Tactical Combat Casualty Care

Journal Article Abstracts

Committee on Tactical Combat Casualty Care
August 2014

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Abstracts

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Does A Kaolin Impregnated Hemostatic Dressing Reduce Intra-Operative Blood Loss and Blood Transfusions in Pediatric Spinal Deformity Surgery?

Abbott EM, Nandyala SV, Schwend RM.

Study Design. Retrospective case control study.

Objective. To evaluate the hemostatic benefits of using a kaolin impregnated dressing during pediatric spinal deformity correction surgery.

Summary of Background Data. Minimizing blood loss and transfusions are clear benefits for patient safety. A technique common in both severe trauma and combat medicine that has not been reported in the spine literature is wound packing with a kaolin impregnated haemostatic dressing.Methods. Estimated blood loss and transfusion amounts were analyzed in a total of 117 retrospectively identified cases. The control group included 65 patients (46F, 19M, 12.7±4.5 years, 10.2± 4.8 levels fused) who received standard operative care with gauze packing between June 2007 and March 2010. The treatment group included 52 patients (33F, 19M, 13.9±3.2 years, 10.4 ± 4.3 levels fused) who underwent intra-operative packing with QuikClot Trauma Pads (QCTP, Z-Medica Corporation) for all surgeries from July 2010 to August 2011. No other major changes in the use of antifibrinolytics or perioperative, surgical, or anesthesia technique were noted. Statistical differences were analyzed using ANCOVA in R with $p<0.05$. The statistical model included sex, age, weight, scoliosis type, the number of vertebral levels fused, and surgery duration as covariates.

Results. The treatment group had 40% less intra-operative estimated blood loss than the control group (974 cc vs 1620 cc) ($p<0.001$). Patients who received the QCTP treatment also had 42% less total perioperative transfusion volume (499 cc vs 862 cc) ($p<0.01$).

Conclusion. The use of a kaolin impregnated intra-operative trauma pad appears to be an effective and inexpensive method to reduce intra-operative blood loss and transfusion volume in pediatric spinal deformity surgery.

J Neurosurg Spine. 2014 Jun 13:1-8. [Epub ahead of print]

Cervical spine injury from gunshot wounds.

Beaty N, Slavin J, Diaz C, Zeleznick K, Ibrahimi D, Sansur C.

Object: Gunshot wounds (GSWs) to the cervical spine have been examined in a limited number of case series, and operative management of this traumatic disease has been sparsely discussed. The current literature supports and the authors hypothesize that patients without neurological deficit need neither surgical fusion nor decompression. Patients with GSWs and neurological deficits, however, pose a greater management challenge. The authors have compiled the experience of the R Adams Cowley Shock Trauma Center in Baltimore, Maryland, over the past 12 years, creating the largest series of such injuries, with a total number of 40 civilian patients needing neurosurgical evaluation. The current analysis examines presenting bone injury, surgical indication, presenting neurological examination, and neurological outcome. In this study, the authors characterize the incidence, severity, and recovery potential of cervical GSWs. The rate of unstable fractures requiring surgical intervention is documented. A detailed discussion of surgical indications with a treatment algorithm for cervical instability is offered.

Methods: A total of 144 cervical GSWs were retrospectively reviewed. Of these injuries, 40 had documented neurological deficits. No neurosurgical consultation was requested for patients without deficit. Epidemiological and clinical information was collected on patients with neurological deficit, including age, sex, timing, indication, type of surgery, initial examination after resuscitation, follow-up examination, and imaging data.

Results: Twenty-eight patients (70%) presented with complete neurological deficits and 12 patients (30%) presented with incomplete injuries. Fourteen (35%) of the 40 patients underwent neurosurgical intervention. Twelve patients (30%) required intervention for cervical instability. Seven patients required internal fixation involving 4 anterior fusions, 2 posterior fusions, and 1 combined approach. Five patients were managed with halo immobilization. Two patients underwent decompression alone for neurological deterioration and persistent compressive injury, both of whom experienced marked neurological recovery. Follow-up was obtained in 92% of cases. Three patients undergoing stabilization converted at least 1 American Spinal Injury Association (ASIA) Impairment Scale (AIS) grade and the remaining operative cases experienced small ASIA motor score improvement. Eighteen patients underwent inpatient MRI. No patient suffered complications or neurological deterioration related to retained metal. Three of 28 patients presenting with AIS Grade A improved to Grade B. For those 12 patients with incomplete injury, 1 improved from AIS Grade C to D, and 3 improved from Grade D to E.

Conclusions: Spinal cord injury from GSWs often results in severe neurological deficits. In this series, 30% of these patients with deficits required intervention for instability. This is the first series that thoroughly documents AIS improvement in this patient population. Adherence to the proposed treatment algorithm may optimize neurological outcome and spine stability.

Air Med J. 2014 Jul-Aug;33(4):152-6. doi: 10.1016/j.amj.2014.04.009.

Air transport of patients with pneumothorax: is tube thoracostomy required before flight?

Braude D, Tutera D, Tawil I, Pirkl G

OBJECTIVE: It is conventionally thought that patients with pneumothorax (PTX) require tube thoracostomy (TT) before air medical transport (AMT), especially in unpressurized rotor-wing (RW) aircraft, to prevent deterioration from expansion of the PTX or development of tension PTX. We hypothesize that patients with PTX transported without TT tolerate RW AMT without serious deterioration, as defined by hypotension, hypoxemia, respiratory distress, intubation, bag valve mask ventilation, needle thoracostomy (NT), or cardiac arrest during transport.

METHODS: We conducted a retrospective review of a case series of trauma patients transported to a single Level 1 trauma center via RW with confirmed PTX and no TT. Using standardized abstraction forms, we reviewed charts for signs of deterioration. Those patients identified as having clinical deterioration were independently reviewed for the likelihood that the clinical deterioration was a direct consequence of PTX.

RESULTS: During the study period, 66 patients with confirmed PTX underwent RW AMT with an average altitude gain of 1890 feet, an average barometric pressure 586-600 mmHg, and average flight duration of 28 minutes. All patients received oxygen therapy; 14/66 patients (21%) were supported with positive pressure ventilation. Eleven of 66 patients (17%) had NT placed before flight and 4/66 (6%) had NT placed during flight. Four of 66 patients (6% CI 0.3-11.7) may have deteriorated during AMT as a result of PTX; all were successfully managed with NT.

CONCLUSIONS: In this series, 6% of patients with PTX deteriorated as result of AMT without TT, yet all patients were managed successfully with NT. Routine placement of TT in patients with PTX before RW AMT may not be necessary. Further prospective evaluation is warranted.

Prehosp Emerg Care. 2014 Jul 30. [Epub ahead of print]

Design of the Study of Tranexamic Acid during Air Medical Prehospital Transport (STAAMP) Trial: Addressing the Knowledge Gaps.

Brown JB, Neal MD, Guyette FX, Peitzman AB, Billiar TR, Zuckerbraun BS, Sperry JL.

Abstract

Hemorrhage and coagulopathy remain major drivers of early preventable mortality in military and civilian trauma. The development of trauma-induced coagulopathy and hyperfibrinolysis is associated with poor outcomes. Interest in the use of tranexamic acid (TXA) in hemorrhaging patients as an antifibrinolytic agent has grown recently. Additionally, several reports describe immunomodulatory effects of TXA that may confer benefit independent of its antifibrinolytic actions. A large trial demonstrated a mortality benefit for early TXA administration in patients at risk for hemorrhage; however, questions remain about the applicability in developed trauma systems and the mechanism by which TXA reduces mortality. We describe here the rationale, design, and challenges of the Study of Tranexamic Acid during Air Medical Prehospital transport (STAAMP) trial. The primary objective is to determine the effect of prehospital TXA infusion during air medical transport on 30-day mortality in patients at risk of traumatic hemorrhage. This study is a multicenter, placebo-controlled, double-blind, randomized clinical trial. The trial will enroll trauma patients with hypotension and tachycardia from 4 level I trauma center air medical transport programs. It includes a 2-phase intervention, with a prehospital and in-hospital phase to investigate multiple dosing regimens. The trial will also explore the effects of TXA on the coagulation and inflammatory response following injury. The trial will be conducted under exception for informed consent for emergency research and thus required an investigational new drug approval from the U.S. Food and Drug Administration as well as a community consultation process. It was designed to address several existing knowledge gaps and research priorities regarding TXA use in trauma.

J Spec Oper Med. 2014 Spring;14(1):13-25.

A Triple-Option Analgesia Plan for Tactical Combat Casualty Care: TCCC Guidelines Change 13-04.

Butler FK, Kotwal RS, Buckenmaier CC 3rd, Edgar EP, O'Connor KC, Montgomery HR, Shackelford SA, Gandy JV 3rd, Wedmore IS, Timby JW, Gross KR, Bailey JA.

Abstract

Although the majority of potentially preventable fatalities among U.S. combat forces serving in Afghanistan and Iraq have died from hemorrhagic shock, the majority of U.S. medics carry morphine autoinjectors for prehospital battlefield analgesia. Morphine given intramuscularly has a delayed onset of action and, like all opioids, may worsen hemorrhagic shock. Additionally, on a recent assessment of prehospital care in Afghanistan, combat medical personnel noted that Tactical Combat Casualty Care (TCCC) battlefield analgesia recommendations need to be simplified. There are too many options and not enough clear guidance on which medication to use in specific situations. They also reported that ketamine is presently being used as a battlefield analgesic by some medics in theater with good results. This report proposes that battlefield analgesia be achieved using one or more of three options: (1) the meloxicam and Tylenol in the TCCC Combat Pill Pack for casualties with relatively minor pain who are still able to function as effective combatants; (2) oral transmucosal fentanyl citrate (OTFC) for casualties who have moderate to severe pain, but who are not in hemorrhagic shock or respiratory distress and are not at significant risk for developing either condition; or (3) ketamine for casualties who have moderate to severe pain but who are in hemorrhagic shock or respiratory distress or are at significant risk for developing either condition. Ketamine may also be used to increase analgesic effect for casualties who have previously been given opioids (morphine or fentanyl.).

J Trauma Acute Care Surg. 2014 Jul;77(1):28-33; discussion 33. doi: 10.1097/TA.0000000000000276.

Never-frozen liquid plasma blocks endothelial permeability as effectively as thawed fresh frozen plasma.

Cao Y(1), Dua A, Matijevic N, Wang YW, Pati S, Wade CE, Ko TC, Holcomb JB.

BACKGROUND: Thawed fresh frozen plasma (TP) is a preferred plasma product for resuscitation but can only be used for up to 5 days after thawing. Never-frozen, liquid plasma (LQP) is approved for up to 26 days when stored at 1°C to 6°C. We have previously shown that TP repairs tumor necrosis factor α (TNF-α)-induced permeability in human endothelial cells (ECs). We hypothesized that stored LQP repairs permeability as effectively as TP.

METHODS: Three single-donor LQP units were pooled. Aliquots were frozen, and samples were thawed on Day 0 (TP0) then refrigerated for 5 days (TP5). The remaining LQP was kept refrigerated for 28 days, and aliquots were analyzed every 7 days. The EC monolayer was stimulated with TNF-α (10 ng/mL), inducing permeability, followed by a treatment with TP0, TP5, or LQP aged 0, 7, 14, 21, and 28 days. Permeability was measured by leakage of fluorescein isothiocyanate-dextran through the EC monolayer. Hemostatic profiles of samples were evaluated by thrombogram and thromboelastogram. Statistical analysis was performed using two-way analysis of variance, with $p < 0.05$ deemed significant.

RESULTS: TNF-α increased permeability of the EC monolayer twofold compared with medium control. There was a significant decrease in permeability at 0, 7, 14, 21, and 28 days when LQP was used to treat TNF-α-induced EC monolayers ($p < 0.001$). LQP was as effective as TP0 and TP5 at reducing permeability. Stored LQP retained the capacity to generate thrombin and form a clot.

CONCLUSION: LQP corrected TNF-α-induced EC permeability and preserved hemostatic potential after 28 days of storage, similar to TP stored for 5 days. The significant logistical benefit (fivefold) of prolonged LQP storage improves the immediate availability of plasma as a primary resuscitative fluid for bleeding patients.

J Trauma Acute Care Surg. 2014 May;76(5):1169-76. doi: 10.1097/TA.0000000000000216.

Traumatic brain injury causes platelet adenosine diphosphate and arachidonic acid receptor inhibition independent of hemorrhagic shock in humans and rats.

Castellino FJ, Chapman MP, Donahue DL, Thomas S, Moore EE, Wohlauer MV, Fritz B, Yount R, Ploplis V, Davis P, Evans E, Walsh M.

BACKGROUND: Coagulopathy in traumatic brain injury (CTBI) is a well-established phenomenon, but its mechanism is poorly understood. Various studies implicate protein C activation related to the global insult of hemorrhagic shock or brain tissue factor release with resultant platelet dysfunction and depletion of coagulation factors. We hypothesized that the platelet dysfunction of CTBI is a distinct phenomenon from the coagulopathy following hemorrhagic shock.

METHODS: We used thrombelastography with platelet mapping as a measure of platelet function, assessing the degree of inhibition of the adenosine diphosphate (ADP) and arachidonic acid (AA) receptor pathways. First, we studied the early effect of TBI on platelet inhibition by performing thrombelastography with platelet mapping on rats. We then conducted an analysis of admission blood samples from trauma patients with isolated head injury (n = 70). Patients in shock or on clopidogrel or aspirin were excluded.

RESULTS: In rats, ADP receptor inhibition at 15 minutes after injury was 77.6% ± 6.7% versus 39.0% ± 5.3% for controls ($p < 0.0001$). Humans with severe TBI (Glasgow Coma Scale [GCS] score ≤ 8) showed an increase in ADP receptor inhibition at 93.1% (interquartile range [IQR], 44.8-98.3%; n = 29) compared with 56.5% (IQR, 35-79.1%; n = 41) in milder TBI and 15.5% (IQR, 13.2-29.1%) in controls ($p = 0.0014$ and $p < 0.0001$, respectively). No patient had significant hypotension or acidosis. Parallel trends were noted in AA receptor inhibition.

CONCLUSION: Platelet ADP and AA receptor inhibition is a prominent early feature of CTBI in humans and rats and is linked to the severity of brain injury in patients with isolated head trauma. This phenomenon is observed in the absence of hemorrhagic shock or multisystem injury. Thus, TBI alone is shown to be sufficient to induce a profound platelet dysfunction.

Anesth Analg. 2014 Aug;119(2):498-9. doi: 10.1213/ANE.0000000000000254.

Tranexamic Acid: more than inhibition of fibrinolysis?

Couturier R(1), Grassin-Delyle S.

Quote:
"In conclusion, maintaining TA concentrations just adequate to inhibit fibrinolysis might not be sufficient to achieve full clinical efficacy, especially since the dosing schemes used in studies that have demonstrated the efficacy of TA in cardiac surgery do so at concentrations substantially greater than the threshold concentrations. Furthermore, large-scale randomized clinical trials powered to evaluate efficacy outcomes (blood loss, transfusion requirements, and return to surgery…) and safety outcomes with low- and high-dose schemes in neonates and children are needed."

J Spec Oper Med. 2013 Fall;13(3):1-4.

Abdominal aortic tourniquet controls junctional hemorrhage from a gunshot wound of the axilla.

Croushorn J, Thomas G, McCord SR.

Abstract:
Junctional hemorrhage, bleeding from the areas at the junction of the trunk and its appendages, is a difficult problem in trauma. These areas are not amenable to regular tourniquets as they cannot fit to give circumferential pressure around the extremity. Junctional arterial injuries can rapidly lead to death by exsanguination, and out-of-hospital control of junctional bleeding can be lifesaving. The present case report describes an off-label use of the Abdominal Aortic Tourniquet™ in the axilla and demonstrates its safety and effectiveness of stopping hemorrhage from a challenging wound. To our knowledge, the present report is the first human use of a junctional tourniquet to control an upper extremity junctional hemorrhage.

J Clin Diagn Res. 2014 Mar;8(3):80-4

i-gel™ in Ambulatory Surgery: A Comparison with LMA-ProSeal™ in Paralyzed Anaesthetized Patients.

Das A, Majumdar S, Mukherjee A, Mitra T, Kundu R, Hajra BK, Mukherjee D, Das B

INTRODUCTION: Supraglottic devices have mostly eliminated the need of hemodynamically stressful routine endotracheal intubation for ambulatory surgeries. We aimed to compare hemodynamics- like blood pressure (BP) and heart rate (HR) alterations caused by stress response due to i-gel™ and LMA-ProSeal™ usage in Day care surgeries. Secondary outcomes included ease of insertion, time and number of attempts for the placement of devices.

MATERIALS AND METHODS: From April 2008 to July 2009, Sixty adult ASA I-II patients of either sex, aged 20-30, were randomly allocated into two groups (Group i-gel (n=30) receiving i-gel and Group PLMA (n=30) receiving LMA-ProSeal for airway maintenance) undergoing day care surgical procedures under general anaesthesia (GA).The ease of insertion and time taken for placement of device, postoperative complications were assessed. Haemodynamic parameters (HR, BP) were noted. It was a prospective, double blinded, and randomized controlled study. Parametric data were analyzed with the unpaired t-test and non-parametric data were analyzed with the Chi-square test. Unless otherwise stated, data are presented as mean (+ SD). $p < 0.05$ was considered statistically significant.

RESULTS: Demographically both the groups were similar. i-gel was more easily inserted than LMA-ProSeal (90% vs. 83.33% respectively). i-gel insertion time was shorter than PLMA (14.9 vs. 20.0 sec respectively) and was statistically significant. Hemodynamics (HR, BP) were less altered in i-gel than PLMA and the results were statistically significant ($p < 0.05$).

CONCLUSION: i-Gel; a relatively newer and cheap supraglottic device; insertion is easier and quicker as well as hemodynamically less stressful when compared with LMA-ProSeal in a day care setting.

J Trauma Acute Care Surg. 2014 Aug;77(2):213-8. doi: 10.1097/TA.0000000000000292.

An analysis of prehospital deaths: Who can we save?

Davis JS, Satahoo SS, Butler FK, Dermer H, Naranjo D, Julien K, Van Haren RM, Namias N, Blackbourne LH, Schulman CI.

BACKGROUND: Since their inception in the late 1970s, trauma networks have saved thousands of lives in the prehospital setting. However, few recent works have been done to evaluate the patients who die in the field. Understanding the epidemiology of these deaths is crucial for trauma system performance evaluation and improvement. We hypothesized that specific patterns of injury could be identified and targeted for intervention.

METHODS: Medical examiner reports in a large, urban county were reviewed including all trauma deaths during 2011 that were not transported to a hospital (i.e., died at the scene) or dead on arrival. Age, sex, date of death, mechanism, and list of injuries were recorded. An expert panel reviewed each case to determine the primary cause of death, and if the patient's death was caused by potentially survivable injuries or nonsurvivable injuries.

RESULTS: A total of 512 patients were included. Patients were 80% male, died mostly of blunt (53%) and penetrating (46%) causes, and included 21% documented suicides. The leading cause of death was neurotrauma (36%), followed by hemorrhage (34%), asphyxia (15%), and combined neurotrauma/hemorrhage (15%). The anatomic regions most frequently injured were the brain (59%), chest (54%), and abdomen (35%). Finally, 29% of the patient deaths were classified as a result of potentially survivable injuries given current treatment options, mostly from hemorrhage and chest injuries.

CONCLUSION: More than one of every five trauma deaths in our study population had potentially survivable injuries. In this group, chest injuries and death via hemorrhage were predominant and suggest targets for future research and implementation of novel prehospital interventions. In addition, efforts targeting suicide prevention remain of great importance.

LEVEL OF EVIDENCE: Epidemiologic study, level V.

Surg Infect (Larchmt). 2014 May 15. [Epub ahead of print]

Efficacy and Safety of Moxifloxacin in Hospitalized Patients with Secondary Peritonitis: Pooled Analysis of Four Randomized Phase III Trials.

De Waele JJ, Tellado JM, Weiss G, Alder J, Kruesmann F, Arvis P, Hussain T, Solomkin JS.

Background: Secondary peritonitis is an advanced form of complicated intra-abdominal infection (cIAI) requiring hospitalization, surgical source control, and empiric antibiotic therapy against causative aerobic and anaerobic bacteria.

Methods: This pooled analysis of four prospective, active-controlled randomized clinical trials compared the efficacy and safety of moxifloxacin with that of comparator antibiotics in patients with confirmed secondary peritonitis. The primary efficacy endpoint was clinical success rate at test-of-cure (TOC) between day 10 and 45 post-therapy in the per-protocol (PP) population. Safety and clinical efficacy were assessed also in the intent-to-treat population (ITT). Bacteriological success was assessed at TOC in the microbiologically-valid population as a secondary efficacy endpoint.

Results: Overall clinical success rates at TOC were 85.3% (431 of 505 patients) in the moxifloxacin and 88.4% (459 of 519 patients) in the comparator treatment groups (PP population, point estimate for the difference in success rates: -3.0%; 95% CI -7.06%, 1.05%), respectively. Similar clinical success rates between moxifloxacin and comparators were observed by anatomical site of infection, and ranged from 80.6% to 100% for moxifloxacin and from 71.4% to 96.6% for comparators, respectively. Bacteriologic success rates were similar with moxifloxacin (82.4%) and comparators (86.8%), respectively. The proportion of patients experiencing any treatment-emergent adverse events was slightly higher with moxifloxacin (67.3%) versus comparators (59.8%). Rates of drug-related adverse events (20.9% versus 20.0%) and deaths (4.3% versus 3.4%) were similar in moxifloxacin and comparator groups; none of the deaths were drug-related.

Conclusions: The data suggests that once-daily IV (or IV/PO) moxifloxacin has a comparable efficacy and safety profile to antibiotic regimens approved previously in the subgroup of patients with secondary peritonitis of mild-to-moderate severity.

N Engl J Med. 2014 Jun 12;370(24):e35. doi: 10.1056/NEJMvcm1211371.

Videos in clinical medicine. Insertion of an intraosseous needle in adults.

Dev SP(1), Stefan RA, Saun T, Lee S.

Abstract:
Intraosseous needle insertion is used as a temporary measure when intravascular access cannot be achieved through peripheral or central venous routes. The intraosseous needle may remain in situ for 72 to 96 hours, but it is best removed within 6 to 12 hours, as soon as an alternative site of intravascular access has been established. The intraosseous route provides fast and reliable vascular access in emergency medical situations. The use of the appropriate technique will ensure that the procedure is performed as safely and effectively as possible.

Ann Emerg Med. 2014 Jul;64(1):79-81. doi: 10.1016/j.annemergmed.2013.09.026. Epub 2013 Oct 23

Temporization of Penetrating Abdominal-Pelvic Trauma With Manual External Aortic Compression: A Novel Case Report

Douma M, Smith KE, Brindley PG

Abstract:
A young civilianman experienced multiple gunshots to the lower abdomen, pelvis, and thigh. These were not amenable to direct compression by a single rescuer. This report outlines the first case in the peer-reviewed literature of manual external aortic compression after severe trauma. This technique successfully temporized external bleeding for more than 10 minutes and restored consciousness to the moribund victim. Subsequently, external bleeding could not be temporized by a second smaller rescuer, or during ambulance transfer. Therefore, we also gained insights about the possible limits of bimanual compression and when alternates, such as pneumatic devices,may be required. Research is needed to test our presumption that successful bimanual compression requires larger-weight rescuers, smaller-weight victims, and a hard surface. It is therefore unclear whether manual external aortic compression is achievable by most rescuers or for most victims. However, it offers an immediate and equipment-free life-sustaining strategy when there are limited alternatives.

PLoS One. 2014 Apr 16;9(4):e90617

Efficacy of N-acetyl cysteine in traumatic brain injury.

Eakin K, Baratz-Goldstein R, Pick C, Zindel O, Balaban C, Hoffer M, Lockwood M, Miller J, Hoffer B

Abstract:
In this study, using two different injury models in two different species, we found that early post-injury treatment with N-Acetyl Cysteine (NAC) reversed the behavioral deficits associated with the TBI. These data suggest generalization of a protocol similar to our recent clinical trial with NAC in blast-induced mTBI in a battlefield setting, to mild concussion from blunt trauma. This study used both weight drop in mice and fluid percussion injury in rats. These were chosen to simulate either mild or moderate traumatic brain injury (TBI). For mice, we used novel object recognition and the Y maze. For rats, we used the Morris water maze. NAC was administered beginning 30-60 minutes after injury. Behavioral deficits due to injury in both species were significantly reversed by NAC treatment. We thus conclude NAC produces significant behavioral recovery after injury. Future preclinical studies are needed to define the mechanism of action, perhaps leading to more effective therapies in man.

N Engl J Med. 2014 Apr 10;370(15):1441-51

Case records of the Massachusetts General Hospital. Case 11-2014. A man with traumatic injuries after a bomb explosion at the Boston Marathon.

Eikermann M, Velmahos G, Abbara S, Huang PL, Fagan SP, Hirschberg RE, Kwon JY, Nosé V.

Quote

"A tourniquet had been applied to the right upper leg by prehospital providers but was not controlling the bleeding fully, as evidenced by a large pool of blood at the site of the amputation. The tourniquet was tightened, and a second, military-style tourniquet was added. Tourniquets have been shown to control bleeding effectively and save lives in the prehospital and emergency department setting. Much of the evidence comes from recent wars, in which leg injuries have become frequent and devastating because of the use of improvised explosive devices (IEDs). Application of a tourniquet for up to 1 hour seems to be safe, and even a period of up to 2 hours is associated with low morbidity. Complications related to aggressive use of tourniquets are a concern, but the major concern lies with the inadequate control of bleeding due to insufficient tightening, misplacement, or suboptimal design of the tourniquet."

Arch Orthop Trauma Surg. 2014 Aug 9. [Epub ahead of print]

The combat burst fracture study-results of a cohort analysis of the most prevalent combat specific mechanism of major thoracolumbar spinal injury.

Freedman BA, Serrano JA, Belmont PJ Jr, Jackson KL, Cameron B, Neal CJ, Wells R, Yeoman C, Schoenfeld AJ.

INTRODUCTION: In 2009-2010, military physicians hypothesized that a new pattern of spinal injury had emerged, resulting from improvised explosive device assault on up-armored vehicles, associated with a high rate of point of first contact fracture and neurological injury-the combat burst fracture. We sought to determine the incidence of all thoracolumbar (TL) burst fractures and combat burst fractures in 2009-2010 as compared to two antecedent years.

METHODS: A screening process identified all individuals who sustained TL burst fractures in the time-period studied. Demographics, injury-specific characteristics, mechanism of injury, surgical interventions and early complications were recorded. Incidence rates were calculated for the three time periods using total deployed troop-strength and number of LRMC combat admissions as denominators. The incidences of TL burst fractures within each year group and by mechanism were compared, and clinical characteristics and process of care were described.

RESULTS: Between 2007-2010, 65 individuals sustained a TL burst fracture. The incidence of these injuries in 2009-2010 was 2.1 per 10,000 soldier-years and accounted for 3.0 % of LRMC combat-casualty admissions, a significant increase from 0.6 % and 1.1 % in 2007-2008 and 2008-2009, respectively ($p \leq 0.001$). In 2009-2010, US soldiers were 3.4-4.6 times more likely to sustain a TL burst fracture compared to 2008-2009 and 2007-2008 ($p < 0.001$), and the most common mechanism of injury was IED vs. vehicle (65 %)-the combat burst fracture mechanism. Neurological deficits were present in 43 % of TL burst fractures and 1/3 were complete injuries. Spinal fixation was performed in 68 % overall and 74 % of combat burst fractures.

CONCLUSIONS: There was a 3.4- to 4.6-fold increase in TL burst fractures in 2009-2010 compared to antecedent years. The primary driver of this phenomenon was the marked increased in combat burst fractures. Mitigating/preventing the mechanism behind this major spinal injury is a key research initiative for the US military.

Level of Evidence III (Case-control).

Ann Emerg Med. 2014 Jul;64(1):19-25.e6. doi: 10.1016/j.annemergmed.2013.10.026. Epub 2013 Dec 4.

Ondansetron and the risk of cardiac arrhythmias: a systematic review and postmarketing analysis.

Freedman SB, Uleryk E, Rumantir M, Finkelstein Y

STUDY OBJECTIVE: To explore the risk of cardiac arrhythmias associated with ondansetron administration in the context of recent recommendations for identification of high-risk individuals.

METHODS: We conducted a postmarketing analysis and systematically reviewed the published literature, grey literature, manufacturer's database, Food and Drug Administration Adverse Events Reporting System, and the World Health Organization Individual Safety Case Reports Database (VigiBase). Eligible cases described a documented (or perceived) arrhythmia within 24 hours of ondansetron administration. The primary outcome was arrhythmia occurrence temporally associated with the administration of a single, oral ondansetron dose. Secondary objectives included identifying all cases associating ondansetron administration (any dose, frequency, or route) to an arrhythmia.

RESULTS: Primary: No reports describing an arrhythmia associated with single oral ondansetron dose administration were identified. Secondary: Sixty unique reports were identified. Route of administration was predominantly intravenous (80%). A significant medical history (67%) or concomitant use of a QT-prolonging medication (67%) was identified in 83% of reports. Approximately one third occurred in patients receiving chemotherapeutic agents, many of which are known to prolong the QT interval. An additional third involved administration to prevent postoperative vomiting.

CONCLUSION: Current evidence does not support routine ECG and electrolyte screening before single oral ondansetron dose administration to individuals without known risk factors. Screening should be targeted to high-risk patients and those receiving ondansetron intravenously.

J Emerg Med. 2014 Sep;47(3):294-300

Prevalence of Difficult Airway Predictors in Cases of Failed Prehospital Endotracheal Intubation.

Gaither JB, Spaite DW, Stolz U, Ennis J, Mosier J, Sakles JJ.

BACKGROUND: Difficult airway predictors (DAPs) are associated with failed endotracheal intubation (ETI) in the emergency department (ED). However, little is known about the relationship between DAPs and failed prehospital ETI.

OBJECTIVE: Our aim was to determine the prevalence of common DAPs among failed prehospital intubations.

METHODS: We reviewed a quality-improvement database, including all cases of ETI in a single ED, over 3 years. Failed prehospital (FP) ETI was defined as a case brought to the ED after attempted prehospital ETI, but bag-valve-mask ventilation, need for a rescue airway supraglottic device, cricothyrotomy, etc.), or esophageal intubation was discovered at the ED. Physicians performing ETI evaluated each case for the presence of DAPs, including blood/emesis, facial/neck trauma, airway edema, spinal immobilization, short neck, and tongue enlargement.

RESULTS: There were a total of 1377 ED ETIs and 161 had an FP-ETI (11.8%). Prevalence of DAPs in cases with FP-ETI was obesity 13.0%, large tongue 18.0%, short neck 13%, small mandible 4.3%, cervical immobility 49.7%, blood in airway 57.8%, vomitus in airway 23.0%, airway edema 12.4%, and facial or neck trauma 32.9%. The number of cases with FP-ETI and 0, 1, 2, 3, or 4 or more DAPs per case was 22 (13.6%), 43 (26.7%), 23 (24.3%), 42 (26.1%), and 31 (19.3%), respectively.

CONCLUSIONS: DAPs are common in cases of FP-ETI. Some of these factors may be associated with FP-ETI. Additional study is needed to determine if DAPs can be used to identify patients that are difficult to intubate in the field.

Curr Opin Crit Care. 2014 Aug;20(4):385-9.

Intravenous fluids in traumatic brain injury: what's the solution?

Gantner D, Moore EM, Cooper DJ.

PURPOSE OF REVIEW: Intravenous fluid is a fundamental component of trauma care and fluid management influences patient outcomes. This narrative review appraises recent clinical studies of fluid therapy in patients with traumatic brain injury (TBI), with respect to its use in volume resuscitation and prevention of secondary injury.

RECENT FINDINGS: Despite the development of level 1 evidence in fluid resuscitation, in patients with TBI key questions concerning optimal composition and volume remain unanswered. In the absence of randomized trials demonstrating patient outcome differences, clinical practice is often based on physiological principles and surrogate endpoints. There is a physiological rationale why excessive fluid administration and positive fluid balance may increase brain swelling and intracranial pressure (ICP); in some patients, a lower cumulative fluid balance may improve outcomes, but limited human data exist. Resuscitation with 4% albumin in TBI patients in ICU worsens mortality, which may be mediated by increased ICP during the first week after injury. Hypertonic saline and mannitol decrease ICP, but may not improve survival or neurological outcomes. Sodium lactate may be a future therapy for treatment and prevention of secondary brain injury.

SUMMARY: In patients with TBI, intravenous fluids are integral to management; they may be both a source of harm and a potential therapy to limit secondary brain injury. They should be prescribed in accordance with other pharmaceutical or therapeutic interventions. Refined usage may improve patient outcomes.

J Trauma Acute Care Surg. 2014 Jul;77(1):20-7

Cryopreserved red blood cells are superior to standard liquid red blood cells.

Hampton DA(1), Wiles C, Fabricant LJ, Kiraly L, Differding J, Underwood S, Le D, Watters J, Schreiber MA.

BACKGROUND: Liquid preserved packed red blood cell (LPRBC) transfusions are used to treat anemia and increase end-organ perfusion. Throughout their storage duration, LPRBCs undergo biochemical and structural changes collectively known as the storage lesion. These changes adversely affect perfusion and oxygen off-loading. Cryopreserved RBCs (CPRBC) can be stored for up to 10 years and potentially minimize the associated storage lesion. We hypothesized that CPRBCs maintain a superior biochemical profile compared with LPRBCs.

METHODS: This was a prospective, randomized, double-blinded study. Adult trauma patients with an Injury Severity Score (ISS) greater than 4 and an anticipated 1-U to 2-U transfusion of PRBCs were eligible. Enrolled patients were randomized to receive either CPRBCs or LPRBCs. Serum proteins (haptoglobin, serum amyloid P, and C-reactive protein), proinflammatory and anti-inflammatory cytokines, d-dimer, nitric oxide, and 2,3-DPG concentrations were analyzed. Mann-Whitney U-test and Wilcoxon rank sum test were used to assess significance ($p < 0.05$).

RESULTS: Fifty-seven patients were enrolled (CPRBC, n = 22; LPRBC, n = 35). The LPRBC group's final interleukin 8, tumor necrosis factor α, and d-dimer concentrations were elevated compared with their pretransfusion values ($p < 0.05$). After the second transfused units, 2,3-DPG was higher in the patients receiving CPRBCs ($p < 0.05$); this difference persisted throughout the study. Finally, serum protein concentrations were decreased in the transfused CPRBC units compared with LPRBC ($p < 0.01$).

CONCLUSION: CPRBC transfusions have a superior biochemical profile: an absent inflammatory response, attenuated fibrinolytic state, and increased 2,3-DPG. A blood banking system using both storage techniques will offer the highest-quality products to critically injured patients virtually independent of periodic changes in donor availability and transfusion needs.

LEVEL OF EVIDENCE: Therapeutic study, level II.

J Trauma Acute Care Surg. 2014 Jul;77(1):170-5

Standard laparoscopic trocars for the treatment of tension pneumothorax: a superior alternative to needle decompression.

Hatch Q, Debarros M, Johnson E, Inaba K, Martin M.

BACKGROUND: Needle thoracostomy (NT) is a commonly taught intervention for tension pneumothorax (tPTX) but has a high failure rate. We hypothesize that standard 5-mm laparoscopic trocars may be a safe and more effective alternative.

METHODS: Thirty episodes of tPTX and 27 episodes of tension-induced pulseless electrical activity (PEA) were induced in five adult swine using thoracic CO2 insufflation via balloon trocar. Tension was defined as a 50% decrease in cardiac output. Chest decompression was performed with 5-mm laparoscopic trocars for the treatment of both tPTX with hemodynamic compromise and tension-induced PEA. The lungs and heart were inspected and graded at necropsy for trocar-related injury. Results were also compared with success rates with NT in the same model.

RESULTS: The placement of a 5-mm trocar rapidly and immediately relieved tension physiology in 100% of the cases. Mean arterial pressure, cardiac output, central venous pressure, and pulmonary capillary wedge pressure all returned to baseline within 1 minute of trocar placement. Adequate perfusion was restored in 100% of tension-induced PEA cases within 30 seconds of trocar placement. There was no evidence of trocar-related heart or lung damage in any of the experimental animals at necropsy (mean injury scores, 0 for both). Five-millimeter trocars significantly outperformed standard NT for both tPTX and tension-induced PEA arrest.

CONCLUSION: tPTX and tension-induced PEA can be safely and effectively treated with chest decompression using 5-mm laparoscopic trocars. This technique may serve as a more rapid and reliable alternative to needle decompression.

Injury. 2014 Jul;45(7):1028-34

Systematic review of the prevalence and characteristics of battle casualties from NATO coalition forces in Iraq and Afghanistan.

Hoencamp R, Vermetten E, Tan E, Putter H, Leenen L, Hamming J

BACKGROUND: The North Atlantic Treaty Organization (NATO) coalition forces remain heavily committed on combat operations overseas. Understanding the prevalence and characteristics of battlefield injury of coalition partners is vital to combat casualty care performance improvement. The aim of this systematic review was to evaluate the prevalence and characteristics of battle casualties from NATO coalition partners in Iraq and Afghanistan. The primary outcome was mechanism of injury and the secondary outcome anatomical distribution of wounds.

METHODS: This systematic review was performed based on all cohort studies concerning prevalence and characteristics of battlefield injury of coalition forces from Iraq and Afghanistan up to December 20th 2013. Studies were rated on the level of evidence provided according to criteria by the Centre for Evidence Based Medicine in Oxford. The methodological quality of observational comparative studies was assessed by the modified Newcastle-Ottawa Scale.

RESULTS: Eight published articles, encompassing a total of n=19,750 battle casualties, were systematically analyzed to achieve a summated outcome. There was heterogeneity among the included studies and there were major differences in inclusion and exclusion criteria regarding the target population among the included trials, introducing bias. The overall distribution in mechanism of injury was 18% gunshot wounds, 72% explosions and other 10%. The overall anatomical distribution of wounds was head and neck 31%, truncal 27%, extremity 39% and other 3%.

CONCLUSIONS: The mechanism of injury and anatomical distribution of wounds observed in the published articles by NATO coalition partners regarding Iraq and Afghanistan differ from previous campaigns. There was a significant increase in the use of explosive mechanisms and a significant increase in the head and neck region compared with previous wars.

JAMA Surg 2014; 2014 Jul 16. doi: 10.1001/jamasurg.2014.961. [Epub ahead of print

Resuscitation is better for combat casualty outcomes. Now let's forcefully close the performance improvement loop on adverse outcomes.

Holcomb, JB

Quote:
"Clearly published but unfortunately largely overlooked by the military leadership is the finding that a large percentage of both prehospital and hospital combat deaths are potentially preventable.3In addition, there are less-than-optimal outcomes (not resulting in death) that routinely occur. Both of these findings deserve to be given equal attention and to receive an immediate response. Data on these potentially preventable adverse outcomes should be compiled on a weekly basis by the Joint Trauma System. They then need to be reviewed by the US Secretary of Defense, and each adverse outcome should serve as an immediate catalyst for focused research efforts and rapid system change. Similar preventable outcomes on the operational side of the military (eg, negligent discharge, losing a weapon, and leadership deficiencies) routinely incur an immediate command reaction. Preventable adverse outcomes on the medical side deserve a similar immediate command response. Today, some of the service's medical commanders are drifting away from a focus on combat casualty care."

Prehosp Emerg Care. 2014 Jun 16

Prehospital Transfusion of Plasma and Red Blood Cells in Trauma Patients.

Holcomb JB, Donathan DP, Cotton BA, Del Junco DJ, Brown G, Wenckstern TV, Podbielski JM, Camp EA, Hobbs R, Bai Y, Brito M, Hartwell E, Duke JR, Wade CE.

Objective. Earlier use of plasma and red blood cells (RBCs) has been associated with improved survival in trauma patients with substantial hemorrhage. We hypothesized that prehospital transfusion (PHT) of thawed plasma and/or RBCs would result in improved patient coagulation status on admission and survival.

Methods. Adult trauma patient records were reviewed for patient demographics, shock, coagulopathy, outcomes, and blood product utilization from September 2011 to April 2013. Patients arrived by either ground or two different helicopter companies. All patients transfused with blood products (either pre- or in-hospital) were included in the study. One helicopter system (LifeFlight, LF) had thawed plasma and RBCs while the other air (OA) and ground transport systems used only crystalloid resuscitation. Patients receiving PHT were compared with all other patients meeting entry criteria to the study cohort. All comparisons were adjusted in multilevel regression models. Results. A total of 8,536 adult trauma patients were admitted during the 20-month study period, of which 1,677 met inclusion criteria. They represented the most severely injured patients (ISS = 24 and mortality = 26%). There were 792 patients transported by ground, 716 by LF, and 169 on OA. Of the LF patients, 137 (19%) received prehospital transfusion. There were 942 units (244 RBCs and 698 plasma) placed on LF helicopters, with 1.9% wastage. PHT was associated with improved acid-base status on hospital admission, decreased use of blood products over 24 hours, a reduction in the risk of death in the sickest patients over the first 6 hours after admission, and negligible blood products wastage. In this small single-center pilot study, there were no differences in 24-hour (odds ratio 0.57, $p = 0.117$) or 30-day mortality (odds ratio 0.71, $p = 0.441$) between LF and OA.

Conclusions. Prehospital plasma and RBC transfusion was associated with improved early outcomes, negligible blood products wastage, but not an overall survival advantage. Similar to the data published from the ongoing war, improved early outcomes are associated with placing blood products prehospital, allowing earlier infusion of life-saving products to critically injured patients.

Shock. 2014 May;41 Suppl 1:13-20

Challenges and possibilities in forward resuscitation.

Hooper T, De Pasquale M, Strandenes G, Sunde G, Ward K

Abstract:
The environmental and logistical constraints of the prehospital setting make it a challenging place for the treatment of trauma patients. This is perhaps more pronounced in the management of battlefield casualties before extraction to definitive care. In seeking solutions, interest has been renewed in implementing damage control resuscitation principles in the prehospital setting, a concept termed remote damage control resuscitation. These developments, while improving conflict survival rates, are not exclusive to the military environment, with similar situations existing in the civilian setting. By understanding the pathophysiology of shock, particularly the need for oxygen debt repayment, improvements in the assessment and management of trauma patients can be made. Technology gaps have previously hampered our ability to accurately monitor the prehospital trauma patient in real time. However, this is changing, with devices such as tissue hemoglobin oxygen saturation monitors and point-of-care lactate analysis currently being refined. Other monitoring modalities including newer signal analysis and artificial intelligence techniques are also in development. Advances in hemostatic resuscitation are being made as our understanding and ability to effectively monitor patients improve. The reevaluation of whole-blood use in the prehospital environment is yielding favorable results and challenging the negative dogma currently associated with its use. Management of trauma-related airway and respiratory compromise is evolving, with scope to improve on currently accepted practices. The purpose of this review is to highlight the challenges of treating patients in the prehospital setting and suggest potential solutions. In doing so, we hope to maintain the enthusiasm from people in the field and highlight areas for prehospital specific research and development, so that improved rates of casualty survival will continue.

Surg Clin North Am. 2014 Aug;94(4):893-907

Burn Care in Disaster and Other Austere Settings.

Jeng J, Gibran N, Peck M

Abstract:
In some circumstances, burn care must be delivered in a simple manner without the luxury of modern resources. Such circumstances include care in low- and middle-income countries, war zones, and mass casualty incidents. Triage decisions need to be made carefully, allowing the focus of limited personnel and equipment on those most likely to survive. Simple techniques can be used to help many burn victims, such as utilizing oral resuscitation formulas for burn resuscitation. Although even the best attempts at preparation often fall short, there are many benefits from planning and training.

Ann Emerg Med. 2014 Jun;63(6):699-703

Safety of intranasal fentanyl in the out-of-hospital setting: a prospective observational study.

Karlsen A, Pedersen D, Trautner S, Dahl J, Hansen M

STUDY OBJECTIVE: Initial out-of-hospital analgesia is sometimes hampered by difficulties in achieving intravenous access or lack of skills in administering intravenous opioids. We study the safety profile and apparent analgesic effect of intranasal fentanyl in the out-of-hospital setting.

METHODS: In this prospective observational study, we administered intranasal fentanyl in the out-of-hospital setting to adults and children older than 8 years with severe pain resulting from orthopedic conditions, abdominal pain, or acute coronary syndrome refractory to nitroglycerin spray. Patients received 1 to 3 doses of either 50 or 100 μg, and the ambulance crew recorded adverse effects and numeric rating scale (0 to 10) pain scores before and after treatment.

RESULTS: Our 903 evaluable patients received a mean cumulative fentanyl dose of 114 μg (range 50 to 300 μg). There were no serious adverse effects and no use of naloxone. Thirty-six patients (4%) experienced mild adverse effects: mild hypotension, nausea, vomiting, vertigo, abdominal pain, rash, or decrease of Glasgow Coma Scale score to 14. The median reduction in pain score was 3 (interquartile range 2 to 5) after fentanyl administration.

CONCLUSION: The out-of-hospital administration of intranasal fentanyl in doses of 50 to 100 μg is safe and appears effective.

Anesthesiology. 2014 Jul 22. [Epub ahead of print]

Effect of Hydroxyethyl Starch on Postoperative Kidney Function in Patients Having Noncardiac Surgery.

Kashy B, Podolyak A, Makarova N, Dalton JE, Sessler D, Kurz A

BACKGROUND: Whether intraoperative use of hydroxyethyl starch impairs kidney function remains unknown. The authors thus tested the primary hypothesis that Hextend promotes renal injury in surgical patients. Secondarily, the authors evaluated the dose-outcome relationship, in-hospital and 90-day mortality, and whether the relationship between colloid use and acute kidney injury (AKI) depends on baseline risk for AKI.

METHODS: The authors evaluated the data of 44,176 adults without preexisting kidney failure who had inpatient noncardiac surgery from 2005 to 2012. Patients given a combination of colloid and crystalloid were propensity matched on morphometric, and baseline characteristics to patients given only crystalloid. The primary analysis was a proportional odds logistic regression with AKI as an ordinal outcome based on the Acute Kidney Injury Network classification.

RESULTS: The authors matched 14,680 patients receiving colloids with 14,680 patients receiving noncolloids for a total of 29,360 patients. After controlling for potential confounding variables, the odds of developing a more serious level of AKI with Hextend was 21% (6 to 38%) greater than with crystalloid only ($P = 0.001$). AKI risk increased as a function of colloid volume ($P < 0.001$). In contrast, the relationship between colloid use and AKI did not differ on baseline AKI risk ($P = 0.84$). There was no association between colloid use and risk of in-hospital ($P = 0.81$) or 90-day ($P = 0.02$) mortality.

CONCLUSION: Dose-dependent renal toxicity associated with Hextend in patients having noncardiac surgery is consistent with randomized trials in critical care patients.

Curr Neurol Neurosci Rep. 2014 Sep;14(9):482

Hypertonic saline for the treatment of intracranial hypertension.

Kheirbek T, Pascual JL.

Abstract:
Intracranial hypertension is caused by brain edema generated by different disorders, the commonest of which is traumatic brain injury. The treatment of brain edema focuses on drawing water out of brain tissue into the intravascular space. This is typically accomplished with osmolar therapy, most commonly mannitol and hypertonic saline. Recent human trials suggest that hypertonic saline may have a more profound and long-lasting effect in reducing intracranial hypertension following traumatic brain injury when compared with mannitol. However, reports suffer from inconsistencies in dose, frequency, concentration, and route of administration. Side effect profile, potential complications, and contraindications to administration need to be factored in when considering which first-line osmotherapy to choose for a given patient with head injury.

J Spec Oper Med. 2014;14:1-5

First Case Report of SAM Junctional Tourniquet Use in Afghanistan to Control Inguinal Hemorrhage on the Battlefield.

Klotz J, Leo M, Anderson B, Nkodo A, Garcia G, Wichern A, Chambers M, Gonzalez O, Pahle M, Wagner J, Robinson J, Kragh JF Jr.

Abstract:
Junctional hemorrhage, bleeding that occurs at the junction of the trunk and its appendages, is the most common preventable cause of death from compressible hemorrhage on the battlefield. As of January 2014, four types of junctional tourniquets have been developed and cleared by the U.S. Food and Drug Administration (FDA). Successful use of the Abdominal Aortic Tourniquet (AAT™) and Combat Ready Clamp (CRoC™) has already been reported. We report here the first known prehospital use of the SAM® Junctional Tourniquet (SJT) for a battlefield casualty with inguinal junctional hemorrhage.

Ann Emerg Med. 2014 Jul;64(1):17-8

Critical care paramedics - a missing component for safe interfacility transport in the United States.

Kupas D, Wang H

Quote:
Technologic advances and the regionalization of health care will likely increase the need for interfacility transport of critically ill patients. In the United States, there is growing sentiment supporting the national recognition of advanced-level paramedics to facilitate interfacility transport. Further studies are certainly needed to build the evidence base to guide this model of care. However, the addition of a specially educated advanced-level provider to the national EMS scope of practice model may provide an important first step toward ensuring competent and safe care during interfacility transport of critically ill patients.

Int J Crit Illn Inj Sci. 2014 Apr;4(2):143-55

Thoracostomy tubes: A comprehensive review of complications and related topics.

Kwiatt M, Tarbox A, Seamon M, Swaroop M, Cipolla J, Allen C, Hallenbeck S, Davido H, Lindsey D, Doraiswamy V, Galwankar S, Tulman D, Latchana N, Papadimos T, Cook C, Stawicki S

Abstract:
Tube thoracostomy (TT) placement belongs among the most commonly performed procedures. Despite many benefits of TT drainage, potential for significant morbidity and mortality exists. Abdominal or thoracic injury, fistula formation and vascular trauma are among the most serious, but more common complications such as recurrent pneumothorax, insertion site infection and nonfunctioning or malpositioned TT also represent a significant source of morbidity and treatment cost. Awareness of potential complications and familiarity with associated preventive, diagnostic and treatment strategies are fundamental to satisfactory patient outcomes. This review focuses on chest tube complications and related topics, with emphasis on prevention and problem-oriented approaches to diagnosis and treatment. The authors hope that this manuscript will serve as a valuable foundation for those who wish to become adept at the management of chest tubes.

Mil Med. 2014 Jul;179(7):783-6

Measure of chest wall thickness in French soldiers: which technique to use for needle decompression of tension pneumothorax at the front?

Lamblin A, Turc J, Bylicki O, Lohéas D, Martinez J, Derkenne C, Wey P, Précloux P

OBJECTIVES: Needle decompression of tension pneumothorax in soldiers of the French infantry has a risk for failure when the standard procedure that involves the insertion of a 14-gauge, 5-cm catheter into the 2nd intercostal space (ICS) is used. This study measured the chest wall thickness (CWT) to assess whether this approach is appropriate.

METHODS: CWT was measured by ultrasound in 122 French soldiers at the 2nd and 4th ICSs on both the right and left sides.

RESULTS: CWT was measured at 4.19 cm (± 0.96 cm) at the 2nd ICS and 3.00 cm (± 0.91 cm) at the 4th ICS ($p < 0.001$). CWT was greater than 5 cm in 24.2% of cases at the 2nd ICS and 4.9% of cases at the 4th ICS ($p < 0.001$).

CONCLUSIONS: This study suggests a high risk of failure when using the technique currently taught in the French army. A lateral approach into the 4th ICS could decrease this risk. The results of this study must be validated in patients presenting tension pneumothorax.

JAMA Surg. 2014 Jul 16

Changing Patterns of In-Hospital Deaths Following Implementation of Damage Control Resuscitation Practices in US Forward Military Treatment Facilities.

Langan N, Eckert M, Martin M

Importance: Analysis of combat deaths provides invaluable epidemiologic and quality-improvement data for trauma centers and is particularly important under rapidly evolving battlefield conditions.

Objective: To analyze the evolution of injury patterns, early care, and resuscitation among patients who subsequently died in the hospital, before and after implementation of damage control resuscitation (DCR) policies.

Design, Setting, and Participants: In a review of the Joint Theater Trauma Registry (2002-2011) of US forward combat hospitals, cohorts of patients with vital signs at presentation and subsequent in-hospital death were grouped into 2 time periods: pre-DCR (before 2006) and DCR (2006-2011).

Main Outcomes and Measures: Injury types and Injury Severity Scores (ISSs), timing and location of death, and initial (24-hour) and total volume of blood products and fluid administered.

Results: Of 57 179 soldiers admitted to a forward combat hospital, 2565 (4.5%) subsequently died in the hospital. The majority of patients (74%) were severely injured (ISS > 15), and 80% died within 24 hours of admission. Damage control resuscitation policies were widely implemented by 2006 and resulted in a decrease in mean 24-hour crystalloid infusion volume (6.1-3.2 L) and increased fresh frozen plasma use (3.2-10.1 U) (both $P < .05$) in this population. The mean packed red blood cells to fresh frozen plasma ratio changed from 2.6:1 during the pre-DCR period to 1.4:1 during the DCR period ($P < .01$). There was a significant increase in mean ISS between cohorts (pre-DCR ISS = 23 vs DCR ISS = 27; $P < .05$) and a marked shift in injury patterns favoring more severe head trauma in the DCR cohort.

Conclusions and Relevance: There has been a significant shift in resuscitation practices in forward combat hospitals indicating widespread military adoption of DCR. Patients who died in a hospital during the DCR period were more likely to be severely injured and have a severe brain injury, consistent with a decrease in deaths among potentially salvageable patients.

J Trauma Acute Care Surg. 2014 Jul;77(1):67-72

Traumatic brain injury is not associated with coagulopathy out of proportion to injury in other body regions.

Lee T, Hampton D, Diggs B, McCully S, Kutcher M, Redick B, Podbielski J, Cotton B, Cohen M, Schreiber M

BACKGROUND: Coagulopathy following trauma is associated with poor outcomes. Traumatic brain injury has been associated with coagulopathy out of proportion to other body regions. We hypothesized that injury severity and shock determine coagulopathy independent of body region injured.

METHODS: We performed a prospective, multicenter observational study at three Level 1 trauma centers. Conventional coagulation tests (CCTs) and rapid thrombelastography (r-TEG) were used. Admission vital signs, base deficit (BD), CCTs, and r-TEG data were collected. The Abbreviated Injury Scale (AIS) score and Injury Severity Score (ISS) were obtained. Severe injury was defined as AIS score greater than or equal to 3 for each body region. Patients were grouped according to their dominant AIS region of injury. Dominant region of injury was defined as the single region with the highest AIS score. Patients with two or more regions with the same greatest AIS score and patients without a region with an AIS score greater than or equal to 3 were excluded. Coagulation parameters were compared between the dominant AIS region. Significant hypoperfusion was defined as BD greater than or equal to 6.

RESULTS: Of the 795 patients enrolled, 462 met criteria for grouping by dominant AIS region. Patients were predominantly white (59%), were male (75%), experienced blunt trauma (71%), and had a median ISS of 25 (interquartile range, 14-29). Patients with BD greater than or equal to 6 (n = 110) were hypocoagulable by CCT and r-TEG compared with patients with BD less than 6 (n = 223). Patients grouped by dominant AIS region showed no significant differences for any r-TEG or CCT parameter. Patients with BD greater than or equal to 6 demonstrated no difference in any r-TEG or CCT parameter between dominant AIS regions.

CONCLUSION: Coagulopathy results from a combination of tissue injury and shock independent of the dominant region of injury. With the use of AIS as a measure of injury severity, traumatic brain injury was not independently associated with more profound coagulopathy.

LEVEL OF EVIDENCE: Epidemiologic study, level III.

Blood Coagul Fibrinolysis. 2014 Jun;25(4):353-9

The influence of coagulopathy on outcome after traumatic subdural hematoma: a retrospective single-center analysis of 319 patients.

Lemcke J, Al-Zain F, von der Brelie C, Ebenau M, Meier U.

Abstract:
The aim of this study was to identify the effects of coagulopathy on the outcome of patients with traumatic subdural hematoma (SDH). Based on a retrospective study, the records of all patients admitted between 2001 and 2007 to a large emergency hospital with acute SDH resulting from traumatic brain injury (TBI) were analyzed. An initial Glasgow coma score (GCS), clinical state, and Glasgow outcome score (GOS) were recorded for all patients. All computer assisted tomography and MRI scans obtained from patients were saved on an electronic storage device and were reviewed by a neurosurgeon and a neuroradiologist. The coagulation parameters were analyzed for all patients. Coagulopathy was defined as international normalized ratio more than 1.2 or partial thromboplastin time more than 37 s. One hundred and five women and 214 men aged between 1 and 100 years (mean 59 years) were included in the study. Patients with coagulopathy had a significantly worse outcome. Almost twice as many patients died in the coagulopathy group (mean GOS 3.10±1.46) than in the group without coagulopathy (mean GOS 2.16±1.45), ($P<0.001$). In-hospital mortality is twice as frequent in patients with coagulopathy with traumatic SDH compared with noncoagulopathic patients, even if the initial severity of the TBI does not differ.

Emerg Med J. 2014 Sep;31(9):784. doi: 10.1136/emermed-2014-204221.16.

Saving the critically injured trauma patient: a retrospective analysis of 1000 uses of intraosseous access.

Lewis P, Wright C.

OBJECTIVES & BACKGROUND: Intraosseous (IO) access is becoming increasingly accepted in adult populations as an alternative to peripheral vascular access, however there is still insufficient evidence in large patient groups supporting its use.

METHODS: Retrospective review. This paper reports on the use of intraosseous devices over a 7 year period from August 2006 to August 2013 during combat operations in Afghanistan. A search of the Joint Theatre Trauma Registry (JTTR-UK), a database of all trauma patients treated by Defence Medical Services in Iraq and Afghanistan, was carried out looking for all the incidences of intraosseous access use during this time. Adults were defined as patients aged 17 or above. Patient demographics, injuries, treatments and complications were retrieved. The results were collated and analysed using Excel TM (Microsoft).

RESULTS: 1014 intraosseous devices were used in 830 adult patients with no major complications. The rate of minor complications, the majority of which were device failure, was 1.38%. 5124 separate infusions of blood products or fluids occurred via intraosseous access, with 36% being of packed red cells. On average each casualty received 6.95 different infusions of blood products and fluids, and 3.28 separate infusions of drugs through intraosseous access. 32 different drugs were infused to 367 patients via IO, the most frequent being anaesthetic agents. Intraosseous access was used in the pre-hospital environment, during tactical helicopter evacuation and within hospitals.

CONCLUSION: Intraosseous access can be used for the infusion of a wide variety of life saving medications, quickly, easily with low complication rates. This highlights its valuable role as an alternative method of obtaining vascular access, vital when resuscitating the critically injured trauma patient.

Br J Anaesth. 2014 Aug;113(2):220-5

Observational study of the success rates of intubation and failed intubation airway rescue techniques in 7256 attempted intubations of trauma patients by pre-hospital physicians.

Lockey D, Crewdson K, Weaver A, Davies G

BACKGROUND: Effective airway management is a priority in early trauma management. Data on physician pre-hospital tracheal intubation are limited; this study was performed to establish the success rate for tracheal intubation in a physician-led system and examine the management of failed intubation and emergency surgical cricothyroidotomy in pre-hospital trauma patients. Failed intubation rates for anaesthetists and non-anaesthetists were compared.

METHODS: A retrospective database review was conducted to identify trauma patients undergoing pre-hospital advanced airway management between September 1991 and December 2012. The success rate of tracheal intubation and the use and success of rescue techniques were established. Success rates of tracheal intubation by individuals and by specialty were recorded.

RESULTS: The doctor-paramedic team attended 28 939 patients; 7256 (25.1%) required advanced airway management. A surgical airway was performed immediately, without attempted laryngoscopy, in 46 patients (0.6%). Tracheal intubation was successful in 7158 patients (99.3%). Rescue surgical airways were performed in 42 patients, seven had successful insertion of supraglottic devices, and two patients had supraglottic device insertion and a surgical airway. One patient breathed spontaneously with bag-valve-mask support during transfer. All rescue techniques were successful. Non-anaesthetists performed 4394 intubations and failed to intubate in 41 cases (0.9%); anaesthetists performed 2587 intubations and failed in 11 (0.4%) (P=0.02).

CONCLUSIONS: This is the largest series of physician pre-hospital tracheal intubation; the success rate of 99.3% is consistent with other reported data. All rescue airways were successful. Non-anaesthetists were twice as likely to have to perform a rescue airway intervention than anaesthetists. Surgical airway rates reported here (0.7%) are lower than most other physician-led series (median 3.1%, range 0.1-7.7%).

Travel Med Infect Dis. 2014 July - August;12(4):318-329

Prevention of combat-related infections: Antimicrobial therapy in battlefield and barrier measures in French military medical treatment facilities.

Mérens A, Rapp C, Delaune D, Danis J, Berger F, Michel R

Abstract:
Infection is a major complication associated with combat-related injuries. Beside immobilization, wound irrigation, surgical debridement and delayed coverage, post-injury antimicrobials contribute to reduce combat-related infections, particularly those caused by bacteria of the early contamination flora. In modern warfare, bacteria involved in combat-related infections are mainly Gram-negative bacteria belonging to the late contamination flora. These bacteria are frequently resistant or multiresistant to antibiotics and spread through the deployed chain of care. This article exposes the principles of war wounds antimicrobial prophylaxis recommended in the French Armed Forces and highlights the need for high compliance to hygiene standard precautions, adapted contact precautions and judicious use of antibiotics in French deployed military medical treatment facilities (MTF).

Blood Coagul Fibrinolysis. 2014 Jul 3. [Epub ahead of print]

Acetaminophen and meloxicam inhibit platelet aggregation and coagulation in blood samples from humans.

Martini A, Rodriguez C, Cap A, Martini W, Dubick M

Abstract:
Acetaminophen (ACE) and meloxicam (Mel) are the two types of analgesic and antipyretic medications. This study investigated the dose responses of acetaminophen and meloxicam on platelet aggregation and coagulation function in human blood samples. Blood samples were collected from six healthy humans and processed to make platelet-adjusted (100×10cells/μl) blood samples. Acetaminophen (Tylenol, Q-PAP, 100mg/ml) was added at the doses of 0μg/ml (control), 214μg/ml (the standard dose, 1×), 4×, 8×, 10×, 12×, 16×, and 20×. Similarly, meloxicam (Metacam, 5mg/ml) was added at doses of 0μg/ml (control), 2.85μg/ml (the standard dose, 1×), 4×, 8×, 10×, 12×, 16×, and 20×. Fifteen minutes after the addition of acetaminophen and/or meloxicam, platelet aggregation was stimulated with collagen (2μg/ml) or arachidonic acid (0.5mmol/l) and assessed using a Chrono-Log 700 aggregometer. Coagulation function was assessed by prothrombin time (PT), activated partial thromboplastin time (aPTT), and using Rotem thrombelastogram. A robust inhibition by acetaminophen and/or meloxicam was observed in arachidonic acid-stimulated platelet aggregation starting at 1× dose. Collagen-stimulated platelet aggregation was inhibited by ACE starting at 1× (78±10% of control), and by meloxicam starting at 4× (72±5% of control, both $P<0.05$). The inhibitions by acetaminophen and meloxicam combined were similar to those by acetaminophen or meloxicam. aPTT was prolonged by meloxicam starting at 4×. No changes were observed in PT or any of Rotem measurements by acetaminophen and/or meloxicam. Acetaminophen and meloxicam compromised platelet aggregation and aPTT. Further effort is warranted to characterize the effects of acetaminophen and meloxicam on bleeding in vivo.

Injury. 2014 Jan;45(1):61-5

The utility of a shock index ≥ 1 as an indication for pre-hospital oxygen carrier administration in major trauma.

Mitra B, Fitzgerald M, Chan J

INTRODUCTION AND AIMS: The use of intravenous oxygen carriers (packed red blood cells (PRBC), whole blood and synthetic haemoglobins (HBOCs) for selected pre-hospital trauma resuscitation cases has been reported, despite a lack of validated clinical indications. The aim of this study was to retrospectively identify a sub-group of adult major trauma patients most likely to benefit from pre-hospital oxygen carrier administration and determine the predictive relationship between pre-hospital shock index (SI) [pulse rate/systolic blood pressure] and haemorrhagic shock, blood transfusion and mortality.

METHODS: A retrospective review of adult major trauma patients recorded in The Alfred Trauma Registry was conducted. Patients were included if they received at least 1L of pre-hospital crystalloid and spent over 30 min in transit. The association of shock index and transfusion was determined. Patients were further sub-grouped by mode of transport to determine the population of trauma patients who could be included into prospective studies of intravenous oxygen carriers.

RESULTS: There were 1149 patients included of whom 311 (21.9%) received an acute blood transfusion. The SI correlated well with transfusion practice. A SI ≥ 1.0, calculated after at least 1L of crystalloid transfusion, identified patients with a high specificity (93.5%; 95% CI: 91.8-94.8) for receiving a blood transfusion within 4h of hospital arrival. While patients transported by helicopter had higher injury severity and blood transfusion requirement, there were no difference in physiological variables and outcomes when compared to patients transported by road car.

CONCLUSIONS: A shock index ≥ 1.0 is an easily calculated variable that may identify patients for inclusion into trials for pre-hospital oxygen carriers. Shocked patients have high mortality rates whether transported by road car or by helicopter. The efficacy of pre-hospital intravenous oxygen carriers should be trialled using a shock index ≥ 1.0 despite fluid resuscitation as the clinical trigger for administration.

Emerg Med Australas. 2014 Apr;26(2):194-7

Tranexamic acid for trauma: filling the 'GAP' in evidence.

Mitra B, Mazur S, Cameron P, Bernard S, Burns B, Smith A, Rashford S, Fitzgerald M, Smith K, Gruen R; PATCH-Trauma Study Investigators.

Abstract:
Following findings of the Clinical Randomisation of an Antifibrinolytic in Significant Haemorrhage (CRASH-2) trial, tranexamic acid (TxA) use post trauma is becoming widespread. However, issues of generalisability, applicability and predictability beyond the context of study sites remain unresolved. Internal and external validity of the CRASH-2 trial are currently lacking and therefore incorporation of TxA into routine trauma resuscitation guidelines appears premature. The Pre-hospital Antifibrinolytics for Traumatic Coagulopathy and Haemorrhage (PATCH)-Trauma study is a National Health and Medical Research Council-funded randomised controlled trial of early administration of TxA in severely injured patients likely to have acute traumatic coagulopathy. The study population chosen has high mortality and morbidity and is potentially most likely to benefit from TxA's known mechanisms of action. This and further trials involving appropriate sample populations are required before evidence based guidelines on TxA use during trauma resuscitation can be developed.

JAMA Surg. 2013 Mar;148(3):218-25

Association of cryoprecipitate and tranexamic acid with improved survival following wartime injury: findings from the MATTERs II Study.

Morrison J, Ross J, Dubose J, Jansen J, Midwinter M, Rasmussen T

OBJECTIVE: To quantify the impact of fibrinogen-containing cryoprecipitate in addition to the antifibrinolytic tranexamic acid on survival in combat injured.

DESIGN: Retrospective observational study comparing the mortality of 4 groups: tranexamic acid only, cryoprecipitate only, tranexamic acid and cryoprecipitate, and neither tranexamic acid nor cryoprecipitate. To balance comparisons, propensity scores were developed and added as covariates to logistic regression models predicting mortality.

SETTING: A Role 3 Combat Surgical Hospital in southern Afghanistan.

PATIENTS: A total of 1332 patients were identified from prospectively collected U.K. and U.S. trauma registries who required 1 U or more of packed red blood cells and composed the following groups: tranexamic acid (n = 148), cryoprecipitate (n = 168), tranexamic acid/cryoprecipitate (n = 258), and no tranexamic acid/cryoprecipitate (n = 758).

MAIN OUTCOME MEASURE: In-hospital mortality.

RESULTS: Injury severity scores were highest in the cryoprecipitate (mean [SD], 28.3 [15.7]) and tranexamic acid/cryoprecipitate (mean [SD], 26 [14.9]) groups compared with the tranexamic acid (mean [SD], 23.0 [19.2]) and no tranexamic acid/cryoprecipitate (mean [SD], 21.2 [18.5]) ($P < .001$) groups. Despite greater Injury Severity Scores and packed red blood cell requirements, mortality was lowest in the tranexamic acid/cryoprecipitate (11.6%) and tranexamic acid (18.2%) groups compared with the cryoprecipitate (21.4%) and no tranexamic acid/cryoprecipitate (23.6%) groups. Tranexamic acid and cryoprecipitate were independently associated with a similarly reduced mortality (odds ratio, 0.61; 95% CI, 0.42-0.89; $P = .01$ and odds ratio, 0.61; 95% CI, 0.40-0.94; $P = .02$, respectively). The combined tranexamic acid and cryoprecipitate effect vs. neither in a synergy model had an odds ratio of 0.34 (95% CI, 0.20-0.58; $P < .001$), reflecting nonsignificant interaction ($P = .21$).

CONCLUSIONS: Cryoprecipitate may independently add to the survival benefit of tranexamic acid in the seriously injured requiring transfusion. Additional study is necessary to define the role of fibrinogen in resuscitation from hemorrhagic shock.

Ann Surg. 2014 Jan 13. [Epub ahead of print]

Prehospital Use of Nonsteroidal Anti-inflammatory Drugs (NSAIDs) Is Associated With a Reduced Incidence of Trauma-Induced Coagulopathy.

Neal M, Brown J, Moore E, Cuschieri J, Maier R, Minei J, Billiar T, Peitzman A, Cohen M, Sperry J; The Inflammation and the Host Response to Injury Investigators.

OBJECTIVE: To determine whether prehospital nonsteroidal anti-inflammatory drug (NSAID) use may lead to a reduced incidence of trauma-induced coagulopathy (TIC) in severely injured patients.

BACKGROUND: TIC is present in up to a quarter of severely injured trauma patients and is linked to worse outcomes after injury. Evidence linking TIC to inflammation has emerged; however, the mechanism behind this association is still under investigation. NSAIDs are commonly used anti-inflammatory drugs, but their effects on TIC and outcomes after injury are largely unexplored.

METHODS: We performed a secondary analysis of the Inflammation and the Host Response to Injury Large Scale Collaborative Program (Glue Grant) data set. Prehospital medications and comorbidities were analyzed by logistic regression analysis for association with TIC as defined by laboratory (international normalized ratio >1.5) or clinical (transfusion >2 units of fresh frozen plasma or >1 pack of platelets in 6 hours) parameters.

RESULTS: Prehospital NSIAD use was independently associated with a 72% lower risk of TIC and was the only medication among 15 analyzed to retain significance in the model. Stepwise logistic regression also demonstrated that preadmission use of NSAIDs was independently associated with a 66% lower risk of clinically significant coagulopathy. These findings were independent of comorbid conditions linked to NSAID use.

CONCLUSIONS: NSAID use before admission for severe injury is associated with a reduced incidence of TIC. These findings provide further evidence to a potential leak (sic) between TIC and inflammation.

Int Orthop. 2013 May;37(5):827-32.

Tourniquet time affects postoperative complications after knee arthroplasty.

Olivecrona C, Lapidus L, Benson L, Blomfeldt R.

PURPOSE: Pneumatic tourniquets are frequently used in knee arthroplasty surgery. However, there is a lack of evidence to define safe tourniquet time in lower limb surgery. The primary aim of this study was to investigate whether tourniquet time influences the risk of postoperative complications after primary and secondary knee arthroplasty.

METHODS: This study was a prospective register study. Since we wanted dispersion in tourniquet time, we included a consecutive series of 577 primary knee arthroplasties, 46 revision knee arthroplasties, and 18 patellar supplementing knee arthroplasties from a clinical audit database over a period of five years. The following postoperative complications were recorded: superficial wound infections, deep wound infections, deep vein thrombosis, pulmonary embolism, nerve injuries, compartment syndrome, cuff pressure injuries, and bandage injuries.

RESULTS: Tourniquet time over 100 minutes was associated with an increased risk of complications after knee arthroplasty surgery (OR 2.2, CI 1.5-3.1). This increase in risk remained after adjusting for cuff pressure, sex, age, American Society of Anesthesiologists (ASA) classification, smoking, diabetes, and surgery indication (OR 2.4, CI 1.6-3.6).

CONCLUSIONS: Tourniquet time over 100 minutes increases the risk of complications after knee arthroplasty surgery and special attention is advocated to reduce the tourniquet time.

Injury. 2014 Mar;45(3):573-7

Tourniquet use for peripheral vascular injuries in the civilian setting.

Passos E, Dingley B, Smith A, Engels P, Ball C, Faidi S, Nathens A, Tien H; Canadian Trauma Trials Collaborative.

BACKGROUND: Haemorrhage in peripheral vascular injuries may cause life-threatening exsanguination. Tourniquets are used extensively by the military, with increased interest in the civilian setting to prevent deaths. This is a retrospective study of trauma patients at two large Canadian trauma centres with arterial injury after isolated extremity trauma. We hypothesized that tourniquet use may decrease mortality rate and transfusion requirements if applied early.

METHODS: The study group was all adult patients at two Level 1 Trauma Centres in two Canadian cities in Canada, who had arterial injuries from extremity trauma. The study period was from January 2001 to December 2010. We excluded patients with significant associated injuries. The intervention in this study was prehospital tourniquet use. The main outcome was in-hospital mortality. Secondary outcomes were length of stay, compartment syndrome, amputation, and blood product transfusion.

RESULTS: 190 patients were included in the study, and only 4 patients had a prehospital tourniquet applied. They arrived directly from the scene of injury, had improvised tourniquets by police or bystanders, and showed a trend to be more hypotensive and acidotic. Four other patients had tourniquets applied in the trauma bay within 1h of injury. There were no differences in age, sex, injury severity or physiologic presentation between patients who had an early tourniquet applied and those who died without a tourniquet. However, six patients died without a tourniquet, and all bled to death. Of the eight patients who had early tourniquets applied, none died.

CONCLUSIONS: Tourniquets may prevent exsanguination in the civilian setting for patients suffering either blunt or penetrating trauma to the extremity. Future studies will help determine the utility of deploying tourniquets in the civilian setting, given the rarity of exsanguinating haemorrhage from isolated extremity trauma in this setting.

Eur J Emerg Med. 2014 May 16. [Epub ahead of print]

First-pass intubation success rate during rapid sequence induction of prehospital anaesthesia by physicians versus paramedics.

Peters J, van Wageningen B, Hendriks I, Eijk R, Edwards M, Hoogerwerf N, Biert J.

INTRODUCTION: Endotracheal intubation is a frequently performed procedure for securing the airway in critically injured or ill patients. Performing prehospital intubation may be challenging and intubation skills vary. We reviewed the first-attempt tracheal intubation success rate in a Dutch prehospital setting.

PATIENTS AND METHODS: We studied our database for all intubations performed by helicopter emergency medical services (HEMS) physicians, HEMS nurses and ambulance paramedics under HEMS supervision between January 2007 and July 2012. The primary outcome was success rate, number of intubation attempts and alternative airway procedures.

RESULTS: In all, 1399 patients were in need of a secured airway. In 571 (40.8%) of these cases, ambulance paramedics made a first intubation attempt under HEMS supervision. If necessary, rapid sequence induction medication was administered. In comparable patient groups, the first intubation success rate was significantly lower in ambulance paramedics compared with helicopter physicians (46.4 vs. 84.5%, P<0.0001). The overall physician intubation success rate was 98.4% after one or more intubation attempts. In 19 cases, a surgical airway was created and in three cases an alternative ventilation method was used.

CONCLUSION: Prehospital intubations had a significantly higher success rate when performed by helicopter physicians. We promote a low threshold for HEMS deployment in cases of a potentially compromised airway.

Tourniquets make comeback as police try to duplicate battlefield success in Afghanistan, Iraq

By RAMIT PLUSHNICK-MASTI Associated Press
The Associated Press July 1st, 2014.

Quote:
HOUSTON (AP) – “Rushing into a Houston home, police officer Austin Huckabee encountered a drunken, combative man bleeding profusely on the kitchen floor. He quickly realized the blood was spurting in rhythm with the man's heart and cardiac arrest was just moments away. Pulling a tourniquet from his belt, the former Army captain and his partner restrained the man, wrapped the band around his arm and twisted an attached rod to tighten it until the bleeding stopped. Then Huckabee waited for paramedics, knowing a life had been saved.”

Crit Care Med. 2014 Jun;42(6):1372-8

The process of prehospital airway management: challenges and solutions during paramedic endotracheal intubation.

Prekker M, Kwok H, Shin J, Carlbom D, Grabinsky A, Rea T

OBJECTIVES: Endotracheal intubation success rates in the prehospital setting are variable. Our objective was to describe the challenges encountered and corrective actions taken during the process of endotracheal intubation by paramedics.

DESIGN: Analysis of prehospital airway management using a prospective registry that was linked to an emergency medical services administrative database.

SETTING: Emergency medical services system serving King County, Washington, 2006-2011. Paramedics in this system have the capability to administer neuromuscular blocking agents to facilitate intubation (i.e., rapid sequence intubation).

PATIENTS: A total of 7,523 patients more than 12 years old in whom paramedics attempted prehospital endotracheal intubation.

INTERVENTIONS: None.

MEASUREMENTS AND MAIN RESULTS: An intubation attempt was defined as the introduction of the laryngoscope into the patient's mouth, and the attempt concluded when the laryngoscope was removed from the mouth. Endotracheal intubation was successful on the first attempt in 77% and ultimately successful in 99% of patients (7,433 of 7,523). Paramedics used a rapid sequence intubation strategy on 54% of first attempts. Among the subset with a failed first attempt (n = 1,715), bodily fluids obstructing the laryngeal view (50%), obesity (28%), patient positioning (17%), and facial or spinal trauma (6%) were identified as challenges to intubation. A variety of adjustments were made to achieve intubation success, including upper airway suctioning (used in 43% of attempts resulting in success), patient repositioning (38%), rescue bougie use (19%), operator change (16%), and rescue rapid sequence intubation (6%). Surgical cricothyrotomy (0.4%, n = 27) and bag-valve-mask ventilation (0.8%, n = 60) were rarely performed by paramedics as final rescue airway strategies.

CONCLUSIONS: Airway management in the prehospital setting has substantial challenges. Success can require a collection of adjustments that involve equipment, personnel, and medication often in a simultaneous fashion.

Wilderness Environ Med. 2014 Sep;25(3):295-310

Wilderness Medical Society Practice Guidelines for Basic Wound Management in the Austere Environment.

Quinn R, Wedmore I, Johnson E, Islas A, Anglim A, Zafren K, Bitter C, Mazzorana V

Abstract:
In an effort to produce best-practice guidelines for wound management in the austere environment, the Wilderness Medical Society convened an expert panel charged with the development of evidence-based guidelines for the management of wounds sustained in an austere (dangerous or compromised) environment. Recommendations are made about several parameters related to wound management. These recommendations are graded based on the quality of supporting evidence and the balance between the benefits and risks or burdens for each parameter according to the methodology stipulated by the American College of Chest Physicians.

Wilderness Environ Med. 2014 Sep;25(3):367-369. doi: 10.1016/j.wem.2014.03.016. Epub 2014 Jun 13.

In Reply to Spine Protection in the Austere Environment.

Quinn R, Williams J, Bennett B, Stiller G, Islas A, McCord S

Quote:
"The algorithm is not meant to provide the definitive answer to spine care in the field. It is meant as a template open to modification by skilled and knowledgeable providers. As Dr Zafren et al point out, the evidence fails to support the use of immobilization altogether, and in that light, there is no need for the algorithm. We realize, however ,that the levels of evidence currently available, although likely accurate, are not high level. That, combined with the fact that many will consider the very notion of discarding immobilization in its entirety "heresy," makes our algorithm a reasonable transition to a new paradigm while allowing (and, it is hoped, promoting) further study to improve our understanding of spine injury, spinal protection, and the quality of evidence on which to base further recommendations."

Crit Care Med. 2014 Jul;42(7):1585-91

Association between the choice of IV crystalloid and in-hospital mortality among critically ill adults with sepsis.

Raghunathan K, Shaw A, Nathanson B, Stürmer T, Brookhart A, Stefan M, Setoguchi S, Beadles C, Lindenauer P

OBJECTIVE: Isotonic saline is the most commonly used crystalloid in the ICU, but recent evidence suggests that balanced fluids like Lactated Ringer's solution may be preferable. We examined the association between choice of crystalloids and in-hospital mortality during the resuscitation of critically ill adults with sepsis.

DESIGN: A retrospective cohort study of patients admitted with sepsis, not undergoing any surgical procedures, and treated in an ICU by hospital day 2. We used propensity score matching to control for confounding and compared the following outcomes after resuscitation with balanced versus with no-balanced fluids: in-hospital mortality, acute renal failure with and without dialysis, and hospital and ICU lengths of stay. We also estimated the dose-response relationship between receipt of increasing proportions of balanced fluids and in-hospital mortality.

SETTING: Three hundred sixty U.S. hospitals that were members of the Premier Healthcare alliance between November 2005 and December 2010.

PATIENTS: A total of 53,448 patients with sepsis, treated with vasopressors and crystalloids in an ICU by hospital day 2 including 3,396 (6.4%) that received balanced fluids.

INTERVENTIONS: None.

MEASUREMENTS AND MAIN RESULTS: Patients treated with balanced fluids were younger and less likely to have heart or chronic renal failure, but they were more likely to receive mechanical ventilation, invasive monitoring, colloids, steroids, and larger crystalloid volumes (median 7 vs 5 L). Among 6,730 patients in a propensity-matched cohort, receipt of balanced fluids was associated with lower in-hospital mortality (19.6% vs 22.8%; relative risk, 0.86; 95% CI, 0.78, 0.94). Mortality was progressively lower among patients receiving larger proportions of balanced fluids. There were no significant differences in the prevalence of acute renal failure (with and without dialysis) or in-hospital and ICU lengths of stay.

CONCLUSIONS: Among critically ill adults with sepsis, resuscitation with balanced fluids was associated with a lower risk of in-hospital mortality. If confirmed in randomized trials, this finding could have significant public health implications, as crystalloid resuscitation is nearly universal in sepsis.

J Trauma Acute Care Surg. 2014 Jul;77(1):73-7

Self-expanding foam improves survival following a lethal, exsanguinating iliac artery injury.

Rago A, Duggan M, Marini J, Beagle J, Velmahos G, De Moya M, Sharma U, Hwabejire J, King D

BACKGROUND: Noncompressible abdominal bleeding is a significant cause of preventable death on the battlefield and in the civilian setting, with no effective therapies available at point of injury. We previously reported that a self-expanding polyurethane foam significantly improved survival in a lethal hepatoportal injury model of massive venous hemorrhage. In this study, we hypothesized that foam treatment could improve survival in a lethal iliac artery injury model in noncoagulopathic swine.

METHODS: In swine with a closed abdomen, an iliac artery transection was created, resulting in massive noncompressible exsanguination. After injury, animals were treated with damage control fluid resuscitation alone (n = 14) or foam treatment in addition to fluids. Two doses of foam treatment were studied: 100 mL (n = 12) and 120 mL (n = 13); all animals were monitored for 3 hours or until death.

RESULTS: Foam treatment at both doses resulted in a significant survival benefit and reduction in hemorrhage rate relative to the control group. Median survival time was 135 minutes and 175 minutes for the 120-mL and 100-mL doses, compared with 32 minutes in the control group ($p < 0.001$ for both groups). Foam resulted in an immediate, persistent improvement in mean arterial pressure and a transient increase in intra-abdominal pressure. The median hemorrhage rate was 0.27 g/kg per minute in the 120-mL group and 0.23 g/kg per minute in the 100-mL group, compared with 1.4 g/kg per minute in the control group ($p = 0.003$ and 0.006, respectively, as compared with the control).

CONCLUSION: Self-expanding foam treatment significantly improves survival in an otherwise lethal, noncompressible, massive, arterial injury. This treatment may provide a prehospital intervention for control of noncompressible abdominal hemorrhage.

Respir Care. 2014 Jun;59(6):920-31

Supraglottic airway devices.

Ramachandran S, Kumar A

Abstract:
Supraglottic airway devices (SADs) are used to keep the upper airway open to provide unobstructed ventilation. Early (first-generation) SADs rapidly replaced endotracheal intubation and face masks in > 40% of general anesthesia cases due to their versatility and ease of use. Second-generation devices have further improved efficacy and utility by incorporating design changes. Individual second-generation SADs have allowed more dependable positive-pressure ventilation, are made of disposable materials, have integrated bite blocks, are better able to act as conduits for tracheal tube placement, and have reduced risk of pulmonary aspiration of gastric contents. SADs now provide successful rescue ventilation in > 90% of patients in whom mask ventilation or tracheal intubation is found to be impossible. However, some concerns with these devices remain, including failing to adequately ventilate, causing airway damage, and increasing the likelihood of pulmonary aspiration of gastric contents. Careful patient selection and excellent technical skills are necessary for successful use of these devices.

Mil Med. 2014 Aug;179(8 Suppl):24-8

A review of the evolution of intraosseous access in tactical settings and a feasibility study of a human cadaver model for a humeral head approach.

Rush S, D'Amore J, Boccio E

Abstract:
In the tactical setting, intraosseous (IO) access has become popular to treat hemorrhagic shock when peripheral intravenous access is difficult or impractical. The traditional sites most commonly used by combat medics, corpsmen, and Pararescuemen (PJs) include the sternum and tibial tuberosity. Recent studies have shown that the humeral head (HH) is an appropriate and effective access site for IO infusion and fluid resuscitation in the clinical setting. In this procedural feasibility study, we assessed the ability of 26 U.S. Air Force PJs to perform HH IO placement on fresh, unfixed human cadavers over two consecutive cadaver lab training sessions. Following a formal didactic session, which highlighted proper patient positioning and technique, the PJs were instructed to attempt to place an IO needle using both a drill and manual driver. Once performed, correct placement was reviewed by a physician and confirmed by aspiration of bone marrow. Rates of success were calculated on first and second pass. First pass success rates were 96% and 90.5% for the drill and driver, respectively. Both devices achieved 100% success by the second pass. Military field personnel would benefit from a HH approach, especially in the care and management of patients of explosive injuries.

Resuscitation. 2014 Aug 7. pii: S0300-9572(14)00677-7. doi: 10.1016/j.resuscitation.2014.07.014. [Epub ahead of print]

Complications associated with the prehospital use of laryngeal tubes - A systematic analysis of risk factors and strategies for prevention.

Schalk R, Seeger F, Mutlak H, Schweigkofler U, Zacharowski K, Peter N, Byhahn C

OBJECTIVE: With the increasing spread of laryngeal tubes (LT) in emergency medicine, complications and side-effects are observed. We sought to identify complications associated with the use of LTs in emergency medicine, and to develop strategies to prevent these incidents.

METHODS: In a prospective clinical study, all patients who had their airways managed in the field with a LT and who were admitted through the emergency department of the Frankfurt University Hospital during a 6 year period were evaluated using anonymised data collection sheets. A team of experts was available 24/7 and was requested whenever a patient was admitted with a LT in place. This team evaluated the condition of the patients with respect to prehospital airway management and was responsible for further advanced airway management. All complications were analysed, and strategies for prevention developed.

RESULTS: One hundred eighty nine patients were included and analysed. The initial cuff pressure of the LTs was 100cm H2O on the median. Complications consisted of significant tongue swelling (n=73; 38.6%), resulting in life-threatening cannot ventilate, cannot intubate scenarios in two patients (1.0%) and the need for surgical tracheostomy in another patient, massive distension of the stomach (n=20, 10.6%) with ventilation difficulties when LTs without gastric drainage were used; malposition of the LT in the piriform sinus (n=1, 0.5%) and significant bleeding from soft tissue injuries (n=4, 2.1%).

CONCLUSIONS: The prehospital use of LTs may result in severe and even life-threatening complications. Likely, such complications could have been prevented by using gastric drainage and cuff pressure adjustment. Both, prehospital health care providers and emergency department staff should develop a greater awareness of such complications to best avoid them in the future.

Air Med J. 2014 July - August;33(4):161-164.

Intraosseous Access in Trauma by Air Medical Retrieval Teams.

Sheils M, Ross M, Eatough N, Caputo N

Abstract:
Trauma accounts for a significant portion of overall mortality globally. Hemorrhage is the second major cause of mortality in the prehospital environment. Air medical retrieval services throughout the world have been developed to help improve the outcomes of patients suffering from a broad range of medical conditions, including trauma. These services often utilize intraosseous (IO) devices as an alternative means for access of both medically ill and traumatically injured patients in austere environments. However, studies have suggested that IO access cannot reach acceptable rates for massive transfusion. We review the subject to find the answer of whether IO access should be performed by air medical teams in the prehospital setting, or would central venous (CVC) access be more appropriate? We decided to assess the literature for capacity of IO access to meet resuscitation requirements in the prehospital management of trauma. We also decided to compare the insertion and complication characteristics of IO and CVC access.

Summary:

“When adequate peripheral access is impossible for hypotensive trauma patients, current evidence suggests that the use of IO devices offers rapid access with a high success rate. The IO device allows a bridge to initiate resuscitation while minimizing on-scene delays. These factors, combined with the complication profile of IO devices, offer benefit over the insertion of CVCs for prehospital air medical teams. In trauma, if access is required, we recommend the use of the IO device after 2 failed attempts at peripheral cannulation. Concerns over flow rates can be overcome using pressure bags and multiple sites in the short-term. Long-term access will be required for ongoing resuscitation once the patient arrives at the hospital.”

Shock. 2014 May;41 Suppl 1:76-83. doi: 10.1097/SHK.0000000000000114.

Emergency whole-blood use in the field: a simplified protocol for collection and transfusion.

Strandenes G, De Pasquale M, Cap A, Hervig T, Kristoffersen E, Hickey M, Cordova C, Berseus O, Eliassen H, Fisher L, Williams S, Spinella PC.

Abstract:
Military experience and recent in vitro laboratory data provide a biological rationale for whole-blood use in the treatment of exsanguinating hemorrhage and have renewed interest in the reintroduction of fresh whole blood and cold-stored whole blood to patient care in austere environments. There is scant evidence to support, in a field environment, that a whole blood-based resuscitation strategy is superior to a crystalloid/colloid approach even when augmented by a limited number of red blood cell (RBC) and plasma units. Recent retrospective evidence suggests that, in this setting, resuscitation with a full compliment of RBCs, plasma, and platelets may offer an advantage, especially under conditions where evacuation is delayed. No current evacuation system, military or civilian, is capable of providing RBC, plasma, and platelet units in a prehospital environment, especially in austere settings. As a result, for the vast minority of casualties, in austere settings, with life-threatening hemorrhage, it is appropriate to consider a whole blood-based resuscitation approach to provide a balanced response to altered hemostasis and oxygen debt, with the goal of reducing the risk of death from hemorrhagic shock. To optimize the successful use of fresh whole blood/cold-stored whole blood in combat field environments, proper planning and frequent training to maximize efficiency and safety will be required. Combat medics will need proper protocol-based guidance and education if whole-blood collection and transfusion are to be successfully and safely performed in austere environments. In this article, we present the Norwegian Naval Special Operation Commando unit-specific remote damage control resuscitation protocol, which includes field collection and transfusion of whole blood. This protocol can serve as a template for others to use and adjust for their own military or civilian unit-specific needs and capabilities for care in austere environments.

J Spec Oper Med. 2014 Summer;14(2):46-55.

Evaluation of commercially available traction splints for battlefield use.

Studer N, Grubbs S, Horn G, Danielson P

Background: Femoral fracture is a common battlefield injury with grave complications if not properly treated. Traction splinting has been proved to decrease morbidity and mortality in battlefield femur fractures. However, little standardization of equipment and training exists within the United States Armed Forces. Currently, four traction splints that have been awarded NATO Stock Numbers are in use: the CT-6 Leg Splint, the Kendrick Traction Device (KTD), the REEL Splint (RS), and the Slishman Traction Splint (STS).

Objective: The purpose of this study was to determine the differences between the four commercially available traction devices sold to the U.S. Government.

Methods: After standardized instruction, subjects were timed and evaluated in the application of each of the four listed splints. Participant confidence and preferences were assessed by using Likert-scaled surveys. Free response remarks were collected before and after timed application.

Results: Subjects had significantly different application times on the four devices tested (analysis of variance [ANOVA], $p < .01$). Application time for the STS was faster than that for both the CT-6 (t-test, $p < .0028$) and the RS ($p < .0001$). Subjects also rated the STS highest in all post-testing subjective survey categories and reported significantly higher confidence that the STS would best treat a femoral fracture ($p < .00229$).

Conclusions: The STS had the best objective performance during testing and the highest subjective evaluation by participants. Along with its ability to be used in the setting of associated lower extremity amputation or trauma, this splint is the most suitable for battlefield use of the three devices tested.

J Trauma Acute Care Surg. 2014 Jun;76(6):1373-8

Do all trauma patients benefit from tranexamic acid?

Valle E, Allen C, Van Haren R, Jouria J, Li H, Livingstone A, Namias N, Schulman C, Proctor K

BACKGROUND: This study tested the hypothesis that early routine use of tranexamic acid (TXA) reduces mortality in a subset of the most critically injured trauma intensive care unit patients.

METHODS: Consecutive trauma patients (n = 1,217) who required emergency surgery (OR) and/or transfusions from August 2009 to January 2013 were reviewed. At surgeon discretion, TXA was administered at a median of 97 minutes (1-g bolus then 1-g over 8 hours) to 150 patients deemed high risk for hemorrhagic death. With the use of propensity scores based on age, sex, traumatic brain injury (TBI), mechanism of injury, systolic blood pressure, transfusion requirements, and Injury Severity Score (ISS), these patients were matched to 150 non-TXA patients.

RESULTS: The study population was 43 years old, 86% male, 54% penetrating mechanism of injury, 25% TBI, 28 ISS, with 22% mortality. OR was required in 78% at 86 minutes, transfusion was required in 97% at 36 minutes, and 75% received both. For TXA versus no TXA, more packed red blood cells and total fluid were required, and mortality was 27% versus 17% (all $p < 0.05$). The effects of TXA were similar in those with or without TBI, although ISS, fluid, and mortality were all higher in the TBI group. Mortality associated with TXA was influenced by the timing of administration ($p < 0.05$), but any benefit was eliminated in those who required more than 2,000-mL packed red blood cells, who presented with systolic blood pressure of less than 120 mm Hg or who required OR (all $p < 0.05$).

CONCLUSION: For the highest injury acuity patients, TXA was associated with increased, rather than reduced, mortality, no matter what time it was administered. This lack of benefit can probably be attributed to the rapid availability of fluids and emergency OR at this trauma center. Prospective studies are needed to further identify conditions that may override the benefits from TXA.

LEVEL OF EVIDENCE: Therapeutic study, level IV.

J Trauma Acute Care Surg. 2014 Aug;77(2):243-50

Does traumatic brain injury increase the risk for venous thromboembolism in polytrauma patients?

Valle E, Van Haren R, Allen C, Jouria J, Bullock M, Schulman C, Namias N, Livingstone A, Proctor K

BACKGROUND: Trauma is a major risk factor for venous thromboembolism (VTE). Traumatic brain injury (TBI) is generally considered to further increase the VTE risk, which should prompt routine thromboprophylaxis. However, the associated risk for intracranial hemorrhage often delays anticoagulants. We test the hypothesis that TBI associated with polytrauma results in a higher rate of VTE than polytrauma without TBI.

METHODS: From August 2011 to June 2013, a prospective observational trial with informed consent was performed in 148 intensive care unit (ICU) patients with a Greenfield Risk Assessment Profile score of 10 or greater.

RESULTS: Demographics, Greenfield Risk Assessment Profile scores, the incidence of polytrauma, and mortality were similar, but TBI patients had worse Injury Severity Scores (ISS) (32 vs. 22), longer ICU lengths of stay (21 days vs. 12 days), more hypercoagulable thromboelastogram values on admission (94% vs. 79%), more received unfractionated heparin prophylaxis (65% vs. 36%), and the prophylaxis start date was more than a day later (all $p < 0.05$). Nevertheless, the VTE rate with TBI was similar to that without TBI (25% vs. 26%, $p = 0.507$). Furthermore, VTE occurred at similar time points after ICU admission with and without TBI. In both groups, about 30% of the VTEs were detected within 2 days of ICU admission and 50% of the VTEs occurred within 10 days of admission despite chemical and mechanical thromboprophylaxis.

CONCLUSION: In complex polytrauma patients who survived to ICU admission and who were prescreened for high VTE risk, TBI did not further increase the risk for VTE. The most likely explanation is that no single risk factor is necessary or sufficient for VTE development, especially in those who routinely receive chemical and mechanical thromboprophylaxis.

LEVEL OF EVIDENCE: Epidemiologic study, level III.

Injury. 2014 Jul 16. pii: S0020-1383(14)00323-4. doi: 10.1016/j.injury.2014.07.004. [Epub ahead of print]

UK combat-related pelvic junctional vascular injuries 2008-2011: Implications for future intervention.

Walker NM, Eardley W, Clasper J

Abstract:
In a recent publication, 297 of 6450 (4.6%) military coalition deaths over ten years were reported to be due to junctional bleeding. The authors suggested that some of these deaths could have been avoided with a junctional haemorrhage control device. Prospectively collected data on all injuries sustained in Afghanistan by UK military personnel from 1 August 2008 to 31 July 2011 period were reviewed, using the UK Joint Theatre Trauma Registry. All fatalities with significant pelvic injuries were identified and analysed, and the cause of death established to assess the potential role for a junctional haemorrhage control device. Significant upper thigh, groin or pelvic injuries were recorded in 124 casualties, of which 93 died. Of these the pelvic injury was the cause of death in 37, but only 1 casualty with potentially survivable injuries was identified where death was due to a vascular injury below the inguinal ligament, not controlled by a CAT. This represents <1% of all deaths in this period, a lower figure than previously published. We further identified 32 casualties where the cause of death was due to a vascular injury between the aortic bifurcation and the inguinal ligament. Eight of these survived to a medical facility but subsequently died of their wounds. These represent a subset in which vascular control proximal to the inguinal ligament could have altered the outcome. Some potentially survivable deaths due to exsanguination may be amenable to proximal vascular control. Our study does not substantiate previous conclusions that this can be achieved through use of a groin junctional tourniquet. We believe there may be a role for more proximal vascular control of pelvic bleeding, and this merits further research.

J Anesth. 2014 May 24. [Epub ahead of print]

Ketamine does not increase intracranial pressure compared with opioids: meta-analysis of randomized controlled trials.

Wang X, Ding X, Tong Y, Zong J, Zhao X, Ren H, Li Q.

BACKGROUND: Ketamine is traditionally avoided in sedation management of patients with risk of intracranial hypertension. However, results from many clinical trials contradict this concern. We critically analyzed the published data of the effects of ketamine on intracranial pressure (ICP) and other cerebral hemodynamics to determine whether ketamine was safe for patients with hemodynamic instability and brain injuries.

METHODS: We systematically searched the online databases of PubMed, Medline, Embase, Current Controlled Trials, and Cochrane Central (last search performed on January 15, 2014). Trial characteristics and outcomes were independently extracted by two assessors (Xin Wang, Xibing Ding). For continuous data, mean differences (MD) were formulated. If the P value of the chi-square test was >0.10 or I (2) <50 %, a fixed-effects model was used; otherwise, the random effects model was adopted.

RESULTS: Five trials (n = 198) met the inclusion criteria. Using ICP levels within the first 24 h of ketamine administration as the main outcome, the use of ketamine leads to the same ICP levels as opioids [MD = 1.94; 95 % confidence interval (95 % CI), -2.35, 6.23; P = 0.38]. There were no significant differences in mean arterial pressure values between the two groups (MD = 0.99; 95 % CI, -2.24, 4.22; P = 0.55). Ketamine administration was also comparable with opioids in the maintenance of cerebral perfusion pressure (MD = -1.07; 95 % CI, -7.95, 5.8; P = 0.76).

CONCLUSIONS: The results of this study suggest that ketamine does not increase ICP compared with opioids. Ketamine provides good maintenance of hemodynamic status. Clinical application of ketamine should not be discouraged on the basis of ICP-related concerns.

J Trauma Acute Care Surg. 2014 Aug;77(2):231-7.

Characterization of the hypercoagulable state following severe orthopedic trauma.

White A, Edelman J, Lott N, Bannon P, McElduff P, Curnow J, Balogh Z

BACKGROUND: Acute traumatic coagulopathy develops in seriously injured patients, which is followed by a paradoxical hypercoagulable state. The hypercoagulable state contributes to venous thromboembolism, and yet, there are no sensitive tests available to detect it. The aim of this study was to characterize the hypercoagulable state caused by major orthopedic trauma using the overall hemostatic potential (OHP) assay.

METHODS: Major orthopedic trauma patients admitted during a 7-month period in 2012 were included in the study. Blood samples were drawn 1 hour before surgery, then 1, 7, 24 hours and 3, 5, 10, and 42 days postoperatively. The assay parameters were determined and analyzed according to injury severity (polytrauma or nonpolytrauma), type of surgical intervention, and shock status. Values were compared with 20 healthy controls.

RESULTS: Forty-one consecutive patients were enrolled (age, 41.5 ± 2.7 years; 70% male; Injury Severity Score [ISS], 21.5 ± 2.1). Hypercoagulability based on OHP was present in the preoperative sample compared with the controls (OHP, 13.8 ± 1.4 U vs. 8.1 ± 0.5 U; $p = 0.020$) and then further elevated after surgery (1 hour postoperative, 17.8 ± 2.0 U vs. preoperative, 13.8 ± 1.4 U, $p = 0.008$). Polytrauma patients were more hypercoagulable than nonpolytrauma at the preoperative sample time (17.7 ± 2.6 U vs. 10.7 ± 1.2 U, $p = 0.040$) and postoperative period (24.3 ± 3.4 U vs. 11.9 ± 1.4 U, $p = 0.006$). The OHP for patients undergoing open pelvic surgery (28.3 ± 3.0 U) was higher than both intramedullary nailing (16.2 ± 2.0 U) and percutaneous pelvic surgery (17.0 ± 1.7 U) on Day 5 ($p < 0.05$). Patients demonstrated a higher OHP than controls did at alltime points, except at 6 weeks (patients, 10.8 ± 1.7 U vs. controls, 8.1 ± 0.5 U; $p = 0.400$).

CONCLUSION: The OHP assay detected the hypercoagulable state following major orthopedic trauma and surgical intervention, which was present for 10 days postoperatively. The extent of hypercoagulability could be associated with polytrauma and the type of surgical intervention; however, further studies are needed to confirm this.

LEVEL OF EVIDENCE: Epidemiologic study, level III.

Biosci Trends. 2014;8(3):169-75.

Repeated doses of intravenous tranexamic acid are effective and safe at reducing perioperative blood loss in total knee arthroplasty.

Xu Q(1), Yang Y, Shi P, Zhou J, Dai W, Yao Z, Zhang C.

Abstract:
Fibrin sealant (FS) and tranexamic acid (TXA) have been used in total knee arthroplasty (TKA) to minimize perioperative blood loss. The efficacy of FS has been debated, and few studies have looked into the effects of FS and TXA on perioperative coagulability. The current study retrospectively reviewed 100 cases of unilateral primary TKA. Twenty-five cases served as blank controls, FS was used without TXA in 23, TXA was used without FS in 20, and both FS and TXA (FS + TXA) were used in 32. FS was sprayed before wound closure whereas 1 g of TXA was intravenously administered before incision and 1 g was administered 15 min before tourniquet release. Hematocrit and hemoglobin levels and thromboelastography (TEG) parameters were assessed pre-operatively and on day 1, 4, and 9 post-operatively. Blood transfusions were noted and the incidence of symptomatic DVT/PE was determined. Hematocrit and hemoglobin levels were significantly higher in the TXA and FS + TXA groups compared to the control and FS groups on day 1, 4, and 9 post-operatively. Hematocrit and hemoglobin levels in the control group were similar to those in the FS group and hematocrit and hemoglobin levels in the TXA group were similar to those in the FS + TXA group. TEG parameters (R, K, α, MA, and CI) remained within normal ranges. Mean CI was less than +3 in all four groups, suggesting that hypercoagulation was not promoted. One patient in the FS group received an allogeneic transfusion. Incidence of symptomatic DVT/PE was not noted. Intravenous TXA significantly reduced perioperative blood loss in patients undergoing a TKA but FS did not. Administration of FS in addition to TXA was not superior to TXA alone. FS and/or TXA did not increase the risk of hypercoagulation according to TEG parameters. Intravenous administration of 1 g of TXA pre-operatively and administration of 1 g before tourniquet release is an effective and safe method of reducing blood loss in TKA.

Ophthalmology. 2014 May 17. pii: S0161-6420(14)00321-2.

Ocular Blast Injuries in Mass-Casualty Incidents: The Marathon Bombing in Boston, Massachusetts, and the Fertilizer Plant Explosion in West, Texas.

Yonekawa Y, Hacker H, Lehman R, Beal C, Veldman P, Vyas N, Shah S, Wu D, Eliott D, Gardiner M, Kuperwaser M, Rosa R, Ramsey J, Miller J, Mazzoli R, Lawrence G, Arroyo J

PURPOSE: To report the ocular injuries sustained by survivors of the April 15, 2013, Boston Marathon bombing and the April 17, 2013, fertilizer plant explosion in West, Texas.

DESIGN: Multicenter, cross-sectional, retrospective, comparative case series.

PARTICIPANTS: Seventy-two eyes of 36 patients treated at 12 institutions were included in the study.

METHODS: Ocular and systemic trauma data were collected from medical records.

MAIN OUTCOME MEASURES: Types and severity of ocular and systemic trauma and associations with mechanisms of injury.

RESULTS: In the Boston cohort, 164 of 264 casualties were transported to level 1trauma centers, and 22 (13.4%) required ophthalmology consultations. In the West cohort, 218 of 263 total casualties were transported to participating centers, of which 14 (6.4%) required ophthalmology consultations. Boston had significantly shorter mean distances to treating facilities (1.6 miles vs. 53.6 miles; P = 0.004). Overall, rigid eye shields were more likely not to have been provided than to have been provided on the scene (P<0.001). Isolated upper body and facial wounds were more common in West largely because of shattered windows (75.0% vs. 13.6%; P = 0.001), resulting in more open-globe injuries (42.9% vs. 4.5%; P = 0.008). Patients in Boston sustained more lower extremity injuries because of the ground-level bomb. Overall, 27.8% of consultations were called from emergency rooms, whereas the rest occurred afterward. Challenges in logistics and communications were identified.

CONCLUSIONS: Ocular injuries are common and potentially blinding in mass-casualty incidents. Systemic and ocular polytrauma is the rule in terrorism, whereas isolated ocular injuries are more common in other calamities. Key lessons learned included educating the public to stay away from windows during disasters, promoting use of rigid eye shields by first responders, the importance of reliable communications, deepening the ophthalmology call algorithm, the significance of visual incapacitation resulting from loss of spectacles, improving the rate of early detection of ocular injuries in emergency departments, and integrating ophthalmology services into trauma teams as well as maintaining a voice in hospital-wide and community-based disaster planning.

Wilderness Environ Med. 2014 Sep;25(3):364-366.

Spine Protection in the Austere Environment. (Letter to Quinn, et al))

Zafren K, Smith W, Johnson D, Kovacs T

Quote:
"The risk of unnecessary immobilization could be be decreased by including all or parts of a validated instrument, the Canadian C-spine Rule. The Canadian C-spine Rule includes "sitting position," "ambulatory at any time," and "delayed onset of neck pain" as criteria for low-risk patients who need only be "able to actively rotate neck 45 degrees left and right" to avoid radiography. Patients who will not need radiography certainly do not need stretcher transport for spinal protection. We call on the authors to revise the algorithm by using validated criteria rather than untested novel decision points to prevent ambulatory patients from being placed on stretchers."