Tactical Combat Casualty Care

Journal Article Abstracts

Committee on Tactical Combat Casualty Care
February 2015

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Abstracts

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Comparing low-dose intravenous ketamine-midazolam with intravenous morphine with respect to pain control in patients with closed limb fracture.

Ahmadi O, Isfahani M, Feizi A

BACKGROUND: We assessed the effects of low-dose IV ketamine-midazolam versus morphine on pain control in patients with closed limb fracture(s); and also compared the incidence of adverse events (cardio-pulmonary) between two groups.

MATERIALS AND METHODS: This prospective, single-blind, non-inferiority trial randomized consecutive emergency department (ED) patients aged 18-60 years to two groups: Receiving 300-500 mcg/kg ketamine plus 0.03 mg/kg midazolam, or 0.05-0.1 mg/kg morphine. Visual analogue score (VAS) and adverse events were verified during an interval of 30 minutes.

RESULTS: Two hundred and thirty-six patients were selected, among whom 207 were males (87.3%). The average age was 29 ± 2, (range, 18-60 years). The VAS score at T30 (i.e., 30 minutes after initial analgesic dose) was significantly decreased compared with VAS score at T0, in both groups. No statistically significant difference, however, was observed between the two groups (-6.1 ± 1.1 versus -6.2 ± 1.0; P = 0.16). With regard to systolic blood pressure and respiratory rate, however, a meaningful difference was noted between the two groups (1.5 ± 6.4 versus -2.1 ± 6.6; P = 0.000 for SBP, and -0.2 ± 1.1 versus -1.1 ± 6.1; P = 0.048 for RR).

CONCLUSION: Low-dose intravenous ketamine plus midazolam has the same analgesic effects as morphine on pain control in trauma patients with closed limb fracture(s) in addition to less respiratory adverse events.

J Trauma Acute Care Surg. 2014 Dec;77(6):859-64.

Differences between blunt and penetrating trauma after resuscitation with hydroxyethyl starch.

Allen C, Valle E, Jouria J, Schulman C, Namias N, Livingstone A, Proctor K

BACKGROUND: The purpose of this study was to test the hypothesis that a single bolus of 6% hydroxyethyl starch (HES 450/0.7 in lactated electrolyte injection) during initial resuscitation has a differential effect in blunt and penetrating trauma patients.

METHODS: Consecutive admissions to the trauma service were reviewed. Patients who died within 24 hours were excluded. Multivariate analysis defined individual predictors for the primary outcomes, acute kidney injury (AKI) and mortality within 90 days. Data were expressed as mean ± SD, and significance was assessed at $p < 0.05$.

RESULTS: There were 1,410 patients (76% male; mean ± SD, age 43 ± 18 years; 68% blunt trauma; mean ± SD Injury Severity Score [ISS] 14 ± 11; AKI, 4.4%; and mortality, 3.4%). HES (0.5-1.5 L) was administered to 216 patients (15.3%). After multiple logistic regression, HES remained a significant independent predictor of AKI after blunt trauma (odds ratio [OR], 2.54; 95% confidence interval [CI], 1.24-5.19; area under the receiver operating characteristic curve [AUROC], 0.809) but not penetrating trauma (OR, 0.90; 95% CI, 0.23-3.60; AUROC, 0.849). In separate logistic regression models, HES was a significant predictor of mortality after blunt trauma (OR, 3.77; 95% CI, 0.91-0.97; AUROC, 0.921) but not penetrating trauma (OR, 0.72; 95% CI, 0.13-3.94; AUROC, 0.904).

CONCLUSION: HES is an independent risk factor for AKI and death after blunt, but not penetrating, trauma, which underscores a fundamental difference between these two injury types.

LEVEL OF EVIDENCE: Epidemiologic study, level III.

Journal of Trauma and Acute Care Surgery February 2015;78(2): 386–390

Does chest tube location matter? An analysis of chest tube position and the need for secondary interventions

Benns, Matthew V. MD; Egger, Michael E. MD; Harbrecht, Brian G. MD; Franklin, Glen A. MD; Smith, Jason W. MD, PhD; Miller, Keith R. MD; Nash, Nicholas A. MD; Richardson, J. David MD

BACKGROUND: Tube thoracostomy is a common procedure used in the management of thoracic trauma. Traditional teaching suggests that chest tubes should be directed in specific locations to improve function. Common examples include anterior and superior placement for pneumothorax, inferior and posterior placement for hemothorax, and avoidance of the pulmonary fissure. The purpose of this study was to examine the effect of specific chest tube position on subsequent chest tube function.

METHODS: A retrospective review of all patients undergoing tube thoracostomy for trauma from January 1, 2010, to September 30, 2012, was performed. Only patients undergoing computed tomography scans following chest tube insertion were included so that positioning could be accurately determined. Rib space insertion level and positioning of the tube relative to the lung parenchyma were recorded. The duration of chest tube drainage and the need for secondary interventions were determined and compared for tubes in different rib spaces and locations. For purposes of comparison, tubes placed above the sixth rib space were considered “high,” and those at or below it were considered “low.”

RESULTS: A total of 291 patients met criteria for inclusion. Forty-eight patients (16.5%) required secondary intervention. Neither high chest tube placement nor chest tube location relative to lung parenchyma was associated with an increased need for secondary interventions. On multivariate analysis, only chest Abbreviated Injury Scale (AIS) scores, mechanism, and volume of hemothorax were found to be significant risk factors for the need for secondary interventions.

CONCLUSION: Chest tube location does not influence the need for secondary interventions as long as the tube resides in the pleural space. The severity of chest injury is the most important factor influencing outcome in patients undergoing tube thoracostomy for trauma. Tube thoracostomy technique should focus on safe insertion within the pleural space and not on achieving a specific tube location.

LEVEL OF EVIDENCE: Therapeutic study, level IV.

J Intensive Care Med. 2014 Nov 10. pii: 0885066614558018. [Epub ahead of print]

Damage Control Resuscitation.

Bogert J, Harvin J, Cotton B

Abstract:

Resuscitation of the hemorrhaging patient has undergone significant changes in the last decade resulting in the concept of damage control resuscitation (DCR). Hemostatic resuscitation aims to address the physiologic derangements found in the hemorrhaging patient, namely coagulopathy, acidosis, and hypothermia. Strategies to achieve this are permissive hypotension, high ratio of plasma and platelet transfusion to packed red blood cell transfusion, and limitation of crystalloid administration. Damage control surgery aims for early hemorrhage control and minimizing operative time by delaying definitive repair until the patient's physiologic status has normalized. Together these strategies constitute DCR and have led to improved outcomes for hemorrhaging patients over the last 2 decades. Recently, DCR has been augmented by both pharmacologic and laboratory adjuncts to improve the care of the hemorrhaging patient. These include thrombelastography as a detailed measure of the clotting cascade, tranexamic acid as an antifibrinolytic, and the procoagulant activated factor VII. In this review, we discuss the strategies that makeup DCR, their adjuncts, and how they fit into the care of the hemorrhaging patient.

Mil Med. 2014 Dec;179(12):1439-43.

Highly realistic, immersive training for navy corpsmen: preliminary results.

Booth-Kewley S, McWhorter S

Abstract:

Highly realistic, immersive training has been developed for Navy corpsmen based on the success of the Infantry Immersion Trainer. This new training is built around scenarios that are designed to depict real-life, operational situations. Each scenario used in the training includes sights, sounds, smells, and distractions to simulate realistic and challenging combat situations. The primary objective of this study was to assess corpsmen participants' satisfaction with highly realistic training. The study sample consisted of 434 male Navy service members attending Field Medical Training Battalion-West, Camp Pendleton, California. Corpsmen participants completed surveys after receiving the training. Participants expressed high levels of satisfaction with the training overall and with several specific elements of the training. The element of the training that the corpsmen rated the highest was the use of live actors. The vast majority of
the participants reported that the training had increased their overall confidence about being successful corpsmen and had strengthened their confidence in their ability to provide care under pressure. Additional research should extend highly realistic training to other military medical provider populations.

Br J Oral Maxillofac Surg. 2015 Jan;53(1):3-7.

Novel method for comparing coverage by future methods of ballistic facial protection.

Breeze J, Allanson-Bailey LC, Hepper AE, Lewis EA

Abstract:

The wearing of eye protection by United Kingdom soldiers in Afghanistan has reduced the morbidity caused by explosive fragments. However, the remaining face remains uncovered because there is a lack of evidence to substantiate the procurement of methods to protect it. Using a new computerised tool we entered details of the entry sites of surface wounds caused by explosive fragments in all UK soldiers who were injured in the face between 1 January 2010 and 31 December 2011. We compared clinical and predicted immediate and long term outcomes (as defined by the Abbreviated Injury Score (AIS) and the Functional Capacity Index (pFCI), respectively). We also used the tool to predict how additional protection in the form of a visor and mandible guard would affect outcomes. **A soldier wearing eye protection was 9 times (1.03/0.12) less likely to sustain an eye injury than one without.** However, 38% of soldiers in this series were not wearing eye protection at the time of injury. There was no significant difference between the AIS and pFCI scores predicted by the tool and those found clinically. There is limited evidence to support the use of a mandible guard; its greatest asset is better protection of the nose, but a visor would be expected to reduce long-term
morbidity more than eye protection alone, and we recommend future trials to assess its acceptability to users. We think that use of this novel tool can help in the selection of future methods of ballistic facial protection.

Junctional Tourniquets for Controlling Hemorrhage from Wounds in Adults: A Review of Clinical Effectiveness, Cost-Effectiveness, Safety, and Guidelines [Internet].

Ottawa (ON): Canadian Agency for Drugs and Technologies in Health; 2014 Apr. CADTH Rapid Response Reports

Abstract:

Until recently, three junctional tourniquet models were available on the market: the Junctional Emergency Treatment Tool (JETT), the SAM Junctional TQ, and the Combat Ready Clamp (CRoC). The Abdominal Aortic & Junctional Tourniquet (AAJT), previously only indicated for truncal use to prevent inguinal bleeding, can be now added to this list since it has recently received FDA clearance for junctional use. According to the American Committee on Tactical Combat Casualty Care (TCCC), the desirable traits of junctional tourniquets include: effective control of hemorrhage from junctional areas, safety, amenable to battlefield and tactical situations, low weight, low cost, ease of use, speed of application and stability. The introduction and appropriate use of junctional tourniquets has the potential to save many lives. A review of the clinical effectiveness and safety of the various junctional tourniquets on the market, along with the associated guidelines, will inform decisions on the best model to select for pre-hospital control of hemorrhages.

Ketamine for Adult Patients who Have Suffered Painful and Traumatic Injuries: A Review of Clinical Effectiveness, Cost-Effectiveness, Safety and Guidelines [Internet].

Ottawa (ON): Canadian Agency for Drugs and Technologies in Health; 2014 Mar. CADTH Rapid Response Reports

Abstract:

This report will review the evidence surrounding the clinical effectiveness, safety, and cost-effectiveness of ketamine and guidelines for its use in adult patients who have suffered painful and traumatic brain or eye injury. This report will also review the evidence around the optimal dose of ketamine and its safety in adults with moderate to severe pain from traumatic injury who are conscious, and the comparative safety of ketamine against fentanyl and morphine in this population.

Ann Emerg Med. 2015 Jan;65(1):61-2.

Expert opinion: supplementing the gaps in evidence-based medicine.

Callaham ML

Quotes:

"However, the current model of evidence-based medicine fails to address the fact that we don't have solid evidence for the majority of the care we provide, and no concrete plan for remedying that problem exists. Such a solution would take decades to achieve, and I personally think it will not ever be realized with the current approach. A good example of why is provided by reviewing any sound meta-analysis and noting how authors thoroughly search all conceivable databases for relevant articles, usually finding hundreds. However, many of these then do not meet the authors' thresholds for number of subjects, study design, adequate controls, accurate analysis, etc. This leads to most being eliminated from further assessment so that most meta-analyses are based on only a few dozen studies at best. All the rest are discarded; no doubt many of them were junk, but probably not all. We're just not smart enough to know how to extract the nuggets of truth and innovative ideas from less-than-perfect research. By the time the final careful analysis is done, we usually are left with a dozen or so articles deemed good enough to include. **In many of these cases, the final conclusion is either that the results are contradictory or the studies have too much heterogeneity and no conclusions can**
be drawn. This is so common as to be a cliché, and yet it is the best medicine can do at present."

"When you try to apply the results of these RCTS to real life, you find yourself conjecturing and extrapolating about how variables that exist in the patient in front of you, but were carefully excluded from the study, might possibly affect the outcome. Of course you don't have any really reliable method of doing that; all you can do is hope that the results from that narrow well-controlled population also apply to everyone else. As
we have found out over the years, they often don't. This limitation makes many RCTs a specific and narrow tool, focused at a microscope-level view and providing little insight about the problem as a whole."

Orthop Traumatol Surg Res. 2015 Feb;101(1):83-7

Bleeding reduction after topical application of tranexamic acid together with Betadine solution in total knee arthroplasty. A randomised controlled study.

Carvalho LH Jr, Frois Temponi E, Machado Soares LF, Gonçalves MB, Paiva Costa L, Tavares de Souza ML

INTRODUCTION: Topical application of tranexamic acid to the knee joint before closure in total knee arthroplasty reduces postoperative bleeding without increase in complication. However, it is unknown the effectiveness of topic TXA performed with other topical medications, like povidone-iodine solution.

MATERIALS AND METHODS: One hundred and twenty-five patients were randomized to receive 100mL of povidone-iodine solution (control: group A) or 1.5 (group B) and 3.0g (group C) of topical TXA in povidone-iodine solution applied into the knee before closure in total knee arthroplasty.

RESULTS: The patients in the TXA groups had higher mean postoperative hemoglobin levels (P=0.01 and P=0.03 in groups B and C, respectively) and a reduced postoperative blood loss in the TXA groups (P=0.07 and P=0.09 in groups B and C, respectively). No significant complications were observed.

DISCUSSION: In this study, topical application of tranexamic acid after total knee arthroplasty together with povidone-iodine solution results in higher postoperative hemoglobin levels and lower blood loss compared with those in the control group without other complications.

LEVEL OF EVIDENCE: I - I: high-powered prospective randomized trial.

Emerg Med Clin North Am. 2014 Nov;32(4):889-905.

Neurotrauma.

Chang WT, Badjatia N

Abstract:

Neurotrauma continues to be a significant cause of morbidity and mortality. Prevention of primary neurologic injury is a critical public health concern. Early and thorough assessment of the patient with neurotrauma with high index of suspicion of traumatic spinal cord injuries and traumatic vascular injuries requires a multidisciplinary approach involving prehospital providers, emergency physicians, neurosurgeons, and neurointensivists. Critical care management of the patient with neurotrauma is focused on the prevention of secondary injuries. Much research is still needed for potential neuroprotection therapies.

J Trauma Acute Care Surg. 2015 Jan;78(1)

Traumatic intra-abdominal hemorrhage control: has current technology tipped the balance toward a role for prehospital intervention?

Chaudery M, Clark J, Wilson MH, Bew D, Yang GZ, Darzi A

BACKGROUND: The identification and control of traumatic hemorrhage from the torso remains a major challenge and carries a significant mortality despite the reduction of transfer times. This review examines the current technologies that are available for abdominal hemorrhage control within the prehospital setting and evaluates their effectiveness.

METHODS: A systematic search of online databases was undertaken. Where appropriate, evidence was highlighted using the Oxford levels of clinical evidence. The primary outcome assessed was mortality, and secondary outcomes included blood loss and complications associated with each technique.

RESULTS: Of 89 studies, 34 met the inclusion criteria, of which 29 were preclinical in vivo trials and 5 were clinical. Techniques were subdivided into mechanical compression, endovascular control, and energy-based hemostatic devices. Gas insufflation and manual pressure techniques had no associated mortalities. There was one mortality with high intensity focused ultrasound. The intra-abdominal infiltration of foam treatment had 64% and the resuscitative endovascular balloon occlusion of the aorta had 74% mortality risk reduction. In the majority of cases, morbidity and blood loss associated with each interventional procedure were less than their respective controls.

CONCLUSION: Mortality from traumatic intra-abdominal hemorrhage could be reduced through early intervention at the scene by emerging technology. Manual pressure or the resuscitative endovascular balloon occlusion of the aorta techniques have demonstrated clinical effectiveness for the control of major vessel bleeding, although complications need to be carefully considered before advocating clinical use. At present, fast transfer to the trauma center remains paramount.

LEVEL OF EVIDENCE: Systematic review, level IV.

Ann Emerg Med. 2015 Jan;65(1):43-51.e2.

The effect of ketamine on intracranial and cerebral perfusion pressure and health outcomes: a systematic review.

Cohen L, Athaide V, Wickham ME, Doyle-Waters MM, Rose NG, Hohl CM

STUDY OBJECTIVE: We synthesize the available evidence on the effect of ketamine on intracranial and cerebral perfusion pressures, neurologic outcomes, ICU length of stay, and mortality.

METHODS: We developed a systematic search strategy and applied it to 6 electronic reference databases. We completed a gray literature search and searched medical journals as well as the bibliographies of relevant articles. We included randomized and nonrandomized prospective studies that compared the effect of ketamine with another intravenous sedative in intubated patients and reported at least 1 outcome of interest. Two authors independently performed title, abstract, and full-text reviews, and abstracted data from all studies, using standardized forms. Data from randomized controlled trials and prospective studies were synthesized in a qualitative manner because the study designs, patient populations, reported outcomes, and follow-up periods were heterogeneous. We used the Jadad score and Cochrane Risk of Bias tool to assess study quality.

RESULTS: We retrieved 4,896 titles, of which 10 studies met our inclusion criteria, reporting data on 953 patients. One study was deemed at low risk of bias in all quality assessment domains. All others were at high risk in at least 1 domain. Two of 8 studies reported small reductions in intracranial pressure within 10 minutes of ketamine administration, and 2 studies reported an increase. None of the studies reported significant differences in cerebral perfusion pressure, neurologic outcomes, ICU length of stay, or mortality.

CONCLUSION: According to the available literature, the use of ketamine in critically ill patients does not appear to adversely affect patient outcomes.

Ann Surg. 2015 Feb;261(2):390-4.

Tranexamic acid use in severely injured civilian patients and the effects on outcomes: a prospective cohort study.

Cole E, Davenport R, Willett K, Brohi K

OBJECTIVE: To characterize the relationship between tranexamic acid (TXA) use and patient outcomes in a severely injured civilian cohort, and to determine any differential effect between patients who presented with and without shock.

BACKGROUND: TXA has demonstrated survival benefits in trauma patients in an international randomized control trial and the military setting. The uptake of TXA into civilian major hemorrhage protocols (MHPs) has been variable. The evidence gap in mature civilian trauma systems is limiting the widespread use of TXA and its potential benefits on survival.

METHODS: Prospective cohort study of severely injured adult patients (Injury severity score > 15) admitted to a civilian trauma system during the adoption phase of TXA into the hospital's MHP. Outcomes measured were mortality, multiple organ failure (MOF), venous thromboembolism, infection, stroke, ventilator-free days (VFD), and length of stay.

RESULTS: Patients receiving TXA (n = 160, 42%) were more severely injured, shocked, and coagulopathic on arrival. TXA was not independently associated with any change in outcome for either the overall or nonshocked cohorts. In multivariate analysis, TXA was independently associated with a reduction in MOF [odds ratio (OR) = 0.27, confidence interval (CI): 0.10-0.73, P = 0.01] and was protective for adjusted all-cause mortality (OR = 0.16 CI: 0.03-0.86, P = 0.03) in shocked patients.

CONCLUSIONS: TXA as part of a major hemorrhage protocol within a mature civilian trauma system provides outcome benefits specifically for severely injured shocked patients.

Ann Otol Rhinol Laryngol. 2014 Nov 25. pii: 0003489414560432. [Epub ahead of print]

Intraoperative use of QuikClot during adenotonsillectomy: a prospective pediatric trial.

Derkay CS, Baydoun HA, Stone L

BACKGROUND: Achieving hemostatic control after intracapsular adenotonsillectomy with minimal cauterization may potentially lead to improved outcomes with respect to return to normal diet, normal activity, and less use of narcotic pain medications.

METHODS: A prospective, nonrandomized, consecutive series of children with obstructive tonsils and adenoids at a tertiary children's hospital was undertaken.

RESULTS: One hundred consecutive children (52 boys/48 girls) ages 0-16 (mean = 4.8, SD = 3.7, median = 4.0) years were recruited with complete data available on all 100. Mean total procedure time was 19.8 (SD = 4.3, median = 19.5) minutes, including mean total cauterization time of 155.3 (SD = 59.7 seconds, median = 143.0) (adenoids: mean = 60.9, SD = 31.5, median = 53.0; tonsils: mean = 94.5, SD = 41.9, median = 82.0) minutes. Mean estimated blood loss was 29.4 (SD = 40.9, median = 25.0) ml. There were no major complications (0/100 episodes of bleeding or dehydration after surgery). Mean return to normal diet was 3.4 (SD = 2.2, median = 3.0) days; mean return to normal activity was 2.8 (SD = 2.1, median = 3.0) days, and mean days to no further narcotics was 3.0 (SD = 2.3, median = 2.0) days. Mean days to complete recovery (normal diet, normal activity, and no narcotics) was 4.5 (SD = 2.1, median = 4.0, range: 1-10). Total cautery time was significantly correlated with time to complete recovery ($P < .05$).

CONCLUSIONS: Intracapsular microdebrider tonsillectomy with adenoidectomy utilizing QuikClot to enhance the hemostasis results in recovery times better than previously reported for this common operation in children.

Int J Surg Case Rep. 2015;6C:55-7.

Upper extremity deep vein thrombosis with tourniquet use.

Desai K, Dinh TP, Chung S, Pierpont YN, Naidu DK, Payne WG

INTRODUCTION: Upper extremity deep vein thrombosis is an increasingly important clinical finding with significant morbidity and mortality. The condition may be under-diagnosed in trauma and surgery settings.

PRESENTATION OF CASE: We present a case of upper extremity thrombosis with venous congestive symptoms secondary to the use of an operative tourniquet. A literature review and discussion of the causes of upper extremity deep vein thrombosis and the pathophysiological disturbances seen with tourniquet use are presented.

DISCUSSION: Upper extremity deep venous thrombosis is uncommon. In this case the likely cause was operative tourniquet use.

CONCLUSION: Operative tourniquet may be a risk factor in upper extremity deep vein thrombosis.

Curr Opin Anaesthesiol. 2014 Dec 12. [Epub ahead of print]

What is new in the blood bank for trauma resuscitation.

Dudaryk R, Hess AS, Varon AJ, Hess JR

PURPOSE OF REVIEW: The aim of the present review was to describe recent changes in blood banking thinking, practice, and products that affect trauma care.

RECENT FINDINGS: Prompt balanced hemostatic resuscitation of major hemorrhage from trauma improves outcome and reduces blood use. New blood processes and products can help deliver appropriate doses of procoagulant plasma and platelets quicker and more safely. New processes include holding larger inventories of thawed plasma with risk of wastage and rapid plasma thawers. New products in the blood bank include group A or group A low-titer B thawed plasma and AB or A liquid (never-frozen) plasma for resuscitation, prepooled cultured whole blood-derived platelets in plasma, and prepooled cryoprecipitate in varying pool sizes. Single-donor apheresis or pooled whole blood-derived platelets in additive solution, designed to reduce plasma-related transfusion reactions, are also increasingly available but are not an appropriate blood component for hemorrhage control resuscitation because they reduce the total amount of administered plasma coagulation factors by 10%.

SUMMARY: Early initiation of balanced massive transfusion protocols leading to hemostatic resuscitation is lifesaving. Changing blood product availability and composition will lead to higher complexity of massive transfusion. It is critical that anesthesiologists understand the composition of the available new blood products to use them correctly.

BMC Emerg Med. 2014 Feb 22;14:5.

Consensus on items and quantities of clinical equipment required to deal with a mass casualties big bang incident: a national Delphi study.

Duncan EA, Colver K, Dougall N, Swingler K, Stephenson J, Abhyankar P

BACKGROUND: Major short-notice or sudden impact incidents, which result in a large number of casualties, are rare events. However health services must be prepared to respond to such events appropriately. In the United Kingdom (UK), a mass casualties incident is when the normal response of several National Health Service organizations to a major incident, has to be supported with extraordinary measures. Having the right type and quantity of clinical equipment is essential, but planning for such emergencies is challenging. To date, the equipment stored for such events has been selected on the basis of local clinical judgment and has evolved without an explicit evidence-base. This has resulted in considerable variations in the types and quantities of clinical equipment being stored in different locations. This study aimed to develop an expert consensus opinion of the essential items and minimum quantities of clinical equipment that is required to treat 100 people at the scene of a big bang mass casualties event.

METHODS: A three round modified Delphi study was conducted with 32 experts using a specifically developed web-based platform. Individuals were invited to participate if they had personal clinical experience of providing a pre-hospital emergency medical response to a mass casualties incident, or had responsibility in health emergency planning for mass casualties incidents and were in a position of authority within the sphere of emergency health planning. Each item's importance was measured on a 5-point Likert scale. The quantity of items required was measured numerically. Data were analyzed using nonparametric statistics.

RESULTS: Experts achieved consensus on a total of 134 items (54%) on completion of the study. Experts did not reach consensus on 114 (46%) items. Median quantities and interquartile ranges of the items, and their recommended quantities were identified and are presented.

CONCLUSIONS: This study is the first to produce an expert consensus on the items and quantities of clinical equipment that are required to treat 100 people at the scene of a big bang mass casualties event. The findings can be used, both in the UK and internationally, to support decision makers in the planning of equipment for such incidents.

J Trauma Acute Care Surg. 2014 Dec;77(6):852-8

Tranexamic acid administration to pediatric trauma patients in a combat setting: the pediatric trauma and tranexamic acid study (PED-TRAX).

Eckert MJ(1), Wertin TM, Tyner SD, Nelson DW, Izenberg S, Martin MJ

BACKGROUND: Early administration of tranexamic acid (TXA) has been associated with a reduction in mortality and blood product requirements in severely injured adults. It has also shown significantly reduced blood loss and transfusion requirements in major elective pediatric surgery, but no published data have examined the use of TXA in pediatric trauma.

METHODS: This is a retrospective review of all pediatric trauma admissions to the North Atlantic Treaty Organization Role 3 hospital, Camp Bastion, Afghanistan, from 2008 to 2012. Univariate and logistic regression analyses of all patients and select subgroups were performed to identify factors associated with TXA use and mortality. Standard adult dosing of TXA was used in all patients.

RESULTS: There were 766 injured patients 18 years or younger (mean [SD] age, 11 [5] years; 88% male; 73% penetrating injury; mean [SD], Injury Severity Score [ISS], 10 [9]; mean [SD] Glasgow Coma Scale [GCS] score, 12 [4]). Of these patients, 35% required transfusion in the first 24 hours, 10% received massive transfusion, and 76% required surgery. Overall mortality was 9%. Of the 766 patients, 66 (9%) received TXA. The only independent predictors of TXA use were severe abdominal or extremity injury (Abbreviated Injury Scale [AIS] score ≥ 3) and a base deficit of greater than 5 (all $p < 0.05$). Patients who received TXA had greater injury severity, hypotension, acidosis, and coagulopathy versus the patients in the no-TXA group. After correction for demographics, injury type and severity, vitals, and laboratory parameters, TXA use was independently associated with decreased mortality among all patients (odds ratio, 0.3; $p = 0.03$) and showed similar trends for subgroups of severely injured (ISS > 15) and transfused patients. There was no significant difference in thromboembolic complications or other cardiovascular events. Propensity analysis confirmed the TXA-associated survival advantage and suggested significant improvements in discharge neurologic status as well as decreased ventilator dependence.

CONCLUSION: TXA was used in approximately 10% of pediatric combat trauma patients, typically in the setting of severe abdominal or extremity trauma and metabolic acidosis. TXA administration was independently associated with decreased mortality. There were no adverse safety- or medication-related complications identified.

LEVEL OF EVIDENCE: Therapeutic study, level IV.

J Trauma Acute Care Surg 2015 Feb;78(2): 330–335

The effects of balanced blood component resuscitation and crystalloid administration in pediatric trauma patients requiring transfusion in Afghanistan and Iraq 2002 to 2012

Edwards, Mary J. MD; Lustik, Michael B. MS; Clark, Margaret E. MD; Creamer, Kevin M. MD; Tuggle, David MD

BACKGROUND: Component balanced resuscitation and avoidance of crystalloids in traumatically injured adults requiring massive transfusion are beneficial. Evidence for children is lacking.

METHODS: After institutional review board approval was obtained, the Department of Defense Trauma Database identified 1,311 injured children 14 years or younger requiring transfusion after an injury and admitted to a deployed US military hospital from 2002 to 2012. Logistic regression determined risk factors for high-volume (>=40 mL/kg) or massive (>=70 mL/kg) transfusions. The effects of crystalloid and balanced component resuscitation in the first 24 hours were assessed.

RESULTS: Nine hundred seven patients had recorded data sufficient for analysis. Two hundred twenty-four children received high-volume transfusion, and 77 received massive transfusions. Mortality was significantly higher for massive transfusions and high-volume transfusions than others (25% vs. 10% and 19% vs. 9%, respectively). Age of less than 4 years, penetrating injury, and Injury Severity Score (ISS) greater than 15 were associated with high-volume transfusions; an ISS greater than 15 and penetrating injury were associated with massive transfusions. Increased crystalloid administration showed a significant positive association with hospital days and intensive care unit days for both massive and high-volume transfusions, as well as a significant positive association with increased ventilator days in patients with high-volume transfusions. Balanced component resuscitation was not associated with improved measured outcomes and was independently associated with a higher mortality when all transfused patients were considered.

CONCLUSION: In this cohort, heavy reliance on crystalloid for resuscitation had an adverse effect on outcomes. Balanced component resuscitation did not improve outcomes and was associated with higher mortality when all transfused patients were considered. Further study is needed regarding efficacy and clinical triggers for the implementation of massive transfusion in children.

LEVEL OF EVIDENCE: Prognostic study, level IV.

J Spec Oper Med. 2014 Winter;14(4):11-7.

Prehospital analgesia with ketamine for combat wounds: a case series.

Fisher AD, Rippee B, Shehan H, Conklin C, Mabry RL

BACKGROUND: No data have been published on the use of ketamine at the point of injury in combat.

OBJECTIVE: To provide adequate pain management for severely injured Rangers, ketamine was chosen for its analgesic and dissociative properties. Ketamine was first used in the 75th Ranger Regiment in 2005 but fell out of favor because medical providers had limited experience with its use. In 2009, with new providers and change in medic training at the battalion level, the Regiment implemented a protocol using doses of ketamine that exceed the current Tactical Combat Casualty Care recommendations.

METHODS: Medical after-action reports were reviewed for all Ranger casualties who received ketamine at the point of injury for combat wounds from January 2009 to October 2014. Patients and medics were also interviewed.

RESULTS: Unit medical protocols authorize ketamine for tourniquet pain, amputations, long-bone fractures, and pain refractory to other agents. Nine of the 11 patients were US Forces; two were local nationals (one female, one male). The average initial dose given intramuscularly was 183mg, about 2 to 3mg/kg and intravenously 65mg, about 1mg/kg. The patients also received an opioid, a benzodiazepine, or both. There was one episode of apnea that was corrected quickly with stimulus. Eight of the 11 patients required the application of at least one tourniquet; four patients needed between two and four tourniquets to control hemorrhage. Pain was assessed with a subjective 1?10 scale. Before ketamine, the pain was rated as 9?10, with one patient claiming a pain level of 8. Of the US Forces, seven of the nine had no pain after receiving ketamine and two had a pain level of four. Two of the eight had posttraumatic stress disorder.

CONCLUSIONS: In this small, retrospective sample of combat casualties, ketamine appeared to be a safe and effective battlefield analgesic.

Ann Surg. 2014 Dec;260(6):960-6.

The initial response to the Boston marathon bombing: lessons learned to prepare for the next disaster.

Gates JD, Arabian S, Biddinger P, Blansfield J, Burke P, Chung S, Fischer J, Friedman F, Gervasini A, Goralnick E, Gupta A, Larentzakis A, McMahon M, Mella J, Michaud Y, Mooney D, Rabinovici R, Sweet D, Ulrich A, Velmahos G, Weber C, Yaffe MB

OBJECTIVE: We discuss the strengths of the medical response to the Boston Marathon bombings that led to the excellent outcomes. Potential shortcomings were recognized, and lessons learned will provide a foundation for further improvements applicable to all institutions.

BACKGROUND: Multiple casualty incidents from natural or man-made incidents remain a constant global threat. Adequate preparation and the appropriate alignment of resources with immediate needs remain the key to optimal outcomes.

METHODS: A collaborative effort among Boston's trauma centers (2 level I adult, 3 combined level I adult/pediatric, 1 freestanding level I pediatric) examined the details and outcomes of the initial response. Each center entered its respective data into a central database (REDCap), and the data were analyzed to determine various prehospital and early in-hospital clinical and logistical parameters that collectively define the citywide medical response to the terrorist attack.

RESULTS: A total of 281 people were injured, and 127 patients received care at the participating trauma centers on that day. There were 3 (1%) immediate fatalities at the scene and no in-hospital mortality. A majority of the patients admitted (66.6%) suffered lower extremity soft tissue and bony injuries, and 31 had evidence for exsanguinating hemorrhage, with field tourniquets in place in 26 patients. Of the 75 patients admitted, 54 underwent urgent surgical intervention and 12 (22%) underwent amputation of a lower extremity.

CONCLUSIONS: Adequate preparation, rapid logistical response, short transport times, immediate access to operating rooms, methodical multidisciplinary care delivery, and good fortune contributed to excellent outcomes.

Prehosp Disaster Med. 2015 Feb;30(1):89-92.

Intra-articular placement of an intraosseous catheter.

Grabel Z, DePasse JM, Lareau CR, Born CT, Daniels AH

Abstract:

Gaining vascular access is essential in the resuscitation of critically ill patients. Intraosseous (IO) placement is a fundamentally important alternative to intravenous (IV) access in conditions where IV access delays resuscitation or is not possible. This case report presents a previously unreported example of prehospital misplacement of an IO catheter into the intra-articular space of the knee joint. This report serves to inform civilian and military first responders, as well as emergency medicine physicians, of intra-articular IO line placement as a potential complication of IO vascular access. Infusion of large amounts of fluid into the joint space could damage the joint and be catastrophic to a patient who needs immediate IV fluids or medications. In addition, intra-articular IO placement could result in septic arthritis of the knee.

Ann Emerg Med. 2015 Mar;65(3):248-254.e1.

The PICHFORK (Pain in Children Fentanyl or Ketamine) Trial: A Randomized Controlled Trial Comparing Intranasal Ketamine and Fentanyl for the Relief of Moderate to Severe Pain in Children With Limb Injuries.

Graudins A, Meek R, Egerton-Warburton D, Oakley E, Seith R

STUDY OBJECTIVE: We compare the analgesic effectiveness of intranasal fentanyl and ketamine in children.

METHODS: This was a double-blind, randomized, controlled trial comparing fentanyl at 1.5 μg/kg with ketamine at 1 mg/kg in children aged 3 to 13 years and weighing less than 50 kg, with isolated limb injury and pain of more than 6 of 10 at triage. The sample size was 40 in each arm. Subjects were coadministered oral ibuprofen at 10 mg/kg. The primary outcome was median pain rating reduction at 30 minutes. Secondary outcomes were pain rating reduction at 15 and 60 minutes, subjective improvement and satisfaction, University of Michigan Sedation Score, adverse events, and rescue analgesia.

RESULTS: Eighty children enrolled, and 73 were available for analysis: 37 fentanyl and 36 ketamine. Median age was 8 years; 63% were male children; median baseline pain rating was 80 mm. At 30 minutes, median reductions for ketamine and fentanyl were 45 and 40 mm, respectively (difference 5 mm; 95% confidence interval [CI] -10 to 20 mm). Reductions exceeded 20 mm for ketamine and fentanyl in 82% and 79% of patients, respectively (difference 3%; 95% CI -22% to 16%). Pain rating reduction was maintained to 60 minutes in both groups. Satisfaction was reported for ketamine and fentanyl by 83% and 72% of patients, respectively (difference 11%; 95% CI -9% to 30%). Adverse events, mainly mild, were reported for ketamine and fentanyl by 78% and 40% of patients, respectively (difference 38%; 95% CI -58% to 16%). Three ketamine patients had a moderate degree of sedation by University of Michigan Sedation Score.

CONCLUSION: Intranasal fentanyl and ketamine were associated with similar pain reduction in children with moderate to severe pain from limb injury. Ketamine was associated with more minor adverse events.

Ann Emerg Med. 2015 Jan;65(1):52-4.

Ketamine and intracranial pressure: no contraindication except hydrocephalus.

Green SM, Andolfatto G, Krauss BS

Quote:

"Myth debunking is hardly new with regard to ketamine. The early anesthesiologists who were concerned about ketamine's effect on intracranial pressure also advised that it should be routinely coadministered with a benzodiazepine and an anticholinergic. The intent of these adjuncts was to mitigate distressing recovery reactions and problematic airway secretions, respectively.(10) Both of these maxims were later disproved when it was shown that there was no benefit to midazolam prophylaxis in children (17-20) and no increase in airway problems or clinically important secretions when an anticholinergic was omitted.(20-23) Other historical concerns—enhanced laryngospasm risk with minor oropharyngeal procedures and in children aged 3 to 12 months—have similarly been shown to have been substantially overstated.(20,22,23) So after 45 years of experience with ketamine, what do we know? This sympathomimetic drug can certainly elevate intracranial pressure, but it can also decrease it. More important, the crucial measure of cerebral perfusion pressure is not adversely affected, and there are no reported cases of patients actually experiencing resulting harm, excepting those with structural barriers to normal cerebrospinal fluid flow. In the absence of evidence of such obstruction, emergency physicians should freely consider using ketamine for otherwise-indicated procedural sedation, rapid sequence intubation, and analgesia in the critically ill. It is time to put this ketamine maxim in perspective and declare it yet another misstep in the colorful lore of this unique drug."

Injury. 2015 Jan 16. pii: S0020-1383(15)00012-1.

The influence of prehospital time on trauma patients' outcome: A systematic review.

Harmsen AM, Giannakopoulos GF, Moerbeek PR, Jansma EP, Bonjer HJ, Bloemers FW

OBJECTIVE: Time is considered an essential determinant in the initial care of trauma patients. Salient tenet of trauma care is the 'golden hour', the immediate time after injury when resuscitation and stabilization are perceived to be most beneficial. Several prehospital strategies exist regarding time and transport of trauma patients. Literature shows little empirical knowledge on the exact influence of prehospital times on trauma patient outcome. The objective of this study was to systematically review the correlation between prehospital time intervals and the outcome of trauma patients.

METHODS: A systematic review was performed in MEDLINE, Embase and the Cochrane Library from inception to May 19th, 2014. Studies reporting on prehospital time intervals for emergency medical services (EMS), outcome parameters and potential confounders for trauma patients were included. Two reviewers collected data and assessed the outcomes and risk of bias using the STROBE-tool. The primary outcome was the influence on mortality.

RESULTS: Twenty level III-evidence articles were considered eligible for this systematic review. Results demonstrate a decrease in odds of mortality for the undifferentiated trauma patient when response-time or transfer-time are shorter. On the contrary increased on-scene time and total prehospital time are associated with increased odds of survival for this population. Nevertheless rapid transport does seem beneficial for patients suffering penetrating trauma, in particular hypotensive penetratingly injured patients and patients with a traumatic brain injury.

CONCLUSION: Swift transport is beneficial for patients suffering neurotrauma and the haemodynamically unstable penetratingly injured patient. For haemodynamically stable undifferentiated trauma patients, increased on-scene-time and total prehospital time does not increase odds of mortality. For undifferentiated trauma patients, focus should be on the type of care delivered prehospital and not on rapid transport.

J Arthroplasty. 2015 Feb;30(2):192-5.

Does tranexamic Acid reduce blood transfusion cost for primary total hip arthroplasty? A case-control study.

Harris RN, Moskal JT, Capps SG

Abstract:

Peri-operative tranexamic acid (TXA) significantly reduces the need for allogeneic blood transfusion in total hip arthroplasty (THA) and thus hospital costs are reduced. Before employing TXA in primary THA at our institution, facility costs were $286.90/THA for blood transfusion and required 0.45 man-hours/THA (transfusion rate 19.87%). After incorporating TXA, the cost for intravenous application was $123.38/THA for blood transfusion and TXA medication and 0.07 man-hours/THA (transfusion rate 4.39%) and the cost for topical application was $132.41/THA for blood transfusion and TXA and 0.14 man-hours/THA (transfusion rate 12.86%). TXA has the potential to reduce the facility cost per THA and the man-hours/THA from blood transfusions.

JAMA. 2015 Feb 3;313(5):471-82.

Transfusion of plasma, platelets, and red blood cells in a 1:1:1 vs a 1:1:2 ratio and mortality in patients with severe trauma: the PROPPR randomized clinical trial.

Holcomb JB, Tilley BC, Baraniuk S, Fox EE, Wade CE, Podbielski JM, del Junco DJ, Brasel KJ, Bulger EM, Callcut RA, Cohen MJ, Cotton BA, Fabian TC, Inaba K, Kerby JD, Muskat P, O'Keeffe T, Rizoli S, Robinson BR, Scalea TM, Schreiber MA, Stein DM, Weinberg JA, Callum JL, Hess JR, Matijevic N, Miller CN, Pittet JF, Hoyt DB, Pearson GD, Leroux B, van Belle G; PROPPR Study Group

IMPORTANCE: Severely injured patients experiencing hemorrhagic shock often require massive transfusion. Earlier transfusion with higher blood product ratios (plasma, platelets, and red blood cells), defined as damage control resuscitation, has been associated with improved outcomes; however, there have been no large multicenter clinical trials.

OBJECTIVE: To determine the effectiveness and safety of transfusing patients with severe trauma and major bleeding using plasma, platelets, and red blood cells in a 1:1:1 ratio compared with a 1:1:2 ratio.

DESIGN, SETTING, AND PARTICIPANTS: Pragmatic, phase 3, multisite, randomized clinical trial of 680 severely injured patients who arrived at 1 of 12 Level I trauma centers in North America directly from the scene and were predicted to require massive transfusion between August 2012 and December 2013.

INTERVENTIONS: Blood product ratios of 1:1:1 (338 patients) vs 1:1:2 (342 patients) during active resuscitation in addition to all local standard-of-care interventions (uncontrolled).

MAIN OUTCOMES AND MEASURES: Primary outcomes were 24-hour and 30-day all-cause mortality. Prespecified ancillary outcomes included time to hemostasis, blood product volumes transfused, complications, incidence of surgical procedures, and functional status.

RESULTS: No significant differences were detected in mortality at 24 hours (12.7% in 1:1:1 group vs 17.0% in 1:1:2 group; difference, -4.2% [95% CI, -9.6% to 1.1%]; P = .12) or at 30 days (22.4% vs 26.1%, respectively; difference, -3.7% [95% CI, -10.2% to 2.7%]; P = .26). Exsanguination, which was the predominant cause of death within the first 24 hours, was significantly decreased in the 1:1:1 group (9.2% vs 14.6% in 1:1:2 group; difference, -5.4% [95% CI, -10.4% to -0.5%]; P = .03). More patients in the 1:1:1 group achieved hemostasis than in the 1:1:2 group (86% vs 78%, respectively; P = .006). Despite the 1:1:1 group receiving more plasma (median of 7 U vs 5 U, P < .001) and platelets (12 U vs 6 U, P < .001) and similar amounts of red blood cells (9 U) over the first 24 hours, no differences between the 2 groups were found for the 23 prespecified complications, including acute respiratory distress syndrome, multiple organ failure, venous thromboembolism, sepsis, and transfusion-related complications.

CONCLUSIONS AND RELEVANCE: Among patients with severe trauma and major bleeding, early administration of plasma, platelets, and red blood cells in a 1:1:1 ratio compared with a 1:1:2 ratio did not result in significant differences in mortality at 24 hours or at 30 days. However, more patients in the 1:1:1 group achieved hemostasis and fewer experienced death due to exsanguination by 24 hours. Even though there was an increased use of plasma and platelets transfused in the 1:1:1 group, no other safety differences were identified between the 2 groups.

TRIAL REGISTRATION: clinicaltrials.gov Identifier: NCT01545232.

Kidney Int. 2014 Dec;86(6):1087-95.

The case for 0.9% NaCl: is the undefendable, defensible?

Ince C, Groeneveld AB

Abstract:

Although 0.9% NaCl solution is by far the most-used fluid for fluid therapy in resuscitation, it is difficult to find a paper advocating its use over other types of crystalloid solutions. Literature on the deleterious effects of 0.9% NaCl has accumulated over the last decade, but critical appraisal of alternative crystalloid solutions is lacking. As such, the literature seems to suggest that 0.9% NaCl should be avoided at all costs, whereas alternative crystalloid solutions can be used without scrutiny. The basis of this negative evaluation of 0.9% NaCl is almost exclusively its effect on acid-base homeostasis, whereas the potentially deleterious effects present in other types of crystalloids are neglected. We have the challenging task of defending the use of 0.9% NaCl and reviewing its positive attributes, while an accompanying paper will argue against the use of 0.9% NaCl. It is challenging because of the large amount of literature, including our own, showing adverse effects of 0.9% NaCl. We will discuss why 0.9% NaCl solution is the most frequently used resuscitation fluid. Although it has some deleterious effects, all fluids share common features of concern. As such the emphasis on fluid resuscitation should be on volume rather than on composition and should be accompanied by a physiological assessment of the impact of fluids. In this paper, we hope to discuss the context within which fluids, specifically 0.9% NaCl, can be given in a safe and effective manner

Journal of Trauma and Acute Care Surgery 2015;78(2):442–445

Tourniquet application training for individuals with and without a medical background in a hospital setting

Jacobs, Lenworth M. MD, MPH; Burns, Karyl J. PhD

Quote:

"**With the ever increasing incidents of shootings, stabbings, and mass-casualty events, it is time to teach hemorrhage control techniques and tourniquet application to individuals working in places frequented by the public as well as to any interested citizen.** In particular, school personnel should be targeted for hemorrhage control and tourniquet application training. Since the Sandy Hook Elementary School shootings of December 14, 2012, through June 10, 2014, there have been 74 school shootings in the United States. (15)

Although the TCCC guidelines for military tactical care are comprehensive, it seems that the models already in place by TCCC to teach military personnel tourniquet application can be formally modified to teach civilian, nonprofessional audiences tourniquet application. Modification of the TCCC guidelines for use by professional civilian first responders has been completed by the Committee for Tactical Emergency Casualty Care. (16) The National Association of Emergency Medical Technicians offers a course consistent with the principles of Tactical Emergency Casualty Care to civilian law enforcement and other professional first responders. (17) These programs could be adapted to focus on bleeding control training for civilian bystanders.

The promotion and delivery of training can perhaps be accomplished in a manner similar to how the American Heart Association and the American Red Cross promote cardiopulmonary resuscitation (CPR) to the public. However, unlike CPR training, individuals will need to be taught to first consider their personal safety. As recommended by the Hartford Consensus, the concept of ''run, hide, fight'' must be taught. (3) However, it is recognized that bystanders may wish to render assistance or that they may be sheltered in place with injured individuals during which time they can provide care."

Ann Med Surg (Lond). 2014 Mar 26;3(2):21-5.

The effects of QuikClot Combat Gauze on hemorrhage control in the presence of hemodilution and hypothermia.

Johnson D, Bates S, Nukalo S, Staub A, Hines A, Leishman T, Michel J, Sikes D, Gegel B, Burgert J

Abstract:

Hemorrhage is the leading cause of death from trauma. Intravenous (IV) fluid resuscitation in these patients may cause hemodilution and secondary hemorrhage. In addition, hypothermia may interfere with coagulation. The purposes of this study were to compare the effectiveness QuikClot Combat Gauze (QCG) to a control group on hemorrhage in a hemodiluted, hypothermic model, and to determine the effects of IV volume resuscitation on rebleeding. This was a prospective, between subjects, experimental design. Yorkshire swine were randomly assigned to two groups: QCG (n = 13) or control (n = 13). The subjects were anesthetized. Hypothermia (temperature of ≤34.0 °C) was induced; 30% of their blood volume was exsanguinated. A 3:1 replacement of Lactated Ringer's was administered to dilute the remaining blood. The femoral artery and vein were transected. After 1 min of uncontrolled hemorrhage, QCG was placed into the wound followed by standard wound packing. The control group underwent the same procedures without QCG. After 5 min of manual pressure, a pressure dressing was applied. Following 30 min, the dressings were removed, and blood loss was calculated. For subjects achieving hemostasis, up to 5 L of IV fluid was administered or until bleeding occurred, which was defined as >2% total blood volume. **The QCG had significantly less hemorrhage than the control (QCG = 30 ± 99 mL; control = 404 ± 406 mL) (p = .004).** Further, the QCG group was able to tolerate more resuscitation fluid before hemorrhage (QCG = 4615 ± 1386 mL; control = 846 ± 1836) (p = .000).

J Spec Oper Med. 2014 Winter;14(4):7-10.

Tactical hemorrhage control case ctudies using a point-of-care mechanical direct pressure device.

Kirkpatrick AW, McKee JL

Abstract:

In 2012, a new hemorrhage control device entered the market, and by May 2013, the iTClamp 50 had acquired US Food and Drug Administration approval. The authors describe the use of the iTClamp 50 and present two case studies in which the iTClamp 50 was successfully used in the military environment to control potentially fatal hemorrhage.

Prehosp Emerg Care. 2014 Nov 24. [Epub ahead of print]

U.S. Military Use of Tourniquets from 2001 to 2010.

Kragh JF Jr, Dubick MA, Aden JK, McKeague AL, Rasmussen TE, Baer DG, Blackbourne LH

Objective. This study was conducted to associate tourniquet use and survival in casualty care over a decade of war in order to provide evidence to emergency medical personnel for the implementation and efficacy of tourniquet use in a large trauma system. Methods. This survey is a retrospective review of data extracted from a trauma registry. The decade (2001-2010) outcome trend analysis of tourniquet use in the current wars was made in order to associate tourniquet use and survival in an observational cohort design.

Results. Of 4,297 casualties with extremity trauma in the total study, 30% (1,272/4,297) had tourniquet use and 70% (3,025/4,297) did not. For all 4,297 casualties, the proportion of casualties with severe or critical extremity Abbreviated Injury Scales (AIS) increased during the years surveyed ($p < 0.0001$); the mean annual Injury Severity Score (ISS) rose from 13 to 21. Tourniquet use increased during the decade by almost tenfold from 4 to nearly 40% ($p < 0.0001$). Survival for casualties with isolated extremity injury varied by injury severity; the survival rate for AIS 3 (serious) was 98%, the rate for AIS 4 (severe) was 76%, and the rate for AIS 5 (critical) was 0%. Survival rates increased for casualties with injuries amenable to tourniquets but decreased for extremity injuries too proximal for tourniquets.

Conclusions. Average injury severity increased during the decade of war for casualties with extremity injury. Both tourniquet use rates and casualty survival rates rose when injuries were amenable to tourniquets.

Prehosp Emerg Care. 2014 Dec 12. [Epub ahead of print]

Performance of Junctional Tourniquets in Normal Human Volunteers.

Kragh JF, Kotwal RS, Cap AP, Aden JK, Walters TJ, Kheirabadi BS, Gerhardt RT, DeLorenzo RA, Pidcoke HF, Cancio LC

Background. Inguinal bleeding is a common and preventable cause of death on the battlefield. Four FDA-cleared junctional tourniquets (Combat Ready Clamp [CRoC], Abdominal Aortic and Junctional Tourniquet [AAJT], Junctional Emergency Treatment Tool [JETT], and SAM Junctional Tourniquet [SJT]) were assessed in a laboratory on volunteers in order to describe differential performance of models.

Objective. To examine safety and effectiveness of junctional tourniquets in order to inform the discussions of device selection for possible fielding to military units. Methods. The experiment measured safety and effectiveness parameters over timed, repeated applications. Lower extremity pulses were measured in 10 volunteers before and after junctional tourniquet application aimed at stopping the distal pulse assessed by Doppler auscultation. Safety was determined as the absence of adverse events during the time of application. Results. The CRoC, SJT, and JETT were most effective; their effectiveness did not differ ($p > 0.05$). All tourniquets were applied safely and successfully in at least one instance each but pain varied by model. Subjects assessed the CRoC as most tolerable. The CRoC and SJT were the fastest to apply. Users ranked CRoC and SJT equally as performing best.

Conclusion. The CRoC and SJT were the best-performing junctional tourniquets using this model.

Ann Emerg Med. 2015 Mar;65(3):290-6

Transfusion for Shock in US Military War Casualties With and Without Tourniquet Use.

Kragh JF Jr, Nam JJ, Berry KA, Mase VJ Jr, Aden JK 3rd, Walters TJ, Dubick MA, Baer DG, Wade CE, Blackbourne LH

STUDY OBJECTIVE: We assess whether emergency tourniquet use for transfused war casualties admitted to military hospitals is associated with survival.

METHODS: A retrospective review of trauma registry data was made of US casualties in Afghanistan and Iraq. Patients with major limb trauma, transfusion, and tourniquet use were compared with similar patients who did not receive tourniquet use. A propensity-matching analysis was performed by stratifying for injury type and severity by tourniquet-use status. Additionally, direct comparison without propensity matching was made between tourniquet use and no-tourniquet use groups.

RESULTS: There were 720 casualties in the tourniquet use and 693 in the no-tourniquet use groups. Of the 1,413 casualties, 66% (928) also had nonextremity injury. Casualties with tourniquet use had worse signs of hemorrhagic shock (admission base deficit, admission hemoglobin, admission pulse, and transfusion units required) than those without. Survival rates were similar between the 2 groups (1% difference; 95% confidence interval -2.5% to 4.2%), but casualties who received tourniquets had worse shock and received more blood products. In propensity-matched casualties, survival rates were not different (2% difference; 95% confidence interval -6.7% to 2.7%) between the 2 groups.

CONCLUSION: Tourniquet use was associated with worse shock and more transfusion requirements among hospital-admitted casualties, yet those who received tourniquets had survival rates similar to those of comparable, transfused casualties who did not receive tourniquets.

PREHOSPITAL EMERGENCY CARE 2015;Early Online:1–6

Tourniquet use in a civilian emergency medical services setting: a descriptive analysis of the Boston EMS experience.

Ricky C. Kue, MD, MPH, Elizabeth S. Temin, MD, MPH, Scott G.Weiner, MD, MPH, Jonathan Gates, MD, MBA, Melissa H. Coleman, MD, Jonathan Fisher, MD, MPH, Sophia Dyer, MD

Introduction. Despite the resurgence of early tourniquet use for control of exsanguinating limb hemorrhage in the military setting, its appropriate role in civilian emergency medical services (EMS) has been less clear.

Objective. To describe the experience of prehospital tourniquet use in an urban, civilian EMS setting.

Methods. A retrospective review of EMS prehospital care reports was performed from January 1, 2005 to December 1, 2012. Data, including the time duration of prehospital tourniquet placement, EMS scene time, mechanisms of injury, and patient demographics, underwent descriptive analysis. Outcomes data for participating receiving hospitals were also reviewed.

Results. Ninety-eight cases of prehospital tourniquet use were identified. The most common causes of injury were penetrating gunshot or stabbing wounds (67.4%, 66/98); 7.1% (7/98) of cases were due to blunt trauma; 23.5% (23/98) of cases were from nontraumatic hemorrhage related to uncontrolled hemodialysis shunt or wound bleeding; 45.4% (44/97) of cases were placed on a lower extremity; 54.6% (53/97) were placed on an upper extremity. Placement was successful in hemorrhage control in 91% (87/95, 95% CI: 85.9–97.3%) of cases. The average prehospital tourniquet placement time was 14.9 minutes. Half of all tourniquet placements were performed by basic life support providers. Hospital follow-up was available for 96.9% (95/98) of cases. Of these, the tourniquet was removed by EMS in 3.2% (3/95), the emergency department in 54.7% (52/95), or in the operating room (OR) in 31.6% (30/95) of the time; 46.7% (14/30) of these OR cases had a documented vascular injury needing repair. Ten deaths with hospital follow-up data were identified, none of which were due to tourniquet use. There was one case of forearm numbness potentially due to nerve injury and one case with potential vascular complication, representing an overall complication
rate of 2.1% (2/95).

Conclusion. The early use of tourniquets for extremity hemorrhage in an urban civilian EMS setting appears to be safe, with complications occurring infrequently.

Key words: tourniquet; emergency medical services; trauma; hemorrhage

J Spec Oper Med. 2014 Winter;14(4):48-52.

Predicting When to Administer Blood Products During Tactical Aeromedical Evacuation: Evaluation of a US Model.

Le Clerc S, McClennan J, Kyle A, Mann-Salinas E, Russell R

Abstract:

The administration of blood products to battlefield casualties in the prehospital arena has contributed significantly to the survival of critically injured patients in Afghanistan over the past 5 years. Given as part of an established military "chain of survival," blood product administration has represented a step-change improvement in capability for both UK and US tactical aeromedical evacuation (TACEVAC) platforms. The authors explore current concepts, analyzing and exploring themes associated with early use of blood products (fresh frozen plasma [FFP] and red blood cells [RBCs]), and they compare and evaluate a US/UK study analyzing the differences and recommending future strategy. The subject matter expert (SME) consensus guidelines developed for use by the US Army Air Ambulance units commonly known as call sign "DUSTOFF." These TACEVAC assets in Afghanistan were validated in this retrospective study. Using statistical analysis, the authors were able to ascertain that the current DUSTOFF SME-derived guidelines offer a sensitivity of 63.04% and a specificity of 89.07%. By adjusting the indicators to include a single above-ankle amputation with a systolic blood pressure (SBP) less than 90mmHg and pulse greater than 120/min, the sensitivity could be increased to 67.39% while maintaining the specificity at 89.07%. In our data set, a single amputation above the ankle, in combination with an SBP of less than 100mmHg and a pulse of greater than 120/min, increased the sensitivity to 76% but with a slight drop in specificity to 86%. Further study of military prehospital casualty data is under way to identify additional physiological parameters that will allow simple scoring tools in the remote setting to guide the administration of prehospital blood products.

J Arthroplasty. 2014 Dec 5. pii: S0883-5403(14)00914-0. doi: 10.1016/j.arth.2014.12.001. [Epub ahead of print]

The Efficacy of Combined Use of Intraarticular and Intravenous Tranexamic Acid on Reducing Blood Loss and Transfusion Rate in Total Knee Arthroplasty.

Lin SY, Chen CH, Fu YC, Huang PJ, Chang JK, Huang HT

Abstract:

The purpose of this study is to investigate the effect of preoperative intravenous (IV) and intraoperative topical administration of tranexamic acid (TXA) in total knee arthroplasty (TKA). A total of 120 patients were and randomly allocated to either topical group, combined group, or control group. The mean total blood loss was lower in the combined and topical groups (705mL and 579mL, respectively) in comparison with control group (949mL, $P<0.001$). There was a significant difference in transfusion rate among groups ($P=0.009$). The postoperative hemoglobin drop and total drain amount were significantly less in the combined group compared to other groups. In conclusion, combining preoperative IV injection and topical administration of TXA can effectively reduce blood loss and transfusion rate.

Kidney Int. 2014 Dec;86(6):1096-105.

Should chloride-rich crystalloids remain the mainstay of fluid resuscitation to prevent 'pre-renal' acute kidney injury?: con.

Lobo DN, Awad S

Abstract:

The high chloride content of 0.9% saline leads to adverse pathophysiological effects in both animals and healthy human volunteers, changes not seen after balanced crystalloids. Small randomized trials confirm that the hyperchloremic acidosis induced by saline also occurs in patients, but no clinical outcome benefit was demonstrable when compared with balanced crystalloids, perhaps due to a type II error. A strong signal is emerging from recent large propensity-matched and cohort studies for the adverse effects that 0.9% saline has on the clinical outcome in surgical and critically ill patients when compared with balanced crystalloids. Major complications are the increased incidence of acute kidney injury and the need for renal replacement therapy, and that pathological hyperchloremia may increase postoperative mortality. However, there are no large-scale randomized trials comparing 0.9% saline with balanced crystalloids. Some balanced crystalloids are hypo-osmolar and may not be suitable for neurosurgical patients because of their propensity to cause brain edema. Saline may be the solution of choice used for the resuscitation of patients with alkalosis and hypochloremia. **Nevertheless, there is evidence to suggest that balanced crystalloids cause less detriment to renal function than 0.9% saline, with perhaps better clinical outcome. Hence, we argue that chloride-rich crystalloids such as 0.9% saline should be replaced with balanced crystalloids as the mainstay of fluid resuscitation to prevent 'pre-renal' acute kidney injury.**

Ann Emerg Med. 2015 Jan;65(1):55-6.

When used for sedation, does ketamine increase intracranial pressure more than fentanyl or sufentanil?

Loflin R, Koyfman A

Results:

"The authors identified 120 potential studies, of which 5 met inclusion criteria; the total number of subjects across all studies was 198. The authors noted clinical heterogeneity among the included studies, which spanned 17 years, with 4 of the studies performed in head-injured, mechanically ventilated adult patients in European ICUs and 1 study performed in spontaneously breathing pediatric patients without head injury who were undergoing lumbar puncture in the United States. Intracranial pressure was measured by various methods among the studies, including frontal ventriculostomy and opening pressure on lumbar puncture, or the specific method was not provided. The study quality was also variable, with 3 of the studies having unclear allocation concealment and 1 study that was not blinded. **Given these limitations, the results suggest no difference in mean intracranial pressure or cerebral perfusion pressure in patients receiving ketamine compared with opioids.** The results were robust to sensitivity and subgroup analyses with regard to mechanical versus spontaneous ventilation, concomitant medications, and secular trends in ICU care."

J Spec Oper Med. 2014 Winter;14(4):136-8.

Management of open chest wounds in tactical emergency casualty care: application of vented versus nonvented chest seals.

Margolis AM, Tang N, Levy MJ, Callaway DW

Quote:

"Placement of a chest seal is the first step in the field management of open chest wounds and presumed pneumothoraces. Independent of whether the seal is vented, a chest seal provides initial treatment of respiratory compromise associated with the violation of the chest cavity and resultant hypoxia. It is the position of C-TECC that for agencies that are developing new policy, procedures, and protocols for the management of penetrating chest trauma, vented chest seals likely confer additional clinical benefit without a significant difference in cost or compromise and durability. Alternatively, if an agency is already deploying a nonvented chest seal or other occlusive dressing, C-TECC currently recommends using a tiered approach for chest decompression that includes serial reassessments, burping, applied dressings, and needle decompression when signs and symptoms indicating tension physiology develop."

J Trauma Acute Care Surg. 2014 Dec;77(6):811-7; discussion 817

Hyperfibrinolysis, physiologic fibrinolysis, and fibrinolysis shutdown: the spectrum of postinjury fibrinolysis and relevance to antifibrinolytic therapy.

Moore HB, Moore EE, Gonzalez E, Chapman MP, Chin TL, Silliman CC, Banerjee A, Sauaia A

BACKGROUND: Fibrinolysis is a physiologic process maintaining patency of the microvasculature. Maladaptive overactivation of this essential function (hyperfibrinolysis) is proposed as a pathologic mechanism of trauma-induced coagulopathy. Conversely, the shutdown of fibrinolysis has also been observed as a pathologic phenomenon. We hypothesize that there is a level of fibrinolysis between these two extremes that have a survival benefit for the severely injured patients.

METHODS: Thrombelastography and clinical data were prospectively collected on trauma patients admitted to our Level I trauma center from 2010 to 2013. Patients with an Injury Severity Score (ISS) of 15 or greater were evaluated. The percentage of fibrinolysis at 30 minutes by thrombelastography was used to stratify three groups as follows: hyperfibrinolysis (≥3%), physiologic (0.081-2.9%), and shutdown (0-0.08%). The threshold for hyperfibrinolysis was based on existing literature. The remaining groups were established on a cutoff of 0.8%, determined by the highest point of specificity and sensitivity for mortality on a receiver operating characteristic curve.

RESULTS: One hundred eighty patients were included in the study. The median age was 42 years (interquartile range [IQR], 28-55 years), 70% were male, and 21% had penetrating injuries. The median ISS was 29 (IQR, 22-36), and the median base deficit was 9 mEq/L (IQR, 6-13 mEq/L). Distribution of fibrinolysis was as follows: shutdown, 64% (115 of 180); physiologic, 18% (32 of 180); and hyperfibrinolysis, 18% (33 of 180). Mortality rates were lower for the physiologic group (3%) compared with the hyperfibrinolysis (44%) and shutdown (17%) groups ($p = 0.001$).

CONCLUSION: We have identified a U-shaped distribution of death related to the fibrinolysis system in response to major trauma, with a nadir in mortality, with level of fibrinolysis after 30 minutes between 0.81% and 2.9%. Exogenous inhibition of the fibrinolysis system in severely injured patients requires careful selection, as it may have an adverse affect on survival.

LEVEL OF EVIDENCE: Prognostic study, level III.

J Trauma Acute Care Surg. 2014 Mar;76(3):791-7.

Evaluation of the iTClamp 50 in a human cadaver model of severe compressible bleeding.

Mottet K, Filips D, Logsetty S, Atkinson I

BACKGROUND: Uncontrolled hemorrhage is a significant cause of preventable death. The iTClamp 50 is a temporary wound closure device designed to control bleeding within seconds of an injury. This study evaluates the ability of the iTClamp to control compressible bleeding in a human cadaver model.

METHODS: Sterile water was pumped through the major arteries to mimic blood flow. Full-thickness, elliptical segments of skin were excised; arteriotomies or complete transections were performed on the major arteries in the thigh (distal femoral), groin (common femoral), neck (carotid), and arm (brachial). Scalp wounds were created by making a 4.4-cm linear incision to the level of the bone. Fluid losses from the wounds were compared with and without the iTClamp applied and with and without movement of the cadaver. Angiographic images of pressure-injected contrast were obtained of the neck and groin wounds. Hematoma volumes and needle penetration depth into the skin were measured.

RESULTS: In all wounds tested, application of the iTClamp significantly reduced fluid loss in all wounds studied ($p < 0.05$), and movement of the cadaver did not affect the function of the iTClamp. For example, in one groin wound, the average fluid loss during 1 minute was reduced from 728.4 ± 79.3 mL to 5.6 ± 3.4 mL. Distal flow was maintained during application of the iTClamp, as illustrated in angiographic images obtained of the iTClamp applied to the neck and groin wounds. The average needle penetration depth into the skin was 4.21 ± 0.02 mm; furthermore, the iTClamp did not cause any visible skin damage or skin tearing.

CONCLUSION: The iTClamp is effective at controlling fluid loss from open wounds within multiple compressible areas. The iTClamp does not occlude distal flow, and aside from small needle punctures, there was no other visible skin damage or skin tearing.

Air Med J. 2015 Jan-Feb;34(1):37-9.

Rural trauma patients cannot wait: tranexamic acid administration by helicopter emergency medical services.

Mrochuk M, ÓDochartaigh D, Chang E

OBJECTIVE: Tranexamic acid (TXA) administration has been shown to reduce mortality in bleeding trauma patients if given in the hospital within 3 hours of injury. Its use has been theorized to be of benefit in the prehospital environment. This study evaluates the timing of TXA administration in a critical care helicopter emergency medical service (HEMS) versus that of the destination trauma hospital.

METHODS: We performed a retrospective chart review of consecutive trauma patients who were given TXA during HEMS transfer. The time of injury to HEMS arrival, TXA administration, and hospital arrival was collected.

RESULTS: Twenty complete records were identified in which TXA was administered by HEMS: 11 scene calls and 9 interfacility transfers. The median time in minutes from the time of injury to HEMS arrival, TXA administration, and receiving hospital arrival was 90, 114, and 171, respectively, for scene calls and 134, 173, and 224, respectively, for interfacility transfers.

CONCLUSION: TXA must be administered before arrival at a trauma hospital to meet the recommendation of administration within 3 hours of injury for all patients transferred between facilities and for many patients transported from a trauma scene.

Mil Med. 2014 Nov;179(11):1254-7.

The Israeli Defense Force experience with intraosseous access.

Nadler R, Gendler S, Chen J, Lending G, Abramovitch A, Glassberg E

INTRODUCTION: Obtaining vascular access is of paramount importance in trauma care. When peripheral venous access is indicated but cannot be obtained, the intraosseous route represents an alternative. The Bone Injection Gun (BIG) is the device used for intraosseous access by the Israeli Defense Force (IDF). The purpose of this study is to assess the success rate of intraosseous access using this device.

METHOD: The IDF Trauma Registry from 1999 to 2012 was searched for patients for whom at least 1 attempt at intraosseous access was made.

RESULTS: 37 attempts at intraosseous access were identified in 30 patients. Overall success rate was 50%. No differences in success rates were identified between different care givers. Overall mortality was 87%.

CONCLUSION: The use of BIG in the IDF was associated with a low success rate at obtaining intraosseous access. Although inability to achieve peripheral venous access can be considered an indicator for poor prognosis, the high mortality rate for patients treated with BIG can also stand for the provider's low confidence in using this tool, making its use a last resort. This study serves as an example to ongoing learning process that includes data collection, analysis, and improvement, constantly taking place in the IDF.

J Trauma Acute Care Surg. 2015 Jan;78(1):132-5.

Nonoperative management of hemodynamically unstable abdominal trauma patients with angioembolization and resuscitative endovascular balloon occlusion of the aorta.

Ogura T, Lefor AT, Nakano M, Izawa Y, Morita H

BACKGROUND: Many hemodynamically stable patients with blunt abdominal solid organ injuries are successfully managed nonoperatively, while unstable patients often require urgent laparotomy. Recently, therapeutic angioembolization has been used in the treatment of intra-abdominal hemorrhage in hemodynamically unstable patients. We undertook this study to review a series of hemodynamically unstable patients with abdominal solid organ injuries managed nonoperatively with angioembolization and resuscitative endovascular balloon occlusion of the aorta.

METHODS: The institutional review board approved this study. All patients were appropriately resuscitated with transfusions, and angiography was performed after computed tomography. Resuscitative endovascular balloon occlusion of the aorta was performed before computed tomography in all patients.

RESULTS: Seven patients underwent resuscitative endovascular balloon occlusion of the aorta following severe blunt abdominal trauma. The 28-day survival rate was 86% (6 of 7). There were no complications related to the procedure.

CONCLUSION: We describe the first clinical series of hemodynamically unstable patients with abdominal solid organ injury treated nonoperatively with angioembolization and resuscitative endovascular balloon occlusion of the aorta. Survival rate was 86%, supporting the need for further study of this modality as an adjunct to the nonoperative management of patients with severe traumatic injuries.

Journal of Trauma and Acute Care Surgery; Feb 2015 78(2): 295–299

Intraosseous infusion rates under high pressure: A cadaveric comparison of anatomic sites

Pasley, Jason DO; Miller, Catriona H.T. PhD; DuBose, Joseph J. MD; Shackelford, Stacy A. MD; Fang, Raymond MD; Boswell, Kimberly MD; Halcome, Chuck; Casey, Jonathan MSN; Cotter, Michael; Matsuura, Michael MD; Relph, Nathaniel; Tarmey, Nicholas T. MBChB; Stein, Deborah M. MD, MPH

BACKGROUND: When traditional vascular access methods fail, emergency access through the intraosseous (IO) route can be lifesaving. Fluids, medications, and blood components have all been delivered through these devices. We sought to compare the performance of IO devices placed in the sternum, humeral head, and proximal tibia using a fresh human cadaver model.

METHODS: Commercially available IO infusion devices were placed into fresh human cadavers: sternum (FAST-1), humeral head (EZ-IO), and proximal tibia (EZ-IO). Sequentially, the volume of 0.9% saline infused into each site under 300 mm Hg pressure over 5 minutes was measured. Rates of successful initial IO device placement and subjective observations related to the devices were also recorded.

RESULTS: For 16 cadavers over a 5-minute bolus infusion, the total volume of fluid infused at the three IO access sites was 469 (190) mL for the sternum, 286 (218) mL for the humerus, and 154 (94) mL for the tibia. Thus, the mean (SD) flow rate infused at each site was as follows: (1) sternum, 93.7 (37.9) mL/min; (2) humerus, 57.1 (43.5) mL/min; and (3) tibia, 30.7 (18.7) mL/min. The tibial site had the greatest number of insertion difficulties.

CONCLUSION: This is the first study comparing the rate of flow at the three most clinically used adult IO infusion sites in an adult human cadaver model. Our results showed that the sternal site for IO access provided the most consistent and highest flow rate compared with the humeral and tibial insertion sites. The average flow rate in the sternum was 1.6 times greater than in the humerus and 3.1 times greater than in the tibia.

Wilderness Environ Med. 2014 Dec;25(4 Suppl):S19-29.

Wilderness Medical Society practice guidelines for treatment of eye injuries and illnesses in the wilderness: 2014 update.

Paterson R, Drake B, Tabin G, Butler FK Jr, Cushing T

Abstract:

A panel convened to develop an evidence-based set of guidelines for the recognition and treatment of eye injuries and illnesses that may occur in the wilderness. These guidelines are meant to serve as a tool to help wilderness providers accurately identify and subsequently treat or evacuate for a variety of ophthalmologic complaints. Recommendations are graded on the basis of the quality of their supporting evidence and the balance between risks and benefits according to criteria developed by the American College of Chest Physicians. This is an updated version of the original guidelines published in Wilderness & Environmental Medicine 2012;23(4):325-336.

Injury. 2014 Nov 27. pii: S0020-1383(14)00610-X. doi: 10.1016/j.injury.2014.11.024. [Epub ahead of print]

Indications and results of emergency surgical airways performed by a physician-staffed helicopter emergency service.

Peters J, Bruijstens L, van der Ploeg J, Tan E, Hoogerwerf N, Edwards M

BACKGROUND: Airway management is essential in critically ill or injured patients. In a "can't intubate, can't oxygenate" scenario, an emergency surgical airway (ESA), similar to a cricothyroidotomy, is the final step in airway management. This procedure is infrequently performed in the prehospital or clinical setting. The incidence of ESA may differ between physician- and non-physician-staffed emergency medical services (EMS). We examined the indications and results of ESA procedures among our physician-staffed EMS compared with non-physician-staffed services.

METHODS: Data for all forms of airway management were obtained from our EMS providers and analyzed and compared with data from non-physician-staffed EMS found in the literature.

RESULTS: Among 1871 patients requiring a secured airway, the incidence of a surgical airway was 1.6% (n=30). Fourteen patients received a primary ESA. In 16 patients, a secondary ESA was required after failed endotracheal intubation. The total prehospital ESA tracheal access success rate was 96.7%.

CONCLUSION: The incidence of ESA in our patient population was low compared with those reported in the literature from non-physician-staffed EMS. Advanced intubation skills might be a contributing factor, thus reducing the number of ESAs required.

Anesth Analg. 2014 Sep;119(3):731-6.

Intravenous starches: is suspension the best solution?

Raghunathan K, Miller TE, Shaw AD

CONCLUSIONS:

Careful consideration of quantitative and qualitative toxicities is needed. Timing of therapy, volume context, fluid type, patient comorbidities, mortality risk, and the type of
surgical procedure (effects on the endothelial glycocalyx) are all relevant but beyond the scope of this discussion. There may yet be a role for perioperative HES but precisely who will benefit and how much is unclear. To work within the recent regulatory restrictions placed on HES, clinicians may find the following considerations helpful:

- Define the problem that IV fluid therapy is intended to solve. For example, volume responsiveness does not equal volume deficiency. Conversely, volume deficiency should be assessed by testing for volume responsiveness rather than assumed based on changes in blood pressure or urine output.
- Define the goal of therapy. This may vary according to the clinical setting. With active bleeding, for example, the goal may be to allow moderate hypotension until surgical control is established rather than to volume load with crystalloids. In contrast, the goal with preemptive GDT is to fluid load for maximal stroke volume.
- Determine the type of fluid to use. We believe that balanced crystalloid solutions may be a safe default for most situations. Colloids may be indicated in specific settings such as to avoid large crystalloid volumes during the management of acute hypovolemia or in preemptive GDT.
- Delineate starting and stopping points with monitoring for response during treatment. This implies measuring end-organ perfusion, recognizing that this varies by organ.

J Trauma Acute Care Surg. 2015 Mar;78(3):607-13.

Diagnosis and deployment of a self-expanding foam for abdominal exsanguination: translational questions for human use.

Rago AP, Marini J, Duggan MJ, Beagle J, Runyan G, Sharma U, Peev M, King DR

BACKGROUND: We have previously described the hemostatic efficacy of a self-expanding polyurethane foam in lethal venous and arterial hemorrhage models. A number of critical translational questions remain, including prehospital diagnosis of hemorrhage, use with diaphragmatic injury, effects on spontaneous respiration, the role of omentum, and presence of a laparotomy on foam properties.

METHODS: In Experiment 1, diagnostic blood aspiration was attempted through a Veress needle before foam deployment during exsanguination (n = 53). In Experiment 2: a lethal hepatoportal injury/diaphragmatic laceration was created followed by foam (n = 6) or resuscitation (n = 10). In Experiment 3, the foam was deployed in naïve, spontaneously breathing animals (n = 7), and respiration was monitored. In Experiments 4 and 5, the foam was deployed above (n = 6) and below the omentum (n = 6) and in naïve animals (n = 6). Intra-abdominal pressure and organ contact were assessed.

RESULTS: In Experiment 1, blood was successfully aspirated from a Veress needle in 70% of lethal iliac artery injuries and 100% of lethal hepatoportal injuries. In Experiment 2, in the presence of a diaphragm injury, between 0 cc and 110 cc of foam was found within the pleural space. Foam treatment resulted in a survival benefit relative to the control group at 1 hour (p = 0.03). In Experiment 3, hypercarbia was observed: mean (SD) Pco2 was 48 (9.4) mm Hg at baseline and 65 (14) mm Hg at 60 minutes. In Experiment 4, abdominal omentum seemed to influence organ contact and transport in two foam deployments. In Experiment 5, there was no difference in intra-abdominal pressure following foam deployment in the absence of a midline laparotomy.

CONCLUSION: In a series of large animal studies, we addressed key translational issues surrounding safe use of foam treatment. These additional data, from diagnosis to deployment, will guide human experiences with foam treatment for massive abdominal exsanguination where no other treatments are available.

Indian J Anaesth. 2014 Sep;58(5):609-15.

Transfusion practices in trauma.

Ramakrishnan VT, Cattamanchi S

Abstract:

Resuscitation of a severely traumatised patient with the administration of crystalloids, or colloids along with blood products is a common transfusion practice in trauma patients. The determination of this review article is to update on current transfusion practices in trauma. A search of PubMed, Google Scholar, and bibliographies of published studies were conducted using a combination of key-words. Recent articles addressing the transfusion practises in trauma from 2000 to 2014 were identified and reviewed. Trauma induced consumption and dilution of clotting factors, acidosis and hypothermia in a severely injured patient commonly causes trauma-induced coagulopathy. Early infusion of blood products and early control of bleeding decreases trauma-induced coagulopathy. Hypothermia and dilutional coagulopathy are associated with infusion of large volumes of crystalloids. Hence, the predominant focus is on damage control resuscitation, which is a combination of permissive hypotension, haemorrhage control and haemostatic resuscitation. Massive transfusion protocols improve survival in severely injured patients. Early recognition that the patient will need massive blood transfusion will limit the use of crystalloids. Initially during resuscitation, fresh frozen plasma, packed red blood cells (PRBCs) and platelets should be transfused in the ratio of 1:1:1 in severely injured patients. Fresh whole blood can be an alternative in patients who need a transfusion of 1:1:1 thawed plasma, PRBCs and platelets. Close monitoring of bleeding and point of care coagulation tests are employed, to allow goal-directed plasma, PRBCs and platelets transfusions, in order to decrease the risk of transfusion-related acute lung injury.

Army AL & T 2015; Jan-Mar;80-85

In The 'Golden Hour' - combat casualty care research drives innovation to improve survivability and reimagine future combat care.

RasmussenT, Baer D, Doll B, Caravalho Jr

QUOTE:

"….the U.S. Combat Casualty Care Research Program (CCCRP) is charged with driving innovation in trauma care to support Force 2025 and Beyond. Central to this effort is a reappraisal of the time between injury and life-sustaining medical treatment—known as the "golden hour" standard. In the past, the end of the golden hour was marked by the time a patient arrived at a fixed facility or traditional echelon of care. Now that advanced resuscitative capability can be pushed closer to the point of injury, regardless of setting or location, we must redefine the golden hour end point…..The CCCRP guides the nation's rejuvenated investment in requirements-driven military trauma research. The program, co-located at Fort Detrick, MD, and the Defense Health Headquarters, Falls Church, VA, plans, programs, budgets and oversees the execution of approximately $300 million in requirements-driven research aimed at producing knowledge and materiel solutions for the full spectrum of military trauma care, including at the point of injury, en route in rotary and fixed-wing transport, and in Level II through Level V facilities. "

CONCLUSION:

"The CCCRP's uniquely "top-down," requirements-driven medical research is recognized nationally as an effective alternative to other federal entities that fund investigator-initiated research without specific urgency. CCCRP is essential, as no other entity—federal or private—funds trauma research. As the program sets its eyes on 2025 and beyond, including reappraisal of the golden hour, its efforts will continue to be patient- and physiology-focused, aimed at developing solutions to meet warfighters' needs and enable an agile joint force in future combat missions."

Crit Care. 2014 Dec 13;18(6):685. [Epub ahead of print]

Mechanism of action of tranexamic acid in bleeding trauma patients: an exploratory analysis of data from the CRASH-2 trial.

Roberts I, Prieto-Merino D, Manno D

Introduction: To investigate the mechanism of action of tranexamic acid (TXA) in bleeding trauma patients, we examined the timing of its effect on mortality. We hypothesised that if TXA reduces mortality by decreasing blood loss, its effect should be greatest on the day of the injury when bleeding is most profuse. However, if TXA reduces mortality via an anti-inflammatory mechanism its effect should be greater over the subsequent days.

Methods: Exploratory analysis, including per-protocol analyses, of data from the CRASH-2 trial, a randomised placebo controlled trial of the effect of TXA on mortality in 20,211 trauma patients with, or at risk of, significant bleeding. We examined hazard ratios (HR) and 95% confidence intervals for all-cause mortality, deaths due to bleeding and non-bleeding deaths, according to the day since injury. The CRASH-2 trial is registered as ISRCTN86750102 and ClinicalTrials.gov NCT00375258.

Results: The effect of TXA on mortality is greatest for deaths occurring on the day of the injury (HR all-cause mortality =0.83, 0.73 to 0.93). This survival benefit is only evident in patients in whom treatment is initiated within 3 hours of their injury (HR ¿3 hours =0.78, 0.68 to 0.90; HR >3 hours =1.02, 0.76 to 1.36). Initiation of TXA treatment within 3 hours of injury reduced the hazard of death due to bleeding on the day of the injury by 28% (HR =0.72, 0.60 to 0.86). TXA treatment initiated beyond 3 hours of injury appeared to increase the hazard of death due to bleeding, although the estimates were imprecise.

Conclusions: Early administration of tranexamic acid appears to reduce mortality primarily by preventing exsanguination on the day of the injury.

Prehosp Emerg Care. 2014 Dec 12. [Epub ahead of print]

Fat intravasation from intraosseous flush and infusion procedures.

Rubal BJ, Meyers BL, Kramer SA, Hanson MA, Andrews JM, DeLorenzo RA

Study hypothesis. The primary study objective was to delineate the procedural aspects of intraosseous (IO) infusions responsible for fat intravasation by testing the hypothesis that the fat content of effluent blood increases during IO infusions.

Methods. IO cannulas were inserted into the proximal tibiae of 35 anesthetized swine (Sus scrofa, 50.1 ± 3.5 kg) and intravasated fat was assessed using a lipophilic fluoroprobe (Nile red) and by vascular ultrasound imaging. Effluent blood bone marrow fat was assessed at baseline, during flush, and with regimens of controlled infusion pressures (73-300 mmHg) and infusion flow rates (0.3-3.0 mL per second). Fat intravasation was also assessed with IO infusions at different tibial cannulation sites and in the distal femur. In 7 animals, the lipid uptake of alveolar macrophages and lung tissue assessed for fat embolic burden using oil red O stain 24 hours post infusion. Additionally, bone marrow shear-strain was assessed radiographically with IO infusions.

Results. Fat intravasation was observed during all IO infusion regimens, with subclinical pulmonary fat emboli persisting 24 hours post infusion. It was noted that initial flush was a significant factor in fat intravasation, low levels of intravasation occurred with infusions ≤300 mmHg, fat intravasation and bone marrow shear-strain increased with IO infusion rates, and intravasation was influenced by cannula insertion site. Ultrasound findings suggest that echogenic particles consistent with fat emboli are carried in fast and slow venous blood flow fields. Echo reflective densities were observed to rise to the nondependent endovascular margins and coalesce in accordance with Stoke's law. In addition, ultrasound findings suggested that intravasated bone marrow fat was thrombogenic.

Conclusion. Results suggest that in swine the intravasation of bone marrow fat is a common consequence of IO infusion procedures and that its magnitude is influenced by the site of cannulation and infusion forces. Although the efficacy and benefits of IO infusions for emergent care are well established, emergency care providers also should be cognizant that infusion procedures affect bone marrow fat intravasation.

Br J Anaesth. 2015 Jan 8. pii: aeu448. [Epub ahead of print]

Tranexamic acid for the prevention and treatment of postpartum haemorrhage.

Sentilhes L, Lasocki S, Ducloy-Bouthors AS, Deruelle P, Dreyfus M, Perrotin F, Goffinet F, Deneux-Tharaux C

Abstract:

Postpartum haemorrhage (PPH) is a major cause of maternal mortality, accounting for one-quarter of all maternal deaths worldwide. Uterotonics after birth are the only intervention that has been shown to be effective for PPH prevention. Tranexamic acid (TXA), an antifibrinolytic agent, has therefore been investigated as a potentially useful complement to this for both prevention and treatment because its hypothesized mechanism of action in PPH supplements that of outerotonics and because it has been proved to reduce blood loss in elective surgery, bleeding in trauma patients, and menstrual blood loss. This review covers evidence from randomized controlled trials (RCTs) for PPH prevention after caesarean (n=10) and vaginal (n=2) deliveries and for PPH treatment after vaginal delivery (n=1). It discusses its efficacy and side effects overall and in relation to the various doses studied for both indications. TXA appears to be a promising drug for the prevention and treatment of PPH after both vaginal and caesarean delivery. Nevertheless, the current level of evidence supporting its efficacy is insufficient, as are the data about its benefit:harm ratio. Large, adequately powered multi-centre RCTs are required before its widespread use for preventing and treating PPH can be recommended.

Journal of Trauma and Acute Care Surgery Feb 2015;78(2),:336–341

Damage-control resuscitation increases successful nonoperative management rates and survival after severe blunt liver injury

Shrestha, Binod MD; Holcomb, John B. MD; Camp, Elizabeth A. PhD; Del Junco, Deborah J. PhD; Cotton, Bryan A. MD, MPH; Albarado, Rondel MD; Gill, Brijesh S. MD; Kozar, Rosemary A. MD, PhD; Kao, Lillian S. MD; McNutt, Michelle K. MD; Moore, Laura J. MD; Love, Joseph D. DO; Tyson, George H. III MD; Adams, Phillip R. MD; Khan, Saleem MD; Wade, Charles E. PhD

BACKGROUND: Nonoperative multidisciplinary management for severe (American Association for the Surgery of Trauma Grades IV and V) liver injury has been used for two decades. We have previously shown that Damage Control Resuscitation (DCR) using low-volume, balanced resuscitation improves survival of severely injured trauma patients; however, little attention has been paid to organ-specific outcomes. We wanted to determine if implementation of DCR has improved survival and successful nonoperative management after severe blunt liver injury.

METHODS: A retrospective study was performed on all adult trauma patients with severe blunt liver injury who were admitted from 2005 to 2011. Patients were divided into pre-DCR (2005–2008) and DCR (2009–2011) groups. Patients who died before leaving the emergency department (ED) were excluded. Outcomes (resuscitation products used, survival, and length of stay) were then compared by univariate and multivariate analyses.

RESULTS: Between 2005 and 2011, 29,801 adult trauma patients were admitted, and 1,412 (4.7%) experienced blunt liver injury. Of these, 244 (17%) sustained Grade IV and V injuries, with 206 patients surviving to leave the ED. The pre-DCR group (2005–2008) was composed of 108 patients, and the DCR group (2009–2011) had 98 patients. The groups were not different in demographics as well as prehospital and ED vital signs or Injury Severity Score (ISS). No change in operative or interventional radiology techniques occurred in this time frame. The DCR cohort had an increase in successful nonoperative management (from 54% to 74%, $p < 0.01$) as well as a reduction in initial 24-hour packed red blood cell (median, from 13 U to 6.5 U; $p < 0.01$), plasma (median, from 13 U to 8 U; $p < 0.01$), and crystalloid (median, from 5,800 mL to 4,100 mL; $p < 0.01$) administration. The DCR treatment was associated with improved survival, from 73% to 94% ($p < 0.01$).

CONCLUSION: In patients with severe blunt liver injury, DCR was associated with less crystalloid and blood product use, a higher successful nonoperative management rate, and improved survival. Resuscitation technique may improve outcomes after severe liver injury.

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

Curr Opin Anaesthesiol. 2015 Apr;28(2):191-200.

Tranexamic acid: from trauma to routine perioperative use.

Simmons J, Sikorski RA, Pittet JF

PURPOSE OF REVIEW: Optimizing hemostasis with antifibrinolytics is becoming a common surgical practice. Large clinical studies have demonstrated efficacy and safety of tranexamic acid (TXA) in the trauma population to reduce blood loss and transfusions. Its use in patients without pre-existing coagulopathies is debated, as thromboembolic events are a concern. In this review, perioperative administration of TXA is examined in nontrauma surgical populations. Additionally, risk of thromboembolism, dosing regimens, and timing of dosing are assessed.

RECENT FINDINGS: Perioperative use of TXA is associated with reduced blood loss and transfusions. Thromboembolic effects do not appear to be increased. However, optimal dosing and timing of TXA administration is still under investigation for nontrauma surgical populations.

SUMMARY: As part of a perioperative blood management programme, TXA can be used to help reduce blood loss and mitigate exposure to blood transfusion.

J Trauma Acute Care Surg. 2014 Dec;77(6):892-7

Detection of low-volume blood loss: compensatory reserve versus traditional vital signs.

Stewart CL, Mulligan J, Grudic GZ, Convertino VA, Moulton SL

BACKGROUND: Humans are able to compensate for low-volume blood loss with minimal change in traditional vital signs. We hypothesized that a novel algorithm, which analyzes photoplethysmogram (PPG) wave forms to continuously estimate compensatory reserve would provide greater sensitivity and specificity to detect low-volume blood loss compared with traditional vital signs. The compensatory reserve index (CRI) is a measure of the reserve remaining to compensate for reduced central blood volume, where a CRI of 1 represents supine normovolemia and 0 represents the circulating blood volume at which hemodynamic decompensation occurs; values between 1 and 0 indicate the proportion of reserve remaining.

METHODS: Subjects underwent voluntary donation of 1 U (approximately 450 mL) of blood. Demographic and continuous noninvasive vital sign wave form data were collected, including PPG, heart rate, systolic blood pressure, cardiac output, and stroke volume. PPG wave forms were later processed by the algorithm to estimate CRI values.

RESULTS: Data were collected from 244 healthy subjects (79 males and 165 females), with a mean (SD) age of 40.1 (14.2) years and mean (SD) body mass index of 25.6 (4.7). After blood donation, CRI significantly decreased in 92% ($\alpha = 0.05$; 95% confidence interval [CI], 88-95%) of the subjects. With the use of a threshold decrease in CRI of 0.05 or greater for the detection of 1 U of blood loss, the receiver operating characteristic area under the curve was 0.90, with a sensitivity of 0.84 and specificity of 0.86. In comparison, systolic blood pressure (52%; 95% CI, 45-59%), heart rate (65%; 95% CI, 58-72%), cardiac output (47%; 95% CI, 40-54%), and stroke volume (74%; 95% CI, 67-80%) changed in fewer subjects, had significantly lower receiver operating characteristic area under the curve values, and significantly lower specificities for detecting the same volume of blood loss.

CONCLUSION: Consistent with our hypothesis, CRI detected low-volume blood loss with significantly greater specificity than other traditional physiologic measures. These findings warrant further evaluation of the CRI algorithm in actual trauma settings.

LEVEL OF EVIDENCE: Diagnostic study, level II.

Journal of Trauma and Acute Care Surgery Jan 2015;78(1):178–183

Improvised tourniquets: Obsolete or obligatory?

Stewart, Sarah K. MBChB; Duchesne, Juan C. MD; Khan, Mansoor A. MBBS, FRCS

CONCLUSION:

This review of the medical literature has intended to expose the current evidence for the efficacy of improvised tourniquets and the arguments that are for and against their use. The literature presents differing opinions as to their value, and undoubtedly, a considered balance of risk and benefit exists. We conclude that improvised tourniquets, when applied correctly, do have a vital role in the control of life-threatening bleeding. Objective evidence has shown certain improvised designs, namely, the windlass type, to be as effective as, if not better than, commercially available tourniquets at controlling arterial blood flow in a limb. Moreover, the risk of complications from their use does not differ hugely from that seen in formal devices. **However, it would be naive to suggest that improvised tourniquets can be regarded as equal in their efficacy to commercial tourniquets such as the CAT. By the very nature of its being, the improvised tourniquet can vary hugely in its fabrication and hence its effectiveness.** Tourniquets do harm, and it is those that are applied incorrectly that cause the most harm. It is also accepted that pain is often a more pertinent feature of improvised devices, but we argue that in the context of life-threatening exsanguination, pain is of little relevance. Similarly, the decision as to when to remove a tourniquet may be ill timed in the hands of an experienced responder. However, we advocate that a lost limb is favorable to a lost life.

J Spec Oper Med. 2014 Fall;14(3):102-6.

A Multiyear Analysis of the Clinical Encounters of the ATF Tactical Medical Program.

Tang N, Kubit J, Berrett OM, Levy MJ

BACKGROUND: The Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) Tactical Medical Program provides tactical medical support for ATF's tactical Special Response Teams (SRTs) and investigative National Response Teams (NRTs) through the deployment of specially trained ATF Agent-Medics. All patient care activities are centrally coordinated through ATF Headquarters.

METHODS: A retrospective analysis of de-identified patient care reports (PCRs) from the ATF Tactical Medical Program from 2009 to 2012 was performed. Clinical and operational data were extracted from PCRs and were entered into a database by the research team. Descriptive and summative analyses were performed to assess patient type, law enforcement incident type, chief complaint, and interventions performed.

RESULTS: Analysis was performed on the 254 charts. Nearly half (114; 44.9%) of patients encountered during the study period were law enforcement officers. High-risk warrant service was associated with one third (85; 33.5%) of the ATF medics' clinical encounters. The most common chief complaints of patients encountered were musculoskeletal pain/injury (57; 22.4%) and wounds/lacerations (57; 22.4%), followed by heat illness (17; 6.7%). The most common intervention was wound care (61; 26.9%), followed by control of bleeding with direct pressure (43; 18.9%). The most common medications administered were ibuprofen (28; 25.2%), topical antibiotic (12; 10.8%), and acetaminophen (12;10.8%).

CONCLUSION: This multiyear analysis represents an important contribution to the growing body of scientific literature surrounding tactical medicine. The results of this analysis demonstrate a continued need for expanded scope of practice training, as well as enhanced treatment protocols for tactical medics.

Clin Ther. 2015 Jan 29. pii: S0149-2918(14)00837-6.

Efficacy and tolerability of intranasal fentanyl spray in cancer patients with breakthrough pain.

Thronæs M, Popper L, Eeg M, Jaatun E, Kvitberg M, Kaasa S

PURPOSE: The aims of this study were to explore the efficacy of intranasal fentanyl spray* (INFS) 400 µg to evaluate 12-week tolerability of the nasal mucosa and to explore safety data for all dose strengths of INFS in patients with cancer-related breakthrough pain (BTP).

METHODS: Patients received a test dose of INFS 50 µg, followed by a titration phase. Those patients with doses titrated to 200 or 400 µg entered a randomized, double-blind, cross-over efficacy phase, in which 8 episodes of BTP were randomly treated with INFS 400 µg (6 episodes) and placebo (2 episodes), followed by a tolerability phase. Patients with doses titrated to 50 or 100 µg entered the tolerability phase directly. Primary outcome was measured by pain intensity difference at 10 minutes, analyzed using ANCOVA, and presented as least square mean difference. Examination of the nasal cavity was conducted at inclusion and after 12 weeks of treatment by an otorhinolaryngologist.

FINDINGS: Forty-six patients were included. Thirty-eight patients' doses were titrated to an effective dose of INFS; 50 µg (n = 8), 100 µg (n = 9), 200 µg (n = 9), and 400 µg (n = 12); 15 patients entered the efficacy phase and 31 entered the tolerability phase. In the efficacy phase, 88 and 29 episodes of BTP were treated with INFS 400 µg and placebo, respectively. Pain intensity difference at 10 minutes least square mean for INFS 400 µg was 2.5 (95% CI, 1.42-3.49) (P < 0.001) and least square mean difference between INFS 400 µg and placebo was 1.1 (95% CI, 0.41-1.79) (P = 0.002). Runny nose (10%) and change in color of the mucosa (9%) were the most frequent findings of nasal examination, and nausea and dizziness were the most frequent treatment-related adverse events. One serious adverse event (ie, respiratory depression) was considered related to INFS.

IMPLICATIONS: INFS 400 µg is effective and nasal tolerability and overall safety profile is acceptable during 12 weeks of use.

Saudi J Anaesth. 2015 Jan;9(1):42-8.

Effect of low dose tranexamic acid on intra-operative blood loss in neurosurgical patients.

Vel R, Udupi BP, Satya Prakash MV, Adinarayanan S, Mishra S, Babu L

BACKGROUND: Blood loss is often a major complication in neurosurgery that requires transfusion of multiple units of blood. The purpose of this study was to assess the effect of tranexamic acid (TXA) on intraoperative blood loss and the need for blood transfusion in patients undergoing craniotomy for tumor excision.

MATERIALS AND METHODS: A total of 100 patients aged 18-60 years, with American Society of Anesthesiologists physical Status 1 and 2 scheduled to undergo elective craniotomy for tumor excision were enrolled. Patients received 10 mg/kg bolus about 20 min before skin incision followed by 1 mg/kg/h infusion of either TXA or saline. Hemodynamic variables, intravenous fluid transfused, amount of blood loss and blood given were measured every 2 h. Laboratory parameters such as serum electrolytes and fibrinogen values were measured every 3 h. On the 5(th) postoperative day hemoglobin (POD Hb5), Hb estimation was done and the estimated blood loss (EBL) calculated. Patients were also monitored for any complications.

RESULTS: The mean heart rate in TXA group was significantly lower compared with the saline group. Mean arterial pressure and fibrinogen levels were higher in TXA group. The mean total blood loss in the TXA group was less than in the saline group. Blood transfusion requirements were comparable in two groups. The EBL and POD5 Hb were comparable in two groups.

CONCLUSION: Even though, there is a significant reduction in the total amount of blood loss in TXA group. However, there was no reduction in intraoperative transfusion requirement.

J Craniofac Surg. 2015 Jan;26(1):26-36.

Systematic review of interventions for minimizing perioperative blood transfusion for surgery for craniosynostosis.

White N, Bayliss S, Moore D

BACKGROUND: Surgery for craniosynostosis is associated with the potential for significant blood loss. Multiple technologies have been introduced to reduce the volume of blood transfused. These are preoperative autologous donation; preoperative erythropoietin; intraoperative cell salvage (CS); acute normovolemic hemodilution; antifibrinolytic drugs such as tranexamic acid, ε-aminocaproic acid, and aprotinin; fibrin sealants or fibrin glue; and postoperative drain reinfusion.

METHODS: All comparative studies with a treatment group and a control group were considered. There was a range of different study types from randomized controlled trials to case series with historic controls. These were intervention versus no intervention or a comparison of 2 interventions. Studies were identified by searching Cochrane CENTRAL, MEDLINE, and EMBASE; manufacturer's Web sites; and bibliographies of relevant published articles. The primary outcome measures were the number of allogeneic blood donor exposures, the volume of allogeneic blood transfused, and the postoperative hemoglobin or hematocrit levels.

RESULTS: A total of 696 studies were identified. After removal of duplicates and after exclusion criteria were applied, there were 18 studies to be included. Fourteen were case series with controls and 4 were randomized controlled trials.

CONCLUSIONS: The production of high-quality evidence on the interventions to minimize blood loss and transfusion in children undergoing surgery for craniosynostosis is difficult. Most of the literature is nonrandomized and noncomparative. Several areas remain unaddressed. Erythropoietin and tranexamic acid are comparatively well studied; CS, acute normovolemic hemodilution, and aprotinin are less so. There is only 1 comparative study on the use of fibrin glue and drain reinfusion, with no studies on preoperative autologous donation and [Latin Small Letter Open E]-aminocaproic acid. Tranexamic acid is clinically effective in reducing allogeneic blood transfusion. There is some evidence that CS and erythropoietin may be clinically effective. None of the interventions \studied are shown to be cost-effective because of lack of evidence.

J Spec Oper Med. 2014 Winter;14(4):19-29.

Tourniquet pressures: strap width and tensioning system widths.

Wall PL, Coughlin O, Rometti M, Birkholz S, Gildemaster Y, Grulke L, Sahr S, Buising CM

BACKGROUND: Pressure distribution over tourniquet width is a determinant of pressure needed for arterial occlusion. Different width tensioning systems could result in arterial occlusion pressure differences among nonelastic strap designs of equal width.

METHODS: Ratcheting Medical Tourniquets (RMTs; m2 inc., http://www.ratcheting buckles.com) with a 1.9cm-wide (Tactical RMT) or 2.3cm-wide (Mass Casualty RMT) ladder were directly compared (16 recipients, 16 thighs and 16 upper arms for each tourniquet x 2). Then, RMTs were retrospectively compared with the windlass Combat Application Tourniquet (C-A-T ["CAT"], http://combattourniquet.com) with a 2.5cm-wide internal tensioning strap. Pressure was measured with an air-filled No. 1 neonatal blood pressure cuff under each 3.8cm-wide tourniquet.

RESULTS: RMT circumferential pressure distribution was not uniform. Tactical RMT pressures were not higher, and there were no differences between the RMTs in the effectiveness, ease of use ("97% easy"), or discomfort. However, a difference did occur regarding tooth skipping of the pawl during ratchet advancement: it occurred in 1 of 64 Tactical RMT applications versus 27 of 64 Mass Casualty RMT applications. CAT and RMT occlusion pressures were frequently over 300mmHg. RMT arm occlusion pressures (175?397mmHg), however, were lower than RMT thigh occlusion pressures (197?562mmHg). RMT effectiveness was better with 99% reached occlusion and 1% lost occlusion over 1 minute versus the CAT with 95% reached occlusion and 28% lost occlusion over 1 minute. RMT muscle tension changes (up to 232mmHg) and pressure losses over 1 minute (24 ± 11mmHg arm under strap to 40 ± 12mmHg thigh under ladder) suggest more occlusion losses may have occurred if tourniquet duration was extended.

CONCLUSIONS: The narrower tensioning system Tactical RMT has better performance characteristics than the Mass Casualty RMT. The 3.8cm-wide RMTs have some pressure and effectiveness similarities and differences compared with the CAT. Clinically significant pressure changes occur under nonelastic strap tourniquets with muscle tension changes and over time periods as short as 1 minute. An examination of pressure and occlusion changes beyond 1 minute would be of interest.

Eur J Emerg Med. 2014 Dec 1. [Epub ahead of print]

In a difficult access scenario, supraglottic airway devices improve success and time to ventilation.

Wetsch WA, Schneider A, Schier R, Spelten O, Hellmich M, Hinkelbein J

Abstract:

The success of tracheal intubation (TI) is unacceptably low in unconventional positions. Supraglottic airway devices (SAD) have become an important alternative. An airway manikin was placed in a car, simulating an entrapped motor vehicle accident victim. The rescuer only had access through the driver's door. Participants were (n=25) anaesthesiologists with experience in prehospital emergency medicine. They attempted to secure the airway by TI or an SAD (Ambu AuraOnce, iGel, laryngeal tube) in a random sequence. Performance was compared using the Wilcoxon signed-rank test. P values less than 0.05 were considered statistically significant. Fastest effective ventilation was achieved with iGel (11.5±6.9 s, P<0.001), followed by a laryngeal mask (15.1±5.6 s, P<0.001) and a laryngeal tube (17.6±5.3 s, P<0.001); TI was the slowest (42.8±23.9 s, comparator). iGel (P<0.001) and laryngeal mask (P=0.01) also significantly
outperformed the laryngeal tube. First ventilation was achieved significantly faster with SADs compared with TI. Success rates were also higher when using SADs.

J Craniofac Surg. 2015 Jan;26(1):26-36.

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METHODS: All comparative studies with a treatment group and a control group were considered. There was a range of different study types from randomized controlled trials to case series with historic controls. These were intervention versus no intervention or a comparison of 2 interventions. Studies were identified by searching Cochrane CENTRAL, MEDLINE, and EMBASE; manufacturer's Web sites; and bibliographies of relevant published articles. The primary outcome measures were the number of allogeneic blood donor exposures, the volume of allogeneic blood transfused, and the postoperative hemoglobin or hematocrit levels.

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Br J Anaesth. 2015 Jan 13. pii: aeu444. [Epub ahead of print]

Pre-emptive treatment with fibrinogen concentrate for postpartum haemorrhage: randomized controlled trial.

Wikkelsø AJ, Edwards HM, Afshari A, Stensballe J, Langhoff-Roos J, Albrechtsen C, Ekelund K, Hanke G, Secher EL, Sharif HF, Pedersen LM, Troelstrup A, Lauenborg J, Mitchell AU, Fuhrmann L, Svare J, Madsen MG, Bødker B, Møller AM; FIB-PPH trial group

BACKGROUND: In early postpartum haemorrhage (PPH), a low concentration of fibrinogen is associated with excessive subsequent bleeding and blood transfusion. We hypothesized that pre-emptive treatment with fibrinogen concentrate reduces the need for red blood cell (RBC) transfusion in patients with PPH.

METHODS: In this investigator-initiated, multicentre, double-blinded, parallel randomized controlled trial, we assigned subjects with severe PPH to a single dose of fibrinogen concentrate or placebo (saline). A dose of 2 g or equivalent was given to all subjects independent of body weight and the fibrinogen concentration at inclusion. The primary outcome was RBC transfusion up to 6 weeks postpartum. Secondary outcomes were total blood loss, total amount of blood transfused, occurrence of rebleeding, haemoglobin <58 g litre(-1), RBC transfusion within 4 h, 24 h, and 7 days, and as a composite outcome of 'severe PPH', defined as a decrease in haemoglobin of >40 g litre(-1), transfusion of at least 4 units of RBCs, haemostatic intervention (angiographic embolization, surgical arterial ligation, or hysterectomy), or maternal death.

RESULTS: Of the 249 randomized subjects, 123 of 124 in the fibrinogen group and 121 of 125 in the placebo group were included in the intention-to-treat analysis. At inclusion the subjects had severe PPH, with a mean blood loss of 1459 (sd 476) ml and a mean fibrinogen concentration of 4.5 (sd 1.2) g litre(-1). The intervention group received a mean dose of 26 mg kg(-1) fibrinogen concentrate, thereby significantly increasing fibrinogen concentration compared with placebo by 0.40 g litre(-1) (95% confidence interval, 0.15-0.65; P=0.002). Postpartum blood transfusion occurred in 25 (20%) of the fibrinogen group and 26 (22%) of the placebo group (relative risk, 0.95; 95% confidence interval, 0.58-1.54; P=0.88). We found no difference in any predefined secondary outcomes, per-protocol analyses, or adjusted analyses. No thromboembolic events were detected.

CONCLUSIONS: We found no evidence for the use of 2 g fibrinogen concentrate as pre-emptive treatment for severe PPH in patients with normofibrinogenaemia.

Mil Med. 2015 Feb;180(2):216-23.

Spinal injury hospitalizations among U.S. Army Soldiers deployed to Iraq and Afghanistan.

Wojcik BE, Curley KC, Szeszel-Fedorowicz W, Stein CR, Humphrey RJ

Abstract:

This retrospective study examined spinal-related hospitalizations of U.S. Army soldiers deployed to Afghanistan and Iraq. Spinal cord injuries (SCI) and vertebral column injuries (VCI) were identified using International Classification of Disease, 9th Revision, Clinical Modification diagnosis codes. In our study, spinal hospitalizations represented 8.2% of total injury admissions. Risk factors for SCI and VCI incidences were determined using Poisson regression. Lack of previous deployment experience increased risk of having SCI by 33% and VCI by 24% in Iraq (similar increases, but not statistically significant in Afghanistan). Male soldiers had 4.85 times higher risk for SCI in Iraq and 69% higher risk in Afghanistan than female soldiers. In Afghanistan, almost 60% of spinal episodes included traumatic brain injury (TBI), compared to about 40% in Iraq. In both theaters, mild TBI accounted for more than 50% of all TBI-spinal episodes. Sixteen percent of SCI inpatient episodes in Afghanistan and 13% in Iraq were associated with paralysis, with median bed days of 46 and 33 days compared to a median of 6 days in both theaters for nonparalysis spinal injuries. The mortality rate was 2.5 times lower in Afghanistan than in Iraq.

Curr Opin Anaesthesiol. 2015 Feb;28(1):45-9.

Chest tube management: state of the art.

Zardo P, Busk H, Kutschka I

PURPOSE OF REVIEW: Chest tube protocols are still largely dictated by personal preferences and experience. A general lack of published evidence encourages individual decision-making and hinders the development of clear-cut guidelines. The aim of this review is to establish standardized procedures with recommendations for size and number of inserted tubes, ideal suction levels and duration of thoracostomy.

RECENT FINDINGS: Novel digital drainage systems markedly reduce interobserver variability in air leak assessment and may thus shorten chest tube duration and overall hospital stay. Paired with a more aggressive stance that allows chest tube removal even with secretion quantities of 500 ml/day, new protocols need to be established.

SUMMARY: Thoracic procedures are heterogeneous and postsurgical requirements vary in accordance. Most resections will not require more than one large bore (≥20F) catheter and will benefit from postoperative active suction. Even though only moderate-quality evidence suggests that suction reduces incidence of pneumothorax if compared to water seal and its effects on prolonged air leak are controversial, recent studies encourage application of active suction. Removal of chest tubes appears to be well tolerated even with a secretion of above 450 ml/day.

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Tranexamic acid in brain injury: devil in the detail.

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Objective: The antifibrinolytic agent tranexamic acid (TXA) has demonstrated clinical benefit in trauma patients with severe bleeding, but its effectiveness in patientswith traumatic brain injury (TBI) is unclear.We conducted a systematic review to evaluate the following research question: In ED patients with or at risk of intracranial hemorrhage (ICH) secondary to TBI, does TXA compared to placebo improve patients' outcomes?

Methods: MEDLINE, EMBASE, CINAHL, and other databases were searched for randomized controlled trial (RCT) or quasi-RCT studies that compared the effect of TXA to placebo on outcomes of TBI patients. The main outcomes of interest included mortality, neurologic function, hematoma expansion, and adverse effects.We used “Grading quality of evidence and strength of recommendations” to assess the quality of trials. Two authors independently abstracted data using a data collection form. Results from studies were pooled when appropriate.

Results: Of 1030 references identified through the search, 2 high-quality RCTs met inclusion criteria. The effect of TXA onmortality had a pooled relative risk of 0.64 (95% confidence interval [CI], 0.41-1.02); on unfavorable functional status, a relative risk of 0.77 (95% CI, 0.59-1.02); and on ICH progression, a relative risk of 0.76 (95% CI, 0.58-0.98). No serious adverse effects (such as thromboembolic events) associated with TXA group were reported in the included trials.

Conclusion: Pooled results from the 2 RCTs demonstrated statistically significant reduction in ICH progression with TXA and a nonstatistically significant improvement of clinical outcomes in ED patients with TBI. Further evidence is required to support its routine use in patients with TBI.