emergency management of suspected pelvic trauma, compared with the conventional stepwise approach.

METHODS: We enrolled trauma patients with initial stabilization using a pelvic binder when suspecting pelvic injury. The inclusion criteria were traumatic injury requiring a trauma team and at least one of the following: a loss of consciousness or a Glasgow coma score (GCS) of <13; systolic blood pressure of <90 mmHg; falling from ≥6 m; injury to multiple vital organs; and suspected pelvic injury. Various parameters, including gender, age, mechanism of injury, GCS, mortality, hospital stay, initial vital signs, revised trauma score, injury severity score, and outcome, were assessed and compared with historical controls.

RESULTS: A total of 204 patients with high-energy multiple-trauma from a single level I trauma center in North Taiwan were enrolled in the study from August 2013 to July 2014. The two group baseline patient characteristics were all collected and compared. The trauma patients with suspected pelvic fractures initially stabilized with a pelvic binder had shorter hospital and intensive care unit (ICU) stays. The study group achieved statistically significantly improved survival and lower mean blood transfusion volume and mortality rate, although they were more severe in the trauma score.

CONCLUSIONS: We recommend prompt pelvic binder use for suspected pelvic injury before definitive imaging is available, as a cervical spine collar is used to protect the cervical spine from further injury prior to definitive identification and characterization of an injury.

Int J Burns Trauma. 2017 Apr 15;7(2):17-26

Mortality outcomes in trauma patients undergoing prehospital red blood cell transfusion: a systematic literature review.

Huang G, Dunham C

Abstract:

The value of prehospital red blood cell (RBC) transfusion for trauma patients is controversial. The purposes of this literature review were to determine the mortality rate of trauma patients with hemodynamic instability and the benefit of prehospital RBC transfusion. A 30-year systematic literature review was performed in 2016. Eligible studies were combined for meta-analysis when tests for heterogeneity were insignificant. The synthesized mortality was 35.6% for systolic blood pressure ≤ 90 mmHg; 51.1% for ≤ 80 mmHg; and 63.9% for ≤ 70 mmHg. For patients with either hypotension or emergency trauma center transfused RBCs, the synthesized Injury Severity Score (ISS) was 27.0 and mortality was 36.2%; the ISS and mortality correlation was r = 0.766 (P = 0.0096). For civilian patients receiving prehospital RBC transfusions, the synthesized ISS was 27.5 and mortality was 39.5%. One civilian study suggested a decrement in mortality with prehospital RBC transfusion; however, patient recruitment was only one per center per year and mortality was < 10% despite an ISS of 37. The same study created a matched control subset and indicated that mortality decreased using multivariate analysis; however, neither the assessed factors nor raw mortality was presented. Civilian studies with patients undergoing prehospital RBC transfusion and a matched control subset showed that the synthesized mortality was similar for those transfused (37.5%) and not transfused (38.7%; P = 0.8933). A study of civilian helicopter patients demonstrated a similar 30-day mortality for those with and without prehospital blood product availability (22% versus 21%; P = 0.626). Mortality in a study of matched military patients was better for those receiving prehospital blood or plasma (8%) than the controls (20%; P = 0.013). However, transfused patients had a shorter prehospital time, more advanced airway procedures, and higher hospital RBC transfusion (P < 0.05). A subset with an ISS > 16 showed similar mortality with and without prehospital RBC availability (27.6% versus 32.0%; P = 0.343). Trauma patient mortality increases with the magnitude of hemodynamic instability and anatomic injury. Some literature evidence indicates no survival advantage with prehospital RBC availability. However, other data suggesting a potential benefit is confounded or likely to be biased.

J Trauma Acute Care Surg. 2017 Oct;83(4):603-608

Comparison of compensatory reserve and arterial lactate as markers of shock and resuscitation.

Johnson M, Alarhayem A, Convertino V, Carter R 3rd, Chung K, Stewart R, Myers J, Dent D, Liao L, Cestero R, Nicholson S, Muir M, Schwaca M, Wampler D, DeRosa M, Eastridge BJ.

BACKGROUND: During traumatic hemorrhage, the ability to identify shock and intervene before decompensation is paramount to survival. Lactate is extremely sensitive to shock, and its clearance has been demonstrated a useful gauge of shock and resuscitation status. Though lactate can be measured in the field, logistical constraints render it impractical in certain environments. The compensatory reserve represents a new clinical measurement reflecting the remaining capacity to compensate for hypoperfusion. We hypothesized the compensatory reserve index (CRI) would be an effective surrogate marker of shock and resuscitation compared to lactate.

METHODS: The CRI device was placed on consecutive patients meeting trauma center activation criteria and remained on the patient until discharge, admission, or transport to operating suite. All subjects had a lactate level measured as part of their routine admission metabolic analysis. Time-corresponding CRI and lactate values were matched in regards to initial and subsequent lactate levels. Mean time from lactate sample collection to data availability in the electronic medical record was calculated. Predictive capacity of CRI and lactate in predicting hemorrhage was determined by receiver-operator characteristic curve analysis. Correlation analysis was performed to determine if any association existed between changing CRI and lactate values.

RESULTS: Receiver-operator characteristic (ROC) curves were generated and area under the curve was 0.8052 and 0.8246 for CRI and lactate, respectively. There was no significant difference in each parameter's ability to predict hemorrhage ($p = 0.8015$). The mean duration from lactate sample collection to clinical availability was 44 minutes whereas CRI values were available immediately. Analysis of the concomitant change in serial CRI and lactate levels revealed a Spearman's correlation coefficient of -0.73 ($p < 0.01$).

CONCLUSION: CRI performed with equivalent predictive capacity to lactate with respect to identifying initial perfusion status associated with hemorrhage and subsequent resuscitation.

JAMA Surg. 2017 Oct 25. 2017.3821. [Epub ahead of print]

Evaluation of Military Use of Tranexamic Acid and Associated Thromboembolic Events.

Johnston L, Rodriguez C, Elster E, Bradley M

Importance: Since publication of the CRASH-2 and MATTERs studies, the US military has included tranexamic acid (TXA) in clinical practice guidelines. While TXA was shown to decrease mortality in trauma patients requiring massive transfusion, improper administration and increased risk of venous thromboembolism remain a concern.

Objective: To determine the appropriateness of TXA administration by US military medical personnel based on current Joint Trauma System clinical practice guidelines and to determine if TXA administration is associated with venous thromboembolism. Design, Setting, and Participants: This cohort study of US military casualties in US military combat support hospitals in Afghanistan and a single US-based tertiary military treatment facility within the continental United States was conducted from 2011 to 2015, with follow-up through initial hospitalization and readmissions.

Exposures: Data collected for all patients included demographic information as well as Injury Severity Score; receipt of blood products, TXA, and/or a massive transfusion; and admission hemodynamics. Main Outcomes and Measures: Variance from guidelines in TXA administration and venous thromboembolism. Tranexamic acid overuse was defined as a hemodynamically stable patient receiving TXA but not a massive transfusion, underuse was defined as a patient receiving a massive transfusion but not TXA, and TXA administration was considered delayed when given more than 3 hours after injury.

Results: Of the 455 identified patients, 443 (97.4%) were male, and the mean (SD) age was 25.3 (4.8) years. A total of 173 patients (38.0%) received a massive transfusion, and 139 (30.5%) received TXA in theater. Overuse occurred in 18 of 282 patients (6.4%) and underuse in 46 of 173 (26.6%) receiving massive transfusions, and delayed administration was found in 6 of 145 patients (4.3%) receiving TXA. Overuse increased at 3.3% per quarter (95% CI, 4.0-9.9; $P < .001$; $R2 = 0.340$) and underuse decreased at -4.4% per quarter (95% CI, -4.5 to -3.6; $P < .001$; $R2 = 0.410$). Tranexamic acid administration was an independent risk factor for venous thromboembolism (odds ratio, 2.58; 95% CI, 1.20-5.56; $P = .02$).

Conclusions and Relevance: Military medical personnel decreased missed opportunities to appropriately use TXA but also increased overuse. In addition, TXA administration was an independent risk factor for venous thromboembolism. A reevaluation of the use of TXA in combat casualties should be undertaken.

Mil Med. 2017 Nov;182(11):e1881-e1884

Vital Signs and Physiologic Derangement in Patients with Thoracic Trauma in Iraq and Afghanistan.

Keneally R, Szpisjak D, Hoffmann P, Park E, Albergo M

BACKGROUND: Triage is the act of stratifying the need for medical attention. Effective triage must account for injury patterns and severity. Personnel making triage decisions must also consider the patients' physiologic states. Vital signs can possibly be used to assess for the presence of physiological derangements such as coagulopathy, acidosis, or a significant base deficit. Providers could use this knowledge to assist with triage at casualty collection points where laboratory studies or point of care testing may not be available.

METHODS: With institutional approval, data were extracted from the Joint Theater Trauma Registry for all patients with thoracic trauma between 2002 and 2012. Patients were identified by International Statistical Classification of Diseases and Related Health Problems, 9th Revision (ICD-9) codes. Heart rate (HR), systolic blood pressure (SBP), and pulse pressure were correlated with coagulopathy (international normalization ratio ≥ 1.5), acidosis (pH < 7.2) or an elevated base deficit (>6) on admission. Sensitivity, specificity, positive predictive values, negative predictive values, and odds ratios were calculated.

FINDINGS: HR > 100, SBP < 90, or pulse pressure <30 were associated with an increased risk for acidosis (odds ratio 3.06 [95% confidence interval 2.48-3.78], 4.72 [3.85-5.78], and 2.73 [2.15-3.48], respectively), coagulopathy (2.21 [1.72-2.83], 4.55 [3.57-5.80], and 2.73 [2.15-3.48], respectively), and base deficit >6 (2.17 [1.88-2.50], 3.48 [2.87-4.22], and 2.22 [1.78-2.77], respectively). HR was a moderately sensitive marker (0.74), whereas SBP was a specific marker (0.93).

DISCUSSION: SBP < 90 is an effective marker for ruling in physiologic derangement after thoracic trauma. HR > 100 was associated with over twice the odds for physiologic derangement. Vital signs can be used to assess for physiologic derangement in the population studied and may help in triage.

Mil Med. 2017 Sep;182(9):e1834-e1840

The Value of Live Tissue Training for Combat Casualty Care: A Survey of Canadian Combat Medics With Battlefield Experience in Afghanistan.

Kim M, Torrie I, Poisson R, Withers N, Bjarnason S, Da Luz L, Pannell D, Beckett A, Tien H

INTRODUCTION: The optimum method for training military personnel for combat casualty care is unknown. In particular, there is debate regarding the incremental benefit of live animal tissue training (LTT) over inanimate human patient simulators (HPSs). Although both LTT and HPS are currently used for predeployment training, the efficacy of these models has not been established.

MATERIALS AND METHODS: Canadian Armed Forces combat medics, deployed to Afghanistan between 2006 and 2011, were surveyed retrospectively regarding their experience with combat casualty care and pre-deployment training. HPSs were used to prepare these combat medics for early rotations. In later years, personnel received a combination of training modalities including HPS and LTT, using anaesthetized porcine models in accordance with appropriate animal care standards. Among those deployed on multiple rotations, there was a cohort who was prepared for deployment using only HPS training, and who later were prepared using mixed-modality training, which included LTT. We asked these medics to compare their predeployment training using HPS only versus their mixed-modality training in how each training package prepared them for battlefield trauma care.

RESULTS: Thirty-eight individuals responded, with 20 respondents deployed on multiple rotations. Respondents performed life-saving skills during 89% of the rotations. Self-perceived competence and preparedness were notably higher after incorporation of LTT than after HPS alone. Of 17 respondents deployed on both early and late rotations, the majority felt the latter training was more worthwhile. In addition, almost all individuals felt that LTT should be added to HPS training. Narrative comments described multiple benefits of adding LTT to other types of training.

CONCLUSIONS: Among many experienced Canadian Armed Forces personnel, LTT is considered essential pre-deployment preparation. Individuals who experienced only HPS training before active duty on their first combat deployment reported feeling more competent on subsequent combat deployments after the addition of live tissue models.

IMPACT: There has been a movement away from the use of LTT in preparing combat medics for deployment. This article suggests that we should reconsider any decision to completely exclude Live Tissue Training as part of our training plan for combat medics.

RECOMMENDATIONS: Military medical organizations should consider judiciously incorporating LTT with human patient simulation training to prepare combat medics for treating battlefield trauma.

Eur J Anaesthesiol. 2017 Aug 28. [Epub ahead of print]

Comparison of the laryngeal mask airway supreme and the i-gel in paralysed elderly patients: A randomised controlled trial.

Kim M, Lee J, Choi Y, Park S, Shin S.

BACKGROUND: The laryngeal mask airway supreme (LMA-S) and i-gel are both popular second-generation supraglottic airway devices that have been widely studied in surgical patients, but their differences in clinical performance in the elderly are not clear.
OBJECTIVE: We compared the efficacy and safety of the LMA-S and i-gel in anaesthetised and paralysed elderly patients.

DESIGN: A prospective, randomised and parallel study.

SETTING: Single-centre trial, study period January 2014 from to October 2016.

PATIENTS: One hundred and six elderly patients who underwent urological or orthopaedic surgery with an expected duration less than 2 h.

INTERVENTION: Patients were allocated to either the LMA-S (n = 53) or i-gel (n = 53) group. All insertions were performed in a standardized manner according to the manufacturers' instructions.

MAIN OUTCOME MEASURES: Our primary endpoint was the rate of successful insertion at the first attempt. The adequacy of positive pressure ventilation and airway sealing, fibreoptic laryngoscopy grades and stability of airway maintenance during anaesthesia were also assessed.

RESULTS: Although the rate of successful insertion at the first attempt was similar between the two groups (94.3 vs. 82.7%, P = 0.072), more patients required device manipulation during insertion with the LMA-S than the i-gel (42.3 vs. 18.9%, P = 0.011). Good fibreoptic laryngoscopy grades were significantly more common with the i-gel than the LMA-S (79.3 vs. 55.8%, P = 0.042), and peak inspiratory pressures were lower in the i-gel group both immediately after insertion and at the end of surgery. Leak pressures were significantly higher in the i-gel group than the LMA-S group, both immediately after insertion and at the end of surgery (25.8 vs. 23.0, P = 0.036; and 28.1 vs. 23.7, P < 0.001, respectively).

CONCLUSION: Both the LMA-S and i-gel were used successfully and safely in elderly patients. However, the i-gel demonstrated better airway sealing than the LMA-S at insertion and during maintenance of anaesthesia.

Scand J Trauma Resusc Emerg Med. 2017 Jan 5;25(1):2.

The Norwegian guidelines for the prehospital management of adult trauma patients with potential spinal injury.

Kornhall D, Jørgensen J, Brommeland T, Hyldmo P, Asbjørnsen H, Dolven T, Hansen T, Jeppesen E

Abstract:

The traditional prehospital management of trauma victims with potential spinal injury has become increasingly questioned as authors and clinicians have raised concerns about over-triage and harm. In order to address these concerns, the Norwegian National Competence Service for Traumatology commissioned a faculty to provide a national guideline for pre-hospital spinal stabilization. This work is based on a systematic review of available literature and a standardized consensus process. The faculty recommends a selective approach to spinal stabilization as well as the implementation of triaging tools based on clinical findings. A strategy of minimal handling should be observed.

J Spec Oper Med. Fall 2017;17(3):25-34.

Unwrapping a First Aid Tourniquet From Its Plastic Wrapper With and Without Gloves Worn: A Preliminary Study.

Kragh J, Aden J, Lambert C, Moore V, Dubick M

BACKGROUND: The purpose of this study was to gather data about unwrapping a packaged limb tourniquet from its plastic wrapper while wearing different types of gloves. Because already unwrapped tourniquets require no time to unwrap, unwrapping data may provide insights into the issue of having tourniquets unwrapped when stowed in a first aid kit of a Serviceperson at war.

MATERIALS AND METHODS: In a laboratory setting, 36 tests of nine glove groups were performed in which four people, gloved and ungloved, unwrapped tourniquets. Other tourniquets were environmentally exposed for 3 months.

RESULTS: All the users successfully unwrapped each tourniquet. Mean times to unwrap by glove group were not significantly different ($p = .0961$). When mean values of eight experimental groups were compared with that of one control group (i.e., bare hands), results showed no significant difference ($p > .07$). Mean time was least for bare hands (12 seconds) and most for cold gloves layered under mittens (22 seconds). Among the 36 pairwise comparisons of difference between glove group means, after adjustment for multiple comparisons, no comparison was noted to be statistically significant ($p > .052$, all 36 pairs). Glove thickness ranged from 0 mm for bare hands to 2.5 mm for cold gloves layered under mittens. By glove group, the thickness-time association was moderate, as tested by linear regression ($R2 = 0.6096$). The tourniquets exposed to the environment had evidence of rapid photo degradation due to direct exposure to sunlight. Such exposure also destroyed the wrappers.

CONCLUSION: In a preliminary study, different gloves performed similarly when wearers unwrapped a tourniquet from its wrapper. The tourniquet wrappers gave no visible protection from sunlight, and environmental exposure destroyed the wrappers.

J Orthop Trauma. 2017 Oct;31(10):526-530

Effect of Tranexamic Acid on Transfusion: A Randomized Clinical Trial in Acetabular Fracture Surgery.

Lack W, Crist B, Seymour R, Harvin W, Karunakar M; TXA Study Group Ⅱ.

OBJECTIVES: Given the increasing evidence that minimizing blood loss and limiting allogeneic transfusion can improve patient outcome, we are performing a randomized controlled trial of the use of tranexamic acid (TXA) during acetabular fracture surgery.

DESIGN: Prospective, multicenter, and randomized.

SETTING: Two level I trauma centers.

PARTICIPANTS: Eighty-eight patients underwent randomization, with 42 assigned to the TXA group and 46 assigned to the placebo group.

INTERVENTION: The use of TXA during acetabular fracture surgery.

MAIN OUTCOME MEASUREMENTS: The primary outcome was allogeneic blood transfusion. Secondary outcomes consisted of estimate blood loss (EBL) and venous thromboembolism (VTE).

RESULTS: The overall transfusion rate was 40.9% (36 of 88), and the average estimated blood loss was 635 mL. There were no significant differences between groups for transfusion incidence, number of units transfused, EBL, or incidence of VTE. There was no difference in transfusion rate for the TXA group (0.097). Transfusion was significantly more likely in cases with low preoperative hemoglobin levels, higher rates of intraoperative blood loss, and longer surgical times.

CONCLUSIONS: There was no significant difference in transfusion rate, EBL, or VTE for TXA versus placebo. Any potential benefit seems to be overwhelmed by other factors, specifically preoperative anemia and surgical time, which are highly variable in trauma surgery. These findings do not support the routine use of TXA in the setting of open reduction and internal fixation of acetabular fractures.

LEVEL OF EVIDENCE: Therapeutic Level I. See Instructions for Authors for a complete description of levels of evidence.

J Trauma Acute Care Surg. 2017 Dec;83(6):1187-1194

Bigger is better: Comparison of alternative devices for tension hemopneumothorax and pulseless electrical activity in a Yorkshire swine model.

Leatherman M, Fluke L, McEvoy C, Pokorny D, Ricca R, Martin M, Gamble C, Polk T

BACKGROUND: Tension pneumothorax is a cause of potentially preventable death in prehospital and battlefield settings and 14-gauge angiocatheter (14G AC) decompression remains the current treatment standard, despite its high incidence of failure. Traumatic pneumothorax is often associated with hemothorax, but 14G AC has no proven efficacy for associated hemothorax. We sought to compare the 14G AC to three alternative devices for treatment of tension hemopneumothorax (t-H/PTX) in a positive-pressure ventilation swine model.

METHODS: Our tension model was modified to incorporate a persistent air leak and pleural blood. Tension physiology was achieved with escalating carbon dioxide insufflation via transdiaphragmatic trocar, and 10% estimated blood volume was instilled into each chest. Intervention was randomized between 14G AC, 10-gauge angiocatheter (10G AC), modified Veres-type needle (mVN), and 3-mm laparoscopic trocar (LT). After recovery, serial tension-induced pulseless electrical activity (PEA) events were induced and decompressed. Success of rescue, time to rescue, and physiologic data were recorded.

RESULTS: One hundred ninety-five t-H/PTX and 88 PEA events were conducted in 25 swine. Laparoscopic trocar and 10G AC were more successful and had faster median time to rescue for t-H/PTX compared with 14G AC, whereas mVN performed comparably. Following PEA, 14G AC and mVN succeeded at rescue only 50% and 57% of the time, whereas 10G AC and LT had 100% success at return of spontaneous circulation. Time to successful return of circulation following PEA did not differ between devices; however, there was a noticeable difference in the rate of meaningful hemodynamic recovery following PEA favoring LT and 10G AC. There were no significant injuries noted.

CONCLUSIONS: While mVN performed comparably to 14G AC, both have unacceptable failure rates. Ten-gauge AC and LT performed superiorly in both t-H/PTX and PEA. We believe there is now ample evidence supporting replacement of the 14G AC with 10G AC in current treatment recommendations.

J Trauma Acute Care Surg. 2017 Nov;83(5):854-861

Early infectious outcomes after addition of fluoroquinolone or aminoglycoside to posttrauma antibiotic prophylaxis in combat-related open fracture injuries.

Lloyd B, Murray C, Shaikh F, Carson M, Blyth D, Schnaubelt E, Whitman T, Tribble D; Infectious Disease Clinical Research Program Trauma Infectious Disease Outcomes Study Group.

BACKGROUND: We examined combat-related open extremity fracture infections as a function of whether post-trauma antimicrobial prophylaxis included expanded Gram-negative (EGN) coverage.

METHODS: Military personnel with open extremity fractures sustained in Iraq and Afghanistan (2009-2014) who transferred to participating hospitals in the United States were assessed. The analysis was restricted to patients with a U.S. hospitalization period of ≥7 days. Prophylaxis was classified as narrow (e.g., IV cefazolin, clindamycin, and/or amoxicillin-clavulanate) or EGN, if the prophylactic regimen included fluoroquinolones and/or aminoglycosides.

RESULTS: The study population included 1,044 patients, of which 585 (56%) and 459 (44%) received narrow and EGN coverage, respectively ($p < 0.001$). Skin and soft-tissue infections (SSTIs) were more common among patients who received narrow prophylaxis compared to EGN coverage (28% vs. 22%; $p = 0.029$), whereas osteomyelitis rates were comparable between regimens (8%). Similar findings were noted when endpoints were measured at 2 and 4 weeks post-injury. There was no significant difference related to length of hospitalization between narrow and EGN regimens (median: 34 and 32 days, respectively) or operating room visits (median: 5 and 4). A higher proportion of EGN coverage patients had Gram-negative organisms isolated that were not susceptible to fluoroquinolones and/or aminoglycosides (49% vs. 40%; $p < 0.001$). In a Cox proportional model, narrow prophylaxis was independently associated with an increased risk of extremity SSTIs (hazard ratio: 1.41; 95% confidence interval: 1.09-1.83).

DISCUSSION: Despite seeing a small benefit with EGN coverage related to a reduction of SSTIs, it does not decrease the risk of osteomyelitis, and there seems to be a cost of increased antibiotic resistance associated with use. Overall, our findings support the current post-combat trauma antibiotic prophylaxis guidelines, which recommend the use of cefazolin or clindamycin with open fractures.

LEVEL OF EVIDENCE: Prognostic/Epidemiological, Level II; Therapy, level IV.

Microb Drug Resist. 2017 Oct 17. doi: 10.1089/mdr.2017.0141. [Epub ahead of print]

High Prevalence of Multidrug-Resistant Bacteria in Libyan War Casualties Admitted to a Tertiary Care Hospital, Germany.

Lohr B, Pfeifer Y, Heudorf U, Rangger C, Norris D, Hunfeld K

Abstract:

The ongoing Libyan conflict constantly causes victims among the military and civilian population. Cross-border transfer of patients represents a high risk of introducing multidrug-resistant organisms (MDROs), for example, methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant enterococci, and carbapenem-resistant gram-negative organisms (CROs), into the country of destination. This study assessed the MDRO status in Libyan war casualties (n = 67) admitted to Northwest Medical Centre in Frankfurt/Main, Germany, from August 2016 till January 2017. Identified multidrug-resistant nonfermenters and Enterobacteriaceae were subjected to molecular detection of β-lactamases and further mechanisms of resistance. All isolates were typed by enzymatic macrorestriction and subsequent pulsed-field gel electrophoresis. MDROs were found in 40 (60%) patients, including 25 (37%) positive for at least one CRO and 11 (16%) patients with MRSA. A total of 37 isolates of Klebsiella pneumoniae, Acinetobacter baumannii, Escherichia coli, Enterobacter cloacae, and Serratia marcescens produced carbapenemases: NDM (n = 17), OXA-48 (n = 15), and OXA-23 (n = 9) in addition to other β-lactamases (with blaCTX-M-group-1 being most frequent) and plasmid-mediated quinolone resistance genes (qnrB, aac(6')Ib-cr). Bacterial strain typing revealed the presence of various clones. This high MDRO rate in Libyan war casualties demands awareness, appropriate screening, and containment measures for medical institutions involved in medical care to avoid patient-to-patient transmission.

Prehosp Emerg Care. 2017 Sep 28:1-6

Scene Safety and Force Protection in the Era of Ultra-Potent Opioids.

Lynch MJ, Suyama J, Guyette FX.

Abstract:

Ultra-potent opioids (fentanyl, carfentanil) are now widely available and fueling an epidemic of overdose. First responders are increasingly exposed to these potent narcotics necessitating guidance for scene safety and force protection from medical directors. Reports in lay media have sensationalized accounts of exposure and harm that may lead providers to fear providing care to patients suspected of opioid overdose. The likelihood of prehospital providers suffering ill effects from opioid exposure during routine emergency medical services (EMS) operations is extremely low. We propose recommendation to assist medical directors in providing guidance and education to their providers minimizing the risk of provider exposure while allowing the delivery of prompt and appropriate care to patients with suspected overdose.

Eur J Trauma Emerg Surg. 2017 Sep 16. [Epub ahead of print]

Fibrinolysis in trauma: a review.

Madurska M, Sachse K, Jansen J, Rasmussen T, Morrison J

Abstract:

Fibrinolytic dysregulation is an important mechanism in traumatic coagulopathy. It is an incompletely understood process that consists of a spectrum ranging from excessive breakdown (hyperfibrinolysis) and the shutdown of fibrinolysis. Both hyperfibrinolysis and shutdown are associated with excess mortality and post-traumatic organ failure. The pathophysiology appears to relate to endothelial injury and hypoperfusion, with several molecular markers identified in playing a role. Although there are no universally accepted diagnostic tests, viscoelastic studies appear to offer the greatest potential for timely identification of patients presenting with fibrinolytic dysregulation. Treatment is multimodal, involving prompt hemorrhage control and resuscitation, with controversy surrounding the use of antifibrinolytic drug therapy. This review presents the current evidence on the pathophysiology, diagnostic challenges, as well as the management of this hemostatic dysfunction.

LEVEL OF EVIDENCE: Level III

Air Med J. 2017 Sep - Oct;36(5):263-267

Logistical Concerns for Prehospital Blood Product Use by Air Medical Services.

Maher P, Utarnachitt R, Louzon M, Gary R, Sen N, Hess J

Abstract:

Over the past few decades, reports have described favorable results from transfusion of blood products in helicopter EMS (HEMS). Nevertheless, the initiation of a HEMS transfusion program requires consideration of many factors, some unique to each clinical site. This paper describes our experience developing a HEMS transfusion program in an urban non-hospital based HEMS program with a history of long transport times. When considering blood use away from the hospital, major consideration must be given to safe storage and monitoring of blood products both on the ground and while in flight. PRBCs have been shown to generally be resilient to helicopter transit and have a prolonged storage duration. Transfusion of other blood products, such as plasma, involves additional challenges but has been achieved by some HEMS sites. Flight protocols should be developed addressing when and how many blood products should be transported, potentially considering patient factors, scene factors, and the regional availability of blood products during inter-facility transport. Quality assurance and documentation protocols must also be developed for blood product use in flight. In our center's experience, we have so far transfused a limited number of patients with generally good results. Patient outcomes are described as below.

Transfus Med Rev. 2017 Jul 6. pii: S0887-7963(17)30013-5. [Epub ahead of print]

Optimal Dose, Timing and Ratio of Blood Products in Massive Transfusion: Results from a Systematic Review.

McQuilten Z, Crighton G, Brunskill S, Morison J, Richter T, Waters N, Murphy M, Wood E

Abstract:

Optimal dose, timing and ratio to red blood cells (RBC) of blood component therapy (fresh frozen plasma [FFP], platelets, cryoprecipitate or fibrinogen concentrate) to reduce morbidity and mortality in critically bleeding patients requiring massive transfusion is unknown. We performed a systematic review for randomized controlled trials (RCT) in MEDLINE, The Cochrane Library, Embase, CINAHL, PubMed the Transfusion Evidence Library and using multiple clinical trials registries to 21 February 2017. Sixteen RCTs were identified: six completed (five in adult trauma patients, one pediatric burn patients) and ten ongoing trials. Of the completed trials: three were feasibility trials, comparing a FFP, platelets and RBC ratio of 1:1:1 to laboratory-guided transfusion practice [n=69], early cryoprecipitate compared to standard practice [n=41], and early fibrinogen concentrate compared to placebo [n=45]; one trial compared the effect of FFP, platelets and RBC ratio of 1:1:1 with 1:1:2 on 24-hour and 30-day mortality [n=680]; one compared whole blood to blood component therapy on 24-hour blood use [n=107]; one compared a FFP to RBC ratio of 1:1 with 1:4 [n=16]. Data from two trials were pooled in a meta-analysis for 28-day mortality because the transfusion ratios achieved were similar. Results from these two trials suggest higher transfusion ratios were associated with transfusion of more FFP and platelets without evidence of significant difference with respect to mortality or morbidity. On the limited evidence available, there is insufficient basis to recommend a 1:1:1 over a 1:1:2 ratio or standard care for adult patients with critical bleeding requiring massive transfusion.

PLoS One. 2017 Oct 18;12(10):e0186403.

The dose of hydroxyethyl starch 6% 130/0.4 for fluid therapy and the incidence of acute kidney injury after cardiac surgery: A retrospective matched study.

Momeni M, Nkoy Ena L, Van Dyck M, Matta A, Kahn D, Thiry D, Grégoire A, Watremez C

Abstract:

The safety of hydroxyethyl starches (HES) is still under debate. No studies have compared different dosing regimens of HES in cardiac surgery. We analyzed whether the incidence of Acute Kidney Injury (AKI) differed taking into account a weight-adjusted cumulative dose of HES 6% 130/0.4 for perioperative fluid therapy. This retrospective cohort study included all adult patients undergoing elective or emergency cardiac surgery with or without cardiopulmonary bypass. Exclusion criteria were patients on renal replacement therapy (RRT), cardiac trauma surgery, heart transplantation, patients with ventricular assist devices, subjects who required a surgical revision for bleeding and those whose medical records were incomplete. Primary endpoint was AKI following the creatinine based RIFLE classification. Secondary endpoints were 30-day mortality and RRT. Patients were divided into 2 groups whether they had received a cumulative HES dose of < 30 mL/kg (Low HES) or ≥ 30 mL/kg (High HES) during the intra- and postoperative period. A total of 1501 patients were analyzed with 983 patients in the Low HES and 518 subjects in the High HES group. 185 (18.8%) patients in the Low HES and 119 (23.0%) patients in the High HES group developed AKI (P = 0.06). In multivariable regression analysis the dose of HES administered per weight was not associated with AKI. After case-control matching 217 patients were analyzed in each group. AKI occurred in 39 (18.0%) patients in the Low HES and 50 (23.0%) patients in the High HES group (P = 0.19). In conditional regression analysis performed on the matched groups a lower weight-adjusted dose of HES was significantly associated with a reduced incidence of AKI [(Odds Ratio (95% CI) = 0.825 (0.727-0.936); P = 0.003]. In the absence of any safety study the cumulative dose of modern HES in cardiac surgery should be kept less than 30 mL/kg.

Anesth Pain Med. 2016 Nov 22;7(1):e42964. doi: 10.5812/aapm.42964.

The Effects of Endotracheal Tube and i-gel® Supraglottic Airway Device on Respiratory Impedance: A Prospective Observational Study.

Nakano S, Nakahira J, Kuzukawa Y, Sawai T, Minami T

BACKGROUND: The forced oscillation technique (FOT) is a non-invasive means of measuring respiratory resistance and reactance. We tested our hypothesis that endotracheal intubation would cause more substantial preoperative increases in FOT parameters than a supraglottic airway device (SGD).

METHODS: Forty patients requiring general anesthesia and mechanical ventilation for transurethral bladder tumor resection underwent spirometry the day before surgery. Forced oscillation was measured using a MostGraph-01 device the day before surgery and immediately after removal of the airway adjunct. Changes in respiratory resistance and reactance were compared between those intubated and those who used SGD.

RESULTS: The trachea was intubated in 23 patients and SGD was used in the remaining 17 patients. Both airway adjuncts caused significant increases in preoperative respiratory resistance and reactance; however, the magnitude of the changes was significantly greater in the intubated patients.

CONCLUSIONS: The SGD appears to cause less pulmonary injury than tracheal intubation. Further study is needed to illuminate the influence of mechanical ventilation, and longer-term consequences and clinical significance of the changes we found in this study. Spontaneous ventilation through an SGD may be preferable in patients with severe respiratory disease.

J Trauma Acute Care Surg. 2017 Sep;83(3):427-437

Deaths and high-risk trauma patients missed by standard trauma data sources.

Newgard C, Fu R, Lerner E, Daya M, Wright D, Jui J, Mann N, Bulger E, Hedges J, Wittwer L, Lehrfeld D, Rea T.

BACKGROUND: Trauma registries are used to evaluate and improve trauma care, yet potentially miss certain trauma deaths and high-risk patients. We estimated the number of missed deaths and high-risk trauma patients using commonly available sources of trauma data and resulting bias in quality metrics for field trauma triage.

METHODS: This was a preplanned secondary analysis of a population-based prospective cohort of injured patients transported by 44 emergency medical services agencies to 28 hospitals in seven Northwest counties from January 1, 2011 to December 31, 2011 and followed through hospitalization. We used a stratified probability sampling design for 17,633 patients, weighted to represent all 53,487 injured patients transported by emergency medical services. We compared patients meeting National Trauma Data Bank (NTDB) criteria (weighted n = 5,883), all injured patients presenting to major trauma centers (weighted n = 16,859), and all admitted patients (weighted n = 18,433), to the full sample. Outcomes included in-hospital mortality, Injury Severity Score (ISS) of 16 or higher, and critical resource use within 24 hours.

RESULTS: Among 53,487 injured patients, there were 520 emergency department and in-hospital deaths, 1,745 with ISS of 16 or higher, and 923 requiring early critical resources. Compared to the full cohort, the NTDB cohort missed 62.1% of deaths, 39.2% of patients with ISS of 16 or higher, and 23.8% requiring early critical resources, especially older adults injured by falls and admitted to non-trauma hospitals. The admission cohort missed the fewest patients-23.3% of deaths, 10.5% with an ISS of 16 or higher, and 13.1% requiring early resources. Compared to triage sensitivity in the full cohort (66.2%), sensitivity estimates ranged from 63.6% (all admissions) to 93.4% (NTDB). Compared to triage specificity in the full cohort (87.8%), estimates ranged from 36.4% (NTDB) to 77.3% (all admissions).

CONCLUSION: Common sources of trauma data miss substantial numbers of trauma deaths and high-risk trauma patients and can generate biased estimates for trauma system quality metrics.

LEVEL OF EVIDENCE: Epidemiologic, level III.

J Emerg Med. 2017 Nov;53(5):635-641

Effect of Cricoid Pressure on the Insertion Efficacy of Six Supraglottic Devices: A Crossover Randomized Simulation Trial.

Ohchi F, Komasawa N, Mihara R, Hattori K, Minami T

BACKGROUND: No study has ever compared the efficacy of various types of supraglottic devices (SGDs) for securing the airway under cricoid pressure.

OBJECTIVE: This study aimed to evaluate the efficacy of six SGDs, LMA-ProSeal (ProSeal), LMA-Classic (Classic), Laryngeal Tube (LT), LMA-Supreme (Supreme), air-Q (air-Q), and i-gel (i-gel), in airway management under cricoid pressure using a manikin.

METHODS: Fifteen novice doctors and 16 experienced doctors used the six SGDs under cricoid or sham pressure on an adult manikin. Insertion time, successful ventilation rate, and subjective insertion difficulty on a visual analogue scale (VAS) were measured.

RESULTS: Both novice and experienced doctors had a significantly lower ventilation success rate under cricoid pressure than under sham pressure when using the ProSeal, Classic, and LT, but not when using the other three SGDs. Novice doctors required a significantly longer insertion time under cricoid pressure than under sham pressure with all SGDs. Experienced doctors required a significantly longer insertion time under cricoid pressure than with sham pressure when using the ProSeal, Classic, and LT, but not when using the other three SGDs. Subjective insertion difficulty on VAS was significantly higher under cricoid pressure than under sham pressure with all six SGDs.

CONCLUSION: Ventilation success rate under cricoid pressure was significantly lower than under sham pressure when using the ProSeal, Classic, and LT, but not when using the other three SGDs in both novice and experienced doctors.

Afr Health Sci. 2017 Mar;17(1):122-132

A randomized controlled trial to assess the effect of a ketamine infusion on tourniquet hypertension during general anaesthesia in patients undergoing upper and lower limb surgery.

Ongaya J, Mung'ayi V, Sharif T, Kabugi J

BACKGROUND: Tourniquet hypertension arising from tourniquet inflation remains a primary concern to the anaesthetist. One drug commonly used to manage tourniquet hypertension is ketamine. No studies have examined the effect of ketamine on tourniquet hypertension for a period of more than one hour or an infusion of the same.

OBJECTIVE: To compare the effect of an intravenous infusion of ketamine versus placebo on tourniquet induced hypertension in patients undergoing upper and lower limb surgery under general anaesthesia.

METHODS: Forty six adult patients scheduled for upper and lower limb surgery under general anaesthesia were randomized into two equal groups. The ketamine group received an intravenous bolus of 0.1mg/kg of ketamine followed by an infusion of 2ug/kg/min. The saline group received an intravenous bolus of physiological saline followed by an infusion of saline. All the patients were reviewed post-operatively. Data of the baseline characteristics, haemodynamic changes, post-tourniquet pain and side effects were collected. If post-tourniquet pain was present post-operatively, a visual analogue scale (VAS) was used to assess its severity.

RESULTS: 46 patients successfully completed the trial. There were no significant differences between the groups for baseline patient demographics. The incidence of tourniquet hypertension was higher in the saline group (26.1%) compared with ketamine group (4.6%) with a 95% confidence interval. The difference was shown to be statistically significant ('P'<0.05). There was an increase in systolic blood pressure after 60 minutes of tourniquet inflation in the saline group but the difference was not statistically significant('P'>0.866). There were no significant differences between the groups as regards diastolic blood pressure and heart rate. VAS scores did not differ between the two groups. Statistically, there was no difference found between the two groups. Side effects were minimal in the ketamine group whilst in the saline group, nausea and vomiting were predominant but were also not statistically significant.

CONCLUSION: Based on the results of this study, there was a difference in the proportion of tourniquet hypertension between the ketamine and saline groups for patients undergoing upper and lower limb orthopaedic surgery under general anaesthesia.

Prehosp Emerg Care. 2017 Sep-Oct;21(5):583-590

Prehospital Predictors of Traumatic Spinal Cord Injury in Victoria, Australia.

Oteir A, Smith K, Stoelwinder J, Middleton J, Cox S, Sharwood L, Jennings P

OBJECTIVES: To identify the predictors of traumatic spinal cord injury (TSCI) and describe the differences between confirmed and potential TSCI cases in the prehospital setting.

METHODS: A retrospective cohort study including all adult patients over a six-year period (2007-12) with potential TSCI who were attended and transported by Ambulance Victoria (AV). We extracted potential TSCI cases from the AV data warehouse and linked with the Victorian State Trauma Registry to compare with final hospital diagnosis.

RESULTS: We included a total of 106,059 patients with potential TSCI in the study, with 257 having a spinal cord injury confirmed at hospital (0.2%). The median [First and third Quartiles] age of confirmed TSCI cases was 49 [32-69] years, with males comprising 84.1%. Confirmed TSCI were mainly due to falls (44.8%) and traffic incidents (40.5%). AV spinal care guidelines had a sensitivity of 100% to detect confirmed TSCI. There were several factors associated with a diagnosis of TSCI. These were meeting AV Potential Major Trauma criteria, male gender, presence of neurological deficit, presence of an altered state of consciousness, high falls (> 3 meters), diving, or motorcycle or bicycle collisions.

CONCLUSION: This study identified several predictors of TSCI including meeting AV Potential Major Trauma criteria, male gender, presence of neurological deficit, presence of an altered state of consciousness, high falls (> 3 meters), diving, or motorcycle or bicycle collisions. Most of these predictors are included in NEXUS and/or CCR criteria, however, Potential Major Trauma criteria have not previously been linked to the presence of TSCI. Therefore, Emergency Medical Systems are encouraged to integrate similar Potential Major Trauma criteria into their guidelines and protocols to further improve the provider's accuracy in identifying TSCI and to be more selective in their spinal immobilization, thereby reducing unwarranted adverse effects of this practice.

Scand J Trauma Resusc Emerg Med. 2017 Sep 15;25(1):94.

Physician-staffed helicopter emergency medical service has a beneficial impact on the incidence of prehospital hypoxia and secured airways on patients with severe traumatic brain injury.

Pakkanen T, Kämäräinen A, Huhtala H, Silfvast T, Nurmi J, Virkkunen I, Yli-Hankala A

BACKGROUND: After traumatic brain injury (TBI), hypotension, hypoxia and hypercapnia have been shown to result in secondary brain injury that can lead to increased mortality and disability. Effective prehospital assessment and treatment by emergency medical service (EMS) is considered essential for favorable outcome. The aim of this study was to evaluate the effect of a physician-staffed helicopter emergency medical service (HEMS) in the treatment of TBI patients.

METHODS: This was a retrospective cohort study. Prehospital data from two periods were collected: before (EMS group) and after (HEMS group) the implementation of a physician-staffed HEMS. Unconscious prehospital patients due to severe TBI were included in the study. Unconsciousness was defined as a Glasgow coma scale (GCS) score ≤ 8 and was documented either on-scene, during transportation or by an on-call neurosurgeon on hospital admission. Modified Glasgow Outcome Score (GOS) was used for assessment of six-month neurological outcome and good neurological outcome was defined as GOS 4-5.

RESULTS: Data from 181 patients in the EMS group and 85 patients in the HEMS group were available for neurological outcome analyses. The baseline characteristics and the first recorded vital signs of the two cohorts were similar. Good neurological outcome was more frequent in the HEMS group; 42% of the HEMS managed patients and 28% ($p = 0.022$) of the EMS managed patients had a good neurological recovery. The airway was more frequently secured in the HEMS group ($p < 0.001$). On arrival at the emergency department, the patients in the HEMS group were less often hypoxic ($p = 0.024$). In univariate analysis HEMS period, lower age and secured airway were associated with good neurological outcome.

CONCLUSION: The introduction of a physician-staffed HEMS unit resulted in decreased incidence of prehospital hypoxia and increased the number of secured airways. This may have contributed to the observed improved neurological outcome during the HEMS period.

Niger J Surg. 2017 Jul-Dec;23(2):111-114

Role of Tranexamic Acid on Blood Loss in Laparoscopic Cholecystectomy.

Pandove P, Singla R, Mittal P, Mahajan N, Kumar A

CONTEXT: Nonsurgical uses of tranexamic acid include the management of bleeding associated with leukemia, ocular bleeding, recurrent hemoptysis, menorrhagia, hereditary angioneurotic edema, and numerous other medical problems. However, there is hardly any documentation of the use of tranexamic acid in laparoscopic cholecystectomy.

AIMS: This study was conducted to evaluate the role of tranexamic acid in limiting blood loss in laparoscopic cholecystectomy and to evaluate the effect of blood loss on morbidity in terms of hospital stay and mortality of the patient.

SUBJECTS AND METHODS: The study was conducted on sixty patients admitted with gallstones, candidates for laparoscopic cholecystectomy. Thirty patients received an intravenous 20 mg/kg bolus dose of tranexamic acid at induction of anesthesia (Group A), and another thirty did not receive the aforementioned drug at induction (Group B).

STATISTICAL ANALYSIS: The two groups were compared, and the data collected were entered and tabulated using Microsoft Office Excel and analyzed using appropriate statistical tests.

RESULTS: The mean postoperative hospital stay (2.4 vs. 2.63, P = 0.4147), drain fluid hemoglobin (Hb) (0.83 vs. 0.90, P = 0.2087), drain fluid hematocrit (0.2434 vs. 0.2627, P = 0.3787), mean drain output (85 vs. 87.23, P = 0.9271), mean pulse rate at the start of surgery (74.2 vs. 75, P > 0.999), mean pulse rate 24 h after surgery (75.9 vs. 76.4, P = 0.5775), and mean change in Hb (0.240 vs. 0.266, P = 0.2502) in both the groups were not significant.

CONCLUSIONS: There is no active role of tranexamic acid in elective laparoscopic cholecystectomy.

Acad Emerg Med. 2017 Sep 12 [Epub ahead of print]

Prehospital Supraglottic Airway Was Associated With Good Neurologic Outcome in Cardiac Arrest Victims Especially Those Who Received Prolonged Cardiopulmonary Resuscitation.

Park M, Kwon W, Kim K, Suh G, Shin J, Jo Y, Kim K, Lee H, Kim J, Lee S, Kim J, Cho J.

OBJECTIVES: We performed this study to investigate the association of prehospital supraglottic airway (SGA) on neurologic outcome in cardiac arrest victims with adjustment of post-resuscitation variables as well as prehospital and resuscitation variables.

METHODS: This study was a retrospective study based on a multicenter prospective cohort registry from December 2013 to April 2016. According to the 28-day cerebral performance categories (CPCs) scale, patients were divided into the good-outcome group (CPC 1-2) and the poor-outcome group (CPC 3-5). We compared the two groups with respect to demographic variables, prehospital and in-hospital resuscitation variables, and post-resuscitation variables.

RESULTS: A total of 869 cardiac arrest victims who received in-progress cardiopulmonary resuscitation (CPR) were delivered to the emergency department of three hospitals, and 310 patients were admitted to the intensive care unit. The use of a prehospital SGA was independently associated with 28-day good neurologic outcome (odds ratio [OR] = 7.88; 95% confidence interval [CI] = 1.33-46.53; p = 0.023] when post-resuscitation variables were adjusted, although there were no significant association with the acquisition of sustained return of spontaneous circulation (OR = 0.992; 95% CI = 0.591-1.666; p = 0.976). Furthermore, a prehospital SGA was significantly associated with good neurologic outcome, especially in patients who received prolonged CPR (low flow time > 15 minutes; OR = 3.41; 95% CI = 1.23-9.45; p = 0.018) rather than in patients with non-prolonged CPR (OR = 4.50; 95% CI = 0.75-27.13; p = 0.101).

CONCLUSIONS: When post-resuscitation variables were adjusted, the prehospital SGA was independently associated with 28-day good neurologic outcome in cardiac arrest victims.

J Spec Oper Med. Fall 2017;17(3):74-80.

Optimization of Simulation and Moulage in Military-Related Medical Training.

Petersen C, Rush SC, Gallo I, Dalere B, Staak B, Moore L, Kerr W, Chandler M, Smith W.

Abstract:

Preparation of Special Operations Forces (SOF) Medics as first responders for the battle space and austere environments is critical to optimize survival and quality of life for our Operators who may sustain serious and complex wounding patterns and illnesses. In the absence of constant clinical exposure for these medics, it is necessary to maximize all available training opportunities. The incorporation of scenario-based training helps weave together teamwork and the ability to practice treatment protocols in a tactical, controlled training environment to reproduce, to some degree, the environment in and stressors under which care will need to be delivered. We reviewed the evolution of training scenarios within one Pararescue (PJ) team since 2008 and codified various tools used to simulate physical findings and drive medical exercises as part of scenario-based training. We also surveyed other SOF Medic training resources.

Injury. 2017 Oct 12. pii: S0020-1383(17)30709-X. [Epub ahead of print]

Serious game training improves performance in combat life-saving interventions.

Planchon J, Vacher A, Comblet J, Rabatel E, Darses F, Mignon A, Pasquier P

AIM: In modern warfare, almost 25% of combat-related deaths are considered preventable if life-saving interventions are performed. Therefore, Tactical Combat Casualty Care (TCCC) training for soldiers is a major challenge. In 2014, the French Military Medical Service supported the development of 3D-SC1®, a serious game designed for the French TCCC program, entitled Sauvetage au Combat de niveau 1 (SC1). Our study aimed to evaluate the impact on performance of additional training with 3D-SC1®.

MATERIAL AND METHODS: The study assessed the performance of soldiers randomly assigned to one of two groups, before (measure 1) and after (measure 2) receiving additional training. This training involved either 3D-SC1® (Intervention group), or a DVD (Control group). The principal measure was the individual performance (on a 16-point scale), assessed by two investigators during a hands-on simulation. First, the mean performance score was compared between the two measures for Intervention and Control groups using a two-tailed paired t-test. Second, a multivariable linear regression was used to determine the difference in the impacts of 3D-SC1® and DVD training, and the order of presentation of the two scenarios, on the mean change from baseline in performance scores.

RESULTS AND DISCUSSION: A total of 96 subjects were evaluated: seven could not be followed-up, while 50 were randomly allocated to the Intervention group, and 39 to the Control group. Between measure 1 and measure 2, the mean (SD) performance score increased from 9.9 (3.13) to 14.1 (1.23), and from 9.4 (2.97) to 12.5 (1.83), for the Intervention group and Control group, respectively ($p<0.0001$).The adjusted mean difference in performance scores between 3D-SC1® and DVD training was 1.1 (95% confidence interval -0.3, 2.5) ($p=0.14$). Overall, the study found that supplementing SC1 training with either 3D-SC1® or DVD improved performance, assessed by a hands-on simulation. However, our analysis did not find a statistically significant difference between the effects of these two training tools. 3D-SC1® could be an efficient and pedagogical tool to train soldiers in life-saving interventions. In the current context of terrorist threat, a specifically-adapted version of 3D-SC1®may be a cost-effective and engaging way to train a large civilian public.

Clin Anat. 2017 Sep 22. doi: 10.1002/ca.22990. [Epub ahead of print]

Applied anatomy for tibial intraosseous access in adults: A Radioanatomical Study.

Polat O, Oguz A, Eneyli M, Comert A, Acar H, Tuccar E

Abstract:

Intraosseous access is a method for providing vascular access in resuscitation of critically ill and injured patients when traditional intravenous access is difficult or impossible. There is a lack of detailed description for the landmark for the insertion point in the literature. The aim of this study was to determine the exact location for intraosseous access. Radiographic computed tomography (CT) images of a total of 50 dry tibia bones were obtained. With 5-mm intervals, for all transverse images and by selecting transverse section, measurements were taken from the thickness of the cortex at anterior margin and mid-line medial surface, distance from anterior margin, and mid-line medial surface of the tibia to the posterior wall of medullar cavity, distance from anterior margin and mid-line medial surface of the tibia to the posterior surface of the tibia. The thinner part of the cortex of the tibia and the larger width of the medullar cavity is at 0.5 cm below the tibial tuberosity in the midline of the medial surface. The application region for proximal tibia access and landmark and most suitable insertion point for intraosseous infusion should be at level 0.5 cm below the tibial tuberosity in the midline of the medial surface. It was recommended that standard length for intraosseous canule should be 17 mm except for the thickness of skin. In conclusion, presented study provides certain localization for intraosseous access and standard length for intraosseous canule and this will be more effective in using this technique.

Mil Med. 2017 Sep;182(9):e2001-e2005

The Use of the Abdominal Aortic and Junctional Tourniquet During Cardiopulmonary Resuscitation Following Traumatic Cardiac Arrest in Swine.

Rall J, Cox J, Maddry J

BACKGROUND: Standard cardiopulmonary resuscitation (CPR) is ineffective in treating traumatic cardiac arrest (TCA) following hemorrhagic shock despite fluid resuscitation. CPR adjuncts, including abdominal compressions and external counter pressure, have shown some success in laboratory settings. The Abdominal Aortic and Junctional Tourniquet (AAJT) is a device that occludes both venous and arterial blood at the level of the aortic bifurcation and likely increases thoracic pressure when applied to the abdomen. We developed a swine model of controlled hemorrhage to induce a state of TCA to test the ability of the AAJT to improve the efficacy of CPR.

METHODS: Twelve splenectomized, Yorkshire, male swine (70-90 kg) were randomized into two groups: presence or absence of AAJT placement. Controlled hemorrhage was performed at a rate of 2 mL/kg/min until systolic blood pressure reached below 10 mm Hg (defined as cardiac arrest). Following 3 minutes of arrest, the animals underwent CPR using a mechanical compression device along with either the presence or absence of the AAJT. Concurrently, 5 units of whole blood (2,500 mL) were delivered through the jugular vein at 500 mL/min. Efficacy of CPR was assessed by analyzing rates of return of spontaneous circulation (ROSC) and survival. Blood pressure, carotid blood flow, and other hemodynamic values were also compared.

FINDINGS: No significant differences between groups were observed before treatments. The controlled hemorrhage resulted in an average loss of 2,654 ± 323 g of blood over 18.2 ± 3.9 minutes. All animals that had a ROSC survived to the end of the 1-hour observation period. Animals with AAJT survived 83% (5/6) compared to 17% (1/6) of animals without AAJT. Finally, blood pressure, carotid flow, mean pulmonary artery pressure, and end tidal carbon dioxide were all significantly different between groups at the end of the first 10-minute compression period.

DISCUSSION/IMPACT/RECOMMENDATIONS: These results suggest that the AAJT could allow for increased CPR efficacy in cases of TCA when used in conjunction with rapid, massive blood transfusions.

Acad Emerg Med. 2017 Sep 19. doi: 10.1111/acem.13313. [Epub ahead of print]

Randomized Controlled Feasibility Trial of Intranasal Ketamine Compared to Intranasal Fentanyl for Analgesia in Children with Suspected Extremity Fractures.

Reynolds S, Bryant K, Studnek J, Hogg M, Dunn C, Templin M, Moore C, Young J, Walker K, Runyon M

OBJECTIVES: We compared the tolerability and efficacy of intranasal subdissociative ketamine to intranasal fentanyl for analgesia of children with acute traumatic pain and investigated the feasibility of a larger non-inferiority trial that could investigate the potential opioid-sparing effects of intranasal ketamine.

METHODS: This randomized controlled trial compared 1 mg/kg intranasal ketamine to 1.5 μg/kg intranasal fentanyl in children 4 to 17 years old with acute pain from suspected isolated extremity fractures presenting to an urban Level II pediatric trauma center from December 2015 to November 2016. Patients, parents, treating physicians, and outcome assessors were blinded to group allocation. The primary outcome, a tolerability measure, was the frequency of cumulative side effects and adverse events within 60 minutes of drug administration. The secondary outcomes included the difference in mean pain score reduction at 20 minutes, the proportion of patients achieving a clinically significant reduction in pain in 20 minutes, total dose of opioid pain medication in morphine equivalents/kg/hour (excluding study drug) required during the emergency department (ED) stay, and the feasibility of enrolling children presenting to the ED in acute pain into a randomized trial conducted under U.S. regulations. All patients were monitored until 6 hours after their last dose of study drug or until admission to the hospital ward or operating room.

RESULTS: Of 629 patients screened, 87 received the study drug and 82 had complete data for the primary outcome (41 patients in each group). The median (interquartile range) age was 8 (6-11) years and 62% were male. Baseline pain scores were similar among patients randomized to receive ketamine (73 ± 26) and fentanyl (69 ± 26; mean difference [95% CI] = 4 [-7 to 15]). The cumulative number of side effects was 2.2 times higher in the ketamine group, but there were no serious adverse events and no patients in either group required intervention. The most common side effects of ketamine were bad taste in the mouth (37; 90.2%), dizziness (30; 73.2%), and sleepiness (19; 46.3%). The most common side effects of fentanyl were sleepiness (15; 36.6%), bad taste in the mouth (9; 22%), and itchy nose (9; 22%). No patients experienced respiratory side effects. At 20 minutes, the mean pain scale score reduction was 44 ± 36 for ketamine and 35 ± 29 for fentanyl (mean difference = 9 [95% CI = -4 to 23]). Procedural sedation with ketamine occurred in 28 ketamine patients (65%) and 25 fentanyl patients (57%) prior to completing the study.

CONCLUSIONS: Intranasal ketamine was associated with more minor side effects than intranasal fentanyl. Pain relief at 20 minutes was similar between groups. Our data support the feasibility of a larger, non-inferiority trial to more rigorously evaluate the safety, efficacy, and potential opioid-sparing benefits of intranasal ketamine analgesia for children with acute pain.

Plast Reconstr Surg. 2017 Sep 15. [Epub ahead of print]

The Role of Tranexamic Acid in Plastic Surgery: Review and Technical Considerations.

Rohrich R, Cho M

Abstract:

Minimizing blood loss during surgery is critical, and many modalities have been used to decrease unwanted surgical bleeding. Among many methods, use of pharmacological agents such as anti-fibrinolytic drugs have been shown to significantly reduce blood loss and the rates of postoperative blood transfusion in many literatures. Tranexamic acid is an anti-fibrinolytic agent that has been widely used in other surgical specialties, especially in cardiac, orthopedic, and trauma surgery . Despite its known benefits, the use of tranexamic acid in plastic surgery is extremely limited, primarily because most plastic surgery procedures do not involve the extent of blood loss that can lead to anemia and the need for blood transfusion, as is common in major orthopedic and cardiac surgery procedures. Nevertheless, there are significant benefits to be gained from the use of anti-fibrinolytic drugs in the full range of plastic surgery. In this article, we introduce the benefits, dosages, and technical considerations of using tranexamic acid in plastic surgery procedures.

Mil Med. 2017 Nov;182(11):1749-1751

Making Minutes Matter.

Russo R

Quotes:

“The last 15 years of war have emphasized the impact of well-timed prehospital interventions on patient survival. Advancements in prehospital combat casualty care, specifically the Tactical Combat Casualty Care Guidelines and the Golden Hour Policy (to transport patients to a medical treatment facility within 60 minutes), have been called a “military medical revolution.” 2 Training first responders is an essential job of military physicians, to develop critical medical decision-making skills for times when no physician is on the ground for support. Domestic trauma care providers have hoped to translate lauded military advancements (i.e., tourniquets and “en route” damage control resuscitation) into civilian practice. However, training first responders to manage remote traumas alone remains a controversial topic with unclear application to civilian practice. Delivering tactical field care on the battlefield is often different from delivering prehospital care in the civilian environment. The military approach is designed to treat patients with injuries in an austere environment, while potentially under fire. The goal is to provide rapid evacuation from the scene while administering advanced interventions during the sometimes-hour-long transport. Although some draw parallels to rural America, in the United States, “scoop and run” is the predominant strategy for delivering prehospital care. 3 This approach emphasizes spending as little time as possible at the scene and provides only immediately life-saving interventions (i.e., needle thoracostomy for tension pneumothorax) while in the ambulance. Minimizing the time between injury and definitive care has been shown to improve survival for patients who suffer penetrating injuries in urban areas. 3”

“Designing the ideal approach to prehospital patient management requires a cooperative effort between physicians and first responders, and may vary on the basis of location and available resources. Perhaps it is this lesson, more than any other, that civilian trauma-care providers can most readily translate to patient care. At national trauma conferences, numerous presentations inspire lengthy discussions about the potential impact of prehospital interventions on survival, but the prehospital providers themselves are largely absent.”

“A reciprocal relationship with combat medics helped define research priorities, refine battlefield technologies, and improve resuscitation strategies designed for them to implement. 2 Similarly, physician involvement in civilian prehospital care has helped teams establish medical care priorities, improved systems management, and provided an opportunity for role modeling, both medically and managerially. 7”

“However, all of the best hospital care is for naught if the patient never makes it there.”

J Trauma Acute Care Surg. 2017 Dec;83(6):1165-1172

The trauma center is too late: Major limb trauma without a pre-hospital tourniquet has increased death from hemorrhagic shock.

Scerbo M, Holcomb J, Taub E, Gates K, Love J, Wade C, Cotton B

BACKGROUND: To date, no civilian studies have demonstrated that pre-hospital (PH) tourniquets improve survival. We hypothesized that late, trauma center (TC) tourniquet use would increase death from hemorrhagic shock compared to early (PH) placement.

METHODS: All patients arriving to a Level 1, urban TC between October 2008 and January 2016 with a tourniquet placed before (T-PH) or after arrival to the TC (T-TC) were evaluated. Cases were assigned the following designations: indicated (absolute indication [vascular injury requiring repair/ligation, operation within 2 hours for extremity injury, or traumatic amputation] or relative indication [major musculoskeletal/soft tissue injury requiring operation 2-8 hours after arrival, documented large blood loss]) or non-indicated. Outcomes were death from hemorrhagic shock, physiology upon arrival to the TC, and massive transfusion requirements. After univariate analysis, logistic regression was carried out to assess independent predictors of death from hemorrhagic shock.

RESULTS: A total of 306 patients received 326 tourniquets for injuries to 157 upper and 147 lower extremities. Two hundred eighty-one (92%) had an indication for placement. Seventy percent of patients had a blunt mechanism of injury. T-TC patients arrived with a lower systolic blood pressure (SBP, 101 [86, 123] vs. 125 [100, 145] mm Hg, $p < 0.001$), received more transfusions in the first hour of arrival (55% vs. 34%, $p = 0.02$), and had a greater mortality from hemorrhagic shock (14% vs. 3.0%, $p = 0.01$). When controlling for year of admission, mechanism of injury and shock upon arrival (SBP ≤90 mm Hg or HR ≥120 bpm or base deficit ≤ 4) indicated T-TC had a 4.5-fold increased odds of death compared to T-PH (OR 4.5, 95% CI 1.23-16.4, $p = 0.02$).

CONCLUSIONS: Waiting until TC arrival to control hemorrhage with a tourniquet was associated with worsened blood pressure and increased transfusion within the first hour of arrival. In routine civilian trauma patients, delaying to T-TC was associated with 4.5-fold increased odds of mortality from hemorrhagic shock.

LEVEL OF EVIDENCE: Level IV

J Spec Oper Med. Fall 2017;17(3):18-20.

Prehospital Cricothyrotomy Kits Used in Combat.

Schauer S, April M, Cunningham C, Long A, Carter R

BACKGROUND: Surgical cricothyrotomy remains the only definitive airway management modality for the tactical setting recommended by Tactical Combat Casualty Care guidelines. Some units have fielded commercial cricothyrotomy kits to assist Combat Medics with surgical cricothyrotomy. To our knowledge, no previous publications report data on the use of these kits in combat settings. This series reports the the use of two kits in four patients in the prehospital combat setting.

METHODS: Using the Department of Defense Trauma Registry and the Prehospital Trauma Registry, we identified four cases of patients who underwent prehospital cricothyrotomy with the use of commercial kits. In the first two cases, a Medic successfully used a North American Rescue CricKit (NARCK) to obtain a surgical airway in a Service member with multiple amputations from an improvised explosive device explosion. In case 3, the Medic unsuccessfully used an H&H Medical kit to attempt placement of a surgical airway in a Service member shot in the head by small arms fire. A second attempt to place a surgical airway using a NARCK was successful. In case 4, a Soldier sustained a gunshot wound to the chest. A Medic described fluid in the airway precluding bag-valve-mask ventilation; the Medic attempted to place a surgical airway with the H&H kit without success.

CONCLUSION: Four cases of prehospital surgical airway cannulation on the battlefield demonstrated three successful uses of prehospital cricothyrotomy kits. Further research should focus on determining which kits may be most useful in the combat setting.

J Spec Oper Med. Fall 2017;17(3):55-58.

Prehospital Administration of Tranexamic Acid by Ground Forces in Afghanistan: The Prehospital Trauma Registry Experience.

Schauer SG, April MD, Naylor JF, Wiese J, Ryan KL, Fisher AD, Cunningham CW, Mitchell N, Antonacci MA.

BACKGROUND: Tranexamic acid (TXA) was shown to reduce overall mortality and death secondary to hemorrhage in a large prospective study. This intervention is time sensitive. As such, the Tactical Combat Casualty Care (TCCC) guidelines recommend use of this low-cost, safe intervention among patients with possible hemorrhagic shock, penetrating trauma to the thorax or trunk, or extremity amputation.

OBJECTIVE: Prehospital administration of TXA by ground forces in the Afghanistan combat theater is described.

METHODS: We obtained data from the Prehospital Trauma Registry. We searched for all patients with documented hypotension, amputation, or penetrating trauma to the torso.

RESULTS: From January 2013 to September 2014, there were 272 patients who met inclusion criteria. Most injuries (97.8%; n = 266) were battle injuries. Of the 272 patients who met criteria to receive prehospital TXA, 51 (18.8%) received TXA, whereas the remaining 221 (81.2%) did not. Higher proportions of patients receiving TXA versus patients not receiving TXA received hemostatic dressings, pressure dressings, and tourniquet placement. Conversely, the proportion of patients receiving intravenous fluids was higher in the no-TXA group.

CONCLUSION: Overall, proportions of eligible patients receiving TXA were low despite emphasis in the guidelines. The reasons for this low adherence to TCCC guidelines are likely multifactorial. Future research should seek to identify reasons TXA is not given when indicated and to develop training and technology to increase prehospital TXA administration.

Prehosp Emerg Care. 2017 Nov-Dec;21(6):744-749

Multicenter, Prospective Study of Prehospital Administration of Analgesia in the U.S. Combat Theater of Afghanistan.

Schauer S, Mora A, Maddry J, Bebarta V

BACKGROUND: Published data on prehospital medical care in combat is limited, likely due to the chaotic and unpredictable nature of care under fire and difficulty in documentation There is limited data on how often analgesic agents are administered, which drug are being used, and whether there is an association with injury patterns.

METHODS: This study was a prospective, multicenter, observational study to determine which analgesic agents are being used prehospital and whether there is an association with injury patterns. Data was collected and recorded as casualties were brought into combat surgical hospitals in Afghanistan from October 2012 to April 2014. Onsite, trained investigators collected the data as part of a IRB approved protocol. Outcome data to 30 days was obtained from the DoD Trauma Registry (DODTR) within the Joint Trauma System.

RESULTS: During the study period 532 patient encounters available for inclusion with 378 receiving an analgesic agent (total of 541 administrations). The average age was 27 (range 21-31), 99% male, 40% were US or coalition forces. Parenteral medications used were ketamine, fentanyl, morphine, hydromorphone and ketorolac. Penetrating injuries were more likely to receive analgesic agent (89% vs 79%, p=0.0057). Blunt trauma was less likely to receive ketamine (p=0.008). Fentanyl was used more for patients with an Injury Severity Score (ISS) >15 (p=0.016).

CONCLUSION: Patients with penetrating trauma are more likely to receive analgesic agents in the combat prehospital setting. The most common analgesic used was ketamine. Patient ISS was not associated with administration of analgesia. Patients receiving analgesia were more likely to still be hospitalized at 30 days. The prospective nature of this study supports feasibility for future, larger, more comprehensive projects.

Eur J Trauma Emerg Surg. 2017 Oct 12. [Epub ahead of print]

Diagnostics and early treatment in prehospital and emergency-room phase in suspicious pelvic ring fractures.

Schweigkofler U, Wohlrath B, Trentsch H, Greipel J, Tamimi N, Hoffmann R, Wincheringer D

BACKGROUND: Testing for mechanical stability in pelvic ring fractures is advocated for the initial assessment and management of pelvic ring fractures. A survey among trauma surgeons showed that 91% agree with this recommendation. The aim of the present study was to describe the actual workup of patients with a high risk for unstable pelvic fractures in daily routine.

METHODS: We performed a prospective multicenter observational study on patients admitted to the emergency room with suspected pelvic ring fractures. Data were collected anonymously via a standardized case report.

RESULTS: A total of 254 patients with suspected pelvic injuries from 12 different trauma centers were included in this study. In 95 out of 254 cases a per definition unstable pelvic fracture could be confirmed; 46 type B and 49 type C fractures was confirmed. Mechanical stability examination was carried out in 61% and revealed a sensitivity of 31.6% and a specificity of 92.2%. 11.5% (18 patients) actually showed a mechanical instability (6 B# 12 C#). Regardless, 166 patients (65.4%) received noninvasive external stabilization ahead of diagnostic imaging, as a result of clinical judgment. 72% (24×) showed signs of significant bleeding in the subsequent CT scans. 33 pelvic ring fractures (type B or C) had no prehospital stabilization.

CONCLUSION: Testing of mechanical stability of the pelvic ring was carried out less often and with lower consequences for the actual management than expected. It seems worthwhile to rather put on a pelvic binder at earliest occasion based on trauma mechanism or clinical findings to reduce the risk of serious pelvic bleeding.

JAMA. 2017 Oct 24;318(16):1581-1591

Association of Prehospital Blood Product Transfusion During Medical Evacuation of Combat Casualties in Afghanistan With Acute and 30-Day Survival.

Shackelford S, Del Junco D, Powell-Dunford N, Mazuchowski E, Howard J, Kotwal R, Gurney J, Butler F, Gross K, Stockinger Z

Importance: Prehospital blood product transfusion in trauma care remains controversial due to poor-quality evidence and cost. Sequential expansion of blood transfusion capability after 2012 to deployed military medical evacuation (MEDEVAC) units enabled a concurrent cohort study to focus on the timing as well as the location of the initial transfusion.

Objective: To examine the association of prehospital transfusion and time to initial transfusion with injury survival. Design, Setting, and Participants: Retrospective cohort study of US military combat casualties in Afghanistan between April 1, 2012, and August 7, 2015. Eligible patients were rescued alive by MEDEVAC from point of injury with either (1) a traumatic limb amputation at or above the knee or elbow or (2) shock defined as a systolic blood pressure of less than 90 mm Hg or a heart rate greater than 120 beats per minute.

Exposures: Initiation of prehospital transfusion and time from MEDEVAC rescue to first transfusion, regardless of location (ie, prior to or during hospitalization). Transfusion recipients were compared with non-recipients (unexposed) for whom transfusion was delayed or not given. Main Outcomes and Measures: Mortality at 24 hours and 30 days after MEDEVAC rescue were co-primary outcomes. To balance injury severity, non-recipients of prehospital transfusion were frequency matched to recipients by mechanism of injury, prehospital shock, severity of limb amputation, head injury, and torso hemorrhage. Cox regression was stratified by matched groups and also adjusted for age, injury year, transport team, tourniquet use, and time to MEDEVAC rescue.

Results: Of 502 patients (median age, 25 years [interquartile range, 22 to 29 years]; 98% male), 3 of 55 prehospital transfusion recipients (5%) and 85 of 447 non-recipients (19%) died within 24 hours of MEDEVAC rescue (between-group difference, -14% [95% CI, -21% to -6%]; P = .01). By day 30, 6 recipients (11%) and 102 non-recipients (23%) died (between-group difference, -12% [95% CI, -21% to -2%]; P = .04). For the 386 patients without missing covariate data among the 400 patients within the matched groups, the adjusted hazard ratio for mortality associated with prehospital transfusion was 0.26 (95% CI, 0.08 to 0.84, P = .02) over 24 hours (3 deaths among 54 recipients vs 67 deaths among 332 matched non-recipients) and 0.39 (95% CI, 0.16 to 0.92, P = .03) over 30 days (6 vs 76 deaths, respectively). Time to initial transfusion, regardless of location (prehospital or during hospitalization), was associated with reduced 24-hour mortality only up to 15 minutes after MEDEVAC rescue (median, 36 minutes after injury; adjusted hazard ratio, 0.17 [95% CI, 0.04 to 0.73], P = .02; there were 2 deaths among 62 recipients vs 68 deaths among 324 delayed transfusion recipients or non-recipients).

Conclusions and Relevance: Among medically evacuated US military combat causalities in Afghanistan, blood product transfusion prehospital or within minutes of injury was associated with greater 24-hour and 30-day survival than delayed transfusion or no transfusion. The findings support prehospital transfusion in this setting.

J Anaesthesiol Clin Pharmacol. 2017 Apr-Jun;33(2):226-230

Insertion of i-gel™ by the reversed technique improves the success rate and reduces the time taken for its placement: A prospective, randomized, controlled, interventional trial.

Sharda M, Kapoor M, Atray R, Garg S

BACKGROUND AND AIMS: We hypothesized that the i-gel™ supra-glottic airway can be inserted with relative ease in a reversed manner just like a Guedel's airway.

MATERIAL AND METHODS: A prospective, randomized, controlled interventional trial was conducted on 100 patients to compare reversed insertion of the i-gel™ (Group R) with the conventional insertion (Group C). In Group C, i-gel™ was introduced in a conventional manner, whereas in the Group R, i-gel™ was introduced into the oral cavity with the concavity facing the hard palate. On reaching the oropharynx, the device was rotated 180° and advanced further until it fitted over the larynx. The time of insertion, ease, and placement appropriateness were compared.

RESULTS: All patients completed the study. Better success rate of the first attempt insertion was achieved using the reversed technique (96% vs. 86%), but it was not statistically significant. Mean time required for i-gel™ insertion in Group R was 17.5 ± 6.9 s as compared to 20.8 ± 5.9 s in Group C, which was statistically significant. In Group R, it could be inserted within 20 s in 84% of cases, but only in 62% in Group C. The seal of the i-gel™ was similar in both the groups with the leak volumes (inspired - expired tidal volumes) being similar.

CONCLUSION: Reversed insertion technique for the placement of i-gel™ resulted in appropriate placement with easier insertion and lower placement time than that with the conventional technique.

J Trauma Acute Care Surg. 2017 Oct;83(4):675-682

Prehospital administration of freeze-dried plasma, is it the solution for trauma casualties?

Shlaifer A, Siman-Tov M, Radomislensky I, Peleg K, Shina A, Baruch E, Glassberg E, Yitzhak A; ITG*.

BACKGROUND: Hemorrhage is the leading cause of possible preventable death in the battlefield. There is an increasing evidence for the effectiveness of blood component therapy in general, and plasma infusion in particular but their use is less applicable in the prehospital setting due to logistic difficulties. Israeli Defense Force has implemented the use of freeze-dried plasma (FDP) at the point of injury (POI), this adoption of FDP use entailed doubts regarding the feasibility and effectiveness of this practice. In this article, we present our experience with the use of FDP at the POI and prehospital setting regarding the feasibility, safety, adverse reactions, and adherence to clinical practice guidelines.

METHODS: This is a descriptive retrospective cohort study based on all casualties receiving FDP during January 2013 to June 2016. The study describes the injury, treatment, and outcome characteristics from POI until hospital discharge.

RESULTS: During the study period, 109 casualties received FDP. The majority were men, aged 18 years to 35 years. Multiple severe injuries were found in almost half of the casualties, 78% had penetrating injury, and more than half were involved in a multi-casualty event. Eighty-three percent were treated with one unit of FDP, 13% with two units, and 4% casualties with three units, nine patients (8.2%) were also treated in the prehospital setting with packed red blood cells. Fifty-seven percent fulfilled at least one criterion for the administration of FDP. Lifesaving interventions were required in 64%. In five (4.6%) cases, there were difficulties with FDP administration. Side effects were reported in one female patient.

CONCLUSION: This study supports the usage feasibility of FDP at the POI and in the prehospital setting. Further adjustment of the clinical practice guidelines is required basing it not only on pathophysiologic parameters but also on clinical judgment. Further investigation of the available data is required to learn about the effectiveness of FDP at POI.

LEVEL OF EVIDENCE: Retrospective case series study, level IV.

Emerg Med Clin North Am. 2017 Nov;35(4):789-801

Penetrating Vascular Injury: Diagnosis and Management Updates.

Slama R, Villaume F

Abstract:

Penetrating vascular injury is becoming increasingly common in the United States and abroad. Much of the current research and treatment is derived from wartime and translation to the civilian sector has been lacking. Penetrating vascular injury can be classified as extremity, junctional, or noncompressible. Diagnosis can be obvious but at other times subtle and difficult to diagnose. Although there are numerous modalities, computed tomography angiography is the diagnostic study of choice. It is hoped that care will be improved by using an algorithmic approach integrating experience from military and civilian research.

World Neurosurg. 2017 Sep;105:238-248

Severe Traumatic Brain Injury at a Tertiary Referral Center in Tanzania: Epidemiology and Adherence to Brain Trauma Foundation Guidelines.

Smart L, Mangat H, Issarow B, McClelland P, Mayaya G, Kanumba E, Gerber L, Wu X, Peck R, Ngayomela I, Fakhar M, Stieg P, Härtl R

BACKGROUND: Severe traumatic brain injury (TBI) is a major cause of death and disability worldwide. Prospective TBI data from sub-Saharan Africa are sparse. This study examines epidemiology and explores management of patients with severe TBI and adherence to Brain Trauma Foundation Guidelines at a tertiary care referral hospital in Tanzania.

METHODS: Patients with severe TBI hospitalized at Bugando Medical Centre were recorded in a prospective registry including epidemiologic, clinical, treatment, and outcome data.

RESULTS: Between September 2013 and October 2015, 371 patients with TBI were admitted; 33% (115/371) had severe TBI. Mean age was 32.0 years ± 20.1, and most patients were male (80.0%). Vehicular injuries were the most common cause of injury (65.2%). Approximately half of the patients (47.8%) were hospitalized on the day of injury. Computed tomography of the brain was performed in 49.6% of patients, and 58.3% were admitted to the intensive care unit. Continuous arterial blood pressure monitoring and intracranial pressure monitoring were not performed in any patient. Of patients with severe TBI, 38.3% received hyperosmolar therapy, and 35.7% underwent craniotomy. The 2-week mortality was 34.8%.

CONCLUSIONS: Mortality of patients with severe TBI at Bugando Medical Centre, Tanzania, is approximately twice that in high-income countries. Intensive care unit care, computed tomography imaging, and continuous arterial blood pressure and intracranial pressure monitoring are underused or unavailable in the tertiary referral hospital setting. Improving outcomes after severe TBI will require concerted investment in prehospital care and improvement in availability of intensive care unit resources, computed tomography, and expertise in multidisciplinary care.

Curr Opin Hematol. 2017 Nov;24(6):529-535

Prehospital hemostatic resuscitation to achieve zero preventable deaths after traumatic injury.

Spinella P, Cap A

PURPOSE OF REVIEW: To describe how hemostatic resuscitation can be used in the prehospital phase of resuscitation to reduce preventable deaths after traumatic injury.

RECENT FINDINGS: Hemorrhagic shock is the leading cause of death that is preventable after injury. The National Academy of Sciences, recently, recommended that achievement of zero preventable deaths after traumatic injury should be the goal of a national trauma system. In the United States, there are an estimated 25000 preventable deaths per year in the prehospital phase of resuscitation because of traumatic hemorrhagic shock. Therefore, to achieve the goal of zero preventable deaths after injury, both shock and hemostatic dysfunction need to be addressed rapidly in the prehospital phase of resuscitation. This review will highlight the epidemiology and outcomes of traumatic hemorrhagic shock, and explore potential solutions such as group O whole blood and platelets stored at 2-6°C. Trauma research receives the lowest funding relative to the burden of morbidity and mortality it creates when compared with all other diseases. Increased resources are required to achieve zero preventable deaths after injury.

SUMMARY: Prehospital hemostatic resuscitation has the potential to significantly reduce preventable death from hemorrhage.

World J Surg. 2017 Sep 20. [Epub ahead of print]

External Validation of a Tube Thoracostomy Complication Classification System.

Sritharen Y, Hernandez M, Haddad N, Kong V, Clarke D, Zielinski M, Aho J

BACKGROUND: Tube thoracostomy (TT) is a commonly performed procedure which is associated with significant complication rates. Currently, there is no validated taxonomy to classify and compare TT complications across different populations. This study aims to validate such TT complication taxonomy in a cohort of South African trauma patients.

METHODS: Post hoc analysis of a prospectively collected trauma database from Pietermaritzburg Metropolitan Trauma Service (PMTS) in South Africa was performed for the period January 2010 to December 2013. Baseline demographics, mechanism of injury and complications were collected and categorized according to published classification protocols. All patients requiring bedside TT were included in the study. Patients who necessitated operatively placed or image-guided TT insertion were excluded. Summary and univariate analyses were performed.

RESULTS: A total of 1010 patients underwent TT. The mean age was (±SD) of 26 ± 8 years. Unilateral TTs were inserted in n = 966 (96%) and bilateral in n = 44 (4%). Complications developed in 162 (16%) patients. Penetrating injury was associated with lower complication rate (11%) than blunt injury (26%), p = 0.0001. Higher complication rate was seen in TT placed by interns (17%) compared to TT placed by residents (7%), p = 0.0001. Complications were classified as: insertional (38%), positional (44%), removal (9%), infective/immunologic (9%), and instructional, educational or equipment related (0%).

CONCLUSIONS: Despite being developed in the USA, this classification system is robust and was able to comprehensively assign and categorize all the complications of TT in this South African trauma cohort. A universal standardized definition and classification system permits equitable comparisons of complication rates. The use of this classification taxonomy may help develop strategies to improve TT placement techniques and reduce the complications associated with the procedure.

LEVEL OF EVIDENCE: V.

Mil Med. 2017 Nov;182(11):e2046-e2051

Hyperkalemia in Combat Casualties: Implications for Delayed Evacuation.

Stewart I, Snow B, Clemens M, Sosnov J, Ross J, Howard J, Chung K

OBJECTIVE: Fixed facilities and rapid global evacuation ensured that delayed complications of trauma, such as hyperkalemia, occurred late in the evacuation chain where renal replacement therapies were available. However, future conflicts or humanitarian disasters may involve prolonged evacuation times. We sought to quantify one potential risk of delayed evacuation by assessing hyperkalemia in combat casualties.

METHODS: Retrospective study of military members admitted to intensive care units in Iraq and Afghanistan from February 1, 2002, to February 1, 2011. This study was approved by the U.S. Army Medical Research and Materiel Command Institutional Review Board. Demographics, injury severity score, burn injury, mechanism of injury, vital signs, creatinine, and potassium were collected. Logistic regression models were used to identify incidence and risk factors for hyperkalemia.

RESULTS: Of 6,011 patient records, 1,472 had sufficient data to be included for analysis. Hyperkalemia occurred in 5.8% of patients. Those with hyperkalemia had higher injury severity scores, higher shock index, were more likely to have acute kidney injury, and were more likely to die. On multivariate analysis, acute kidney injury and shock index were significantly associated with the development of hyperkalemia. In a subgroup of patients with data on creatine kinase, rhabdomyolysis was associated with hyperkalemia in the univariate model, but was not significant after adjustment.

CONCLUSION: Hyperkalemia occurred in 5.8% of patients in our cohort of critically injured combat casualties. The development of hyperkalemia was independently associated with acute kidney injury and shock index. In future conflicts, with prolonged evacuation times, mitigation strategies should be developed to treat hyperkalemia in casualties before arrival at definitive care.

Transfusion. 2017 Sep 6. doi: 10.1111/trf.14303. [Epub ahead of print]

Cold platelets for trauma-associated bleeding: regulatory approval, accreditation approval, and practice implementation-just the "tip of the iceberg".

Stubbs J, Tran S, Emery R, Hammel S, Haugen A, Zielinski M, Zietlow S, Jenkins D

BACKGROUND: Laboratory and clinical evidence suggest that cold-stored platelets (CS-PLTs) might be preferable to room temperature platelets (RT-PLTs) for active bleeding. Ease of prehospital use plus potential hemostatic superiority led our facility to pursue approval of CS-PLTs for actively bleeding trauma patients.

STUDY DESIGN AND METHODS: From November 18, 2013, through October 8, 2015, correspondence was exchanged between our facility, the AABB, and the US Food and Drug Administration (FDA). An initial AABB variance request was for 5-day CS-PLTs without agitation. The AABB deferred its decision pending FDA approval to use our platelet (PLT) bags for CS-PLTs. On March 27, 2015, the FDA approved 3-day CS-PLTs without agitation. On October 8, 2015, the AABB approved 3-day CS-PLTs without agitation and without bacterial testing for actively bleeding trauma patients. Our facility's goal is to carry CS-PLTs on air ambulances.

RESULTS: CS-PLTs have been used for trauma patients at our facility since October 2015. As of August 2016, a total of 21 (19.1%) of 119 CS-PLTs have been transfused. The short 3-day storage period combined with the formation of clots in plasma-rich CS-PLTs during storage have been the major causes of a high (80.9%) discard rate.

CONCLUSION: In the future, pathogen-reduced (PR), PLT additive solution (PAS) CS-PLTs seem more practical due to low risks of bacterial contamination and storage-related clotting. This should make longer storage of CS-PLTs feasible (e.g., 10 days or more). With a longer shelf life, PR PAS CS-PLTs could potentially be used in a wider range of patient populations.

Eur Heart J Acute Cardiovasc Care. 2017 Sep 1:2048872617731894. [Epub ahead of print]

The impact of airway strategy on the patient outcome after out-of-hospital cardiac arrest: A propensity score matched analysis.

Sulzgruber P, Datler P, Sterz F, Poppe M, Lobmeyr E, Keferböck M, Zeiner S, Nürnberger A, Schober A, Hubner P, Stratil P, Wallmueller C, Weiser C, Warenits A, Zajicek A, Ettl F, Magnet I, Uray T, Testori C, van Tulder R

BACKGROUND: While guidelines mentioned supraglottic airway management in the case of out-of- hospital cardiac arrest, robust data of their impact on the patient outcome remain scare and results are inconclusive.

METHODS: To assess the impact of the airway strategy on the patient outcome we prospectively enrolled 2224 individuals suffering cardiac arrest who were treated by the Viennese municipal emergency medical service. To control for potential confounders, propensity score matching was performed. Patients were matched in four groups with a 1:1:1:1 ratio (n=210/group) according to bag-mask-valve, laryngeal tube, endotracheal intubation and secondary endotracheal intubation after primary laryngeal tube ventilation.

RESULTS: The laryngeal tube subgroup showed the lowest 30-day survival rate among all tested devices ($p<0.001$). However, in the case of endotracheal intubation after primary laryngeal tube ventilation, survival rates were comparable to the primary endotracheal tube subgroup. The use of a laryngeal tube was independently and directly associated with mortality with an adjusted odds ratio of 1.97 (confidence interval: 1.14-3.39; $p=0.015$). Additionally, patients receiving laryngeal tube ventilation showed the lowest rate of good neurological performance (6.7%; $p<0.001$) among subgroups. However, if patients received endotracheal intubation after initial laryngeal tube ventilation, the outcome proved to be significantly better (9.5%; $p<0.001$).

CONCLUSION: We found that the use of a laryngeal tube for airway management in cardiac arrest was significantly associated with poor 30-day survival rates and unfavourable neurological outcome. A primary endotracheal airway management needs to be considered at the scene, or an earliest possible secondary endotracheal intubation during both pre-hospital and in-hospital post-return of spontaneous circulation critical care seems crucial and most beneficial for the patient outcome.

Saudi Med J. 2017 Oct;38(10):1007-1012

A novel method for improving chest tube insertion skills among medical interns. Using biomaterial-covered mannequin.

Tatli O, Turkmen S, Imamoglu M, Karaca Y, Cicek M, Yadigaroglu M, Bayrak S, Asik O, Topbas M, Turedi S.

OBJECTIVES: To develop a low-cost biomaterial-covered chest tube simulation model and assess its possible usefulness for developing the chest tube insertion skills among medical interns.

Methods: This mannequin-based interventional study was performed in a University hospital setting. We included 63 physicians performing emergency medicine internship at the Faculty of Medicine, Karadeniz Technical University, Trabzon, Turkey, between January 2015 and March 2015. A dummy was prepared for training simulation using a display mannequin. Medical interns received instruction concerning pneumothorax and the chest tube procedure. A total of 63 medical interns participating in this interventional study were asked to insert a chest tube in a biomaterial-covered mannequin. A senior trainee scored their performance using a check list and the mean of the total scores was calculated (21 items; total score, 42).

Results: The mean procedural score was 40.9 ± 1.3 of a possible 42. The maximum score of 42 was achieved by 39.7% of the medical interns, while another 33.3% achieved a score of 41. Of the participants, 5% succeeded in inserting the tube via an appropriate technique, achieving a score of 40 or more.

Conclusion: Our results indicated that this model could be useful for effective training of medical interns for chest tube insertion, which is an important skill in emergency medicine. This biomaterial-covered model is inexpensive and its use can potentially be widened to improve training methods without significant financial demand.

Prehosp Emerg Care. 2017 Jun 29:1-8

Use of Hemostatic Nasal Plugs in Emergency Medical Services in the Netherlands: A Prospective Study of 33 Cases.

Te Grotenhuis R, van Grunsven PM, Heutz WMJM, Tan ECTH.

BACKGROUND: Epistaxis is a common medical emergency with possible life-threatening complications. In the prehospital setting, epistaxis can be treated with nasal tampons. HemCon® Nasal Plug is a nasal tampon impregnated with oxidized cellulose, which has hemostatic properties.

OBJECTIVE: The objective of this study was to determine the effectiveness and usability of HemCon Nasal Plugs in the treatment of severe epistaxis in the prehospital setting.

METHODS: From June 2012 to December 2014, all ambulances of two emergency medical services in the Netherlands were equipped with HemCon Nasal Plugs. The plug was used according to protocol; if conventional treatment failed to control severe epistaxis or if conventional treatment was unlikely to achieve hemostasis. The ambulance personnel filled in an evaluation form after each use.

RESULTS: A total of 33 patients were treated with HemCon Nasal Plugs. Twenty-four patients were taking anticoagulants or suffered from a clotting disorder. The cause of epistaxis was idiopathic in the majority of the patients. Inserting HemCon Nasal Plugs resulted in cessation of epistaxis in 25/33 patients and resulted in reduction of epistaxis in 4/33 patients. HemCon Nasal Plugs failed to control epistaxis in 4/33 patients, possible due to an unreachable site of bleeding.

CONCLUSION: This study demonstrated that HemCon Nasal Plug is an effective adjunct in the prehospital treatment of severe and uncontrolled epistaxis.

Injury. 2017 Sep 6. pii: S0020-1383(17)30595-8. [Epub ahead of print]

Association between spinal immobilization and survival at discharge for on-scene blunt traumatic cardiac arrest: A nationwide retrospective cohort study.

Tsutsumi Y, Fukuma S, Tsuchiya A, Ikenoue T, Yamamoto Y, Shimizu S, Kimachi M, Fukuhara S

INTRODUCTION: Spinal immobilization has been indicated for all blunt trauma patients suspected of having cervical spine injury. However, for traumatic cardiac arrest (TCA) patients, rapid transportation without compromising potentially reversible causes is necessary. Our objective was to investigate the temporal trend of spinal immobilization for TCA patients and to examine the association between spinal immobilization and survival.

METHODS: We conducted a retrospective cohort study using the Japan Trauma Data Bank 2004-2015 registry data. Our study population consisted of adult blunt TCA patients encountered at the scene of a trauma. The primary outcome was the survival proportion at hospital discharge, and the secondary outcome was the proportion achieving return of spontaneous circulation (ROSC). We examined the association between spinal immobilization and these outcomes using a logistic regression model based on imputed data sets with the multiple imputation method to account for missing data.

RESULTS: Among 4313 patients who met the inclusion criteria, 3307 (76.7%) were immobilized. The proportion of patients that underwent spinal immobilization gradually decreased from 82.7% in 2004-2006 to 74.0% in 2013-2015. 1.0% of immobilized and 0.9% of non-immobilized patients had severe cervical spine injury. Spinal immobilization was significantly associated with lower survival at discharge (odds ratio [OR], 0.64; 95% confidence interval [CI], 0.42 to 0.98) and ROSC by admission (OR, 0.48; 95%CI, 0.27 to 0.87). There was no significant sub-group difference of the association between spinal immobilization and survival at discharge by patients with or without cervical spine injury (p for interaction 0.73).

CONCLUSION: Spinal immobilization is widely used even for blunt TCA patients, even though it is associated with a lower rate of survival at discharge and ROSC by admission. According to these results, we suggest that spinal immobilization should not be routinely recommended for all blunt TCA patients.

Curr Opin Crit Care. 2017 Dec;23(6):498-502

Novel concepts for damage control resuscitation in trauma.

Van P, Holcomb J, Schreiber M

PURPOSE OF REVIEW: Traumatic injuries are a major cause of mortality worldwide. Damage control resuscitation or balanced transfusion of plasma, platelets, and red blood cells for the management of exsanguinating hemorrhage after trauma has become the standard of care. We review the literature regarding the use of alternatives to achieve the desired 1:1:1 ratio as availability of plasma and platelets can be problematic in some environments.

RECENT FINDINGS: Liquid and freeze dried plasma (FDP) are logistically easier to use and may be superior to fresh frozen plasma. Cold storage platelets (CSPs) have improved hemostatic properties and resistance to bacterial contamination. Low titer type O whole blood can be transfused safely in civilian patients.

SUMMARY: In the face of hemorrhagic shock from traumatic injury, resuscitation should be initiated with 1:1:1 transfusion of plasma, platelets, and red blood cells with limited to no use of crystalloids. Availability of plasma and platelets is limited in some environments. In these situations, the use of low titer type O whole blood, thawed or liquid plasma, cold stored platelets or reconstituted FDP can be used as substitutes to achieve optimal transfusion ratios. The hemostatic properties of CSPs may be superior to room temperature platelets.

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Buddy-aid battlefield pain management.

Vertu N, Nacimento M, Pasquier P

Quote from a Letter to the Editor:

“As members of the French Military Medical Service currently involved in the management of combat casualties in austere setting, we read with great interest the study by Benov et al reviewing all cases of point of injury (POI) pain treatment documented in the Israeli Defense Force Trauma Registry in the past 17 years. 1

In this large retrospective study of 8,576 trauma patients, most casualties at POI did not receive any analgesics while on the battlefield. Indeed, only 12.3% (1,056) of casualties were treated with an analgesic at the prehospital settings. More surprisingly, physicians and/or a paramedic provided the administration of 90.5% of analgesics given to casualties at POI. In the discussion section, the authors justified this high ratio of pain interventions performed by physicians and paramedics, by the rapid availability of these front-line providers.

We would like to go further into the debate since the French Army has a long experience of buddy-aid battlefield pain management, using a 10-mg morphine autoinjector, also known as the Syrette of morphine. The Syrette is a device for injecting liquid through a needle, almost similar to a syringe, except that it has a closed flexible tube, instead of a rigid tube and piston.

During military operations, not only front-line providers, including physicians, paramedics, and medics, can provide an adequate battlefield pain management.
Actually, all soldiers carry a combat first aid kit including a Syrette of morphine. At POI, this individual autoinjector containing 10 mg of morphine is well designed for intramuscular administration of drugs for self-aid or buddy-aid, even before the arrival of front-line providers.”

J Trauma Acute Care Surg. 2017 Sep;83(3):388-397

Platelet transfusions reduce fibrinolysis but do not restore platelet function during trauma hemorrhage.

Vulliamy P, Gillespie S, Gall L, Green L, Brohi K, Davenport R

BACKGROUND: Platelets play a critical role in hemostasis with aberrant function implicated in trauma-induced coagulopathy. However, the impact of massive transfusion protocols on platelet function during trauma hemorrhage is unknown. The aim of this study was to characterize the effects of platelet transfusion on platelet aggregation and fibrinolytic markers during hemostatic resuscitation.

METHODS: Trauma patients enrolled into the prospective Activation of Coagulation and Inflammation in Trauma study between January 2008 and November 2015 who received at least four units of packed red blood cells (PRBCs) were included. Blood was drawn in the emergency department within 2 hours of injury and at intervals after every four units of PRBCs transfused. Platelet aggregation was assessed in whole blood with multiple electrode aggregometry. Plasma proteins were quantified by enzyme-linked immunosorbent assay.

RESULTS: Of 161 patients who received four or more PRBCs as part of their initial resuscitation, 44 received 8 to 11 units and 28 received 12 units or more. At each timepoint during bleeding, platelet aggregation was similar in patients who had received a platelet transfusion compared with those who had only received other blood products ($p > 0.05$ for all timepoints). Platelet transfusion during the four PRBC intervals was associated with a decrease in maximum lysis on rotational thromboelastometry (start of interval, 6% [2-12] vs. end of interval, 2% [0-5]; $p = 0.001$), an increase in plasminogen activator inhibitor-1 (start of interval, 35.9 ± 14.9 vs. end of interval, 66.7 ± 22.0; $p = 0.007$) and a decrease in tissue plasminogen activator (start of interval, 26.2 ± 10.5 vs. end of interval, 19.0 +/- 5.1; $p = 0.04$). No statistically significant changes in these parameters occurred in intervals which did not contain platelets.

CONCLUSION: Current hemostatic resuscitation strategies do not appear to restore platelet aggregation during active hemorrhage. However, stored platelets may attenuate fibrinolysis by providing an additional source of plasminogen activator inhibitor-1. Further investigation into the effects of early platelet transfusion on platelet function, hemostatic, and clinical outcomes during bleeding are warranted.

LEVEL OF EVIDENCE: Therapeutic, level III.

J Trauma Acute Care Surg. 2017 Nov;83(5):965-974

Does prehospital management by doctors affect outcome in major trauma? A systematic review.

Wilson S, Gangathimmaiah V

BACKGROUND: There is substantial variation worldwide in prehospital management of trauma and the role of doctors is controversial. The objective of this review was to determine whether prehospital management by doctors affects outcomes in major trauma, including the prespecified subgroup of severe traumatic brain injuries when compared with management by other advanced life support providers.

METHODS: EMBASE, MEDLINE(R), PubMed, SciELO, Trip, Web of Science, and Zetoc were searched for published articles. HSRProj, OpenGrey, and the World Health Organization International Clinical Trials Registry Platform were searched for unpublished data. Relevant reference lists were hand-searched. There were no limits on publication year, but articles were limited to the English language. Authors were contacted for further information as required. Quality was assessed using the Downs and Black criteria. Mortality was the primary outcome, and disability was the secondary outcome of interest. Studies were subjected to a descriptive analysis alone without a meta-analysis due to significant study heterogeneity. All searches, quality assessment, data abstraction, and data analysis was performed by two reviewers independently.

RESULTS: Two thousand thirty-seven articles were identified, 49 full-text articles assessed and eight studies included. The included studies consisted of one randomized controlled trial with 375 participants and seven observational studies with over 4,451 participants. All included studies were at a moderate to high risk of bias. Six of the eight included studies showed an improved outcome with prehospital management by doctors, five in terms of mortality and one in terms of disability. Two studies found no significant difference.

CONCLUSION: There appears to be an association between prehospital management by doctors and improved survival in major trauma. There may also be an association with improved survival and better functional outcomes in severe traumatic brain injury. Further high-quality evidence is needed to confirm these findings.

LEVEL OF EVIDENCE: Systematic review, level III.

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Placement of a cervical collar increases the optic nerve sheath diameter in healthy adults.

Woster C, Zwank M, Pasquarella J, Wewerka S, Anderson J, Greupner J, Motalib S

INTRODUCTION: Blunt head trauma is a common cause of increased intracranial pressure (ICP). Ultrasound measurement of the optic nerve sheath diameter (OSND) is an accurate and non-invasive way to detect increased ICP. Blunt trauma patients are often immobilized in a rigid cervical spine collar. Our objective was to describe the changes in ONSD following the placement of a c-collar and determine if any changes were time-dependent.

METHODS: We performed a prospective cohort study measuring the ONSD of healthy volunteers before and after placement of a c-collar. Two physicians obtained the measurements. Each eye was scanned twice using a standardized technique. This was done before c-collar placement, 5min after placement and 20min after placement. A mean of both eyes was calculated and analyzed using descriptive statistics. An intraclass correlation coefficient (ICC) was used to assess inter-rater reliability.

RESULTS: Twenty study participants with a mean age of 37.1years old were enrolled. The mean baseline ONSD was 3.77mm (95% CI 3.48-4.07). The mean ONSD 5 min after the c-collar was placed was 4.47 (95% CI 4.17-4.78). The mean ONSD at 20 min after c-collar placement was 4.53 (95% CI 4.13-4.92). These changes were statistically significant (p=0.003 and <0.001). Reliability was relatively strong overall (ICC=0.74; 95% CI: 0.65, 0.81).

CONCLUSION: The placement of a cervical collar increased the ONSD at 5min and this change remained increased at 20min. Future study should assess whether similar results are found in patients with blunt head trauma.

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The life-saving effect of "adenosine, lidocaine, and magnesium" cocktail during hypovolemic shock: One stone, three birds?

Xiang L, Klemcke H, Ryan K

Quote:

“Letson and Dobson showed that treatment with ALM (adenosine, lidocaine, and magnesium) significantly decreased mortality in a severe hypovolemic shock model with uncontrolled hemorrhage1. Similar life-saving effects of ALM were also observed by the same investigators in swine with either volume-controlled hemorrhagic or septic shock2-4. We are particularly intrigued by these findings and believe these studies may provide important insights into the treatment of traumatic shock in prehospital or battlefield scenarios. Herein, we suggest further interpretation of the data in an attempt to better understand the physiological mechanisms underlying the unique benefits of the treatment.

The increased blood pressure following ALM treatment during hemorrhagic shock appears to be predominantly due to an increased cardiac performance, as evidenced by improvements in cardiac index, sinus rhythm, and stroke volume (SV), without increases in systemic vascular resistance (SVR) or heart rate1-4. In the current study, a bolus of ALM normalized SV without affecting the ejection fraction (EF) in an uncontrolled hemorrhage model with the blood pressure reduced below 40 mmHg. These results suggest that, surprisingly, ventricular end diastolic volume (EDV) and thus venous return were both normalized by the ALM treatment after an uncontrolled hemorrhage. This inotropic effect of ALM is impressive but an important question remains to be answered: why were the venous return and SV maintained or tended to be increased concomitant with loss of blood volume?”

Hepatobiliary Pancreat Dis Int. 2017 Oct 15;16(5):458-469

Perioperative fluid management in major hepatic resection: an integrative review.

Yoshino O, Perini M, Christophi C, Weinberg L

BACKGROUND: Fluid intervention and vasoactive pharmacological support during hepatic resection depend on the preference of the attending clinician, institutional resources, and practice culture. Evidence-based recommendations to guide perioperative fluid management are currently limited. Therefore, we provide a contemporary clinical integrative overview of the fundamental principles underpinning fluid intervention and hemodynamic optimization for adult patients undergoing major hepatic resection.

DATA SOURCES: A literature review was performed of MEDLINE, EMBASE and the Cochrane Central Registry of Controlled Trials using the terms "surgery", "anesthesia", "starch", "hydroxyethyl starch derivatives", "albumin", "gelatin", "liver resection", "hepatic resection", "fluids", "fluid therapy", "crystalloid", "colloid", "saline", "plasma-Lyte", "plasmalyte", "hartmann's", "acetate", and "lactate". Search results for MEDLINE and EMBASE were additionally limited to studies on human populations that included adult age groups and publications in English.

RESULTS: A total of 113 articles were included after appropriate inclusion criteria screening. Perioperative fluid management as it relates to various anesthetic and surgical techniques is discussed.

CONCLUSIONS: Clinicians should have a fundamental understanding of the surgical phases of the resection, hemodynamic goals, and anesthesia challenges in attempts to individualize therapy to the patient's underlying pathophysiological condition. Therefore, an ideal approach for perioperative fluid therapy is always individualized. Planning and designing large-scale clinical trials are imperative to define the optimal type and amount of fluid for patients undergoing major hepatic resection. Further clinical trials evaluating different intraoperative goal-directed strategies are also eagerly awaited.