Tactical Combat Casualty Care

Journal Article Abstracts

Committee on Tactical Combat Casualty Care

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Ann Emerg Med. 2016 Feb;67(2):289-94.

Move Over Morphine: Is Ketamine an Effective and Safe Alternative for Treating Acute Pain?: Answers to the September 2015 Journal Club.

Barrett TW, Schriger DL.

Quotes:

"Ketamine has many of the qualities that are desired for a rapid sequence intubation induction agent. It has rapid onset, has short duration, and is not associated with hypotension or bradycardia. It has indirect sympathomimetic effects and typically results in increased blood pressure, pulse rate, and cardiac output, which may be beneficial in hemodynamically unstable trauma patients. (13) Ketamine also has amnestic, analgesic, and anxiolytic effects that are also beneficial qualities for an induction agent in children and adults.(3,13)"

"Ketamine had previously been contraindicated in patients with traumatic brain injury, given the concern that it elevates intracranial pressure. (14-17) These studies were performed primarily on awake patients with known cerebrospinal fluid outflow tract anatomic defects and obstructions, who represent a patient population very different from trauma patients with acute traumatic brain injury. (14-17) Subsequent research has found this concern to be false.(18-21) Recall that cerebral perfusion pressure¼mean arterial pressure–intracranial pressure. Ketamine increases mean arterial pressure with little effect on intracranial pressure, resulting in improved cerebral perfusion pressure."

"The key to managing agitated and violent patients, whether because of traumatic brain injury or intoxication, is rapidly achieving an appropriate level of sedation or dissociative state before they cause additional harm to themselves or health care workers. Ketamine is an excellent agent in such patients, given its rapid onset even when administered intramuscularly, especially compared with available alternatives (haloperidol and benzodiazepines).(23) An intravenous dose at 1 to 1.5 mg/kg would likely achieve the desired dissociative state; however, that same dose would not likely be adequate when given intramuscularly, and most protocols recommend an intramuscular dose of 4 mg/kg.(24) Hopper et al (23) reported that ketamine, although rarely used in their ED for acute agitation, was associated with few adverse effects in agitated patients, including 22% with alcohol intoxication. Our institution has adopted the use of intramuscular ketamine among acutely agitated patients both in our ED and in the out-of-hospital setting during events covered by our Event Medicine team. Our experience has been that it provides a more rapid and reliable response in acutely agitated patients than other commonly used agents (haloperidol, midazolam, or diazepam)."

Injury. 2015 Nov 18. pii: S0020-1383(15)00697-X.

Augmentation of point of injury care: Reducing battlefield mortality-The IDF experience.

Benov Avi, Elon G, Baruch EN, Avi S, Gilad T, Moran L, Itay Z, Ram S, Tarif B, David D, Avraham Y, Yitshak K.

STUDY OBJECTIVE: In 2012, the Israel Defense Forces Medical Corps (IDF-MC) set a goal of reducing mortality and eliminating preventable death on the battlefield. A force buildup plan entitled "My Brother's Keeper" was launched addressing: trauma medicine, training, change of Clinical Practice Guidelines (CPGs), injury prevention, data collection, global collaboration and more. The aim of this article is to examine how military medical care has evolved due "My Brother's Keeper" between Second Lebanon War (SLW, 2006) to Operation Protective Edge (OPE, 2014).

METHODS: Records of all casualties during OPE and SLW were extracted and analyzed from the I.D.F Trauma Registry. Noncombat injuries and civilian injuries from missile attacks were excluded from this analysis.

RESULTS: The plans main impacts were; incorporation of a physician or paramedic as an integral part of each fighting company, implementation of new CPGs, introduction of new approaches for extremity haemorrhage control and Remote Damage Control Resuscitation at point of injury (POI) using single donor reconstituted freeze dried plasma (25 casualties) and transexamic acid (98 casualties). During OPE, 704 soldiers sustained injuries compared with 833 casualties during SLW. Fatalities were 65 and 119, respectively, cumulating to Case Fatality Rate of 9.2% and 14.3%, respectively.

CONCLUSIONS: Significant changes in the way the IDF-MC provides combat casualty care have been made in recent years. It is the transformation from concept to doctrine and integration into a structured and Goal-Oriented Casualty Care System, especially POI care that led to the unprecedented survival rates in IDF as shown in this conflict.

Small Wars Journal 2016;Epub ahead of print

Trauma care in a rucksack? (TRACIR) Disruptive technology concept.

Berkow J, Poropatich R

Conclusion:
The “Trauma Care in a Rucksack” (TRACIR) concept addresses many of the combat casualty care operational deficiencies identified in past conflicts by proposing a novel approach to a fundamental technical challenge. This challenge is to overcome the pervasive use of subjective physiologic signs and symptoms used as the standard of care to triage or assess and treat patients that is also an obstacle towards providing a semi-autonomous and autonomous Tactical Combat Casualty Care (TCCC) solution. A set of disruptive technology building blocks is proposed to create a paradigm shift in how medical data is defined, stored, captured, visualized, and shared such that a more easily transportable semi-autonomous and autonomous TCCC solution can be developed. The proposed TRACIR platform satisfies key operational requirements for use by any vehicle of opportunity, during prolonged field care in denied environments, and for future Unmanned Aerial Systems’ needs.

J Spec Oper Med 2015 Winter;15(4):149-152

The U.S. Military Experience with Tourniquets and Hemostatic Dressings in the Afghanistan and Iraq Conflicts.

Butler F:

CONCLUSION

Never in its long and distinguished history has the U.S. military been so successful at saving the lives of individuals wounded in combat. Many dedicated professionals in the Military Health System have played key roles in bringing about the highest casualty survival rate in history: our courageous combat medical personnel, who perform amazing feats of medical care in the midst of the battle; the helicopter evacuation crews, who willingly risk their lives over and over to evacuate our casualties to safety; the superbly skilled surgical and intensive care teams in our hospitals; the Critical Care Air Transport Teams that fly desperately ill casualties thousands of miles to higher levels of care; the rehabilitation specialists, who enable our casualties to maximize their recovery of life skills and function despite their injuries; and finally, the professionals at the Joint Trauma System, who work ceaselessly to provide oversight of the entire system and make it function smoothly. To all these men and women, our nation owes a great debt.

Because most combat fatalities occur in the prehospital phase of care, our nation's combat medical providers play an especially important role in ensuring the highest casualty-survival rate possible. TCCC has given these individuals a vastly improved set of tools and skills to better accomplish their heroic and lifesaving deeds on the battlefield, and tourniquets and hemostatic dressings are now a permanent fixture in their aid bags.

Acta Biomater. 2016 Feb;31:178-85.

PolySTAT-modified chitosan gauzes for improved hemostasis in external hemorrhage.

Chan LW, Kim CH, Wang X, Pun SH, White NJ, Kim TH.

ABSTRACT: Positively-charged chitosan gauzes stop bleeding from wounds by electrostatically interacting with negatively-charged cell membranes of erythrocytes to cause erythrocyte agglutination and by sealing wounds through tissue adhesion. In the following work, nonwoven chitosan gauze was impregnated with PolySTAT, a synthetic polymer that enhances coagulation by cross-linking fibrin, to generate PolySTAT/chitosan gauzes with improved hemostatic efficacy. When comparing nonwoven chitosan and PolySTAT/chitosan to a commercially-available chitosan-containing gauze (Celox® Rapid), no appreciable differences were observed in fiber size, morphology, and pore size. However, PolySTAT/chitosan demonstrated more rapid blood absorption compared to Celox® Rapid. In a rat model of femoral artery injury, PolySTAT/chitosan gauzes reduced blood loss and improved survival rate compared to non-hemostatic controls and Celox® Rapid. While Celox® Rapid had stronger adherence to tissues compared to PolySTAT/chitosan gauzes, blood loss was greater due to hematoma formation under the Celox® dressing. Animals treated with PolySTAT/chitosan gauzes required less saline infusion to restore and maintain blood pressure above the target blood pressure (60mmHg) while other treatment groups required more saline due to continued bleeding from the wound. These results suggest that PolySTAT/chitosan gauzes are able to improve blood clotting and withstand increasing arterial pressure with the addition of a fibrin cross-linking hemostatic mechanism.

STATEMENT OF SIGNIFICANCE: Blood loss remains one of the leading causes of death after traumatic injury in civilian populations and on the battlefield. Advanced biomaterials that interact with blood components and/or accelerate the clotting process to form a hemostatic plug are necessary to staunch bleeding after injury. Chitosan-based gauzes, which stop bleeding by causing red blood cell aggregation, are currently used on the battlefield and have shown variable performance under high pressure arterial blood flow in animal studies, suggesting that red blood cell aggregates require further mechanical stabilization for more reliable performance. In this work, we investigate the binding and cross-linking of fibrin, a major component in blood clots, on chitosan gauze fiber surfaces to structurally reinforce red blood cell aggregates.

J Anesth. 2016 Jan 13. [Epub ahead of print]

Comparison of remifentanil EC50 for facilitating i-gel and laryngeal mask airway insertion with propofol anesthesia.

Choi JB, Kwak HJ, Lee KC, Lee SR, Lee SY, Kim JY.

OBJECTIVE: Each supraglottic airway requires different anesthetic depth because it has a specific structure and different compressive force in the oropharyngeal cavity. We designed the study to compare the effect-site concentration (Ce) of remifentanil in 50 % of patients (EC50) for successful insertion of the i-gel second-generation supraglottic airway device with that for laryngeal mask airway (LMA) insertion during target-controlled infusion (TCI) of propofol.

METHODS: Forty-one female patients were randomized to the i-gel group (n = 20) or the LMA group (n = 21). Anesthesia was induced with propofol Ce of 5 μg/ml and the predetermined remifentanil Ce, and the i-gel or LMA was inserted 5 min later. The remifentanil Ce was estimated by modified Dixon's up-and-down method (initial concentration: 3.0 ng/ml, step size: 0.5 ng/ml). The patient's response to device insertion was classified as either "success (no movement)" or "failure (movement)".

RESULTS: Using the Dixon's up-and-down method, EC50 of remifentanil Ce for the i-gel (1.58 ± 0.41 ng/ml) was significantly lower than that for LMA (2.25 ± 0.55 ng/ml) (p = 0.038). Using isotonic regression, EC50 (83 % CI) of remifentanil in the i-gel group [1.50 (1.37-1.80) ng/ml] was statistically lower than that in the LMA group [2.00 (1.82-2.34) ng/ml]. EC95 (95 % CI) of remifentanil in the i-gel group [2.38 (1.48-2.50) ng/ml] was statistically lower than that in the LMA group [3.35 (2.58-3.48) ng/ml].

CONCLUSIONS: We found that EC50 of remifentanil Ce for i-gel insertion (1.58 ng/ml) was significantly lower than that for LMA insertion (2.25 ng/ml) in female patients during propofol TCI without neuromuscular blockade.

Case Rep Surg. 2015;2015:120140.

Massive Hemothorax Caused by a Single Intercostal Artery Bleed Ten Days after Solitary Minimally Displaced Rib Fracture.

Curfman KR, Robitsek RJ, Salzler GG, Gray KD, Lapunzina CS, Kothuru RK, Schubl SD.

ABSTRACT: Delayed hemothorax (DHX) following blunt thoracic trauma is a rare occurrence with an extremely variable incidence and time to diagnosis that is generally associated with clinically insignificant blood loss. In this report, we present a case of acute onset DHX ten days after a relatively mild traumatic event that resulted in a single minimally displaced rib fracture. The patient awoke from sleep suddenly with acute onset dyspnea and chest pain and reported to the emergency department (ED). The patient lost over six and a half liters of blood during the first 9 hours of his admission, the largest volume yet reported in the literature for DHX, which was eventually found to be due to a single intercostal artery bleed. Successful management in this case entailed two emergent thoracotomies and placement of multiple thoracostomy tubes to control blood loss. The patient was discharged home on postoperative day 5.

Shock. 2016 Feb 6. [Epub ahead of print]

Plasma First Resuscitation Reduces Lactate Acidosis, Enhances Redox Homeostasis, Amino Acid and Purine Catabolism in a Rat Model of Profound Hemorrhagic Shock.

D'Alessandro A, Moore HB, Moore EE, Wither MJ, Nemkov T, Morton AP, Gonzalez E, Chapman MP, Fragoso M, Slaughter A, Sauaia A, Silliman CC, Hansen KC, Banerjee A.

ABSTRACT: The use of aggressive crystalloid resuscitation to treat hypoxemia, hypovolemia and nutrient deprivation promoted by massive blood loss may lead to the development of the blood vicious cycle of acidosis, hypothermia, and coagulopathy and, utterly, death. Metabolic acidosis is one of the many metabolic derangements triggered by severe trauma/hemorrhagic shock, also including enhanced proteolysis, lipid mobilization, as well as traumatic diabetes. Appreciation of the metabolic benefit of plasma first resuscitation is an important concept. Plasma resuscitation has been shown to correct hyperfibrinolysis secondary to severe hemorrhage better than normal saline. Here we hypothesize that plasma first resuscitation corrects metabolic derangements promoted by severe hemorrhage better than resuscitation with normal saline. Ultra-high-performance liquid chromatography-mass spectrometry-based metabolomics analyses were performed to screen plasma metabolic profiles upon shock and resuscitation with either platelet-free plasma or normal saline in a rat model of severe hemorrhage. Of the 251 metabolites that were monitored, 101 were significantly different in plasma vs normal saline resuscitated rats. Plasma resuscitation corrected lactate acidosis by promoting glutamine/amino acid catabolism and purine salvage reactions. Plasma first resuscitation may benefit critically injured trauma patients by relieving the lactate burden and promoting other non-clinically measured metabolic changes. In the light of our results, we propose that plasma resuscitation may promote fueling of mitochondrial metabolism, through the enhancement of glutaminolysis/amino acid catabolism and purine salvage reactions. The treatment of trauma patients in hemorrhagic shock with plasma first resuscitation is likely not only to improve coagulation, but also to promote substrate-specific metabolic corrections.

Anesth Essays Res. 2015 Sep-Dec;9(3):384-90.

Does the preoperative administration of tranexamic acid reduce perioperative blood loss and transfusion requirements after head neck cancer surgery? A randomized, controlled trial.

Das A, Chattopadhyay S, Mandal D, Chhaule S, Mitra T, Mukherjee A, Mandal SK, Chattopadhyay S.

BACKGROUND: Head and neck cancer (HNC) surgery is associated with high intraoperative blood loss which may require urgent blood transfusion. Many strategies have been recommended to decrease the need for allogenic transfusion. Use of perioperative tranexamic acid (TA) has a promising role.

AIMS: This study was to evaluate the effectiveness of single preoperative bolus dose of TA on blood loss prevention and red blood cell transfusion in patients undergoing HNC surgery.

STUDY DESIGN: A prospective, double-blind, and randomized controlled study.

MATERIALS AND METHODS: From 2007 July to 2010 January; 80 patients, aged (35-55), of American Society of Anesthesiologists II-III scheduled for unilateral HNC surgeries were randomly received either TA (Group T) in a dose of 20 mg/kg diluted to 25 cc with normal saline or an equivalent volume of normal saline (Group C) in a tertiary care hospital. Hemoglobin (Hb) concentration, platelet count, packed cell volume, fibrinogen level, D-dimer level were measured pre- and post-operatively.

RESULTS: Saline (C) Group required more blood, colloid, crystalloid for blood loss. In Group T, 32 patients did not require transfusion of any blood products compared to five patients in Group C ($P < 0.0001$) and only eight units of blood was transfused in Group T, whereas a total of 42 units of blood was transfused in Group C. Even after numerous transfusions, Hb% after 6 h and 24 h in Group C were significantly low in comparison with Group T ($P < 0.05$).

CONCLUSION: Thus, TA significantly reduces blood loss and chances of colloid, blood, and crystalloid transfusion caused by HNC surgery.

Crit Care Nurse. 2016 Feb;36(1):40-51.

Control of Traumatic Extremity Hemorrhage.

Day MW.

ABSTRACT: Although most extremity hemorrhage from trauma can be controlled with direct pressure and/or pressure dressings, the occasional uncontrolled hemorrhage can be life threatening. Tools that may be able to control such life-threatening extremity hemorrhage include hemostatic dressings, tourniquets, and several new devices that have recently become available. Hemostatic dressings, a relatively new concept, incorporate materials that increase coagulation into a dressing that is applied directly to the wound. Although the use of tourniquets has a long history, recent military conflicts have provided numerous studies that supported and refined their use. The novel extremity hemorrhage control devices effectively control bleeding in one of several ways: direct compression, arterial compression above the level of injury, and sealing the wounds' edges, creating a hematoma.

J Trauma Acute Care Surg. 2016 Jan;80(1):135-45.

Adenosine, lidocaine, and Mg2+ (ALM): From cardiac surgery to combat casualty care-Teaching old drugs new tricks.

Dobson GP, Letson HL.

ABSTRACT: New front line drugs and therapies are urgently required to protect the body from primary and secondary injuries. We review more than 10 years of work on adenosine, lidocaine, and magnesium (ALM) and its possible significance to civilian and military medicine. Adenosine is an endogenous nucleoside involved in nucleotide production, adenosine triphosphate turnover, and restoration of supply and demand imbalances. Lidocaine is a local anesthetic and Class 1B antiarrhythmic, and magnesium is essential for ionic regulation and cellular bioenergetics. Individually, each plays important roles in metabolism, immunomodulation, inflammation, and coagulation. The original idea to combine all three was as a "polarizing" cardioplegia, an idea borrowed from natural hibernators. Two recent prospective, randomized human trials have demonstrated its safety and superiority in myocardial protection over high-potassium "depolarizing" solutions. The next idea came from witnessing how the human heart spontaneously reanimated after complex operations with little inotropic support. At high doses, ALM arrests the heart, and at lower doses, it resuscitates the heart. In rat and pig models, we have shown that ALM intravenous bolus and infusion "drip" protects against acute regional myocardial ischemia, lethal arrhythmias, cardiac arrest, compressible and noncompressible blood loss and shock, endotoxemia, and sepsis. Individually, adenosine, lidocaine, or magnesium fails to protect. Protection is afforded in part by reducing inflammation, correcting coagulopathy, and lowering energy demand. We propose a unifying hypothesis involving improved central, cardiovascular and endothelium coupling to maintain sufficient tissue oxygenation and reduce primary and secondary "hit" complications. As with any new drug innovation, translation into humans is challenging.

Mil Med. 2016 Jan;181(1 Suppl):92-8. doi: 10.7205/MILMED-D-15-00237.

Characterization and Comparison of Combat-Related Injuries in Women During OIF and OEF.

Dye JL, Eskridge SL, Tepe V, Clouser MC, Galarneau M.

ABSTRACT: Although historically restricted from combat roles, women suffer from combat-related injuries, especially in recent conflicts where asymmetrical warfare erases distinctions between forward and rear operating areas. U.S. servicewomen who sustained combat-related injury in Operation Iraqi Freedom (OIF) or Operation Enduring Freedom (OEF) between January 2003 and May 2014 were identified from the Expeditionary Medical Encounter Database. Injuries were characterized using Abbreviated Injury Scale and International Classification of Diseases, 9th Revision codes. Of the 844 combat-related injury episodes in women, 51% (n = 433) were OIF injuries and 49% (n = 411) were OEF injuries. Blast events were responsible for 90% of injuries. The average Injury Severity Score was 3, with no statistical difference in means between OIF and OEF. Of significance were increased head injuries in OEF compared with OIF (80% vs. 48%; $p < 0.001$). Although the majority of combat-related injuries suffered by women were mild, some women suffered life-threatening injuries, and nearly 65% of the injury episodes resulted in more than one injury. More research is needed as the roles of women in the military continue to expand. Future studies will investigate quality of life outcomes and gender differences in combat-related injuries.

J Craniofac Surg. 2016 Jan;27(1):97-100.

The Efficacy of Preoperative Oral Tranexamic Acid on Intraoperative Bleeding During Rhinoplasty.

Eftekharian HR, Rajabzadeh Z.

BACKGROUND: Perioperative bleeding is a common side effect of rhinoplasty which may impose the blood transfusion to the patients. As a result of risks and cost of blood transfusion, this study is planned to reduce blood loss in these surgeries. Since tranexamic acid (TXA) has been reported to reduce bleeding and subsequent possible need for blood transfusion, the purpose of this study was to evaluate the efficacy of oral TXA on blood loss during rhinoplasty.

METHODS AND MATERIALS: In this double-blind, randomized, placebo-controlled clinical trial, 50 participants underwent rhinoplastic surgery. These participants were divided into 2 groups; 25 were randomly assigned to each 1. The patients in the first group received 1 g (2×500 mg) tranexamic acid tablets, and the patients in the second group received placebo 2 hours before starting the surgery. All patients were operated by the same surgical team and the same anesthetic techniques were used during the surgery. Gender, age, BMI, duration of operation, the amount of blood loss, and surgeon's satisfaction rate were the variables studied.

RESULTS: The first group (TXA group) consisted of 11 males (44%) and 14 females (56%) and the second group consisted of 13 males (52%) and 12 females (48%). There was no statistical difference in the distribution of the variables between the 2 groups, except for the blood loss, duration of operation, and surgeon's satisfaction. The mean total blood loss was 144.6±60.28 mL in "group 1" and 199.6±73.05 mL in "group 2" ($P<0.05$). Duration of operation in the first group was less than the second group (2.60±0.53 hours vs. 2.99±0.59 hours) ($P=0.017$). The surgeon was more satisfied with the quality of surgical field and visualization in "group 1" (3.76±0.72) than "group 2" (2.16±0.50) ($P=0.001$).

CONCLUSION: The preoperative administration of 1 g oral tranexamic acid significantly decreased the blood loss in patients undergoing rhinoplastic surgery without any significant adverse effects.

Br J Anaesth. 2015 Dec;115(6):827-48.

Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults.

Frerk C, Mitchell VS, McNarry AF, Mendonca C, Bhagrath R, Patel A, O'Sullivan EP, Woodall NM, Ahmad I; Difficult Airway Society intubation guidelines working group.

ABSTRACT: These guidelines provide a strategy to manage unanticipated difficulty with tracheal intubation. They are founded on published evidence. Where evidence is lacking, they have been directed by feedback from members of the Difficult Airway Society and based on expert opinion. These guidelines have been informed by advances in the understanding of crisis management; they emphasize the recognition and declaration of difficulty during airway management. A simplified, single algorithm now covers unanticipated difficulties in both routine intubation and rapid sequence induction. Planning for failed intubation should form part of the pre-induction briefing, particularly for urgent surgery. Emphasis is placed on assessment, preparation, positioning, preoxygenation, maintenance of oxygenation, and minimizing trauma from airway interventions. It is recommended that the number of airway interventions are limited, and blind techniques using a bougie or through supraglottic airway devices have been superseded by video- or fibre-optically guided intubation. If tracheal intubation fails, supraglottic airway devices are recommended to provide a route for oxygenation while reviewing how to proceed. Second-generation devices have advantages and are recommended. When both tracheal intubation and supraglottic airway device insertion have failed, waking the patient is the default option. If at this stage, face-mask oxygenation is impossible in the presence of muscle relaxation, cricothyroidotomy should follow immediately. Scalpel cricothyroidotomy is recommended as the preferred rescue technique and should be practised by all anaesthetists. The plans outlined are designed to be simple and easy to follow. They should be regularly rehearsed and made familiar to the whole theatre team.

AANA J. 2015 Oct;83(5):337-43.

Far Forward Anesthesia and Massive Blood Transfusion: Two Cases Revealing the Challenge of Damage Control Resuscitation in an Austere Environment.

Gaskin D, Kroll NA, Ochs AA, Schreiber MA, Pandalai PK.

ABSTRACT: Since the beginning of Operation Enduring Freedom and Operation Iraqi Freedom, the US military has treated more than 51,000 casualties and sustained more than 6,600 deaths. The past decade of conflict has solidified major advances in the use of blood component therapy and the liberal use of fresh whole blood during damage control resuscitation. This resuscitation strategy, combined with far forward damage control surgery, rapid aeromedical evacuation, and major improvements in critical care air transportation and personal protective equipment has led to a 90% to 92% survival rate in US casualties. We describe 2 cases treated by a Forward Surgical Team serving in Afghanistan during Operation Enduring Freedom in 2014. Both patients suffered severe trauma and required massive blood transfusion and damage control surgery. In describing these 2 cases, we wish to share our experience with damage control, resuscitation in an austere environment, as well as advocate for the critical role of the Certified Registered Nurse Anesthetist in advancing the knowledge and execution of this lifesaving strategy in both military and civilian trauma centers. In addition, we suggest alternatives to the current transfusion strategy, which will mitigate limitations currently encountered.

Prehosp Disaster Med. 2015 Oct;30(5):509-11.

Helicopter In-flight Resuscitation with Freeze-dried Plasma of a Patient with a High-velocity Gunshot Wound to the Neck in Afghanistan - A Case Report.

Gellerfors M, Linde J, Gryth D.

ABSTRACT: Massive hemorrhage with coagulopathy is one of the leading causes of preventable death in the battlefield. The development of freeze-dried plasma (FDP) allows for early treatment with coagulation-optimizing resuscitation fluid in the prehospital setting. This report describes the first prehospital use of FDP in a patient with carotid artery injury due to a high-velocity gunshot wound (HVGSW) to the neck. It also describes in-flight constitution and administration of FDP in a Medevac Helicopter. Early administration of FDP may contribute to hemodynamic stabilization and reduction in trauma-induced coagulopathy and acidosis. However, large-scale studies are needed to define the prehospital use of FDP and other blood products.

Prehosp Emerg Care. 2016 Jan-Feb;20(1):37-44.

Analysis of Prehospital Documentation of Injury-Related Pain Assessment and Analgesic Administration on the Contemporary Battlefield.

Gerhardt RT, Reeves PT, Kotwal RS, Mabry RL, Robinson JB, Butler F.

ABSTRACT: In addition to life-saving interventions, the assessment of pain and subsequent administration of analgesia are primary benchmarks for quality emergency medical services care which should be documented and analyzed. Analyze US combat casualty data from the Department of Defense Trauma Registry (DoDTR) with a primary focus on prehospital pain assessment, analgesic administration and documentation. Retrospective cohort study of battlefield prehospital and hospital casualty data were abstracted by DoDTR from available records from 1 September 2007 through 30 June 2011. Data included demographics; injury mechanism; prehospital and initial combat hospital pain assessment documented by standard 0-to-10 numeric rating scale; analgesics administered; and survival outcome. Records were available for 8,913 casualties (median ISS of 5 [IQR 2 to 10]; 98.7% survived). Prehospital analgesic administration was documented for 1,313 cases (15%). Prehospital pain assessment was recorded for 581 cases (7%; median pain score 6 [IQR 3 to 8]), hospital pain assessment was recorded for 5,007 cases (56%; median pain score5 [CI95% 3 to 8]), and 409 cases (5%) had both prehospital and hospital pain assessments that could be paired. In this paired group, 49.1% (201/409) had alleviation of pain evidenced by a decrease in pain score (median 4,, IQR 2 to 5); 23.5% (96/409) had worsening of pain evidenced by an increase in pain score (median 3, CI95 2.8 to 3.7, IQR 1 to 5); 27.4% (112/409) had no change; and the overall difference was an average decrease in pain score of 1.1 (median 0, IQR 0 to 3, $p < 0.01$). Time-series analysis showed modest increases in prehospital and hospital pain assessment documentation and prehospital analgesic documentation. Our study demonstrates that prehospital pain assessment, management, and documentation remain primary targets for performance improvement on the battlefield. Results of paired prehospital to hospital pain scores and time-series analysis demonstrate both feasibility and benefit of prehospital analgesics. Future efforts must also include an expansion of the prehospital battlefield analgesic formulary.

Transfusion. 2016 Feb 8.

Storage of platelets at 4°C in platelet additive solutions prevents aggregate formation and preserves platelet functional responses.

Getz TM, Montgomery RK, Bynum JA, Aden JK, Pidcoke HF, Cap A.

BACKGROUND: Platelet (PLT) storage has been limited to 5 days at room temperature due to metabolic decline and risk for bacterial contamination. Refrigeration preserves PLT metabolism and function as well as limits bacterial growth; however, cold storage of PLTs also leads to aggregate formation. We hypothesized that storage of PLT concentrates at 4°C leads to glycoprotein (GP)IIb-IIIa activation and thus aggregate formation through fibrinogen binding and that this could be prevented by storing PLTs in PLT additive solution (PAS) without compromising PLT function.

STUDY DESIGN AND METHODS: Apheresis PLTs in plasma (AP) or apheresis PLTs in PAS were stored at 22 or 4°C for up to 15 days. Measurements include PLT counts, blood gases, aggregation response, flow cytometry analysis of integrin levels, activation markers, and microparticle formation.

RESULTS: Storage of AP 4°C led to a gradual decline in PLT count and an increase in aggregate formation that was mediated by intracellular calcium leak and fibrinogen receptor activation. Storage of PAS at 4°C prevented aggregate formation due to dilution of plasma fibrinogen. PAS stored at 4°C maintained aggregation responses to multiple agonists better than 22°C controls.

CONCLUSION: Storage of AP at 4°C leads to low level GPIIb-IIIa activation and results in aggregate formation over time. Separating the PLTs from the plasma component and storing them in PAS at 4°C resolves aggregate formation and preserves the metabolic and functional responses of these stored PLTs.

Eur J Trauma Emerg Surg. 2016 Feb 4. [Epub ahead of print]

Damage control resuscitation: lessons learned.

Giannoudi M, Harwood P.

BACKGROUND: Damage control resuscitation describes an approach to the early care of very seriously injured patients. The aim is to keep the patient alive whilst avoiding interventions and situations that risk worsening their situation by driving the lethal triad of hypothermia, coagulopathy and acidosis or excessively stimulating the immune-inflammatory system. It is critical that the concepts and practicalities of this approach are understood by all those involved in the early management of trauma patients. This review aims to summarise this and discusses current knowledge on the subject.

INTERVENTIONS: Damage control resuscitation forms part of an overall approach to patient care rather than a specific intervention and has evolved from damage control surgery. It is characterised by early blood product administration, haemorrhage arrest and restoration of blood volume aiming to rapidly restore physiologic stability. The infusion of large volumes of crystalloid is no longer appropriate, instead the aim is to replace lost blood and avoid dilution and coagulopathy. In specific situations, permissive hypotension may also be of benefit, particularly in patients with severe haemorrhage from an arterial source. As rapid arrest of haemorrhage is so important, team-based protocols that deliver patients rapidly but safely, via CT scan where appropriate, to operating theatres or interventional radiology suites form a critical part of this process.

CONCLUSIONS: Given that interventions are so time dependent in the severely injured, it is likely that by further improving trauma systems and protocols, improvements in outcome can still be made. Further research work in this area will allow us to target these approaches more accurately to those patients who can benefit most.

J Perianesth Nurs. 2015 Dec;30(6):560-3.

Antifibrinolytic Use in the Perioperative Setting: Aminocaproic Acid and Tranexamic Acid.

Golembiewski J.

Conclusion:

Antifibrinolytics effectively reduce blood loss and blood transfusion in cardiac surgery, total joint arthroplasty, major spine surgery, pediatric scoliosis surgery, and pediatric craniofacial surgery. TXA is better studied than EACA in total joint arthroplasty and pediatric noncardiac surgery. TXA does not appear to increase the risk of thromboembolic events or renal failure.

J Emerg Trauma Shock. 2015 Oct-Dec;8(4):188-92. doi: 10.4103/0974-2700.166589.

Comparison of three supraglottic airway devices for airway rescue in the prone position: A manikin-based study.

Gupta B, Gupta S, Hijam B, Shende P, Rewari V.

BACKGROUND: Accidental extubation during surgery in prone position can be life-threatening. Supraglottic airway devices (SAD) have been used successfully in such situations to rescue the airway. However, which SAD would be most appropriate in this setting has not been described in the literature.

AIMS: The aim of our study was to determine the most appropriate SAD for securing airway in a prone position during accidental extubation.

MATERIALS AND METHODS: In the study, Airway Trainer (Laerdal) manikin was used for studying insertion of three SADs; I-gel, Laryngeal Mask Airway ProSeal™(PLMA) and LMA Classic™ (CLMA) in the prone position. Forty anesthesia resident doctors participated in this study. The time taken for insertion; ease of insertion and ventilation; bronchoscopic view; and insertion score were compared among the three groups.

RESULTS: The time taken for I-gel insertion was significantly lesser (12.89 ± 3.94 seconds) as compared to CLMA (17.07 ± 3.5 seconds) and PLMA (25 + 4.78 seconds). Least resistance was encountered in the insertion of I-gel, while maximum resistance was experienced in PLMA group (22.5% vs. 90%). The maneuver required for optimal positioning was observed in 27.5% of PLMA insertion, 2.5% in CLMA while no maneuver was required in any of the I-gel insertion. Ease of ventilation was comparable in all three SADs. The bronchoscopic view and insertion score were significantly higher with I-gel as compared to CLMA and PLMA.

CONCLUSION: All three SADs were successful as rescue devices during accidental extubation in the prone position. However, the ease of insertion was maximum with I-gel, followed by CLMA and PLMA.

J Trauma Acute Care Surg. 2015 Dec;79(6):911-9. doi: 10.1097/TA.0000000000000789

Addition of low-dose valproic acid to saline resuscitation provides neuroprotection and improves long-term outcomes in a large animal model of combined traumatic brain injury and hemorrhagic shock

Halaweish I, Bambakidis T, Chang Z, Wei H, Liu B, Li Y, Bonthrone T, Srinivasan A, Bonham T, Chtraklin K, Alam HB

BACKGROUND: Combined traumatic brain injury (TBI) and hemorrhagic shock (HS) is highly lethal. In a nonsurvival model of TBI + HS, addition of high-dose valproic acid (VPA) (300 mg/kg) to hetastarch reduced brain lesion size and associated swelling 6 hours after injury; whether this would have translated into better neurologic outcomes remains unknown. It is also unclear whether lower doses of VPA would be neuroprotective. We hypothesized that addition of low-dose VPA to normal saline (NS) resuscitation would result in improved long-term neurologic recovery and decreased brain lesion size.

METHODS: TBI was created in anesthetized swine (40-43 kg) by controlled cortical impact, and volume-controlled hemorrhage (40% volume) was induced concurrently. After 2 hours of shock, animals were randomized (n = 5 per group) to NS (3× shed blood) or NS + VPA (150 mg/kg). Six hours after resuscitation, packed red blood cells were transfused, and animals were recovered. Peripheral blood mononuclear cells were analyzed for acetylated histone-H3 at lysine-9. A Neurological Severity Score (NSS) was assessed daily for 30 days. Brain magnetic resonance imaging was performed on Days 3 and 10. Cognitive performance was assessed by training animals to retrieve food from color-coded boxes.

RESULTS: There was a significant increase in histone acetylation in the NS + VPA-treated animals compared with NS treatment. The NS + VPA group demonstrated significantly decreased neurologic impairment and faster speed of recovery as well as smaller brain lesion size compared with the NS group. Although the final cognitive function scores were similar between the groups, the VPA-treated animals reached the goal significantly faster than the NS controls.

CONCLUSION: In this long-term survival model of TBI + HS, addition of low-dose VPA to saline resuscitation resulted in attenuated neurologic impairment, faster neurologic recovery, smaller brain lesion size, and a quicker normalization of cognitive functions.

PLOS ONE | DOI:10.1371/journal.pone.0143726 December 2, 2015 1 / 15 a11111

Comparison of the Fluid Resuscitation Rate with and without External Pressure Using Two Intraosseous Infusion Systems for Adult Emergencies, the CITRIN (Comparison of InTRaosseous infusion systems in emergency medicINe)-Study

Hammer N, Möbius R Gries A, Hossfeld B, Bechmann I, Bernhard M

Introduction: Intraosseous infusion is recommended if peripheral venous access fails for cardiopulmonary resuscitation or other medical emergencies. The aim of this study, using body donors, was to compare a semi-automatic (EZ-IO1) device at two insertion sites and a sternal intraosseous infusion device (FASTR™).

Methods: Twenty-seven medical students being inexperienced first-time users were randomized into three groups using EZ-IO and FASTR. The following data were evaluated: attempts
required for successful placement, insertion time and flow rates with and without external pressure to the infusion.

Results: The first-pass insertion success of the EZ-IO tibia, EZ-IO humerus and FASTR was 91%, 77%, and 95%, respectively. Insertion times (MW±SD) did not show significant differences with 17±7 (EZ-IO tibia) vs. 29±42 (EZ-IO humerus) vs. 33±21 (FASTR), respectively. Oneminute flow rates using external pressures between 0 mmHg and 300 mmHg ranged between 27±5 to 69±54 ml/min (EZ-IO tibia), 16±3 to 60±44 ml/min (EZ-IO humerus) and 53 ±2 to 112±47 ml/min (FASTR), respectively. Concerning pressure-related increases in flow rates, negligible correlations were found for the EZ-IO tibia in all time frames (c = 0.107– 0.366; p_0.013), moderate positive correlations were found for the EZ-IO humerus after 5 minutes (c = 0.489; p = 0.021) and strong positive correlations were found for the FASTR in all time frames (c = 0.63–0.80; p_0.007). Post-hoc statistical power was 0.62 with the given sample size.

Conclusions: The experiments with first-time users applying EZ-IO and FASTR in body donors indicate that both devices may be effective intraosseous infusion devices, likely suitable for fluid resuscitation using a pressure bag. Variations in flow rate may limit their reliability. Larger sample sizes will prospectively be required to substantiate our findings.

Trauma Mon. 2015 Feb;20(1):e23862.

Celox-coated gauze for the treatment of civilian penetrating trauma: a randomized clinical trial.

Hatamabadi HR, Asayesh Zarchi F, Kariman H, Arhami Dolatabadi A, Tabatabaey A, Amini A.

BACKGROUND: Uncontrolled hemorrhage is a well-recognized cause of mortality in trauma victims and the control of active hemorrhage is among the initial steps in resuscitation.

OBJECTIVES: The purpose of this study was to assess the role of a hemostatic agent "celox" in the management of civilian stab-wound trauma.

PATIENTS AND METHODS: In this clinical trial study, 160 patients with penetrating limb trauma were randomly allocated to either the control or intervention group (n = 80, each group). Controls were treated with the simple pressure dressing, while the celox-coated gauze was used in the intervention group. The time for achievement of hemostasis and the amount of bleeding were recorded. Data were analyzed using SPSS Version 21 and Stata 13. A P value of less than 0.05 was considered statistically significant.

RESULTS: The mean age of participants was 30.5 and the majority of patients were male (90.6%). The forearm and distal leg were the most sites of injury. Hemostasis was achieved within 5 minutes in 32.5% of the control group and 51.3% of the intervention group. Using the celox-coated gauze significantly reduced the time to hemostasis (P = 0.01). Moreover, the blood loss was significantly lower in the celox group compared to the controls (P < 0.05).

CONCLUSIONS: Using the celox-coated gauze is able to achieve hemostasis in penetrating limb trauma faster than the conventional pressure bandage. Further research is required to clarify the subset of patients who will benefit the most from this effect in the emergency department.

N Engl J Med. 2015 Dec 31;373(27):2589-93.

Report from Paris.

Haug CJ.

Quotes:

“Nearby, we saw candles and flowers outside Le Carillon and Le Petit Cambodge, the restaurants where more than a dozen young people had been killed and many more severely injured the previous week. The restaurants are so close to the hospital that wounded people escaping from the massacre walked to the emergency department or were brought there by bystanders.”

“Everyone had gunshot wounds. Fluids went in both arms at full tilt; morphine was added when needed. The problem was that even people who had pain didn’t say they were in pain: they were in shock — that was why there was no noise. “I realized that almost all the patients were, in the medical sense, in shock,” Fontaine explained. “They would be tachycardic, hypotensive, and shaking, and they would tell you, ‘I’m cold.’ I would think, ‘Shit. You have to give more fluids and get them to surgery more quickly. This is hypovolemic shock.”

“Legrand and the surgeons moved quickly between patients to make assessments. All had massive trauma caused by large caliber guns — thoracic, abdominal, or peripheral trauma. There was a lot of bone and soft-tissue damage, but that could wait a little. The first patient on the operating table had two bullets in his abdomen, but he was on the table for only 30 minutes. After resection of 60 cm of intestine, he was metastable, though three other bullets still needed to be removed.”

J Trauma Acute Care Surg. 2016 Jan;80(1):119-24.

Needle decompression of tension pneumothorax: Population-based epidemiologic approach to adequate needle length in healthy volunteers in Northeast Germany.

Hecker M, Hegenscheid K, Völzke H, Hinz P, Lange J, Ekkernkamp A, Frank M.

BACKGROUND: Tension pneumothorax is one of the leading causes of preventable death in both military and civilian trauma patients. Needle decompression is recommended in trauma guidelines as an emergency procedure to relieve increased intrapleural pressure. The main reason for decompression failure is reported to be insufficient needle length in proportion to the chest wall thickness (CWT). So far, population-based epidemiologic data on CWT are missing. Therefore, it was the aim of this work to investigate the CWT in the second intercostal space, midclavicular line, based on magnetic resonance imaging data of a large population-based sample. The second aim of this study was to explore the potential risk of iatrogenic lesions caused by the proximity of the intended puncture track to the internal mammary artery.

METHODS: A total of 2,574 healthy volunteers (mean [SD] age, 53.3 [13.9] years; range, 21-89 years) from the population-based cohort Study of Health in Pomerania (SHIP) were enrolled. CWT and the distance from the intended puncture track to the internal mammary artery were investigated with the chest sequences of a standardized 1.5-T whole-body magnetic resonance imaging.

RESULTS: For all 5,148 measured sites in 2,574 volunteers, the mean (SD) CWT was 5.1 (1.4) cm. The mean body mass index was determined to be 27.7 kg/m. The CWT correlated significantly with body weight and body mass index. The internal mammary artery was located medial to the intended puncture site in all participants; the mean (SD) distance was 5.7 (0.7) cm on the right and 5.5 (0.7) cm on the left side.

CONCLUSION: Based on the population-based epidemiologic data presented in this study, the use of a needle of 7 cm in length is recommended to decompress a tension pneumothorax in the second intercostal space in the midclavicular line, which might successfully decompress more than 90% of the participants in this study. When using this anterior approach at the anatomically correct puncture site, safety margin to the internal mammary artery is sufficient so that the risk of iatrogenic lesion of the internal mammary artery should be minimal.

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

J Spec Oper Med. 2015 Winter;15(4):153-6.

Hemorrhage Control Devices: Tourniquets and Hemostatic Dressings.

Holcomb JB, Butler FK, Rhee P.

Quotes:

"Hemorrhage control is the highest priority in caring for an injured individual. To be maximally effective, hemorrhage control must occur as soon as possible after the wounding event. Unfortunately, uncontrolled hemorrhage remains the single most preventable cause of death after both military and civilian injuries. One of the most important lessons learned in the last 14 years of war is that using tourniquets and hemostatic dressings as soon as possible after injury is absolutely lifesaving."

"The following descriptions are provided as examples of trauma victims for whom tourniquet use is appropriate:

- There is pulsatile or steady bleeding from the wound.
- Blood is pooling on the ground.
- The overlying clothes are soaked with blood.
- Bandages or makeshift bandages used to cover the wound are ineffective and steadily becoming soaked with blood.
- There is a traumatic amputation of the arm or leg.
- There was prior bleeding, and the patient is now in shock (unconscious, confused, pale)."

"The military experience with tourniquets has provided some key teaching points about their use:

- Waiting too long to place a tourniquet is a mistake.
- Tourniquets should be applied just proximal to the site of the severe bleeding and never placed directly over a joint.
- Tourniquets should be tightened as necessary to stop bleeding from the distal injury.
- If bleeding is not controlled with one tourniquet, a second tourniquet should be applied just proximal to the first.
- The need for a second tourniquet is especially applicable when applying tourniquets to generously sized lower extremities.
- The purpose of tourniquets is to stop arterial bleeding. If a distal pulse is still present, the tourniquet should be tightened or a second tourniquet applied just proximal to the first, and the pulse should be checked again.
- If a tourniquet is used, it should be an effective arterial tourniquet and not an ineffective venous tourniquet, as use of the latter can increase bleeding.
- Casualties with tourniquets in place should be rechecked periodically to ensure that the tourniquet is still working and that hemorrhage is controlled.
- Pulses distal to every tourniquet should be checked.
- Correctly applied tourniquets can cause significant pain, but this pain does not signify that the tourniquet has been applied incorrectly or that it should be removed.
- Pain should be managed with analgesics as appropriate, but not for patients in shock. "

J Trauma Acute Care Surg. 2015 Dec;79(6):1044-8.

Cadaveric comparison of the optimal site for needle decompression of tension pneumothorax by prehospital care providers.

Inaba K, Karamanos E, Skiada D, Grabo D, Hammer P, Martin M, Sullivan M, Eckstein M, Demetriades D.

BACKGROUND: Computed tomographic and cadaveric studies have demonstrated needle decompression of tension pneumothorax at the fifth intercostal space (ICS), anterior axillary line (AAL) has advantages over the second ICS midclavicular line (MCL). The purpose of this study was to compare the ability of prehospital care providers to accurately decompress the chest at these two locations.

METHODS: Randomly selected US Navy hospital corpsmen (n = 25) underwent a standardized training session followed by timed needle decompression on unmarked fresh cadavers. A 14-gauge angiocatheter was inserted in the right and left second ICS MCL and fifth ICS AAL in a predetermined computer-generated order. Time from needle uncapping to insertion, accuracy, and ease of placement were examined.

RESULTS: A total of 25 corpsmen inserted 100 needles into 25 cadavers. Mean (SD) age was 25.9 (3.7) years, 72.0% were male, with 4.2 (3.2) years of experience, and 52.0% had previously deployed. A total of 60.0% had attempted decompression previously, 93.3% in a model and 6.7% in a patient. Time to decompression did not differ between the second and fifth ICS (16.8 [10.1] seconds vs. 16.9 [12.3] seconds, $p = 0.438$). Accuracy however was superior at the fifth ICS, with a misplacement rate of only 22.0% versus 82.0% at the second ICS ($p < 0.001$). The aggregate distance from the target position was also significantly greater for the second ICS (3.1 [1.7] cm vs. 1.2 [1.5] cm, $p < 0.001$). Insertion at the fifth ICS was rated as being easier than the second by 76.0% of providers, the same by 12.0%, and more difficult by 12.0%.

CONCLUSION: For prehospital care providers, the fifth ICS AAL can be localized and decompressed with a higher degree of accuracy than the traditional second ICS MCL. It is rated as easier to perform and can be done just as quickly. Based on these data, the fifth ICS AAL should be considered as an equivalent first-line position for needle decompression in patients with clinical evidence of a tension pneumothorax.

JAMA Surg. 2014 Aug;149(8):807-13.

A review of the first 10 years of critical care aeromedical transport during operation iraqi freedom and operation enduring freedom: the importance of evacuation timing.

Ingalls N, Zonies D, Bailey JA, Martin KD, Iddins BO, Carlton PK, Hanseman D, Branson R, Dorlac W, Johannigman J.

IMPORTANCE: Advances in the care of the injured patient are perhaps the only benefit of military conflict. One of the unique aspects of the military medical care system that emerged during Operation Iraqi Freedom and Operation Enduring Freedom has been the opportunity to apply existing civilian trauma system standards to the provision of combat casualty care across an evolving theater of operations.

OBJECTIVES: To identify differences in mortality for soldiers undergoing early and rapid evacuation from the combat theater and to evaluate the capabilities of the Critical Care Air Transport Team (CCATT) and Joint Theater Trauma Registry databases to provide adequate data to support future initiatives for improvement of performance.

DESIGN, SETTING, AND PARTICIPANTS: Retrospective review of CCATT records and the Joint Theater Trauma Registry from September 11, 2001, to December 31, 2010, for the in-theater military medicine health system, including centers in Iraq, Afghanistan, and Germany. Of 2899 CCATT transport records, those for 975 individuals had all the required data elements.

EXPOSURE: Rapid evacuation by the CCATT.

MAIN OUTCOMES AND MEASURES: Survival as a function of time from injury to arrival at the role IV facility at Landstuhl Regional Medical Center.

RESULTS: The patient cohort demonstrated a mean Injury Severity Score of 23.7 and an overall 30-day mortality of 2.1%. Mortality en route was less than 0.02%. Statistically significant differences between survivors and decedents with respect to the Injury Severity Score (mean [SD], 23.4 [12.4] vs 37.7 [16.5]; $P < .001$), cumulative volume of blood transfused among the patients in each group who received a transfusion ($P < .001$), worst base deficit (mean [SD], -3.4 [5.0] vs -7.8 [6.9]; $P = .02$), and worst international normalized ratio (median [interquartile range], 1.2 [1.0-1.4] vs 1.4 [1.1-2.2]; $P = .03$) were observed. We found no statistically significant difference between survivors and decedents with respect to time from injury to arrival at definitive care.

CONCLUSIONS AND RELEVANCE: Rapid movement of critically injured casualties within hours of wounding appears to be effective, with a minimal mortality incurred during movement and overall 30-day mortality. We found no association between the duration of time from wounding to arrival at Landstuhl Regional Medical Center with respect to mortality.

Orthop Clin North Am. 2016 Jan;47(1):137-43.

Application of Tranexamic Acid in Trauma and Orthopedic Surgery.

Jennings JD, Solarz MK, Haydel C.

KEY POINTS:

- Tranexamic acid has been approved by the Food and Drug Administration for the past 30 years as an antifibrinolytic and has recently been added to the World Health Organization's list of essential medications.
- Tranexamic acid is not only effective, but safe in trauma and orthopedics with no increased morbidity including deep venous thrombosis or pulmonary embolism. Furthermore, it is inexpensive and the cost-savings with its use have been confirmed.
- Tranexamic acid has become readily integrated into joint replacement and spine surgeries, although the optimal timing and dosing have not been established. Significant reduction in blood loss and transfusion requirements in this setting was again demonstrated.
- The role of tranexamic acid in orthopedic trauma is emerging, and to date there have only been a small number of heterogeneous studies, which mostly pertained to hip fractures. Results in this cohort are promising, however.
- Significant future investigation, particularly with regards to orthopedic trauma, is needed to maximize the benefit from this drug. Furthermore, optimal timing and dosing should be confirmed.

Clin Otolaryngol. 2015 Dec 18.

Evaluating three hundred and fifty two admissions and predictors of re-admissions for epistaxis - is it time to re-evaluate tranexamic acid in epistaxis?

Jervis S, Saunders T, Belcher J, Skinner D.

Key points:

1. This is a unique paper to concentrate purely on re-admissions for epistaxis in terms of extent and clinical predictors.
2. Re-admissions for epistaxis appear to be falling year on year, with an average of 9.4%.
3. Significant predictors of re-admission were the presence of diabetes and hypertension, after other co-factors were adjusted for.
4. 54.5% of our epistaxis population were considered eligible to use oral tranexamic acid.
5. Emerging evidence from other surgical/trauma specialties shows promising results for the use of tranexamic acid in reducing bleeding. Further evidence for both topical and oral use is eagerly sought in uncomplicated epistaxis.

J Trauma Acute Care Surg. 2015 Oct;79(4 Suppl 2):S75-7.

A strategically aligned Food and Drug Administration: New ways to leverage research and deliver safe, effective, and secure devices for trauma care.

Kumar A, Schwartz S.

Quotes:

“Innovative medical technologies hold great promise for advancing trauma care. In the Emergency Preparedness and Medical Countermeasures Program (EMCM) of the Center for Devices and Radiological Health (CDRH) at the US Food and Drug Administration (FDA), our goals and our mission directly align with the work being conducted by the joint forces, academia, and industry, that is, to ensure that the military and civilians have ready access to safe, effective, and secure medical devices at all timesVespecially before and during response to any natural, accidental, or intentional public health emergency or military conflict.

The 2013 Military Health System Research Symposium was a major catalyst for us. Summarizing the symposium, COL Todd Rasmussen highlighted the prominent decrease in case fatality rate for US service personnel in Afghanistan during the 8 years of active conflict and asked the critical follow-on question, ‘‘Where do we go from here?’’1 His question was indeed a ‘‘call to action’’ for continued investment, focused research, and scientific exchange essential to the advancement of military traumacare in preparation for the nextmilitary conflict.We asked ourselves in parallel, a complementary question, how, at this moment, can EMCM act as a conduit for themilitary to sustain its commitment to advancing combat casualty care, both through facilitating translational trauma research across military and civilian trauma communities and in identifying groundbreaking medical device technologies?”

“Time and cost of bringing a medical device to the market in the United States have been the subject of serious discussion at our Center.We recognize that these two primary concerns weigh heavily on device developers and on those who provide the requisite capital and resources; indeed, these are factors in deciding as to whether to pursue premarket activities in the United States today. Ongoing innovation and testing of newtechnologies in the United States are placed in jeopardy if clinical studies impose prohibitive barriers yet are needed to demonstrate that the product meets FDA standards for safety and effectiveness. It is therefore imperative that we at CDRH redefine the landscape for accrual of clinical data while staying within the regulatory framework so as to encourage medical device innovation, particularly when alternative treatments are unavailable, ineffective, or associated with substantial risks to patient safety. FDA is committed to working with the military to improve access to novel and advanced medical device technology by strengthening and streamlining the clinical trial enterprise so that medical device clinical trials are conducted in an efficient and cost-effective manner, while maintaining appropriate patient protections.”

Injury. 2015 Dec 13. pii: S0020-1383(15)00768-8.

Chest wall thickness and decompression failure: A systematic review and meta-analysis comparing anatomic locations in needle thoracostomy.

Laan DV, Vu TD, Thiels CA, Pandian TK, Schiller HJ, Murad MH, Aho JM.

INTRODUCTION: Current Advanced Trauma Life Support guidelines recommend decompression for thoracic tension physiology using a 5-cm angiocatheter at the second intercostal space (ICS) on the midclavicular line (MCL). High failure rates occur. Through systematic review and meta-analysis, we aimed to determine the chest wall thickness (CWT) of the 2nd ICS-MCL, the 4th/5th ICS at the anterior axillary line (AAL), the 4th/5th ICS mid axillary line (MAL) and needle thoracostomy failure rates using the currently recommended 5-cm angiocatheter.

METHODS: A comprehensive search of several databases from their inception to July 24, 2014 was conducted. The search was limited to the English language, and all study populations were included. Studies were appraised by two independent reviewers according to a priori defined PRISMA inclusion and exclusion criteria. Continuous outcomes (CWT) were evaluated using weighted mean difference and binary outcomes (failure with 5-cm needle) were assessed using incidence rate.Outcomes were pooled using the random-effects model.

RESULTS: The search resulted in 34,652 studies of which 15 were included for CWT analysis, 13 for NT effectiveness. Mean CWT was 42.79mm (95% CI, 38.78-46.81) at 2nd ICS-MCL, 39.85mm (95% CI, 28.70-51.00) at MAL, and 34.33mm (95% CI, 28.20-40.47) at AAL (P=.08). Mean failure rate was 38% (95% CI, 24-54) at 2nd ICS-MCL, 31% (95% CI, 10-64) at MAL, and 13% (95% CI, 8-22) at AAL (P=.01).

CONCLUSION: Evidence from observational studies suggests that the 4th/5th ICS-AAL has the lowest predicted failure rate of needle decompression in multiple populations.

LEVEL OF EVIDENCE: Level 3 SR/MA with up to two negative criteria.

STUDY TYPE: Therapeutic.

Ann Neurol. 2016 Jan;79(1):18-26. doi: 10.1002/ana.24558. Epub 2015 Dec 15

Tranexamic acid–associated seizures: causes and treatment

Lecker I, Wang D, Whissell PD, Avramescu S, Mazer D, Orser BA

Abstract: Antifibrinolytic drugs are routinely used worldwide to reduce the bleeding that results from a wide range of hemorrhagic conditions. The most commonly used antifibrinolytic drug, tranexamic acid, is associated with an increased incidence of postoperative seizures. The reported increase in the frequency of seizures is alarming, as these events are associated with adverse neurological outcomes, longer hospital stays and increased in-hospital mortality. However, many clinicians are unaware that tranexamic acid causes seizures. The goal of this review is to summarize the incidence, risk factors and clinical features of these seizures. This review also highlights several clinical and preclinical studies that offer mechanistic insights into the potential causes of and treatments for tranexamic acid–associated seizures. This review will aid the medical community by increasing awareness about tranexamic acid-associated seizures and by translating scientific findings into therapeutic interventions for patients.

Quote: "In summary, TXA-associated seizures occur most frequently during the early postoperative period after cardiac surgery but also occur in patients undergoing non-cardiac surgery and other medical treatments. To reduce the risk of seizures, the lowest effective TXA dose should be considered and dosing should be adjusted for clinical conditions such as renal dysfunction. A high index of suspicion is required to detect seizures and EEG monitoring may be considered for patients who experience myoclonic movements, twitching or show evidence of focal seizures. Based on results from preclinical studies, general anesthetics including propofol and isoflurane may be considered as the first-line for prevention and/or treatment. In high-risk patients, terminating the TXA infusion early and/or prolonging the administration of anesthetics may prevent seizures……..it is uncertain why cardiac surgery patients are more vulnerable to TXA-associated seizures. One potential factor is the high doses of TXA administered during cardiac surgery.73 Also, cardiac surgery can cause intensive systemic inflammation that increases the permeability of the blood brain barrier.74 A jeopardized blood brain barrier could facilitate the entry of TXA into the CNS."

J Trauma Acute Care Surg. 2016 Feb 2. [Epub ahead of print]

Norman E. McSwain, Jr., MD, FACS: (1937-2015).

Mattox KL.

Quotes:

"What have you done for the good of mankind today?" was Norm's greeting to all he met in the course of his day, throughout his life. Thus, his philosophy of life became an infectious stimulus for the many, many people who had the pleasure and privilege of meeting and knowing him.

It is appropriate that the *Journal of Trauma* is publishing a major memorial tribute to Dr. Norman McSwain. The many aspects of trauma were his profession and his spirit. He epitomized the free spirit of the trauma surgeon, and its derivatives of critical care surgeon, acute care surgeon, and emergency surgeon. As a pioneer in the field of trauma medicine, he helped establish emergency medical service systems on national and international levels. For most of his life, he was on the editorial board of the *Journal of Trauma* and was a frequent contributor."

"Dr. McSwain is the only physician in the history of ACS to receive all five major trauma awards. In 1989, he won the Meritorious Service Award from the Advanced Trauma Life Support's Committee on Trauma. He was awarded the National Safety Council's Surgeon's Award for Service to Safety in 1998, and, in 2000, the Committee on Trauma's Millennium Commitment Award was presented to him. In 2001, he was named a Scudder Orator and also received the Committee on Trauma's Meritorious Achievement Award for state or provincial chairs. He has earned every honor the ACS-COT and the National Association of Emergency Medical Technicians (NAEMT) bestows and received the NAEMT award that now bears his name—the Dr. Norman E. McSwain, Jr., PHTLS Leadership Award. In addition, his awards include the Award of Excellence from the Kansas Emergency Medical Training Association (1977); the President's Leadership Award from the National Association of Emergency Medical Technicians (1980); the President's Award from the National Association of Emergency Medical Technicians (1984 & 2000); the Distinguished Achievement Award from the American Trauma Society (1993); the Virginia S. Furrow Award from Tulane University School of Medicine (1998); the Rocco Morando Award for Lifetime Achievement in EMS from the National Association of Emergency Medical Technicians (2002); AARP the Magazine Award (2005); the National Public Health Hero Award from the University of California-Berkeley's School of Public Health (2006); National Safety Council Award from the National Safety Council; the American Association for the Surgery of Trauma; the Spirit of Charity Award (2008); Distinguished Lectureship Award from the Society of Trauma Nurses (2008); the CAPT Frank K. Butler, Jr. Award for Outstanding Contributions to Tactical Combat Casualty Care (2008); and the Order of Military Medical Merit (2012) among numerous other awards and recognitions."

World J Orthop. 2015 Dec 18;6(11):977-82.

Cost-benefit analysis of the use of tranexamic acid in primary lower limb arthroplasty: A retrospective cohort study.

McGoldrick NP, O'Connor EM, Davarinos N, Galvin R, Quinlan JF.

AIM: To examine the cost benefit conferred by the perioperative administration of intravenous tranexamic acid (TXA) in lower limb arthroplasty.

METHODS: This study evaluates the use of TXA in 200 consecutive lower limb arthroplasties performed in a single surgeon series. The initial 100 patients (control group) underwent surgery without perioperative administration of TXA while the subsequent 100 patients (TXA group) all received 1 g TXA at the time of induction of anaesthesia. Pre- and post-operative haemoglobin, platelet count, haematocrit, the use of blood product post-operatively, length of stay were examined. A financial analysis of both groups was then undertaken.

RESULTS: The mean age of patients in both groups was 63 ± 13 years. There were no significant differences between groups in terms of gender ($P = 0.47$), proportion of total hip replacement to total knee replacement ($P = 0.25$) or pre-operative haemoglobin ($P = 0.43$). In the control group, the transfusion rate was 22%. In the TXA group, the transfusion rate dropped to 2% ($P < 0.001$). The mean post-operative haemoglobin was 10.82 ± 1.55 g/dL in the control group vs 11.33 ± 1.27 g/dL in the TXA group ($P = 0.01$). The total cost of transfused blood products was €11055 and €603 respectively. The mean length of stay in the control group was 6.53 ± 5.93 d vs 5.47 ± 4.26 d in the TXA group ($P = 0.15$) leading to an estimated financial saving of €114586. There was one pulmonary embolus in the control group and one deep venous thrombosis in the TXA group.

CONCLUSION: Intravenous TXA reduces blood loss in lower limb arthroplasty. This leads to lower transfusion rates, shorter length of stay in hospital and significant financial savings.

Crit Care Med 2015;43

Effect of tranexamic acid on transfusion in patients presenting within 3 hours of trauma.

Medeiros K, DiNapoli M, Ross B.

Learning Objectives: Hemorrhage as a result of traumatic injury is often the underlying cause of mortality in the trauma population. Tranexamic acid (TXA), a synthetic derivative of the amino acid lysine, inhibits fibrinolysis by blocking the lysine binding site on plasminogen. The MATTERs and CRASH-2 trials established the mortality benefit of TXA when used for hemorrhage caused by traumatic injury in both military and civilian populations, respectively. A more recent study concluded that TXA decreased mortality, but resulted in increased transfusions of packed red blood cells (pRBCs) and fresh frozen plasma (FFP). In April 2014, our institution added TXA to a preexisting massive transfusion protocol for patients presenting within 3 hr of traumatic injury. The purpose of this study was to evaluate the effect of TXA on transfusions in our trauma population.

Methods: This is a retrospective review comparing transfusion requirements in patients pre and post the addition of TXA to a massive transfusion protocol at a level I trauma center. Data from the pre-TXA group was collected from October 2013- March 2014 and post-TXA data were collected from April 2014-October 2014. Patients were included if they presented within 3 hr of injury, had an Assessment of Blood Consumption (ABC) score >2 (penetrating injury) or >2 (blunt injury), and received >2 units of pRBCs.

Results: Thirty-six patients were included in the analysis; 18 in the pre-TXA group and 18 in the post-TXA group. Baseline characteristics were similar between both groups. Patients in the pre-TXA group required more pRBCs and FFP than the post-TXA group (mean 10.2 + 5.4 units vs. 6.2 + 4.5 units [p=0.02]; mean 7.3+ 6.1 units vs. 2.6 + 2.8 units [p=0.005], respectively). There were no differences in the rate of vascular occlusive events with a total of 3 events (2 DVTs and 1 stroke) in the pre-TXA group vs. 4 events (3 pulmonary embolisms and 1 deep vein thrombosis [DVT]) in the post-TXA group.

Conclusions: TXA was associated with a statistically significant decrease in transfusions of pRBCs and FFP without increasing the risk of vascular occlusive events.

J Trauma Acute Care Surg. 2015 Dec;79(6):897-904.

Shock-induced systemic hyperfibrinolysis is attenuated by plasma-first resuscitation.

Moore HB, Moore EE, Morton AP, Gonzalez E, Fragoso M, Chapman MP, Dzieciatkowska M, Hansen KC, Banerjee A, Sauaia A, Silliman CC.

BACKGROUND: We developed a hemorrhagic shock animal model to replicate an urban prehospital setting where resuscitation fluids are limited to assess the effect of saline versus plasma in coagulopathic patients. An in vitro model of whole blood dilution with saline exacerbated tissue plasminogen activator (tPA)-mediated fibrinolysis, while plasma dilution did not change fibrinolysis. We hypothesize that shock-induced hyperfibrinolysis can be attenuated by resuscitation with plasma while exacerbated by saline.

METHODS: Sprague-Dawley rats were hemorrhaged to a mean arterial pressure of 25 mm Hg and maintained in shock for 30 minutes. Animals were resuscitated with either normal saline (NS) or platelet-free plasma (PFP) with a 10% total blood volume bolus, followed by an additional 5 minutes of resuscitation with NS to increase blood pressure to a mean arterial pressure of 30 mm Hg. Animals were observed for 15 minutes for the assessment of hemodynamic response and survival. Blood samples were analyzed with thrombelastography paired with protein analysis.

RESULTS: The median percentage of total blood volume shed per group were similar (NS, 52.5% vs. PFP, 55.7; p = 0.065). Survival was 50% in NS compared with 100% in PFP. The change in LY30 and tPA levels from baseline to shock was similar between groups (LY30 PFP, 10; interquartile range [IQR], 4.3-11.2; NS, 4.5; IQR, 4.1-14.2; p = 1.00; tPA PFP, 16.6 ng/mL; IQR, 13.7-27.8; NS, 22.4; IQR, 20.1-25.5; p = 0.240). After resuscitation, the median change in LY30 was greater in the NS group (13.5; IQR, 3.5-19.9) compared with PFP (-4.9%; IQR, -9.22 to 0.25 p = 0.004), but tPA levels did not significantly change (NS, 1.4; IQR, -6.2 to 7.1 vs. PFP, 1.7; IQR, -5.2 to 6.8; p = 0.699).

CONCLUSION: Systemic hyperfibrinolysis is driven by hypoperfusion and associated with increased levels of tPA. Plasma is a superior resuscitation fluid to NS in a prehospital model of severe hemorrhagic shock as it attenuates hyperfibrinolysis and improves systemic perfusion.

J Trauma Acute Care Surg. 2016 Feb;80(2):324-34.

A systematic review of the use of resuscitative endovascular balloon occlusion of the aorta in the management of hemorrhagic shock.

Morrison JJ, Galgon RE, Jansen JO, Cannon JW, Rasmussen TE, Eliason JL.

BACKGROUND: Torso hemorrhage remains a leading cause of potentially preventable death within trauma, acute care, vascular, and obstetric practice. A proportion of patients exsanguinate before hemorrhage control. Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an adjunct designed to sustain the circulation until definitive hemostasis. A systematic review was conducted to characterize the current clinical use of REBOA and its effect on hemodynamic profile and mortality.

METHODS: A systematic review (1946-2015) was conducted using EMBASE and MEDLINE. Original studies on human subjects, published in English language journals, were considered. Articles were included if they reported data on hemodynamic profile and mortality.

RESULTS: A total of 83 studies were identified; 41 met criteria for inclusion. Clinical settings included postpartum hemorrhage (5), upper gastrointestinal bleeding (3), pelvic surgery (8), trauma (15), and ruptured aortic aneurysm (10). Of the 857 patients, overall mortality was 423 (49.4%); shock was evident in 643 (75.0%). Pooled analysis demonstrated an increase in mean systolic pressure by 53 mm Hg (95% confidence interval, 44-61 mm Hg) following REBOA use. Data exhibited moderate heterogeneity with an I of 35.5.

CONCLUSION: REBOA has been used in a variety of clinical settings to successfully elevate central blood pressure in the setting of shock. Overall, the evidence base is weak with no clear reduction in hemorrhage-related mortality demonstrated. Formal, prospective study is warranted to clarify the role of this adjunct in torso hemorrhage.

LEVEL OF EVIDENCE: Systematic review, level IV.

Med Oral Patol Oral Cir Bucal. 2016 Jan 1;21(1):e127-34.

Single dose of diclofenac or meloxicam for control of pain, facial swelling, and trismus in oral surgery.

Orozco-Solís M, García-Ávalos Y, Pichardo-Ramírez C, Tobías-Azúa F, Zapata-Morales JR, Aragon-Martínez OH, Isiordia-Espinoza MA.

BACKGROUND: Postoperative pain associated with removal of mandibular third molars has been documented from moderate to severe during the first 24 hours after surgery, with pain peaking between 6 and 8 hours when a conventional local anesthetic is used. Dental pain is largely inflammatory, and evidence-based medicine has shown that nonsteroidal anti-inflammatory drugs are the best analgesics for dental pain. The aim of this study was to compare the analgesic, anti-inflammatory and anti-trismus effect of a single dose of diclofenac and meloxicam after mandibular third molar extraction.

MATERIAL AND METHODS: A total of 36 patients were randomized into two treatment groups, each with 18 patients, using a series of random numbers: Group A, was administered 100 mg of diclofenac; and Group B, 15 mg of meloxicam. Drugs were administered orally 1 hour prior to surgery. We evaluated pain intensity, analgesic consumption, swelling, as well as trismus.

RESULTS: The results of this study showed that patients receiving 15 mg of meloxicam had less postoperative pain (P=0.04) and better aperture than those receiving 100 mg of diclofenac (P=0.03). The meloxicam group presented less swelling than diclofenac group; however, significant statistical differences were not observed.

CONCLUSIONS: Data of this double-blind, randomized, parallel-group clinical trial demonstrated that patients receiving 15 mg of preoperative meloxicam had a better postoperative analgesia and anti-trismus effect compared with who were given 100 mg of diclofenac after third molar extractions.

J Trauma Acute Care Surg. 2015 Dec;79(6):930-6.

Resuscitative endovascular balloon occlusion of the aorta (REBOA): Comparison with immediate transfusion following massive hemorrhage in swine.

Park TS, Batchinsky AI, Belenkiy SM, Jordan BS, Baker WL, Necsoiu CN, Aden JK, Dubick MA, Cancio LC.

BACKGROUND: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is less invasive than emergency department thoracotomy for the treatment of massive hemorrhage. We evaluated the effects of REBOA on carotid blood flow (Qcarotid) in a porcine model of massive hemorrhage. We hypothesized that REBOA restores Qcarotid faster than reinfusion of blood.

METHODS: Spontaneously breathing sedated Sinclair pigs underwent exponential hemorrhage of 65% total blood volume in 1 hour. They were randomized into three groups. Positive control (PC, n = 7) underwent immediate transfusion of shed blood. REBOA (n = 21) received a novel 7 Fr ER-REBOA catheter (Pryor Medical, Arvada, CO) placed into aortic Zone 1 via a femoral artery introducer for 30 minutes or 60 minutes, with transfusion either after deflation or midway through inflation. Negative control (n = 7) received no resuscitation. Qcarotid was recorded continuously using an ultrasonic flow probe. Survival and time between Qcarotid, min and both a stable maximal value (Qcarotid, max) and restoration of baseline flow (Qcarotid, new BL) were compared by Kaplan-Meier analysis.

RESULTS: Median time to Qcarotid, max was 3.0 minutes in the REBOA group versus 9.6 minutes in the control group (p = 0.006). Median time to Qcarotid, new BL was 6.0 minutes in the REBOA group versus 20.5 minutes in the PC group (p = 0.11). Slope of the linear regression between Qcarotid, min and Qcarotid, new BL was 16.7 in REBOA and 10.4 in PC (p = 0.31). Four-hour survival was 95% (20 of 21) in the REBOA group versus 71% (5 of 7) in the PC group (p = 0.06) and 0% in the negative control group.

CONCLUSION: REBOA resulted in the restoration of Qcarotid ("cerebrovascular resuscitation") at least as rapidly as retransfusion of shed blood, with equivalent 4-hour survival. Further studies of REBOA, to include mitigation of end-organ effects and longer follow-up, are needed.

The Wall Street Journal; Published online November 19, 2015

Tourniquet use urged in public-safety push.

Phillips M

Quotes:
“Last week’s attack in Paris, which killed 129 people, is precisely the kind of tragedy advocates believe calls for the ready availability of tourniquets, for use when manual pressure isn't enough to stanch bleeding. "It's not a question of if it will happen on our own soil; it's a matter of when," Dr. Holcomb said.”

“The campaign signals a turnaround for tourniquets, straps that cut off blood flow to extremities. The devices were commonly used through World War II, and then fell out of favor, with doctors warning that they could cause nerve damage or permanently ruin the injured arm or leg.”

“The military however, discovered in Iraq and Afghanistan that uncontrolled bleeding presented a far more lethal risk, and that patients could wear tourniquets for hours without losing limbs. Since 2005, the military has issued tourniquets to all troops in the field, which researchers believe has saved 2000 lives.”

J R Army Med Corps. 2011 Dec;157(4):419-20.

A pre-hospital technique for controlling haemorrhage from traumatic perineal and high amputation injuries.

Quayle JM, Thomas GO.

ABSTRACT: Perineal trauma resulting from the adaptive use of improvised explosive devices (IEDs) has become an increasingly common problem during current operational conflicts in Afghanistan. Control of haemorrhage from the perineum and high amputations is a particular challenge due to the bony anatomy, rich pelvic vascular supply and the difficulty in achieving haemostasis by direct pressure. In this article, the authors describe a potential pre-hospital solution for controlling haemorrhage from perineal and high amputation injuries.

J Trauma Acute Care Surg. 2016 Jan;80(1):166-7.

The giving back: Battlefield lesson to national preparedness.

Rasmussen TE, Baer DG, Goolsby C.

Quotes:

"On October 6, 2015, the White House National Security Council staff and its Office of Medical Preparedness Policy launched a national campaign called Stop the Bleed (https://www.whitehouse.gov/blog/2015/10/06/stop-bleed) (Fig. 1). This program,which is intended to teach citizens how to save lives from major trauma the same way bystander cardiopulmonary resuscitation saves lives from cardiac arrest, directly translates lessons learned on the battlefields of Iraq and Afghanistan to benefit theAmerican public.The initiative's aims are to ensure that the general public will know the Stop the Bleed phrase and logo and have access to effective personal and public bleeding control kits that will provide just-in-time training."

"Foremost, the initiative is based on a decade of research by the US military to identify and mitigate combat-related morbidity and mortality. During the course of this effort, military providers identified the significance of rapid, compressible hemorrhage as a cause of potentially preventable death and swiftly acted to reduce its impact on service personnel.(3) Although tourniquets were not new, their use had largely been abandoned before September 11, 2001. Faced with an unprecedented burden ofmassive extremity injury, vascular trauma and hemorrhage from explosive devices, and high-velocity gunshot wounds, the military reappraised its stance and rapidly reengineered, tested, and deployed tourniquets and hemostatic bandages. Equally important, these components were packaged in an ''individual first aid kit'' or IFAK that provided every warfighter legitimate bleeding control capability. Finally, the military pushed out revamped ''tactical combat casualty care'' training to its medical and nonmedical forces. This training emphasized immediate recognition and control of bleeding using the newly provided materials.(3)"

"These efforts quickly paid off. In a landmark study by Kotwal et al.,(4) the lifesaving effectiveness of implementing tactical combat casualty care training and providing warfighters, combat medics, corpsmen, and medical technicians with the new hemostatic materials was clearly demonstrated. In what was in effect its own Stop the Bleed campaign, the US military demonstrated the power of evidence-supported decision making, materiel development, and training to decrease preventable deaths on the battlefield. While not all aspects of this experience apply to civilian settings, it is a relevant and compelling narrative for the country and the volunteer force that defends it."

Mil Med. 2015 Dec;180(12):1211-3.

Needle Thoracotomy in Trauma.

Rottenstreich M, Fay S, Gendler S, Klein Y, Arkovitz M, Rottenstreich A.

ABSTRACT: Tension pneumothorax is one of the leading causes of preventable death in trauma patients. Needle thoracotomy (NT) is the currently accepted first-line intervention but has not been well validated. In this review, we have critically discussed the evidence for NT procedure, re-examined the recommendations by the Advanced Trauma Life Support organization and investigated the safest and most effective way of NT. The current evidence to support the use of NT is limited. However, when used, it should be applied in the 2nd intercostal space at midclavicular line using a catheter length of at least 4.5 cm. Alternative measures should be studied for better prehospital management of tension pneumothorax.

Reprod Sci. 2015 Dec 29. pii: 1933719115623646.

Efficacy of Tranexamic Acid on Myomectomy-Associated Blood Loss in Patients With Multiple Myomas: A Randomized Controlled Clinical Trial.

Shaaban MM, Ahmed MR, Farhan RE, Dardeer HH.

OBJECTIVE: To evaluate the efficacy of tranexamic acid (TA) in decreasing blood loss during and after open myomectomy for patients with 3 or more uterine fibroids.

METHODS: This prospective randomized trial was conducted among 132 women subjected to abdominal myomectomy. Patients were equally divided into 2 groups by simple randomization. The study group received perioperative intravenous TA while the control group did not. Intraoperative blood loss was calculated by measuring the volume in the suction apparatus and weighing the surgical swabs in addition to postoperative blood loss collected via a suction drain. Hemoglobin and hematocrit values were determined preoperatively and on the third postoperative day for all cases. Any adverse effects were recorded in both groups.

RESULTS: No significant difference was found between the two groups regarding age, body mass index, number, and size of myomas removed. The TA group showed lower amount of blood loss (407 mL) when compared to control group (677 mL; $P < .01$). Risk estimation has revealed that treatment with TA resulted in decrease in risk of perioperative blood loss by 40%. In the study group, 13 (19.7%) patients required blood transfusion in contrast to 23 (34.8%) patients in the control group ($P < .01$). Hemoglobin and hematocrit levels were significantly lower in the control group on the third postoperative day (P value = .001).

CONCLUSION: TA reduces blood loss during and after myomectomy for patients with multiple uterine fibroids.

J Trauma Acute Care Surg. 2015 Dec;79(6):983-90.

Prehospital interventions in severely injured pediatric patients: Rethinking the ABCs.

Sokol KK, Black GE, Azarow KS, Long W, Martin MJ, Eckert MJ.

BACKGROUND: The current conflict in Afghanistan has resulted in a high volume of significantly injured pediatric patients. The austere environment has demanded emphasis on prehospital interventions (PHIs) to sustain casualties during transport.

METHODS: The Department of Defense Trauma Registry was queried for all pediatric patients (≤18 years) treated at Camp Bastion from 2004 to 2012. PHIs were grouped by Advanced Trauma Life Support categories into (1) airway (A)-intubation or surgical airway; 2) breathing (B)-chest tube or needle thoracostomy; and 3) circulation (C)-tourniquet or hemostatic dressing. Outcomes were assessed base on injury severity, hemodynamics, blood products and fluids, as well as mortality rates.

RESULTS: There were 766 injured children identified with 20% requiring one or more PHIs, most commonly circulation (C, 51%) followed by airway (A, 40%) and breathing (B, 8.7%). The majority of C interventions were tourniquets (85%) and hemostatic dressings (15%). Only 38% of patients with extremity vascular injury or amputation received a C intervention, with a significant reduction in blood products and intravenous fluids associated with receiving a C PHI (both $p < 0.05$). A interventions consisted of endotracheal intubation for depressed mental status (Glasgow Coma Scale [GCS] score < 8). Among patients with traumatic brain injury, A interventions were associated with higher unadjusted mortality (56% vs. 20%, $p < 0.01$) and remained independently associated with increased mortality after multivariate adjustment (odds ratio, 5.9; $p = 0.001$). B interventions were uncommon and performed in only 2% of patients with no recorded adverse outcomes.

CONCLUSION: There is a high incidence of PHIs among pediatric patients with severe wartime injuries. The most common and effective were C PHI for hemorrhage control, which should remain a primary focus of equipment and training. A interventions were most commonly performed in the setting of severe traumatic brain injury but were associated with worse outcomes. B interventions seem safe and effective and may be underused.

LEVEL OF EVIDENCE: Care management/therapeutic study, level IV.

J Trauma Acute Care Surg. 2016 Jan;80(1):81-8.

Double-blinded, placebo-controlled study of early tranexamic acid treatment in swine uncontrolled hemorrhage model.

Sondeen JL, Hanson MA, Prince MD, de Guzman R, Polykratis IA, Aden JK 3rd, Cap AP, Dubick MA.

BACKGROUND: Tranexamic acid (TXA) is an antifibrinolytic drug that was shown to increase survival in trauma patients, but the mechanisms remain unclear. The purpose of this double-blinded, randomized placebo-controlled study was to determine if TXA with hypotensive resuscitation with Hextend (HEX) or fresh frozen plasma (FFP) reduced blood loss (BL) and improved survival in a model of uncontrolled hemorrhage.

METHODS: Instrumented, anesthetized pigs (n = 11 per group) were subjected to 24-mL/kg controlled hemorrhage, followed by transection of the spleen. After 15 minutes of bleeding, TXA (1.43 mg/kg/min) or normal saline (NS) was given over 10 minutes, and then 15-mL/kg HEX or FFP was administered. At 90 minutes, a second infusion of TXA or NS was given. BL, coagulation status, and 5-hour survival were determined. Tissue plasminogen activator (tPA) was added to blood samples collected before and after TXA administration to confirm that the TXA inhibited fibrinolysis. In addition, a comparison of a dose response to tPA-induced fibrinolysis was made between swine and human plasma in vitro.

RESULTS: TXA prevented the rise in d-dimers that occurred after spleen injury. However, there was no significant effect of TXA on survival or BL compared with NS with HEX (HEX + NS, 17 ± 2 mL/kg vs. HEX + TXA, 17 ± 2 mL/kg) or FFP (FFP + NS, 7 ± 2 mL/kg vs. FFP + TXA, 12 ± 3 mL/kg), while FFP significantly reduced BL and increased survival compared with HEX in the NS-treated animals. The tPA-induced fibrinolysis was inhibited in the blood from TXA-treated animals, yet in fibrinolysis sensitivity studies, human plasma was 30 times more sensitive to tPA-induced fibrinolysis than swine plasma.

CONCLUSION: TXA did not reduce BL, even though TXA was antifibrinolytic in the pigs. The possibility remains that the pig is highly resistant to fibrinolysis and not a good model to study the effects of antifibrinolytics or that fibrinolysis is not a major factor in bleeding from splenic injury.

J Orthop Trauma. 2015 Dec 16. [Epub ahead of print]

The Effect of Pelvic Binder Placement on OTA Classification of Pelvic Ring Injuries using Computed Tomography. Does it Mask the Injury?

Swartz J, Vaidya R, Hudson I, Oliphant B, Tonnos F.

OBJECTIVES: To assess the diagnostic sensitivity of computed tomography in patients with an unstable pelvic ring injury after application of a pelvic binder.

DESIGN: An IRB approved retrospective study from 2003-2010.

SETTING: Level 1 trauma center PATIENTS:: Inclusion criteria: patients in our trauma database with AO/OTA B or C type pelvic ring injury which first had an AP pelvic x-ray followed by application of a PCCD, then a CT scan, and a fluoroscopic stress exam under anesthesia. (FEUA). (used as gold standard). Of 867 patients, 43 met the inclusion criteria.

INTERVENTION: A senior Orthopaedic Resident and Trauma Attendings assessed X-rays, CT's and FEUA's . Binomial test was used to compare imaging against final diagnosis.

RESULTS: In APC/VS(OTA 61-B1, 61-B3.1,61-C) injury patterns, pre binder x-rays were diagnostic in 69.4% (CI 51.9-83.7%) of cases ,compared with 50% (CI 32.9-67.1%) with CT + PCCD. The x-ray was superior to CT+PCCD for identification of the anterior pelvic injury. (McNemar exact p=0.0352). If x-ray and CT+PCCD were viewed in tandem, 83.3% (CI 67.2-93.6%) of classifications were in agreement with the FEUA. For lateral compression mechanisms the binder did not effect of the sensitivity of the CT scan except in the open book component of an LC3 (61-B3.2) mechanism.

CONCLUSIONS: The placement of a pelvic binder has the potential to mask the severity of unstable pelvic ring injuries when relying only on CT for diagnosis. Fluoroscopic manual pelvic stress examination under anesthesia is an essential adjunct when a binder is placed prior to imaging.

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

Can J Surg. 2015 Jun;58(3 Suppl 3):S104-7.

Cervical spine injury in dismounted improvised explosive device trauma.

Taddeo J, Devine M, McAlister VC.

BACKGROUND: The injury pattern from improvised explosive device (IED) trauma is different if the target is in a vehicle (mounted) or on foot (dismounted). Combat and civilian first response protocols require the placement of a cervical collar on all victims of a blast injury.

METHODS: We searched the Joint Theatre Trauma Registry (JTTR) and the Role 3 Hospital, Kandahar Airfield (KAF) database from Mar. 1, 2008, to May 31, 2011. We collected data on cervical fracture; head injury; traumatic amputation; initial blood pressure, pulse, injury severity score (ISS), Glasgow Coma Scale (GCS) score and base excess; and patient demographic information.

RESULTS: The concordance rate between JTTR and KAF databases was 98%. Of the 15 693 admissions in JTTR, 326 patients with dismounted IED injuries were located. The rate of cervical collar prehospital placement was 7.6%. Cervical fractures were found in 19 (5.8%) dismounted IED victims, but only 4 (1.2%) were considered radiographically unstable. None of these 19 patients had prehospital placement of a collar. Patients with cervical spine fractures were more severely injured than those without (ISS 18.2 v. 13.4; GCS 10.1 v. 12.5). Patients with head injuries had significantly higher risk of cervical spine injury than those with no head injury recorded (13.6% v. 3.9%). No differences in frequency of cervical spine injury were found between patients who had associated traumatic amputations and those who did not (5.4% v. 6.0%).

CONCLUSION: Dismounted IED is a mechanism of injury associated with a low risk for cervical spine trauma. A selective protocol for cervical collar placement on victims of dismounted IED blasts is possible and may be more amenable to combat situations.

Injury. 2015 Dec 29. pii: S0020-1383(15)00833-5.

The iTClamp in the management of prehospital haemorrhage.

Tan EC, Peters JH, Mckee JL, Edwards MJ.

INTRODUCTION: Bleeding remains a leading cause of death in trauma patients. The iTClamp is a temporary wound closure device designed to control external bleeding within seconds of injury. We describe our experience using this device on 10 patients in the prehospital environment.

METHODS: We have implemented the iTClamp for prehospital use through our physician-staffed helicopter emergency medical service (HEMS). Indications were massive bleeding that could not be controlled with an ordinary compressive bandage or a haemostatic bandage.

RESULTS: Ten patients were treated with the iTClamp. Seven patients had a severe head injury due to various traumas, one patient had a neck injury from a disk cutter, one patient had an open chest wound and one patient had an open femur fracture. After applying the iTClamp, bleeding was controlled in 90% of these patients (n=9), with complete cessation reported in 60% (n=6), partial cessation with adequate control reported in 30% (n=3); in one patient, the bleeding could not be controlled with the iTClamp alone. It took an average of 10s to apply the iTClamp, and the average usage satisfaction score was 7.7.

CONCLUSION: We conclude that the iTClamp is a safe, fast and useful tool for stopping or controlling external blood loss in our series of prehospital patients. Further studies of the iTClamp are needed to determine which patients might benefit from this device.

Saudi J Anaesth. 2015 Oct-Dec;9(4):446-50.

A prospective study to evaluate and compare laryngeal mask airway ProSeal and i-gel airway in the prone position.

Taxak S, Gopinath A, Saini S, Bansal T, Ahlawat MS, Bala M.

BACKGROUND: Prone position is commonly used to provide surgical access to a variety of surgeries. In view of the advantages of induction of anesthesia in the prone position, we conducted a randomized study to evaluate and compare ProSeal laryngeal mask airway (LMA) and i-gel in the prone position.

MATERIALS AND METHODS: Totally, 40 patients of either sex as per American Society of Anesthesiologists physical status I or II, between 16 and 60 years of age, scheduled to undergo surgery in prone position were included in the study. After the patients positioned themselves prone on the operating table, anesthesia was induced by the standard technique. LMA ProSeal was used as an airway conduit in group 1 while i-gel was used in group 2. At the end of surgery, the airway device was removed in the same position.

RESULTS: Insertion of airway device was successful in first attempt in 16, and 17 cases in ProSeal laryngeal mask airway (PLMA) and i-gel groups, respectively. A second attempt was required to secure the airway in 4 and 3 patients in PLMA and i-gel groups, respectively. The mean insertion time was 21.8 ± 2.70 s for group 1 and 13.1 ± 2.24 s for group 2, the difference being statistically significant ($P < 0.05$). The mean seal pressure in group 1 was 36 ± 6.22 cm H_2O and in group 2 was 25.4 ± 3.21 cm H_2O. The difference was statistically significant ($P < 0.05$). 13 patients in group 1 had fiberoptic bronchoscopy (FOB) grade 1 while it was 6 for group 2. The remaining patients in both groups had FOB grade 2.

CONCLUSION: Insertion of supraglottic airways and conduct of anesthesia with them is feasible in the prone position. The PLMA has a better seal while insertion is easier with i-gel.

Injury. 2016 Jan 19. pii: S0020-1383(16)00007-3.

Prehospital use of hemostatic dressings in emergency medical services in the Netherlands: A prospective study of 66 cases.

Te Grotenhuis R, van Grunsven PM, Heutz WM, Tan EC.

BACKGROUND: Uncontrolled haemorrhage is the leading cause of potentially preventable death in both civilian and military trauma patients. Animal studies and several case series have shown that hemostatic dressings reduce haemorrhage and might improve survival. One of these products is HemCon ChitoGauze(®). The objective of this study was to determine the effectiveness and safety of ChitoGauze in achieving hemostasis in massive traumatic bleeding in civilian emergency medical services.

METHODS: From June 2012 to December 2014, all ambulances of two emergency medical services in the Netherlands were equipped with ChitoGauze. The dressing was used according to protocol; if conventional treatment (gauze dressing with manual pressure) failed to control external traumatic bleeding or if conventional treatment was unlikely to achieve hemostasis. The ambulance personnel filled in an evaluation form after each use.

RESULTS: A total of 66 patients were treated with ChitoGauze during the study period. Twenty-one patients were taking anticoagulants or suffered from a clotting disorder. The injuries were located in the extremities (n=29), the head and face (n=29), or the neck, thorax and groin (n=8). In 46/66 patients, the use of ChitoGauze resulted in cessation of haemorrhage. In 13/66 patients, Chitogauze application reduced haemorrhage. ChitoGauze failed to control haemorrhage in 7/66 patients, whereby user error was a contributing factor in 3 of these failures. No side effects have been observed during treatment or transport of the patients and no adverse effects have been reported in discharge letters.

CONCLUSION: This is the largest prospective study in civilian healthcare and the second largest case series with prehospital use of hemostatic dressings. It demonstrated that ChitoGauze is an effective and safe adjunct in the prehospital treatment of massive external traumatic haemorrhage.

Prehosp Emerg Care. 2016 Jan 25:1-5.

Needle Thoracostomy in the Prehospital Setting: A Retrospective Observational Study.

Weichenthal L, Crane D, Rond L.

BACKGROUND: The use of needle thoracostomy (NT) is a common prehospital intervention for patients in extremis or cardiac arrest due to trauma; however, controversy surrounds its use. The purpose of this study is to compare outcomes, effectiveness, and complications of NT in an Emergency Medical Services (EMS) system that includes urban, rural, and wilderness environments.

METHODS: This is a retrospective observational study of all patients who had NT performed in a four county EMS system with a catchment area of greater than 1.6 million people. All prehospital records where NT was performed were queried for demographics, mechanism of injury, initial status, and clinical change following NT. Hospital records were queried for exam findings on arrival to the hospital, any complications from NT, and final outcome. The Trauma Registry was accessed to obtain Injury Severity Scores. Information was manually abstracted by study investigators and univariate analysis utilizing chi-squared and two-tailed t-tests were initially conducted before a multivariate analysis was conducted utilizing a binary logistic regression model.

RESULTS: A total of 169 patients with a mean age of 38 years were included in this study; 87% were male and 61% sustained blunt trauma. The overall mortality rate was 79%; 77% in the blunt trauma group; and 83% in the penetrating group, with no significant difference between the two groups relative to mortality ($p = 0.336$). There was a significant difference in survival between patients who were initially presented as a stat trauma versus as a trauma arrest (52% versus 99%, $p > 0.001$). The multivariate model with regard to survival supported that reported clinical change after NT ($p = 0.001$) and status ($p = 0.0001$) are important indicators of survival. No complications from NT were reported.

CONCLUSIONS: NT can safely be performed by paramedics in an EMS system that includes urban, rural, and wilderness settings. Its efficacy does not differ between patients suffering from blunt versus penetrating trauma; however, it appears most beneficial for patients who are unstable but still have vital signs.

Injury. 2016 Feb;47(2):383-8. doi: 10.1016/j.injury.2015.08.023. Epub 2015 Aug 21

Pre-hospital pelvic girdle injury: Improving diagnostic accuracy in a physician-led trauma service

Yong E, Vasireddy A, Pavitt A, Davies GE, Lockey DJ

BACKGROUND: Examination of missed injuries in our physician-led pre-hospital trauma service indicated that the significant injuries missed were often pelvic fractures. We therefore conducted a study whose aim was to evaluate the pre-hospital diagnostic accuracy of pelvic girdle injuries, and how this would be affected by implementing the pelvic injury treatment guidelines recently published by the Faculty of Pre-Hospital Care.

STUDY DESIGN: All blunt trauma patients attended in a 5-month period were included in the study. The presence or absence of pelvic girdle injury on computed tomography (CT) or, if unavailable, pelvic X-ray was used as a primary outcome measure. A retrospective database and case note review was conducted to identify patients who had pelvic binder applied in the study period. For the purposes of the study, pelvic ring and acetabular fractures were grouped together as patients with suspected pelvic girdle injury that should be fitted with a pelvic binder in the pre-hospital setting. The sensitivity and specificity, relating to the presence of pelvic girdle injury in patients with pelvic binders, was calculated in order to determine pre-hospital diagnostic accuracy.

RESULTS: 785 patients were attended during the study period. 170 met the study inclusion criteria. 26 (15.3%) sustained a pelvic girdle injury. 45 (26.5%) had a pelvic binder applied. There were eight missed fractures (31%), of which the majority (six) sustained less severe injuries that were managed non-operatively. Two patients required operative fixation. Radiological images and/or reports were available on 169 (99.4%) patients. As a test of the presence of pelvic fracture, pelvic binder application had a sensitivity of 0.69 (95% CI 0.50-0.85) and a specificity of 0.81 (95% CI 0.74-0.87).

CONCLUSIONS: Even with a careful clinical assessment and a low threshold for binder application, this study highlights the problems of distracting injury when trying to diagnose and manage pelvic fractures. By implementing the pelvic treatment guidelines published by the Faculty of Pre-hospital Care, the missed injury rate could be reduced from 31% to 8%.

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Cervical spine evaluation in the bluntly injured patient.

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BACKGROUND: Cervical spine injuries causing spinal cord trauma are rare in blunt trauma yet lead to devastating morbidity and mortality when they occur. There exists considerable debate in the literature about the best way for clinicians to proceed in ruling out cervical spine injuries in alert or obtunded blunt trauma patients.

METHODS: We reviewed the current literature and practice management guidelines to generate clinical recommendations for the detection and clearance of cervical spine injuries in the blunt trauma patient.

RESULTS: The NEXUS and Canadian C-Spine Rules are clinical tools to guide in the clearance of the cervical spine of patients who have sustained low risk trauma and who are pain free, with the Canadian C-Spine Rules having superior sensitivity and specificity. In the alert, high risk patient with pain (or without, if over the age of 65 years), follow up imaging is required. The best imaging modality to use is Computerized Tomography (CT) of the cervical spine. In the obtunded trauma patient, CT clearance of c-spine injury is adequate, unless there is soft tissue injury or any non-bony abnormalities detected. At such point, definitive clearance may be obtained with Magnetic Resonance Imaging.

CONCLUSIONS: It is imperative to assume cervical spine injury in the blunt trauma patient. Clinical tools for cervical clearance may be used in low risk patients, avoiding imaging. High risk patients require imaging in the form of CT scan of the cervical spine.