Tactical Combat Casualty Care

Journal Article Abstracts

Committee on Tactical Combat Casualty Care

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Abstracts

Arthroplast Today. 2017 Oct 6;4(1):85-88

A prospective, randomized, comparative study of intravenous alone and combined intravenous and intraarticular administration of tranexamic acid in primary total knee replacement.

Adravanti P, Di Salvo E, Calafiore G, Vasta S, Ampollini A, Rosa MA

Background: Studies on the use of tranexamic acid (TXA) to improve clinical outcomes after joint arthroplasty have reported contrasting results between intravenous (IV) TXA alone and combined IV and intraarticular (IA) administration. We compared the effectiveness of the 2 methods in providing higher postoperative hemoglobin (Hb) levels in patients undergoing primary total knee arthroplasty (TKA).

Methods: A total of 100 TKA patients were randomly assigned to receive either IV TXA alone (group 1) or combined IV and topical IA TXA (group 2). Hb and hematocrit levels were measured before and after surgery. The amount of drained blood and transfused blood for the 2 groups was compared.

Results: The Hb level was significantly higher at postoperative day 4, together with a positive, albeit not significant, trend toward less postoperative blood loss in the group that received combined IV and IA TXA. No postoperative infections or deep venous thrombosis events occurred.

Conclusions: This study reinforces evidence that, as compared to IV TXA alone, combined IV and IA administration of TXA has a synergistic effect, leading to higher postoperative Hb levels without influencing drug safety in TKA patients.

J Emerg Med. 2018 Mar;54(3):328-334

Air Versus Ground Transportation in Isolated Severe Head Trauma: A National Trauma Data Bank Study.

Aiolfi A, Benjamin E, Recinos G, De Leon Castro A, Inaba K, Demetriades D

BACKGROUND: The effect of prehospital helicopter emergency medical services (HEMS) on mortality has been analyzed previously in polytrauma patients with discordant results.

OBJECTIVE: Our aim was to compare outcomes in patients with isolated severe blunt traumatic brain injuries (TBIs) transported by HEMS or ground emergency medical services (GEMS).

METHODS: We conducted a National Trauma Data Bank study (2007-2014). All adult patients (≥16 years old) who sustained an isolated severe blunt TBI and were transported by HEMS or GEMS were included in the study.

RESULTS: There were 145,559 patients who met the inclusion criteria. Overall, 116,391 (80%) patients were transported via GEMS and 29,168 (20%) via HEMS. Median transportation time was longer for HEMS patients (41 vs. 25 min; $p < 0.001$). HEMS patients were more likely to have hypotension (2.7% vs. 1.5%; $p < 0.001$), Glasgow Coma Scale (GCS) score < 9 (38.2% vs. 10.9%; $p < 0.001$), and head Abbreviation Injury Scale (AIS) score of 5 (20.1% vs. 9.7%; $p < 0.001$). Stepwise logistic regression analysis identified age ≥ 65 years old, male sex, hypotension, GCS score < 9, prehospital intubation, and head AIS scores 4 and 5 as independent predictors of mortality. Helicopter transportation was independently associated with improved survival (odds ratio [OR] 0.55; 95% confidence interval [CI] 0.47-0.67; $p < 0.001$). Admission to a Level I trauma center was an independent predictor of survival (OR 0.64; 95% CI 0.53-0.82; $p = 0.001$). Regardless of head AIS, helicopter transport was an independent predictor of survival (AIS 3: OR 0.35; $p < 0.001$; AIS 4: OR 0.44; $p < 0.001$; AIS 5: OR 0.76; $p < 0.001$). A prolonged transport time was not an independent predictor of mortality.

CONCLUSIONS: Helicopter transport, in adult patients with isolated severe TBI, is associated with improved survival.

Eur J Orthop Surg Traumatol. 2018 Mar 29. doi: 10.1007/s00590-018-2194-y.

Comparing the efficacy of intravenous or intra-articular tranexamic acid in reducing blood loss in simultaneous bilateral knee replacement surgery without the use of tourniquet.

Arora M, Singh S, Gupta V, Dongre A, Shetty V

PURPOSE: To compare the effect of intravenous or intra-articular route of administration of tranexamic acid in reducing the blood loss in simultaneous bilateral total knee replacement surgeries performed without the use of tourniquets.

METHODS: Prospective cohort study of 30 consecutive patients grouped into two groups; Group 1: intravenous group and group 2: intra-articular group. Two outcome measures were studied; mean drop in post-operative haemoglobin and need for blood transfusion in both groups.

RESULTS: No significant difference in mean drop of haemoglobin and need for blood transfusion in both groups.

CONCLUSION: Route of administration of tranexamic acid does not influence on the mean drop of haemoglobin and need for blood transfusion in simultaneous bilateral total knee replacement surgeries performed without the use of tourniquet.

Ulus Travma Acil Cerrahi Derg. 2018 Mar;24(2):97-103.

The success of endotracheal intubation with a modified laryngoscope using night vision goggles.

Aydın A, Bilge S, Aydın C, Bilge M, Çevik E, Eryılmaz M.

BACKGROUND: Endotracheal intubation (ETI) procedure in the combat area differs from prehospital trauma life support procedures because of the danger of gunfire and the dark environment. We aimed to determine the success, difficulty degree, and duration of ETI procedures with a classical laryngoscope (CL) in a bright room and with a modified laryngoscope (ML) model in a dark room.

METHODS: All interventions were performed by a combatant medical staff of 10 members. We developed an ML model to obtain a tool that can be used in combination with night vision goggles (NVGs) to perform ETI at night. The procedures were performed using a CL with the naked eye in a bright room and using a ML with NVGs in a dark room. The ETI procedure that used the ML was performed by engaging and locking the blade on the handle either in the mouth (ML-IM) or outside of the mouth (ML-OM).

RESULTS: The mean completion times for the ETI procedures, namely Day-CL, ML-OM+NVG, and ML-IM+NVG, performed by the operators were 14.46, 26.9, and 32.38 s, respectively. The ML-OM+NVG and ML-IM+NVG procedures were significantly longer than the Day-CL procedure ($p<0.05$). The ML-IM+NVG procedure was significantly longer than the ML-OM+NVG procedure ($p<0.05$). All ETI procedures were found to be 100% successful. The Day-CL procedure was easier than the ML-OM+NVG and ML-IM+NVG procedures ($p>0.05$).

CONCLUSION: The ETI procedure is applicable using NVGs in dark conditions on the battlefield. Medical interventions performed using NVGs in the dark should be a part of the basic training provided in tactical emergency medicine.

Eur J Orthop Surg Traumatol. 2018 Apr 19. doi: 10.1007/s00590-018-2203-1

Factors affecting mortality and reoperations in high-energy pelvic fractures.

Bakhshayesh P, Weidenhielm L, Enocson A

AIM: Factors affecting mortality during the first year following high-energy pelvic fractures has not been reported previously. Nor has surgical complications leading to reoperations been reported in a cohort with only high-energy pelvic trauma patients.

OBJECTIVES: The aim of this study was to report and analyse factors affecting outcome, in terms of mortality and reoperations, up to 1 year after the injury in patients with a traumatic pelvic ring injury due to a high-energy trauma.

MATERIALS AND METHODS: Data from the SweTrau (Swedish National Trauma Registry) on patients admitted to the Trauma Centre Karolinska in Stockholm, Sweden, were collected. Inclusion criteria were adults (age ≥ 18), trauma with a high-energy mechanism, alive on arrival, Swedish personal identification number, reported pelvic fracture on CT scan. Patient records and radiographies were reviewed. The study period was 2011-2015 with 1-year follow-up time. Univariate and regression analysis on factors affecting mortality was performed. Risk of reoperation was analysed using univariate and case-by-case analysis.

RESULTS: We included 385 cases with mean age 47.5 ± 20.6 years (38% females): 317 pelvic fractures, 48 acetabular fractures and 20 combined injuries. Thirty-day mortality was 8% (30/385), and 1-year mortality was 9% (36/385). The main cause of death at 1 year was traumatic brain injury (14/36) followed by high age (> 70) with extensive comorbidities (8/36). Intentional fall from high altitude (OR 6, CI 2-17), GCS < 8 (OR 12, CI 5-33) and age > 70 (OR 17, CI 6-51) were factors predicting mortality. Thirty patients (22%, 30/134) were further reoperated due to hardware-related (n = 18) or non-hardware-related complications (n = 12). Hardware-related complications included: mal-placed screws (n = 7), mal-placed plate (n = 1), implant failure (n = 6), or mechanical irritation from the implant (n = 4). Non-hardware-related reasons for reoperations were: infection (n = 10), skin necrosis (n = 1), or THR due to post-traumatic osteoarthritis (n = 1).

CONCLUSION: Non-survivors in our study died mainly because of traumatic brain injury or high age with extensive comorbidities. Most of the mortalities occurred early. Intentional injuries and especially intentional falls from high altitude had high mortality rate. Reoperation frequency was high, and several of the hardware-related complications could potentially have been avoided.

J Trauma Acute Care Surg. 2016 Sep;81(3):555-66

Do lactate levels in the emergency department predict outcome in adult trauma patients? A systematic review.

Baxter J, Cranfield KR, Clark G, Harris T, Bloom B, Gray AJ.

BACKGROUND: Serum lactate may be associated with clinical outcomes in trauma, even in the absence of physiological abnormality. Sensitive markers of injury and outcomes are needed to guide triage and management of trauma patients within the Emergency Department. We completed a systematic review to determine if lactate levels in adult trauma patients presenting to the Emergency Department were associated with clinical outcomes including mortality.

METHODS: A systematic literature search was conducted in August 2014, updated in March 2016, using MEDLINE, Embase, and CINAHL. Abstracts and full texts were screened for inclusion by two independent reviewers using predetermined inclusion and exclusion criteria. Data extraction and quality assessment was performed by each reviewer using a standardized form. A total of 998 studies were screened; 28 studies were included and reviewed.

RESULTS: The 28 studies recruited 44,154 adults in eight countries between 1997 and 2016. Twenty-one studies found a significant association between elevated Emergency Department lactate and risk of mortality. Three studies looked at lactate clearance; two showed poor clearance was an additional determinant of mortality, but the other found no association. Ten studies also found an association between elevated lactate and other clinical outcomes. These included injury severity, Intensive Care Unit admission, length of hospital stay, organ failure, respiratory complications, blood loss, blood product requirement, catecholamine support, or emergency operation. Two studies concluded that lactate levels do not affect management.

CONCLUSIONS: This review shows that elevated Emergency Department lactate levels are associated with mortality and may be associated with other clinical outcomes in adult trauma patients. We conclude that lactate is a useful marker of outcome in trauma, in addition to current markers of severity. The potential roles of serial lactate measurement and lactate clearance require further research.

LEVEL OF EVIDENCE: Systematic review, level III.

Mil Med. 2018 Mar 1;183(suppl_1):466-471. doi: 10.1093/milmed/usx144.

Antibiotic Treatment - What Can Be Learned from Point of Injury Experience?

Benov A, Antebi B, Wenke JC, Batchinsky AI, Murray CK, Nachman D, Haim P, Tarif B, Glassberg E, Yitzhak A.

Introduction: Early antibiotic administration after trauma reduces infection rates of open wounds. A clinical practice guideline (CPG) was created to ensure that wounded personnel who are not expected to arrive at the hospital within an hour receive antibiotic treatment in the field. This study evaluated how well-advanced life saver (ALS) providers complied with Israeli Defense Force (IDF) CPG.

Materials and Methods: A retrospective review of all trauma patients between November 2011 and January 2015 was conducted. All casualties who suffered from penetrating injuries with evacuation times greater than 60 min were examined. Casualties who should have received antibiotic treatment in accordance with the IDF CPG were further divided into those who received antibiotics (i.e., "Antibiotic" group) and those who did not receive antibiotic treatment (i.e., "No Antibiotics" group).

Results: For a 3-yr period, a total of 5,142 casualties occurred in the pre-hospital environment. According to parameters established in the CPG, 600 casualties should have received antibiotic treatment. Of these patients, only 49 (8.2%) received antibiotic treatment. Comparative analysis between these groups revealed no significant differences in regards to gender, age, and time to MTF; however, significant differences were found in regards to injury severity score (ISS) ($p < 0.01$), care under fire (i.e., treatment at a combat zone) criteria ($p < 0.00001$), and life-saving interventions ($p < 0.005$).

Discussion: Although the reasons for poor adherence to IDF CPG's are not entirely clear, the data suggest that the severity of the injuries sustained by these casualties requiring a greater number of LSIs, longer evacuation distances, and a more hostile battlefield environment may each contribute to poor adherence. Since this has been identified as a training gap, the importance of antibiotic administration at point of injury in delayed evacuation scenarios has been reinforced.

J Trauma Acute Care Surg. 2017 Jul;83(1 Suppl 1):S71-S76

The effect of blood transfusion on compensatory reserve: A prospective clinical trial.

Benov A, Yaslowitz O, Hakim T, Amir-Keret R, Nadler R, Brand A, Glassberg E, Yitzhak A, Convertino VA, Paran H.

BACKGROUND: Bleeding activates the body's compensatory mechanisms, causing changes in vital signs to appear late in the course of progressive blood loss. These vital signs are maintained even when up to 30% to 40% of blood volume is lost. Laboratory tests such as hemoglobin, hematocrit, lactate, and base deficit levels do not change during acute phase of bleeding. The compensatory reserve measurement (CRM) represents a new paradigm that measures the total of all physiological compensatory mechanisms, using noninvasive photoplethysmography to read changes in arterial waveforms. This study compared CRM to traditional vital signs and laboratory tests in actively bleeding patients.

METHODS: Study patients had gastrointestinal bleeding and required red blood cell (RBC) transfusion (n = 31). Control group patients had similar demographic and medical backgrounds. They were undergoing minor surgical procedures and not expected to receive RBC transfusion. Vital signs, mean arterial pressure, pulse pressure, hemoglobin and hematocrit levels, and CRM were recorded before and after RBC transfusion or the appropriate time interval for the control group. Receiver operator characteristic curves were plotted and areas under the curves (AUCs) were compared.

RESULTS: CRM increased 10.5% after RBC transfusion, from 0.77 to 0.85 ($p < 0.005$). Hemoglobin level increased 22.4% after RBC transfusion from 7.3 to 8.7 ($p < 0.005$). Systolic and diastolic blood pressure, mean arterial pressure, pulse pressure, and heart rate did change significantly. The AUC for CRM as a single measurement for predicting hemorrhage at admission was 0.79, systolic blood pressure was 0.62, for heart rate was 0.60, and pulse pressure was 0.36.

CONCLUSIONS: This study demonstrated that CRM is more sensitive to changes in blood volume than traditional vital signs are and could be used to monitor and assess resuscitation of actively bleeding patients.

LEVEL OF EVIDENCE: Care management, level II.

J Trauma Acute Care Surg. 2018 Mar 8. Epub ahead of print

Prehospital Airway Procedures Performed in Trauma Patients by Ground Forces in Afghanistan.

Blackburn MB, April MMD, Brown CDJ, DeLorenzo RA, Ryan KL, Blackburn AN, Schauer MSG

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

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

RESULTS: 705 total trauma patients were included, 16.9% required a prehospital airway management procedure. There were 132 total airway procedures performed, including 83 (63.4%) endotracheal intubations and 26 (19.8%) nasopharyngeal airway placements. Combat medics were involved in 48 (36.4%) of airway cases and medical officers in 73 (55.3%). Most (94.2%) patients underwent airway procedures due to battle injuries caused by explosion or gunshot wounds. Casualties requiring airway management were more severely injured and less likely to survive as indicated by injury severity score, responsiveness level, Glascow coma score, and outcome.

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

LEVEL OF EVIDENCE: Level III, prognostic and epidemiological.

Crit Care Nurse. 2018 Apr;38(2):e1-e6. doi: 10.4037/ccn2018630.

En Route Care Provided by US Navy Nurses in Iraq and Afghanistan.

Blackman VS, Walrath BD, Reeves LK, Mora AG, Maddry JK, Stockinger ZT

BACKGROUND: US Navy nurses provide en route care for critically injured combat casualties without having a formal program for training, utilization, or evaluation. Little is known about missions supported by Navy nurses.

OBJECTIVES: To characterize the number and types of patients transported and skill sets required by Navy nurses during 2 combat support deployments.

METHODS: All interfacility casualty transfers between 2 separate facilities in Iraq and Afghanistan were assessed. Number of patients treated, number transported, en route care provider type, transport priority level and duration, injury severity, indication for critical care transport, enroute care interventions, and vital signs were evaluated.

RESULTS: Of 1550 casualties, 630 required medical evacuation to a higher level of care. Of those, 133 (21%) were transported by a Navy nurse, with 131 (98.5%) classified as "urgent," accounting for 46% of all urgent transports. The primary indication for enroute care nursing was mechanical ventilation of intubated patients (97%). Mean (SD) patient transport time was 29.8 (7.9) minutes (range, 17-61 minutes). The most common enroute care interventions were administration of intravenous sedation (80%), neuromuscular blockade (79%), and opioids (48%); transfusions (18%); and ventilation changes (11%). No intubations, cricothyroidotomies, chest tube placements, or needle decompressions were performed enroute. No deaths occurred during transport.

CONCLUSIONS: US Navy nurses successfully transported critically injured patients without observed adverse events. Establishing en route care as a program of record in the Navy will facilitate continuous process improvement to ensure that future casualties receive optimized enroute care.

Orthop Clin North Am. 2018 Apr;49(2):157-165.

Use of Tourniquets in Limb Trauma Surgery.

Bogdan Y, Helfet DL

ABSTRACT:
Although tourniquets are commonly used in patients with limb trauma patients, both in the acute and elective settings, no set protocols exist for their indications, contraindications, or proper use. This article addresses the current literature on optimal pressure, timing, cuff design, and complications of tourniquets in trauma patients. General issues are discussed, followed by those specific to upper and lower extremities. Lastly, serious complications, such as pulmonary embolism, are described.

J Emerg Med. 2018 Apr;54(4):487-499

The Association of Prehospital Intravenous Fluids and Mortality in Patients with Penetrating Trauma.

Bores SA, Pajerowski W, Carr BG, Holena D, Meisel ZF, Mechem CC, Band RA

BACKGROUND: The optimal approach to prehospital care of trauma patients is controversial, and thought to require balancing advanced field interventions with rapid transport to definitive care.

OBJECTIVE: We sought principally to examine any association between the amount of prehospital IV fluid (IVF) administered and mortality.

METHODS: We conducted a retrospective cohort analysis of trauma registry data patients who sustained penetrating trauma between January 2008 and February 2011, as identified in the Pennsylvania Trauma Systems Foundation registry with corresponding prehospital records from the Philadelphia Fire Department. Analyses were conducted with logistic regression models and instrumental variable analysis, adjusted for injury severity using scene vital signs before the intervention was delivered.

RESULTS: There were 1966 patients identified. Overall mortality was 22.60%. Approximately two-thirds received fluids and one-third did not. Both cohorts had similar Trauma and Injury Severity Score-predicted mortality. Mortality was similar in those who received IVF (23.43%) and those who did not (21.30%) ($p = 0.212$). Patients who received IVF had longer mean scene times (10.82 min) than those who did not (9.18 min) ($p < 0.0001$), although call times were similar in those who received IVF (24.14 min) and those who did not (23.83 min) ($p = 0.637$). Adjusted analysis of 1722 patients demonstrated no benefit or harm associated with prehospital fluid (odds ratio [OR] 0.905, 95% confidence interval [CI] 0.47-1.75). Instrumental variable analysis utilizing variations in use of IVF across different Emergency Medical Services (EMS) units also found no association between the unit's percentage of patients that were provided fluids and mortality (OR 1.02, 95% CI 0.96-1.08).

CONCLUSIONS: We found no significant difference in mortality or EMS call time between patients who did or did not receive prehospital IVF after penetrating trauma.

J Trauma Acute Care Surg. 2018 Mar 12. Epub ahead of print

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

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

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

METHODS: We performed a retrospective study of data prospectively collected in the TraumaBase registry (a regional registry collecting the prehospital and hospital data of trauma patients admitted in 6 Level One Trauma Centers in Paris Area, France). In hospital mortality was compared between patients having received TXA or not in the early phase of resuscitation among those presenting an unstable hemodynamic state. Propensity score for TXA administration was calculated and results were adjusted for this score. Hemodynamic instability was defined by the need of packed red blood cells (pRBC) transfusion and/or vasopressor administration in the emergency room (ER).

RESULTS: Among patients meeting inclusion criteria (n= 1476), the propensity score could be calculated in 797 and survival analysis could be achieved in 684/797. Four hundred and seventy (59%) received TXA and 327 (41%) did not. The overall hospital mortality rate was 25.7%. There was no effect of TXA use in the whole population but mortality was lowered by the use of TXA in patients requiring pRBC transfusion in the ER (HR= 0.3, CI 95= 0.3 - 0.6).

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

LEVEL OF EVIDENCE: Level III STUDY TYPE: Therapeutic study.

Mil Med. 2018 Mar 1;183(suppl_1):276-286

Combat Helmet Suspension System Stiffness Influences Linear Head Acceleration and White Matter Tissue Strains: Implications for Future Helmet Design.

Bradfield C, Vavalle N, DeVincentis B, Wong E, Luong Q, Voo L, Carneal C

ABSTRACT:
Combat helmets are expected to protect the warfighter from a variety of blunt, blast, and ballistic threats. Their blunt impact performance is evaluated by measuring linear headform acceleration in drop tower tests, which may be indicative of skull fracture, but not necessarily brain injury. The current study leverages a blunt impact biomechanics model consisting of a head, neck, and helmet with a suspension system to predict how pad stiffness affects both (1) linear acceleration alone and (2) brain tissue response induced by both linear and rotational acceleration. The approach leverages diffusion tensor imaging information to estimate how pad stiffness influences white matter tissue strains, which may be representative of diffuse axonal injury. Simulation results demonstrate that a softer pad material reduces linear head accelerations for mild and moderate impact velocities, but a stiffer pad design minimizes linear head accelerations at high velocities. Conversely, white matter tract-oriented strains were found to be smallest with the softer pads at the severe impact velocity. The results demonstrate that the current helmet blunt impact testing standards' stand-alone measurement of linear acceleration does not always convey how the brain tissue responds to changes in helmet design. Consequently, future helmet testing should consider the brain's mechanical response when evaluating new designs.

Mil Med. 2018 Mar 1;183(suppl_1):78-85

Perceptions of Simulator- and Live Tissue-Based Combat Casualty Care Training of Senior Special Operations Medics.

Bukoski A, Uhlich R, Bowling F, Shapiro M, Kerby JD, Llerena L, Armstrong JH, Strayhorn C, Barnes SL; University of Missouri Combat Casualty Training Consortium.

ABSTRACT:
The relative effectiveness of live tissue (LT)- and inanimate simulation (SIM)-based training of combat medics is the subject of intense debate. A structured interview was utilized to determine the training modality preferences and the perceived value of LT- and SIM-based combat casualty care training of 25 senior special operations medics. Participant demographics and training experience, Likert scale-based assessment of training modality value, selection of preferred training modality for 11 combat casualty care procedures, and 12 open-ended questions probing opinions of the limitations and benefits of LT- and SIM-based training were collected from this convenience sample. All participants indicated significant combat medic experience and training. Of the 11 procedures questioned, LT was identified as superior for seven with mixed responses for the remaining four. LT was consistently identified as an essential training modality with tactile sensation and the physiologic responses of animal models to injury and therapy as primary benefits. Across procedures, 100% of participants felt that LT should be used in combat casualty care training and 96% felt that SIM should also be utilized. Repeatability and accuracy of size/weight were identified as key benefits of SIM training. Respondents reported that capability, self-confidence, success, and resilience of the combat medic all benefitted from LT training. The overriding theme was the general superiority of LT with recognition of the unique and complementary benefits of SIM.

Mil Med. 2018 Mar 1;183(suppl_1):193-202

Clinical Impact of Cabin Altitude Restriction Following Aeromedical Evacuation.

Butler WP, Steinkraus LW, Burlingame EE, Smith DE, Fouts BL, Serres JL, Burch DS

ABSTRACT:
Combat medical care relies on aeromedical evacuation (AE). Vital to AE is the validating flight surgeon (VFS) who warrants a patient is "fit to fly." To do this, the VFS considers clinical characteristics and inflight physiological stressors, often prescribing specific interventions such as a cabin altitude restriction (CAR). Unfortunately, limited information is available regarding the clinical consequences of a CAR. Consequently, a dual case-control study (CAR patients versus non-CAR patients and non-CAR patients flown with a CAR versus non-CAR patients) was executed. Data on 1,114 patients were obtained from TRANSCOM Regulating and Command and Control Evacuation System and Landstuhl Regional Medical Center trauma database (January 2007 to February 2008). Demographic and clinical factors essentially showed no difference between groups; however, CAR patients appeared more severely injured than non-CAR patients. Despite being sicker, CAR patients had similar clinical outcomes when compared with non-CAR patients. In contrast, despite an equivocal severity picture, the non-CAR patients flown with a CAR had superior clinical outcomes when compared with non-CAR patients. It appeared that the CAR prescription normalized severely injured to moderately injured and brought moderately injured into a less morbid state. These results suggest that CAR should be seriously considered when evacuating seriously ill/injured patients.

J Trauma Acute Care Surg. 2018 Mar 16. Epub ahead of print

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

Cannon JW, Neff LP, Pidcoke HF, Aden JK, Spinella PC, Johnson MA, Cap AP, Borgman MA

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

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

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

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

LEVEL OF EVIDENCE: Epidemiologic study, level IV.

J Trauma Acute Care Surg. 2018 Apr;84(4):674-678

A retrospective analysis of the respiratory adjusted shock index to determine the presence of occult shock in trauma patients.

Caputo N, Reilly J, Kanter M, West J.

BACKGROUND: The shock index (SI), calculated as heart rate/systolic blood pressure, is a simple hemodynamic marker that may be used to assess for the presence of occult shock in trauma patients. The normal range for a healthy adult patient is 0.5 to 0.7. Recently, studies have demonstrated that tachypnea is the most important predictor of cardiac arrest in hospital wards and is an important indicator of derangements across multiple organ systems. As such, we have sought to determine whether the inclusion of the patient's respiratory rate (RR) to the already existing SI (called the Respiratory Adjusted Shock Index [RASI]), calculated as hear rate/systolic blood pressure*(RR/10), will improve the overall diagnostic accuracy of detecting patients in early occult shock.

METHODS: A retrospective chart review over a 4-year period (2012-2016) at an urban, Level I trauma center was performed. All patients admitted to hospital for trauma were included in the study. Exclusion criteria were patients in traumatic arrest or in overt shock. Charts were reviewed for triage vital signs and point of care lactate drawn within 30 minutes of presentation. A lactate greater than 2 mmol/L was used to determine presence of hypo-perfusion. The upper limit of normal for the RASI was calculated by multiplying the upper limit of the SI by 1.9 (RR of 19 divided by 10) and validated internally.

RESULTS: A total of 3,093 patients were included in this study. There was no difference in SI for patients discharged versus patients admitted, 0.6 (95% CI, 0.5-0.7) versus 0.7 (95% CI, 0.5-0.8) and a significant difference between the same groups of patients (discharged vs. admitted) for the RASI, 1.1 (95% CI, 1.04-1.18) versus 1.46 (95% CI, 1.35-1.55), respectively. Area under the curve for SI was 0.58 and for the RASI score was 0.94.

CONCLUSION: The RASI score improves diagnostic accuracy for detecting early occult shock in trauma patients when compared to the SI.

LEVEL OF EVIDENCE: Diagnostic, level II.

J Trauma Acute Care Surg. 2018 Apr;84(4):549-557

Speed is not everything: Identifying patients who may benefit from helicopter transport despite faster ground transport.

Chen X, Gestring ML, Rosengart MR, Billiar TR, Peitzman AB, Sperry JL, Brown JB.

BACKGROUND: Helicopter emergency medical services (HEMS) have demonstrated survival benefits over ground emergency medical services (GEMS) for trauma patient transport. While HEMS speed is often-cited, factors such as provider experience and level of care may also play a role. Our objective was to identify patient groups that may benefit from HEMS even when prehospital time for helicopter utilization is longer than GEMS transport.

METHODS: Adult patients transported by HEMS or GEMS from the scene of injury in the Pennsylvania State Trauma Registry were included. Propensity score matching was used to match HEMS and GEMS patients for likelihood of HEMS, keeping only pairs in which the HEMS patient had longer total prehospital time than the matched GEMS patient. Mixed-effects logistic regression evaluated the effect of transport mode on survival while controlling for demographics, admission physiology, transfusions, and procedures. Interaction testing between transport mode and existing trauma triage criteria was conducted and models stratified across significant interactions to determine which criteria identify patients with a significant survival benefit when transported by HEMS even when slower than GEMS.

RESULTS: From 153,729 eligible patients, 8,307 pairs were matched. Helicopter emergency medical services total prehospital time was a median of 13 minutes (interquartile range, 6-22) longer than GEMS. Patients with abnormal respiratory rate (odds ratio [OR], 2.39; 95% confidence interval [CI], 1.26-4.55; $p = 0.01$), Glasgow Coma Scale score of 8 or less (OR, 1.61; 95% CI, 1.16-2.22; $p < 0.01$), and hemo/pneumothorax (OR, 2.25; 95% CI, 1.06-4.78; $p = 0.03$) had a significant survival advantage when transported by HEMS even with longer prehospital time than GEMS. Conversely, there was no association between transport mode and survival in patients without these factors ($p > 0.05$).

CONCLUSION: Patients with abnormal respiratory rate, Glasgow Coma Scale score of 8 or less, and hemo/pneumothorax benefit from HEMS transport even when GEMS transport was faster. This may indicate that these patients benefit primarily from HEMS care, such as advanced airway and chest trauma management, rather than simply faster transport to a trauma center.

LEVEL OF EVIDENCE: Therapeutic, level III.

J Trauma Acute Care Surg. 2018 Apr;84(4):558-563

The intraosseous have it: A prospective observational study of vascular access success rates in patients in extremis using video review.

Chreiman KM, Dumas RP, Seamon MJ, Kim PK, Reilly PM, Kaplan LJ, Christie JD, Holena DN.

BACKGROUND: Quick and successful vascular access in injured patients arriving in extremis is crucial to enable early resuscitation and rapid OR transport for definitive repair. We hypothesized that intraosseous (IO) access would be faster and have higher success rates than peripheral intravenous (PIV) or central venous catheters (CVCs).

METHODS: High-definition video recordings of resuscitations for all patients undergoing emergency department thoracotomy from April 2016 to July 2017 were reviewed as part of a quality improvement initiative. Demographics, mechanism of injury, access type, access location, start and stop time, and success of each vascular access attempt were recorded. Times to completion for access types (PIV, IO, CVC) were compared using Kruskal-Wallis test adjusted for multiple comparisons, while categorical outcomes, such as success rates by access type, were compared using χ test or Fisher's exact test.

RESULTS: Study patients had a median age of 30 years (interquartile range [IQR], 25-38 years), 92% were male, 92% were African American, and 93% sustained penetrating trauma. A total of 145 access attempts in 38 patients occurred (median, 3.8; SD, 1.4 attempts per patient). There was no difference between duration of PIV and IO attempts (0.63; IQR, 0.35-0.96 vs. 0.39 IQR, 0.13-0.65 minutes, adjusted $p = 0.03$), but both PIV and IO were faster than CVC attempts (3.2; IQR, 1.72-5.23 minutes; adjusted $p < 0.001$ for both comparisons). Intraosseous lines had higher success rates than PIVs or CVCs (95% vs. 42% vs. 46%, $p < 0.001$).

CONCLUSION: Access attempts using IO are as fast as PIV attempts but are more than twice as likely to be successful. Attempts at CVC access in patients in extremis have high rates of failure and take a median of over 3 minutes. While IO access may not completely supplant PIVs and CVCs, IO access should be considered as a first-line therapy for trauma patients in extremis.

LEVEL OF EVIDENCE: Therapeutic, level III.

J Spec Oper Med. Spring 2018;18(1):150-154.

Medicine on the Edge of Darkness.

Christensen PA.

ABSTRACT:
Austere care of the wounded is challenging for all Western medical professionals-nurse, medic, or physician. There can be no doubt that working for the first time, either for a nongovernment organization or in the Special Forces, you will be taking care of wounded patients outside your training and experience. You must have the ability to adapt to and overcome lack of resources and equipment, and accept standards of treatment often very different and lower than that common in western hospitals. The International Committee of the Red Cross (ICRC) was asked to provide relief for the Pakistan Red Crescent in 1982 and set up the ICRC Hospital for Afghan War Wounded in Peshawar on the border to Afghanistan. This article relates how a western-trained young anesthetist on an ICRC surgical team experienced this, at the time, austere environment.

Scand J Trauma Resusc Emerg Med. 2017 Oct 30;25(1):105

Use of intrathoracic pressure regulation therapy in breathing patients for the treatment of hypotension secondary to trauma.

Convertino VA, Parquette BA, Wampler DA, Manifold CA, Lindstrom DA, Boland LL, Burkhart NT, Lurie KG, Lick CJ

BACKGROUND: Intrathoracic pressure regulation (IPR) therapy has been shown to increase blood pressure in hypotensive patients. The potential value of this therapy in patients with hypotension secondary to trauma with bleeding is not well understood. We hypothesized that IPR would non-invasively and safely enhance blood pressure in spontaneously breathing patients with trauma-induced hypotension.

METHODS: This prospective observational cohort study assessed vital signs from hypotensive patients with a systolic blood pressure (SBP) ≤90 mmHg secondary to trauma treated with IPR (ResQGARD™, ZOLL Medical) by pre-hospital emergency medical personnel in three large US metropolitan areas. Upon determination of hypotension, facemask-based IPR was initiated as long as bleeding was controlled. Vital signs were recorded before, during, and after IPR. An increased SBP with IPR use was the primary study endpoint. Device tolerance and ease of use were also reported.

RESULTS: A total of 54 patients with hypotension secondary to trauma were treated from 2009 to 2016. The mean ± SD SBP increased from 80.9 ± 12.2 mmHg to 106.6 ± 19.2 mmHg with IPR ($p < 0.001$) and mean arterial pressures (MAP) increased from 62.2 ± 10.5 mmHg to 81.9 ± 16.6 mmHg ($p < 0.001$). There were no significant changes in mean heart rate or oxygen saturation. Approximately 75% of patients reported moderate to easy tolerance of the device. There were no safety concerns or reported adverse events.

CONCLUSIONS: These findings support the use of IPR to treat trauma-induced hypotension as long as bleeding has been controlled.

J Trauma Acute Care Surg. 2018 Feb 17. Epub ahead of print

Tourniquet Usage in Pre-Hospital Care and Resuscitation of Pediatric Trauma Patients - Pediatric Trauma Society Position Statement.

Cunningham A, Auerbach M, Cicero M, Jafri M.

BACKGROUND: Recent mass casualty events in the United States have highlighted the need for public preparedness to prevent death from uncontrolled hemorrhage. The Pediatric Trauma Society (PTS) reviewed the literature regarding pediatric tourniquet usage with the aim to provide recommendations about the utility of this adjunct for hemorrhage control in children.

METHODS: Search terms "pediatric" and "tourniquet" were used to query the US National Library of Medicine National Institutes of Health for pertinent literature. Exclusion criteria include: not involving children, not involving the use of an extremity tourniquet, primary outcomes not related to hemorrhage control, tourniquet use to prevent snake envenomation, single case reports, and only foreign language formats available. Bibliographies of remaining studies reviewed to identify additional pertinent research. Four physician members of the Pediatric Trauma Society Guidelines Committee reviewed identified studies.

RESULTS: One hundred and thirty four studies were identified. One hundred and twenty three studies were excluded. Seven additional studies were identified through bibliography review. Eighteen pertinent studies were reviewed. Seven articles evaluated physiologic response to tourniquet use in operating room settings. Six articles were generated from combat experience in conflicts in Afghanistan and Iraq. Four articles discussed technical details of tourniquet usage. One article evaluated the use of tourniquets during the Boston Marathon bombing in 2015.

CONCLUSIONS: Despite limited data of limited quality regarding their use, the PTS supports the usage of tourniquets in the pre-hospital setting and during the resuscitation of children suffering from exsanguinating hemorrhage from severe extremity trauma. Expedited, definitive care must be sought, and tourniquet pressure and time should be limited to the least amount possible. The Society supports the ACS 'Stop the Bleed' campaign and encourages further investigation of tourniquet use in children.

LEVEL OF EVIDENCE: 3a STUDY TYPE: Guidelines/Algorithm.

J Spec Oper Med. Spring 2018;18(1):118-123

Integrating Chemical Biological, Radiologic, and Nuclear (CBRN) Protocols Into TCCC Introduction of a Conceptual Model - TCCC + CBRN = (MARCHE)2

DeFeo DR, Givens ML

ABSTRACT:
The authors would like to introduce TCCC [Tactical Combat Casualty Care] + CBRN [chemical, biological, radiological, and nuclear] = (MARCHE)2 as a conceptual model to frame the response to CBRN events. This model is not intended to replace existing and well-established literature on CBRNE events but rather to serve as a response tool that is an adjunct to agent specific resources.

Mil Med. 2018 Mar 14. doi: 10.1093/milmed/usx129. [Epub ahead of print]

An Evaluation of Navy En Route Care Training Using a High-Fidelity Medical Simulation Scenario of Interfacility Patient Transport.

DeForest CA, Blackman V, Alex JE, Reeves L, Mora A), Perez C, Maddry J, Selby D, Walrath B

Introduction: Military prehospital and en route care (ERC) directly impacts patient morbidity and mortality. Provider knowledge and skills are critical variables in the effectiveness of ERC. No Navy doctrine defines provider choice for patient transport or requires standardized provider training. Frequently, Search and Rescue Medical Technicians (SMTs) and Navy Nurses (ERC RNs) are tasked with this mission though physicians have also been used. Navy ERC provider training varies greatly by professional role. Historically, evaluations of ERC and patient outcomes have been based on retrospective analyses of incomplete data sets that provide limited insight on ERC practices. Little evidence exists to determine if current training is adequate to care for the most common injuries seen in combat trauma patients.

Materials and Methods: Simulation technology facilitates a standardized patient encounter to enable complete, prospective data collection while studying provider type as the independent variable. Information acquired through skill performance observation can be used to make evidence-based recommendations to improve ERC training. This IRB approved multi-center study funded through a Congressionally Directed Medical Research Program grant from the Combat Casualty Care Intramural Research Joint En Route Care portfolio evaluated Navy ERC providers. The study evaluated 84 SMT, ERC RN, and physician participants in the performance of critical and secondary actions during an immersive, high-fidelity, patient transport simulation scenario focused on the care during an interfacility transfer. Simulation evaluators with military ERC expertise, blinded to participant training and background, graded each participant's performance. Inter-rater reliability was calculated using Cohen's Kappa to evaluate concordance between evaluator assessments. Categorical data were reported as frequencies and percentages. Performance attempt and accuracy rates were compared with likelihood ratio chi-square or Fisher's exact test where appropriate. Tests were two-tailed and we considered results significant, that is, a difference not likely due to chance exists between groups, if $p < 0.05$. Confidence intervals were used to present overlap in performance between provider types.

Results: Critical and secondary actions were assessed. A majority of providers completed at least one of the critical life-saving actions; only one participant completed all critical actions. Evaluation of critical actions demonstrated that a tourniquet was applied by 64% of providers, blood products administered by 46%, needle decompression performed by 51%, and a complete handoff report performed by 48%. Assessment of secondary actions demonstrated analgesic was accurately administered by 24% of all providers, and 44% reinforced the "hemorrhaging amputation site dressing."

Conclusion: Over 98% of participants failed to properly perform all critical actions during the interfacility transfer scenario, which in a real-life combat casualty transport scenario could result in a preventable death. Study results demonstrate serious skill deficits among all types of Navy ERC providers. These data can be used to improve the training of Navy ERC providers, ultimately improving care to injured soldiers, sailors, airmen, and marines.

J Anaesthesiol Clin Pharmacol. 2017 Oct-Dec;33(4):467-472

I-Gel versus laryngeal mask airway (LMA) classic as a conduit for tracheal intubation using ventilating bougie.

Dhimar AA, Sangada BR, Upadhyay MR, Patel SH

Background and Aims: Supraglottic airways (SGAs) are generally used for airway management; but can also be used as a conduit for tracheal intubation. Our primary aim was to evaluate i-Gel and laryngeal mask airway (LMA) classic as conduits for tracheal intubation using ventilating bougie by assessing number of attempts and time for insertion of SGAs, ventilating bougie and endotracheal tube (ETT), and total intubation time.

Material and Methods: A randomized clinical trial was carried out in 58 patients requiring general anesthesia and endotracheal intubation for planned surgery. They were randomly divided into Group I and Group C. After induction of anesthesia, i-Gel was inserted in Group I and LMA Classic in Group C; ventilating bougie was passed through SGA followed by the removal of SGA and railroading of ETT over ventilating bougie. Parameters observed were number of attempts and time taken for device insertion, total intubation time, and hemodynamic variables.

Results: Twenty-nine patients were included in each group. First attempt success rate for SGA insertion (86.2% in Group I and 75.9% in Group C ($P = 0.5$)), ventilating bougie insertion (79.32% in Group I and 82.8% in Group C ($P = 0.99$)) and ETT insertion (100% in Group I and 96.5% in Group C) was not different in the two groups. Total intubation time was 93.3 ± 9.0 s in Group I and 108. 96 ± 16.5 s in Group C ($P < 0.0001$).

Conclusions: i-Gel and LMA Classic both can be used as a conduit for tracheal intubation using ventilating bougie with stable hemodynamic parameters.

Mil Med. 2018 Mar 14. Epub ahead of print

Damage Control Resuscitation Supplemented with Vasopressin in a Severe Polytrauma Model with Traumatic Brain Injury and Uncontrolled Internal Hemorrhage.

Dickson JM, Wang X, St John AE, Lim EB, Stern SA, White NJ.

Introduction: Traumatic brain injury (TBI) and hemorrhagic shock (HS) are the leading causes of traumatic death worldwide and particularly on the battlefield. They are especially challenging when present simultaneously (polytrauma), and clear blood pressure end points during fluid resuscitation are not well described for this situation. The goal of this study is to evaluate for any benefit of increasing blood pressure using a vasopressor on brain blood flow during initial fluid resuscitation in a swine polytrauma model.

Materials and Methods: We used a swine polytrauma model with simultaneous TBI, femur fracture, and HS with uncontrolled noncompressible internal bleeding from an aortic tear injury. Five animals were assigned to each of three experimental groups (hydroxyethyl starch only [HES], HES + 0.4 U/kg vasopressin, and no fluid resuscitation [No Fluids]). Fluids were given as two 10 mL/kg boluses according to tactical field care guidelines. Primary outcomes were mean arterial blood pressure (MAP) and brain blood flow at 60 min. Secondary outcomes were blood flows in the heart, intestine, and kidney; arterial blood lactate level; and survival at 6 hr. Organ blood flow was measured using injection of colored microspheres.

Results: Five animals were tested in each of the three groups. There was a statistically significant increase in MAP with vasopressin compared with other experimental groups, but no significant increase in brain blood flow during the first 60 min of resuscitation. The vasopressin group also exhibited greater total internal hemorrhage volume and rate. There was no difference in survival at 6 hours.

Conclusion: In this experimental swine polytrauma model, increasing blood pressure with vasopressin did not improve brain perfusion, likely due to increased internal hemorrhage. Effective hemostasis should remain the top priority for field treatment of the polytrauma casualty with TBI.

J Trauma Acute Care Surg. 2018 Mar;84(3):532-536.

Clinical relevance of a p value: Does tranexamic acid save lives after trauma or postpartum hemorrhage?

Dobson GP, Doma K, Letson HL.

Quote:

“In conclusion, although we agree that TXA may have an early survival benefit in patients who are severely bleeding with or without shock, 3,31 the results of the WOMAN trial are only a beginning toward “saving one in three mothers who would otherwise bleed to death after childbirth,” even if the drug is administered within 3 hours.We believe that the trial investigators and social media have overstated the significance of the WOMAN trial results, and combining the WOMAN and CRASH-2 data in a meta-analysis may result in inherent bias. The need for a consensus on what constitutes adequate statistical evidence for a drug to be clinically useful, and do no harm, is at the heart of our commentary. TXA should not be viewed as a one-size-fits-all approach to treat blood loss in civilian - or combat-related trauma or PPH, but rather we propose the incorporation of a more precision-based set of guidelines for TXA administration to reduce trauma-related and maternal mortality and morbidity.”

JEMS 2018; 1 Feb 2018

Whole blood in EMS may save lives.

Dodge M, Thompson D, Bank E, Nealy W, Fisher A

Quotes:

Why Use Whole Blood?

There are three reasons why whole blood is ideal for prehospital use. First, whole blood is superior to crystalloids and colloids. There's very little room to argue that crystalloid and colloid fluids are appropriate in resuscitation. The hazards of dilutional coagulopathy and acidosis are well documented.15-18

Second, whole blood administration is easier than the administration of components. The administration of whole blood is the simplest way to deliver the functionality of lost blood back to the patient.

The Serious Hazards of Transfusion (SHOT) study from the U.K. looked at the serious hazards of transfusion and found that approximately 78% of the incident reports resulted from human error, despite there being rules in place to improve practice.19

Third, the safety of whole blood transfusions is similar to component therapy, as TTD testing is completed for both. The U.S. military has successfully transfused over 10,000 units of whole blood across the world.20 The body of evidence will grow as more civilian agencies initiate their own whole blood programs.

In late August 2017, Harris County Emergency Services District No. 48 (HCESD 48) Fire Department and Cypress Creek EMS (CCEMS) in Houston, Texas, began carrying cold-stored LTOWB for hemostatic resuscitation. Before this unconventional approach, both services had been carrying RBCs and fresh plasma since mid-2016. There were over 100 units transfused, and currently work is underway to obtain patient outcome data for publication. Both services are use

a response vehicle with a paramedic who delivers blood and oversees its storage. The protocol's inclusion criteria is 12 and older (should have two or more of the following):

>>Hemodynamically unstable (i.e., HR > 120; systolic B/P ≤ 90 mmHg);

>>Penetrating injury or blunt trauma with significant injury;

>>Positive focused assessment with sonography in trauma test (if available); and

>>Hemoglobin < 6.0 mmol/L (if available).

Trauma Surg Acute Care Open. 2017 May 31;2(1):e000106

Methodology to reliably measure preventable trauma death rate.

Drake SA, Wolf DA, Meininger JC, Cron SG, Reynold T, Wade CE, Holcomb JB

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

J Am Coll Surg. 2018 Mar 8. Epub ahead of print

Army General Surgery's Crisis of Conscience.

Edwards MJ, White CE, Remick KN, Edwards KD, Gross KR

Quotes:

“In 2018-2019, the Active Component of the United States Army is anticipated to lose 50% of their current senior general surgeons (rank of Colonel) due to retirements and separations. The number one reason given by surgeons departing from military service is loss of operative skills and concern for maintenance of surgical competence.21 The continued need for minimized surgical teams supporting military missions in remote and austere regions of the globe results in conflict between a limited pool of deployable general surgeons struggling to maintain clinical competence, and a military medical leadership demanding longer and more frequent deployments without concrete plans for skills refreshment at home. In short, surgeons with increasingly limited operative and trauma experience are expected to care for patients with potentially the most horrendous injuries, with minimal access to technology, equipment and personnel to assist them. The new crisis of conscience of the military general surgeon is in continuing to support missions when the true capability they are able to provide is not sufficient to render the care they are purported to give.”

“Moral hazard exists when those making policies do not themselves suffer the effects of such policies.24 As a surgical community, we flirt with some degree of moral hazard if we criticize military surgical care without rising to meet what is clearly a national need ourselves. The Army has an obligation to facilitate accession, skills sustainment, and retention of the surgeons it needs to care for our wounded service members; however, as a society we also have an obligation to fill the need of military service. Only with an effort to awaken a collective conscience for the surgical care of our wounded warriors on the part of military surgeons, military commanders and the surgical community in general can today’s Army General Surgeons’ crisis of conscience be appeased.”

Am J Emerg Med. 2018 Mar 16. Epub ahead of print

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

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

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

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

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

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

J Emerg Trauma Shock. 2018 Jan-Mar;11(1):4-9

Prehospital Ultrasound in Trauma: A Review of Current and Potential Future Clinical Applications.

El Zahran T, El Sayed MJ

ABSTRACT:
Ultrasound (US) is an essential tool for evaluating trauma patients in the hospital setting. Many previous in-hospital studies have been extrapolated to out of hospital setting to improve diagnostic accuracy in prehospital and austere environments. This review article presents the role of prehospital US in blunt and penetrating trauma management with emphasis on its current clinical applications, challenges, and future implications of such use.

J Trauma Acute Care Surg. 2018 Mar 22. Epub ahead of print

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

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

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

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

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

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

Eur J Trauma Emerg Surg. 2018 Mar 15. Epub ahead of print

Systematic review and meta-analysis of tube thoracostomy following traumatic chest injury; suction versus water seal.

Feenstra TM, Dickhoff C, Deunk J

PURPOSE: Tube thoracostomy is frequently used in thoracic trauma patients. However, there is no consensus on whether low pressure suction or water seal is the optimal method of tube management. Against this background, we performed a systematic review of studies comparing suction and water seal management of chest tubes placed for traumatic chest injuries in adults. Evaluated outcomes are duration of chest tube treatment, length of stay in hospital, incidence of persistent air leak, clotted hemothorax, and the need for (re-)interventions.

METHODS: A systematic literature search according to Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines was performed. Included studies were evaluated according to the Cochrane Collaboration's tool for assessing the risk of bias, and according to Grading of Recommendations Assessment, Development and Evaluation (GRADE) guidelines for assessing the quality of evidence.

RESULTS: After assessment of 120 identified studies, three RCT's (randomized controlled trials) were included in this review and meta-analysis. A favorable effect of suction was found for duration of chest tube treatment [MD (mean difference) - 3.38 days, P = 0.005], length of stay in hospital (MD -3.90 days, P = 0.0003), and the incidence of persistent air leak [OR (odds ratio) 0.27, P = 0.001]. No significant difference was found for the incidence of clotted hemothorax and (re-)interventions. The quality of evidence according to GRADE was low, except for persistent air leak (moderate).

CONCLUSIONS: Suction seems to have a positive effect on duration of chest tube treatment, length of stay in hospital and persistent air leakage in chest trauma. However, available data was limited and the quality of evidence was (very) low to moderate according to GRADE.

Mil Med. 2018 Mar 1;183(suppl_1):34-39

Coagulopathy and Mortality in Combat Casualties: Do the Kidneys Play a Role?

Ferencz SE, Davidson AJ, Howard JT, Janak JC, Sosnov JA, Chung KK, Stewart IJ

Background: Acute traumatic coagulopathy (ATC) is a common condition after traumatic injury and is known to be associated with an increase in morbidity and mortality in trauma patients. ATC has been implicated as a causative factor in both early hemorrhage and late organ failure in this population, yet the pathophysiology remains largely unknown. Additionally, acute kidney injury (AKI) is a common condition among critically injured trauma patients. AKI has been associated with an elevated International Normalized Ratio (INR) and warfarin use, but its development has not been well studied in the setting of ATC. We hypothesized that the presence of ATC influences the development of AKI and may mediate mortality in combat casualties.

Methods: Data were obtained from the Department of Defense Trauma Registry, Medical Data Store and Composite Healthcare System, and the Armed Forces Medical Examiner System. A retrospective review was conducted of US service members injured in Iraq or Afghanistan between February 1, 2002 and February 1, 2011, who required ICU level care and survived evacuation out of theater. Exclusions were made for missing data. Cox proportional hazard regression was performed to determine the effect of ATC (a priori defined as first INR > 1.3) on the development of AKI. Further analysis was conducted to determine the influence of these variables on 30-d mortality, and multiple sensitivity analyses were performed to determine the effect of ATC on both AKI and mortality.

Results: A total of 1,288 patients were identified for analysis. ATC was a risk factor for subsequent AKI after adjustment (HR 1.67, 95% CI 1.28-2.18; $p < 0.001$). However, ATC was not a risk factor for mortality after adjustment in the full model (HR 1.87, 95% CI 0.95-3.65; $p = 0.069$). On sensitivity analyses exploring alternate definitions of ATC, an INR of 1.2 remained associated with AKI (HR 1.46, 95% CI 1.13-1.88; $p = 0.004$) and an INR of 1.5 became significant for mortality (HR 1.76, 95% CI 1.32-2.35; $p < 0.001$).

Conclusion: ATC is independently associated with the development of AKI. Although ATC is associated with mortality in the unadjusted model, it is not significant after adjustment for AKI. This implies that the kidneys may play a role in the adverse outcomes observed after ATC. Increased awareness and monitoring for coagulopathy and the subsequent development of AKI in combat casualty patients may lead to earlier diagnosis and treatment of these conditions, possibly decreasing morbidity and mortality.

J Arthroplasty. 2018 Mar 22. Epub ahead of print

The Safety of Tranexamic Acid in Total Joint Arthroplasty: A Direct Meta-Analysis.

Fillingham YA, Ramkumar DB, Jevsevar DS, Yates AJ, Shores P, Mullen K, Bini SA, Clarke HD, Schemitsch E, Johnson RL, Memtsoudis SG, Sayeed SA, Sah AP, Della Valle CJ

BACKGROUND: Tranexamic acid (TXA) is effective in reducing blood loss in total joint arthroplasty (TJA), but concerns still remain regarding the drug's safety. The purpose of this direct meta-analysis was to evaluate and establish a basis for the safety recommendations of the combined clinical practice guidelines on the use of TXA in primary TJA.

METHODS: A search was completed for studies published before July 2017 on TXA in primary TJA. We performed qualitative and quantitative homogeneity testing and a direct comparison meta-analysis. We used the American Society of Anesthesiologists (ASA) score of 3 or greater as a proxy for patients at higher risk for complications in general and performed a meta-regression analysis to investigate the influence of comorbidity burden on the risk of arterial thromboembolic event and venous thromboembolic event (VTE).

RESULTS: Topical, intravenous, and oral TXA were not associated with an increased risk of VTE after TJA. In addition, meta-regression demonstrated that TXA use in patients with an ASA status of 3 or greater was not associated with an increased risk of VTE after total knee arthroplasty.

CONCLUSION: Although most studies included in our analysis excluded patients with a history of prior thromboembolic events, our findings support the lack of evidence of harm from TXA administration in patients undergoing TJA. Moderate evidence supports the safety of TXA in patients undergoing total knee arthroplasty with an ASA score of 3 or greater. The benefits of using TXA appear to outweigh the potential risks of thromboembolic events even in patients with a higher comorbidity.

Transfus Med. 2018 Apr;28(2):140-149

Massive transfusions for critical bleeding: is everything old new again?

Flint AWJ, McQuilten ZK, Wood EM

ABSTRACT:
Massive transfusion or major haemorrhage protocols have been widely adopted in the treatment of critically bleeding patients. Following evidence that higher ratios of transfused plasma and platelets to red blood cells may offer survival benefits in military trauma patients, these ratios are now commonly incorporated into massive transfusion protocols. They more closely resemble the effects of whole blood transfusion, which in the second half of last century was largely replaced by individual blood component transfusion based on laboratory-guided indicators. However, high-quality evidence to guide transfusion support for critically bleeding patients across the range of bleeding contexts is lacking, including for both trauma and non-trauma patients. More data on major haemorrhage support and clinical outcomes are needed to inform guidelines and practice.

Ann Plast Surg. 2018 Mar;80(3 Suppl 2):S98-S105

Inhalation Injury in the Burned Patient.

Foncerrada G, Culnan DM, Capek KD, González-Trejo S, Cambiaso-Daniel J, Woodson LC, Herndon DN, Finnerty CC, Lee JO.

ABSTRACT:
Inhalation injury causes a heterogeneous cascade of insults that increase morbidity and mortality among the burn population. Despite major advancements in burn care for the past several decades, there remains a significant burden of disease attributable to inhalation injury. For this reason, effort has been devoted to finding new therapeutic approaches to improve outcomes for patients who sustain inhalation injuries. The three major injury classes are the following: supraglottic, subglottic, and systemic. Treatment options for these three subtypes differ based on the pathophysiologic changes that each one elicits. Currently, no consensus exists for diagnosis or grading of the injury, and there are large variations in treatment worldwide, ranging from observation and conservative management to advanced therapies with nebulization of different pharmacologic agents. The main pathophysiologic change after a subglottic inhalation injury is an increase in the bronchial blood flow. An induced mucosal hyperemia leads to edema, increases mucus secretion and plasma transudation into the airways, disables the mucociliary escalator, and inactivates hypoxic vasocontriction. Collectively, these insults potentiate airway obstruction with casts formed from epithelial debris, fibrin clots, and inspissated mucus, resulting in impaired ventilation. Prompt bronchoscopic diagnosis and multimodal treatment improve outcomes. Despite the lack of globally accepted standard treatments, data exist to support the use of bronchoscopy and suctioning to remove debris, nebulized heparin for fibrin casts, nebulized N-acetylcysteine for mucus casts, and bronchodilators. Systemic effects of inhalation injury occur both indirectly from hypoxia or hypercapnia resulting from loss of pulmonary function and systemic effects of proinflammatory cytokines, as well as directly from metabolic poisons such as carbon monoxide and cyanide. Both present with nonspecific clinical symptoms including cardiovascular collapse. Carbon monoxide intoxication should be treated with oxygen and cyanide with hydroxocobalamin. Inhalation injury remains a great challenge for clinicians and an area of opportunity for scientists. Management of this concomitant injury lags behind other aspects of burn care. More clinical research is required to improve the outcome of inhalation injury. The goal of this review is to comprehensively summarize the diagnoses, treatment options, and current research.

Mil Med. 2018 Mar 2. Epub ahead of print

Letter in Response to Kim M, Torrie I, Poisson R, Withers N, Bjarnason S, DaLuz LT, Pannell D, Beckett A, Tien HC. The Value of Live Tissue Training for Combat Casualty Care: A Survey of Canadian Combat Medics with Battlefield Experience in Afghanistan.

Gala SG, Balsam MJ

Quotes:

“We thank Kim and colleagues for their study of the perceived value of live tissue training (LTT) on animals versus training on human patient simulators (HPS) in preparing combat medics for battlefield trauma care. However, their recommendation to continue support for LTT in military medical training is based on outdated literature, a study sample size that is too small to be credible, and a disproportionate reliance solely on medics’ emotive preference for a certain training modality without a critical assessment of how such training affects clinical outcomes.”

“As Hall mentioned in his letter to the editor, “[T]he reason animal training has lasted as long as it has is because of a general bias that equates emotional experience with improved skill training.” When objectively looking at the breadth of literature on this topic, it is clear that LTT is “outdated” – as the U.S. Defense Health Agency declared last year – and the evidence clearly favors the equivalency or superiority of HPS compared with LTT. It is with this in mind that we hope military leaders will continue to phase out LTT and transition entirely to HPS training methods.”

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

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

Gendron B, Cronin A, Monti J, Brigg A

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

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

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

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

Mil Med. 2018 Mar 1;183(suppl_1):157-161

Comparison of Two Tourniquets on a Mid-Thigh Model: The Israeli Silicone Stretch and Wrap Tourniquet vs. the Combat Application Tourniquet.

Glick CPTY, Furer MAJA, Glassberg COLE, Sharon R, Ankory MAJR

Introduction: Experience from recent conflicts underlines the dramatic impact of effective tourniquet use on combat casualty mortality. Although the Combat Application Tourniquet (CAT) is replacing the silicone band tourniquets (IST; "Israeli Silicone Tourniquet") in the Israeli Defense Forces, no direct comparison was made between them. The purpose of this study is to compare the performance of the two tourniquets on a mid-thigh model.

Methods: Participants were Israeli military recruits who previously had the military first aid course. Each participant applied both the CAT and the IST. Applications were assessed by the HapMed Leg Tourniquet Trainer, which measured the applied pressure and the time required to reach it.

Results: IST application resulted in higher rates of effective occlusion pressure compared with the CAT (91% vs. 73.1%, $p < 0.01$), and a higher mean occlusion pressure (41 mmHg, $p < 0.01$) was recorded using the IST. Among effective attempts, application time did not differ significantly between the tourniquets.

Conclusion: The IST was superior to the CAT in producing effective occlusion pressure while not prolonging application time. These results may indicate that the IST remains a valid option for controlling mid-thigh bleeding.

Mil Med. 2018 Mar 1;183(suppl_1):219-223

Simplified Method for Rapid Field Assessment of Visual Acuity by First Responders After Ocular Injury.

Godbole NJ, Seefeldt ES, Raymond WR, Karesh JW, Morgenstern A, Egan JA, Colyer MH, Mazzoli RA

Objective: Initial visual acuity after ocular injury is an important measure, as it is an accurate predictor of final visual outcome and gives a rapid estimation of the overall severity of the injury, thereby aiding evacuation prioritization. We devised a simple method for rapidly assessing visual acuity in the field without having to rely on formal screening cards.

Methods: Using common objects, icons, and text found in the injury zone – for example, common military name tapes, rank insignias, patches, emblems, and helmet camouflage bands, which will be known collectively as the Army Combat Optotypes (ACOs) - a Snellen-equivalent method of assessing visual acuity was devised and correlated to the ocular trauma score (OTS).

Results: Ability to read the ACOs at 2, 3, and 5 ft correlates with acuities in the range from 20/20 to 20/400. Identification of ACOs with visual acuity of 20/50 and 20/200 approximates important inflection points of severity for the OTS.

Conclusion: Accurately assessing visual acuity in the field after ocular injury provides essential information but does not require sophisticated screening equipment. Pertinent and accurate acuities can be rapidly estimated using commonly available text or graphical icons such as standard name tapes, patches, and rank insignias.

Crit Care Nurse. 2018 Apr;38(2):69-75

Resuscitative Endovascular Balloon Occlusion of the Aorta: A Bridge to Flight Survival.

Goforth C, Bradley M, Pineda B, See S, Pasley J

ABSTRACT:
Trauma endures as the leading cause of death worldwide, and most deaths occur in the first 24 hours after initial injury as a result of hemorrhage. Historically, about 90% of battlefield deaths occur before the injured person arrives at a theater hospital, and most are due to noncompressible hemorrhage of the torso. Resuscitative endovascular balloon occlusion of the aorta is an evolving technique to quickly place a balloon into the thoracic or abdominal aorta to efficiently block blood flow to distal circulation. Maneuvers, such as resuscitative endovascular balloon occlusion of the aorta, to control endovascular hemorrhage offer a potential intervention to control noncompressible hemorrhage. This technique can be performed percutaneously or open in prehospital environments to restore hemodynamic functions and serve as a survival bridge until the patient is delivered to a treatment facility for definitive surgical hemostasis. This article describes the indications, complications, and application of resuscitative endovascular balloon occlusion of the aorta to military and civilian aeromedical transport.

AEM Education and Training: 27 February 2018; https://doi.org/10.1002/aet2.10093

Brief, Web-based Education Improves Lay Rescuer Application of a Tourniquet to Control Life-threatening Bleeding.

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Objective: The objective was to determine whether brief, Web-based instruction several weeks prior to tourniquet application improves layperson success compared to utilizing just-in-time (JiT) instructions alone.

Background: Stop the Bleed is a campaign to educate laypeople to stop life-threatening hemorrhage. It is based on U.S. military experience with lifesaving tourniquet use. While previous research shows simple JiT instructions boost laypeople's success with tourniquet application, the optimal approach to educate the public is not yet known.

Methods: This is a prospective, non-blinded, randomized study. Layperson participants from the Washington, DC, area were randomized into: 1) an experimental group that received pre-exposure education using a website and 2) a control group that did not receive pre-exposure education. Both groups received JiT instructions. The primary outcome was the proportion of subjects that successfully applied a tourniquet to a simulated amputation. Secondary outcomes included mean time to application, mean placement position, ability to distinguish bleeding requiring a tourniquet from bleeding requiring direct pressure only, and self-reported comfort and willingness to apply a tourniquet.

Results: Participants in the pre-exposure group applied tourniquets successfully 75% of the time compared to 50% success for participants with JiT alone ($p < 0.05$, risk ratio = 1.48, 95% confidence interval = 1.21–1.82). Participants place tourniquets in a timely fashion, are willing to use them, and can recognize wounds requiring tourniquets.

Conclusions: Brief, Web-based training, combined with JiT education, may help as many as 75% of laypeople properly apply a tourniquet. These findings suggest that this approach may help teach the public to Stop the Bleed.

Curr Opin Anaesthesiol. 2018 Apr;31(2):207-214

Blood transfusion management in the severely bleeding military patient.

Gurney JM, Spinella PC

PURPOSE OF REVIEW: Hemorrhage remains the primary cause of preventable death on the battlefield and in civilian trauma. Hemorrhage control is multifactorial and starts with point-of-injury care. Surgical hemorrhage control and time from injury to surgery is paramount; however, interventions in the prehospital environment and perioperative period affect outcomes. The purpose of this review is to understand concepts and strategies for successful management of the bleeding military patient. Understanding the life-threatening nature of coagulopathy of trauma and implementing strategies aimed at full spectrum hemorrhage management from point of injury to postoperative care will result in improved outcomes in patients with life-threatening bleeding.

RECENT FINDINGS: Timely and appropriate therapies impact survival. Blood product resuscitation for life-threatening hemorrhage should either be with whole blood or a component therapy strategy that recapitulates the functionality of whole blood. The US military has transfused over 10 000 units of whole blood since the beginning of the wars in Iraq and Afghanistan. The well recognized therapeutic benefits of whole blood have pushed this therapy far forward into prehospital care in both US and international military forces. Multiple hemostatic adjuncts are available that are likely beneficial to the bleeding military patient; and other products and techniques are under active investigation.

SUMMARY: Lessons learned in the treatment of combat casualties will likely continue to have positive impact and influence and the management of hemorrhage in the civilian trauma setting.

Can J Anaesth. 2018 May;65(5):543-550

Self-pressurized air-Q® intubating laryngeal airway versus the LMA® Classic™: a randomized clinical trial.

Ha SH), Kim MS, Suh J, Lee JS

PURPOSE: The self-pressurized air-Q® (air-Q SP) intubating laryngeal airway is a relatively new supraglottic airway (SGA) device. The intracuff pressure of air-Q dynamically equilibrates with the airway pressure and adjusts to the patient's pharyngeal and periglottic anatomy, potentially providing improved airway fit and seal. The aim of this prospective randomized study was to compare the clinical performance of air-Q to the LMA® Classic™ SGA.

METHODS: Adult patients requiring general anesthesia for elective surgery were prospectively enrolled and randomly assigned to either air-Q SP or the LMA Classic SGA. Oropharyngeal leak pressure (primary endpoint), success rate, insertion features (insertion time, ease of insertion, requirement for device manipulation), sealing function, gastric insufflation, bronchoscopic view, and oropharyngeal complications at device insertion and following its removal (sore throat, dysphagia, dysphonia) were compared.

RESULTS: The mean (standard deviation [SD]) oropharyngeal leak pressure just after insertion was similar in the air-Q SP and LMA [16.8 (4.9) vs 18.6 (5.5) cm H2O, respectively; mean difference, 1.8 cm H2O; 95% CI, -0.5 to 4.2; P = 0.13] and did not differ at ten minutes following device insertion. Median [interquartile range (IQR)] peak inspiratory pressure just after insertion was lower in the air-Q SP (11.0 [10.0-13.0] vs 13.0 [11.0-14.0] cmH2O, median difference, 1.0 cm H2O; 95% CI, 0.0 to 2.0; P = 0.03) but no difference was observed at ten minutes. The median [IQR] insertion time was faster with the air-Q SP (15.9 [13.6-20.3] sec vs 24 [21.2-27.1] sec; median difference, 8.1 sec; 95% CI, 5.6 to 9.9; P < 0.001) and improved bronchoscopic viewing grade were seen with the air-Q SP immediately after insertion (P < 0.001). No differences between the groups were observed with respect to the rate of successful insertion at first attempt, overall insertion success rate, ease of insertion, and complications.

CONCLUSIONS: The air-Q SP had similar leak pressures but a faster insertion time and superior bronchoscopic viewing grade when compared with the LMA Classic. The air-Q SP is a suitable alternative to the LMA Classic in adult patients and may be a superior conduit for tracheal intubation.

TRIAL REGISTRATION: www.clinicaltrials.gov (NCT02206438). Registered 1 August 2014.

Am J Emerg Med. 2018 Feb 8 Epub ahead of print

Impact of prehospital airway management on combat mortality.

Hardy GB, Maddry JK, Ng PC, Savell SC, Arana AA, Kester A, Bebarta VS

INTRODUCTION: Analysis of modern military conflicts suggests that airway compromise remains the second leading cause of preventable death of combat fatalities. This study compares outcomes of combat casualties that received prehospital airway interventions, specifically bag valve mask (BVM) ventilation, cricothyrotomy, and supraglottic airway (SGA) placement. The goal is to compare the effectiveness of airway management strategies used in the military pre-hospital setting.

METHODS: This retrospective chart review of 1267 US Army medical evacuation patient care records, compared outcomes of casualties that received prehospital advanced airway interventions. The patients consisted of US military injured in Operation Enduring Freedom January 2011-March 2014. Compared outcomes consisted of vent-, ICU-, and hospital-free days.

RESULTS: Those with SGA placement experienced fewer vent-free days, ICU-free days, and hospital-free days compared to BVM and cricothyrotomy patients. The groups did not significantly differ in rates of 30-day survival. The odds for survival were not significantly higher for BVM versus SGA patients (OR 1.5, 95% CI 0.2-9.8), cricothyrotomy versus SGA patients (OR 3.9, 95% CI 0.6-24.9), or cricothyrotomy versus BVM patients (OR 2.7, 95% CI 0.5-13.8) in a logistic regression model adjusting for GCS.

CONCLUSION: This study supports prehospital BVM ventilation as a possible alternative to cricothyrotomy as there was no difference in measured outcomes between the groups. It further cautions against SGA use in the prehospital combat setting due to higher morbidity demonstrated by fewer ventilator, hospital, and ICU free days than those receiving cricothyrotomy or BVM ventilation. There was no difference in 30-day survival between the groups.

Injury. 2018 Feb;49(2):149-164

The prehospital management of hypothermia - An up-to-date overview.

Haverkamp FJC, Giesbrecht GG, Tan ECTH.

BACKGROUND: Accidental hypothermia concerns a body core temperature of less than 35°C without a primary defect in the thermoregulatory system. It is a serious threat to prehospital patients and especially injured patients, since it can induce a vicious cycle of the synergistic effects of hypothermia, acidosis and coagulopathy; referred to as the trauma triad of death. To prevent or manage deterioration of a cold patient, treatment of hypothermia should ideally begin prehospital. Little effort has been made to integrate existent literature about prehospital temperature management. The aim of this study is to provide an up-to-date systematic overview of the currently available treatment modalities and their effectiveness for prehospital hypothermia management.

DATA SOURCES: Databases PubMed, EMbase and MEDLINE were searched using the terms: "hypothermia", "accidental hypothermia", "Emergency Medical Services" and "prehospital". Articles with publications dates up to October 2017 were included and selected by the authors based on relevance.

RESULTS: The literature search produced 903 articles, out of which 51 focused on passive insulation and/or active heating. The most effective insulation systems combined insulation with a vapor barrier. Active external rewarming interventions include chemical, electrical and charcoal-burning heat packs; chemical or electrical heated blankets; and forced air warming. Mildly hypothermic patients, with significant endogenous heat production from shivering, will likely be able to rewarm themselves with only insulation and a vapor barrier, although active warming will still provide comfort and an energy-saving benefit. For colder, non-shivering patients, the addition of active warming is indicated as a non-shivering patient will not rewarm spontaneously. All intravenous fluids must be reliably warmed before infusion.

CONCLUSION: Although it is now accepted that prehospital warming is safe and advantageous, especially for a non-shivering hypothermic patient, this review reveals that no insulation/heating combinations stand significantly above all the others. However, modern designs of hypothermia wraps have shown promise and battery-powered inline fluid warmers are practical devices to warm intravenous fluids prior to infusion. Future research in this field is necessary to assess the effectiveness expressed in patient outcomes.

J Trauma Acute Care Surg. 2018 Feb 27 Epub ahead of print

How Hemorrhage Control Became Common Sense.

Hawk AJ

BACKGROUND: Just over 200 years ago, surgeons were puzzled that the use of the tourniquet to control hemorrhage as common sense during surgery was a relatively recent development. Within the last 20 years, much progress has been made to controlling hemorrhage in the prehospital context. Then, as now, it was surprising that progress on something that appeared obvious had occurred only recently, begging the question how controlling blood loss was common sense in a surgical context, but not for emergency treatment.

METHODS: Paper is a historical survey of the evolution of the medical understanding of hemorrhage along with technological response.

RESULTS: The danger of blood loss had historically been consistently underestimated as physicians looked at other explanations for symptoms of how the human body responded to trauma. As the danger from hemorrhage became apparent, even obvious, responsibility for hemorrhage control was delegated down from the surgeon to the paramedic and eventually to individual service members and civilian bystanders with training to "Stop the Bleed."

DISCUSSION: Hippocratic medicine assumed that blood diffused centrifugally into periphery through arteries. William Harvey's observation in 1615 that blood ran through a closed circulatory system gradually transformed conventional wisdom about blood loss, leading to the development of the tourniquet about a century later by Jean-Louis Petit, which made amputation of limbs survivable. However, physicians were cautious about their application during the First World War over concerns over effects on patient recovery. Hemorrhage had generally been seen as symptom to be managed until the patient would be seen by a surgeon who would stop the bleeding. More thorough collection and analysis of data related to case histories of soldiers wounded during the Vietnam Conflict transformed how surgeons understood the importance to hemorrhage leading to development of the doctrine of Tactical Combat Casualty Care in the late 1990's.

LEVEL OF EVIDENCE: Background Information.

J Trauma Acute Care Surg. 2018 Feb 14.Epub ahead of print

Complications in Tube Thoracostomy: Systematic review and Meta-analysis.

Hernandez MC, El Khatib M, Prokop L, Zielinski MD, Aho JM.

BACKGROUND: Tube thoracostomy (TT) complications and their reported rates are highly variable (1-40%) and inconsistently classified. Consistent TT complication classification must be applied to compare reported literature to standardize TT placement. We aim to determine the overall TT related complication rates in patients receiving TT for traumatic indications utilizing uniform definitions.

METHOD: Systematic review and meta-analysis was performed assessing TT related complications. Comprehensive search of several databases (1975-2015) was conducted. We included studies that reported on bedside TT insertion (≥22 F) in trauma patients. Data were abstracted from eligible articles by independent reviewers with discrepancies reconciled by a third. Analyses were based on complication category subtypes: insertional, positional, removal, infection/immunologic/education and malfunction.

RESULTS: Database search resulted in 478 studies; after applying criteria 29 studies were analyzed representing 4981 TTs. Injury mechanisms included blunt 60% [49-71], stab 27% [17-34], and gunshot 13% [7.8-10]. Overall median complication rate was 19% (95% CI, 14 - 24.3). Complication subtypes included insertional (15.3%), positional (53.1%), removal (16.2%), infection/immunologic (14.8%), malfunction (0.6%). Complication rates did not change significantly over time for insertional, immunologic, or removal p=0.8. Over time, there was a decrease in infectious related TT complications as well as an increase in positional TT complications.

CONCLUSIONS: Generation of evidence based approaches to improve TT insertion outcomes is difficult as a variety of complication classifications have been utilized. This meta-analysis of complications after TT insertion in trauma patients suggests that complications have not changed over time remaining stable at 19% over the past three decades.

LEVEL OF EVIDENCE: III STUDY TYPE: Systematic review and meta-analysis.

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

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

Holcomb JB

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

DATA SOURCES: Limited literature review.

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

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

Shock. 2018 Mar;49(3):295-300. doi: 10.1097/SHK.0000000000000959.

Compensatory Reserve Index: Performance of a Novel Monitoring Technology to Identify the Bleeding Trauma Patient.

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

INTRODUCTION: Hemorrhage is one of the most substantial causes of death after traumatic injury. Standard measures, including systolic blood pressure (SBP), are poor surrogate indicators of physiologic compromise until compensatory mechanisms have been overwhelmed. Compensatory Reserve Index (CRI) is a novel monitoring technology with the ability to assess physiologic reserve. We hypothesized CRI would be a better predictor of physiologic compromise secondary to hemorrhage than traditional vital signs.

METHODS: A prospective observational study of 89 subjects meeting trauma center activation criteria at a single level I trauma center was conducted from October 2015 to February 2016. Data collected included demographics, SBP, heart rate, and requirement for hemorrhage-associated, life-saving intervention (LSI) (i.e., operation or angiography for hemorrhage, local or tourniquet control of external bleeding, and transfusion >2 units PRBC). Receiver-operator characteristic (ROC) curves were formulated and appropriate thresholds were calculated to compare relative value of the metrics for predictive modeling.

RESULTS: For predicting hemorrhage-related LSI, CRI demonstrated a sensitivity of 83% and a negative predictive value (NPV) of 91% as compared with SBP with a sensitivity to detect hemorrhage of 26% ($P<0.05$) and an NPV of 78%. ROC curves generated from admission CRI and SBP measures demonstrated values of 0.83 and 0.62, respectively. CRI identified significant hemorrhage requiring potentially life-saving therapy more reliably than SBP ($P<0.05$).

CONCLUSION: The CRI device demonstrated superior capacity over systolic blood pressure in predicting the need for posttraumatic hemorrhage intervention in the acute resuscitation phase after injury.

J Trauma Acute Care Surg. 2018 May;84(5):819-825

Systematic review of prehospital tourniquet use in civilian limb trauma.

Kauvar DS, Dubick MA, Walters TJ, Kragh JF Jr.

BACKGROUND: Military enthusiasm for limb tourniquet use in combat casualty care has resulted in acceptance by the trauma community for use in the prehospital care of civilian limb injuries. To date, there has been no report synthesizing the published data on civilian tourniquet use. The objective of this systematic review was to compile and analyze the content and quality of published data on the civilian use of tourniquets in limb trauma.

METHODS: The MEDLINE database was searched for studies on civilian limb tourniquet use in adults published between 2001 and 2017. Search terms were tourniquet, trauma, and injury. Military reports and case series lacking systematic data collection were excluded. Counts and percentages were aggregated and weighted for analysis.

RESULTS: Reports were included from six regional trauma centers and one interregional collaboration (total of 572 cases). One national prehospital database report was included but analyzed separately (2,048 cases). All were retrospective cohort studies without prospective data collection. Three reports defined a primary outcome, two had a nontourniquet control group, and no two articles reported the same variables. Limb injury severity and characteristics were inconsistently and incompletely described across reports, as were tourniquet indications and effectiveness. Arterial injury was reported in two studies and was infrequent among cases of tourniquet use. Mortality was low, and limb-specific complications were infrequent but variably reported.

CONCLUSION: The rapid increase in the civilian use of tourniquets for limb hemorrhage control has occurred without a large amount or high quality of data. Adoption of a multicenter registry with standardized data collection specific to limb trauma and tourniquet use can serve to improve the trauma community's understanding of the safety and effectiveness of tourniquet use in civilian trauma settings.

LEVEL OF EVIDENCE: Systematic review, level IV.

Ann Emerg Med. 2018 May;71(5):588-596

Intraosseous Vascular Access Is Associated With Lower Survival and Neurologic Recovery Among Patients With Out-of-Hospital Cardiac Arrest.

Kawano T, Grunau B, Scheuermeyer FX, Gibo K, Fordyce CB, Lin S, Stenstrom R, Schlamp R, Jenneson S, Christenson J

STUDY OBJECTIVE: We seek to determine the effect of intraosseous over intravenous vascular access on outcomes after out-of-hospital cardiac arrest.

METHODS: This secondary analysis of the Resuscitation Outcomes Consortium Prehospital Resuscitation Using an Impedance Valve and Early Versus Delayed (PRIMED) study included adult patients with nontraumatic out-of-hospital cardiac arrests treated during 2007 to 2009, excluding those with any unsuccessful attempt or more than one access site. The primary exposure was intraosseous versus intravenous vascular access. The primary outcome was favorable neurologic outcome on hospital discharge (modified Rankin Scale score ≤3). We determined the association between vascular access route and out-of-hospital cardiac arrest outcome with multivariable logistic regression, adjusting for age, sex, initial emergency medical services-recorded rhythm (shockable or nonshockable), witness status, bystander cardiopulmonary resuscitation, use of public automated external defibrillator, episode location (public or not), and time from call to paramedic scene arrival. We confirmed the results with multiple imputation, propensity score matching, and generalized estimating equations, with study enrolling region as a clustering variable.

RESULTS: Of 13,155 included out-of-hospital cardiac arrests, 660 (5.0%) received intraosseous vascular access. In the intraosseous group, 10 of 660 patients (1.5%) had favorable neurologic outcome compared with 945 of 12,495 (7.6%) in the intravenous group. On multivariable regression, intraosseous access was associated with poorer out-of-hospital cardiac arrest survival (adjusted odds ratio 0.24; 95% confidence interval 0.12 to 0.46). Sensitivity analyses revealed similar results.

CONCLUSION: In adult out-of-hospital cardiac arrest patients, intraosseous vascular access was associated with poorer neurologic outcomes than intravenous access.

Clin Exp Emerg Med. 2018 Mar 30;5(1):29-34

Pre-hospital i-gel blind intubation for trauma: a simulation study.

Kim JG, Kim W, Kang GH, Jang YS, Choi HY, Kim H, Kim M

OBJECTIVE: This study aimed to evaluate the efficacy of i-gel blind intubation (IGI) as a rescue device for definitive airway management in ground intubation for pre-hospital trauma patients.

METHODS: A prospective randomized crossover study was conducted with 18 paramedics to examine intubation performance of two blind intubation techniques through a supraglottic airway devices (IGI and laryngeal mask airway Fastrach), compared with use of a Macintosh laryngoscope (MCL). Each intubation was conducted at two levels of patient positions (ground- and stretcher-level). Primary outcomes were the intubation time and the success rate for intubation.

RESULTS: The intubation time (sec) of each intubation technique was not significantly different between the two positions. In both patient positions, the intubation time of IGI was shortest among the three intubation techniques (17.9±5.2 at the ground-level and 16.9±3.8 at the stretcher-level). In the analysis of cumulative success rate and intubation time, IGI was the fastest to reach 100% success among the three intubation techniques regardless of patient position (all $P<0.017$). The success of intubation was only affected by the intubation technique, and IGI achieved more success than MCL (odds ratio, 3.6; 95% confidence interval, 1.1 to 11.6; $P=0.03$).

CONCLUSION: The patient position did not affect intubation performance. Additionally, the intubation time with blind intubation through supraglottic airway devices, especially with IGI, was significantly shorter than that with MCL.

J Spec Oper Med. Spring 2018;18(1):32.

Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA): Introduction.

King DR.

Quotes:

“One of the biggest hurdles for prehospital REBOA is the clearance of the supradiaphragmatic compartment. Unfortunately, the surface anatomy of penetrating wounds does not predict the cavity in which hemorrhage may be occurring. The pleural spaces and the pericardium must be triaged before REBOA is used. Balloon occlusion distal to a vascular injury will likely result in impressive exsanguination and rapid death.”

“REBOA for trauma is in its infancy. Multiple inhospital registries and published experiences exist; however, solid science is still lacking. The use of REBOA in the prehospital environment remains unexplored. Ongoing research hopefully will guide providers in making evidenced-based decisions. In the meantime, we should continue to select our patients to undergo REBOA very carefully and avoid cavalier decisions not based in science.”

J Emerg Med. 2018 May;54(5):e97-e99

Hemoptysis? Try Inhaled Tranexamic Acid.

Komura S, Rodriguez RM, Peabody CR

BACKGROUND: Tranexamic acid (TXA) is a synthetic anti-fibrinolytic agent used to prevent and treat various bleeding complications. In many studies, investigators have evaluated its utility and safety orally, intravenously, and topically, but few studies have described the potential benefits of nebulized TXA.

CASE REPORT: We present a case of massive hemoptysis treated with nebulized TXA in the emergency department (ED) that led to the cessation of bleeding and avoidance of endotracheal intubation. WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?: In massive hemoptysis, rapidly available nebulized TXA may be considered a therapeutic option, serving either as primary therapy or as a bridge until other definitive therapies can be arranged.

Mil Med. 2018 Mar 1;183(suppl_1):134-145

A Review of Casualties Transported to Role 2 Medical Treatment Facilities in Afghanistan.

Kotwal RS, Staudt AM, Trevino JD, Valdez-Delgado KK, Le TD, Gurney JM, Sauer SW, Shackelford SA, Stockinger ZT, Mann-Salinas EA.

ABSTRACT:
Critically injured trauma patients benefit from timely transport and care. Accordingly, the provision of rapid transport and effective treatment capabilities in appropriately close proximity to the point of injury will optimize time and survival. Pre-transport tactical combat casualty care, rapid transport with en route casualty care, and advanced damage control resuscitation and surgery delivered early by small, mobile, forward-positioned Role 2 medical treatment facilities have potential to reduce morbidity and mortality from trauma. This retrospective review and descriptive analysis of trauma patients transported from Role 1 entities to Role 2 facilities in Afghanistan from 2008 to 2014 found casualties to be diverse in affiliation and delivered by various types and modes of transport. Air medical evacuation provided transport for most patients, while the shortest transport time was seen with air casualty evacuation. Although relatively little data were collected for air casualty evacuation, this rapid mode of transport remains an operationally important method of transport on the battlefield. For prehospital care provided before and during transport, continued leadership and training emphasis should be placed on the administration and documentation of tactical combat casualty care as delivered by both medical and non-medical first responders.

Mil Med. 2017 Mar;182(S1):32-40

The Afghan Theater: A Review of Military Medical Doctrine From 2008 to 2014.

Lane I, Stockinger Z, Sauer S, Ervin M, Wirt M, Bree S, Gross K, Bailey J, Hodgetts BT, Mann-Salinas E

ABSTRACT:
This article forms part of a series that will explore the effect that Role 2 (R2) medical treatment facilities (MTFs) had on casualty care during the military campaign in Afghanistan and how we should interpret this to inform the capabilities in, and training for future R2 MTFs. Key aspects of doctrine which influence the effectiveness of R2 MTFs include timelines to care, patient movement capabilities, and MTF capabilities. The focus of this analysis was to review allied doctrine from the United States, United Kingdom, and the North Atlantic Treaty Organization to identify similarities and differences regarding employment of R2 related medical assets in the Afghan Theater, specifically for trauma care. Several discrepancies in medical doctrine persist among allied forces. Timelines to definitive care vary among nations. Allied nations should have clear taxonomy that clearly defines MTF capabilities within the combat casualty care system. The R2 surgical capability discrepancy between United States and North Atlantic Treaty Organization doctrine should be reconciled. Medical evacuation capabilities on the battlefield would be improved with a taxonomy that reflected the level of capability. Such changes may improve interoperability in a dynamic military landscape.

Mil Med. 2018 Feb 6. Epub ahead of print

Chinese Military Evaluation of a Portable Near-Infrared Detector of Traumatic Intracranial Hematomas.

Liang CY, Yang Y, Shen CS, Wang HJ, Liu NM, Wang ZW, Zhu FL, Xu RX

Introduction: Secondary brain injury is the main cause of mortality from traumatic brain injury (TBI). One hallmark of TBI is intracranial hemorrhage, which occurs in 40-50% of severe TBI cases. Early identification of intracranial hematomas in TBI patients allows early surgical evacuation and can reduce the case fatality rate of TBI. As pre-hospital care is the weakest part of Chinese emergency care, there is an urgent need for a capability to detect brain hematomas early. In China, in addition to preventing injuries and diseases in military staff and in enhancing the military armed forces during war, military medicine participates in actions such as emergency public health crises, natural disasters, emerging conflicts, and anti-terrorist campaigns during peacetime. The purpose of this observational study is to evaluate in the Chinese military general hospital the performance of a near-infrared (NIR)-based portable device, developed for US Military, in the detection of traumatic intracranial hematomas. The endpoint of the study was a description of the test characteristics (sensitivity, specificity, and positive and negative predictive values [NPV]) of the portable NIR-based device in identification of hematomas within its detection limits (volume >3.5 mL and depth <2.5 cm) compared with computed tomography (CT) scans as the gold standard.

Materials and Methods: The Infrascanner Model 2000 NIR device (InfraScan, Inc., Philadelphia, PA, USA) was used for hematoma detection in patients sustaining TBI. Data were collected in the People's Liberation Army General Hospital in Beijing using the NIR device at the time of CT scans, which were performed to evaluate suspected TBI. One hundred and twenty seven patients were screened, and 102 patients were included in the per protocol population. Of the 102 patients, 24 were determined by CT scan to have intracranial hemorrhage. The CT scans were read by an independent neuroradiologist who was blinded to the NIR measurements.

Results: The NIR device demonstrated sensitivity of 100% (95% confidence intervals [CI] 82.8-100%) and specificity of 93.6% (95%CI 85-97.6%) in detecting intracranial hematomas larger than 3.5 mL in volume and that were less than 2.5 cm from the surface of the brain. Blood contained within scalp hematomas was found to be a major cause of false-positive results with this technology.

Conclusion: The study showed that the Infrascanner is a suitable portable device in Chinese population for detecting preoperative intracranial hematomas in remote locations, emergency rooms, and intensive care units. It could aid military medics, physicians, and hospital staff, permitting better triage decisions, earlier treatment, and reducing secondary brain injury caused by acute and delayed hematomas.

J Spec Oper Med. Spring 2018;18(1):70-73.

Successful Use of Ketamine as a Prehospital Analgesic by Pararescuemen During Operation Enduring Freedom.

Lyon RF, Schwan C, Zeal J, Kharod C, Staak B, Petersen C, Rush SC.

ABSTRACT:
Effective analgesia is a crucial part of the care and resuscitation of a traumatically injured patient. These secondary effects of pain may increase morbidity and mortality in the acutely injured patient. When ketamine is administered appropriately in the clinical setting, it can provide analgesia, anxiolysis, and amnesia for patients with less respiratory depression and hypotension than equivalent doses of opioid analgesics.

J Trauma Acute Care Surg. 2018 May;84(5):685-692

Effect of door-to-angioembolization time on mortality in pelvic fracture: Every hour of delay counts.

Matsushima K, Piccinini A, Schellenberg M, Cheng V, Heindel P, Strumwasser A, Benjamin E, Inaba K, Demetriades D.

INTRODUCTION: Angioembolization (AE) is widely used for hemorrhagic control in patients with pelvic fracture. The latest version of the Resources for Optimal Care of the Injured Patient issued by the American College of Surgeons Committee on Trauma requires interventional radiologists to be available within 30 minutes to perform an emergency AE. However, the impact of time-to-AE on patient outcomes remains unknown. We hypothesized that a longer time-to-AE would be significantly associated with increased mortality in patients with pelvic fracture.

METHODS: This is a 2-year retrospective cohort study using the American College of Surgeons Trauma Quality Improvement Program database from January 2013 to December 2014. We included adult patients (age ≥ 18 years) with blunt pelvic fracture who underwent pelvic AE within 4 hours of hospital admission. Patients who required any hemorrhage control surgery for associated injuries within 4 hours were excluded. Hierarchical logistic regression was performed to evaluate the impact of time-to-AE on in-hospital and 24-hour mortality.

RESULTS: A total of 181 patients were included for analysis. The median age was 54 years (interquartile range, 38-68) and 69.6% were male. The median injury severity score was 34 (interquartile range, 27-43). Overall in-hospital mortality rate was 21.0%. The median packed red blood cell transfusions within 4 and 24 hours after admission were 4 and 6 units, respectively. After adjusting for other covariates in a hierarchical logistic regression model, a longer time-to-pelvic AE was significantly associated with increased in-hospital mortality (odds ratio, 1.79 for each hour; 95% confidence interval, 1.11-2.91; p = 0.018).

CONCLUSION: The current study showed an increased risk of in-hospital mortality related to a prolonged time-to-AE for hemorrhagic control following pelvic fractures. Our results suggest that all trauma centers should allocate resources to minimize delays in performing pelvic AE.

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

Acute Med Surg. 2018 Feb 12;5(2):154-159

Preoperative fluid restriction for trauma patients with hemorrhagic shock decreases ventilator days.

Matsuyama S, Miki R, Kittaka H, Nakayama H, Kikuta S, Ishihara S, Nakayama S

Aim: In recent years, with the concept of damage control resuscitation, hemostasis and preoperative fluid restriction have been carried out, but there is controversy regarding the effectiveness of fluid restriction.

Methods: From April 2007 to March 2013, 101 trauma patients presented with hemorrhagic shock (systolic blood pressure ≤90 mmHg) at the prehospital or emergency department and were admitted to Hyogo Emergency Medical Center (Hyogo, Japan). They underwent emergency hemostasis by surgery and transcatheter arterial embolization. We compared two groups in a historical cohort study, the aggressive fluid resuscitation (AR) group, which included 59 cases treated in the period April 2007-March 2010, and the fluid restriction (FR) group, which included 42 cases treated in the period April 2010-March 2013.

Results: There was no difference between both groups in patient background (heart rate, 110 bpm; systolic blood pressure, 70 mmHg). The Injury Severity Score was 34 (AR) versus 38 (FR) (not significant). Preoperative infusion volume of crystalloid significantly decreased, from 2310 mL (AR) to 1025 mL (FR) ($P \leq 0.01$). There was no difference in mortality (36% [AR] versus 41% [FR]). Ventilator days significantly decreased, from 8.5 days (AR) to 5.5 days (FR) ($P = 0.02$).

Conclusions: Preoperative fluid restriction for trauma patients with hemorrhagic shock did not improve mortality, but it decreased ventilator days by reducing the perioperative plus water balance and it might contribute to perioperative intensive care.

J Trauma Acute Care Surg. 2018 Mar 16 Epub ahead of print

Pre-hospital Low Titer Cold Stored Whole Blood: Philosophy for Ubiquitous Utilization of O Positive Product for Emergency Use in Hemorrhage due to Injury.

McGinity AC, Zhu CS, Greebon L, Xenakis E, Waltman E, Epley E, Cobb D, Jonas R, Nicholson SE, Eastridge BJ, Stewart RM, Jenkins DH

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

Crit Care Nurse. 2018 Apr;38(2):18-29

Critical Care Performance in a Simulated Military Aircraft Cabin Environment.

McNeill MM

BACKGROUND: Critical Care Air Transport Teams care for 5% to 10% of injured patients who are transported on military aircraft to definitive treatment facilities. Little is known about how the aeromedical evacuation environment affects care.

OBJECTIVES: To determine the effects of 2 stressors of flight, altitude-induced hypoxia and aircraft noise, and to examine the contributions of fatigue and clinical experience on cognitive and physiological performance of the Critical Care Air Transport Team.

METHODS: This repeated measures 2 × 2 × 4 factorial study included 60 military nurses. The participants completed a simulated patient care scenario under aircraft cabin noise and altitude conditions. Differences in cognitive and physiological performance were analyzed using repeated measures analysis of variance. A multiple regression model was developed to determine the independent contributions of fatigue and clinical experience.

RESULTS: Critical care scores ($P = .02$) and errors and omissions ($P = .047$) were negatively affected by noise. Noise was associated with increased respiratory rate ($P = .02$). Critical care scores ($P < .001$) and errors and omissions ($P = .002$) worsened with altitude-induced hypoxemia. Heart rate and respiratory rate increased with altitude-induced hypoxemia; oxygen saturation decreased ($P < .001$ for all 3 variables).

CONCLUSION: In a simulated military aircraft environment, the care of critically ill patients was significantly affected by noise and altitude-induced hypoxemia. The participants did not report much fatigue and experience did not play a role, contrary to most findings in the literature.

J Trauma Acute Care Surg. 2018 Mar;84(3):426-432

Increased risk of fibrinolysis shutdown among severely injured trauma patients receiving tranexamic acid.

Meizoso JP, Dudaryk R, Mulder MB, Ray JJ, Karcutskie CA, Eidelson SA, Namias N, Schulman CI, Proctor KG.

BACKGROUND: The association between tranexamic acid (TXA) and fibrinolysis shutdown is unknown. We hypothesize that TXA is associated with fibrinolysis shutdown in critically injured trauma patients.

METHODS: Two hundred eighteen critically injured adults admitted to the intensive care unit at an urban Level I trauma center from August 2011 to January 2015 who had thromboelastography performed upon intensive care unit admission were reviewed. Groups were stratified based on fibrinolysis shutdown, which was defined as LY30 of 0.8% or less. Continuous variables were expressed as mean ± standard deviation or median (interquartile range). Poisson regression analysis was used to determine predictors of shutdown.

RESULTS: Patients were age 46 ± 18 years, 81% male, 75% blunt trauma, Injury Severity Score of 28 ± 13, 16% received TXA, 64% developed fibrinolysis shutdown, and mortality was 15%. In the first 24 hours, 4 (2-9) units packed red blood cells and 2 (0-6) units fresh frozen plasma were administered. Those with shutdown had worse initial systolic blood pressure (114 ± 38 mm Hg vs. 129 ± 43 mm Hg, $p = 0.006$) and base deficit (-5 ± 6 mEq/L vs -3 ± 5 mEq/L, $p = 0.013$); received more packed red blood cells [6 (2-11) vs. 2 (1-5) units, $p < 0.0001$], and fresh frozen plasma [3 (0-8) vs. 0 (0-4) units, $p < 0.0001$]; and more often received TXA (23% vs. 4%, $p <0.0001$). After controlling for confounders, TXA (relative risk, 1.35; 95% confidence interval, 1.10-1.64; $p = 0.004$) and cryoprecipitate transfusion (relative risk, 1.29; 95% confidence interval, 1.07-1.56; $p = 0.007$) were independently associated with fibrinolysis shutdown.

CONCLUSION: Patients who received TXA were at increased risk of fibrinolysis shutdown compared with patients who did not receive TXA. We recommend that administration of TXA be limited to severely injured patients with evidence of hyperfibrinolysis and recommend caution in those with evidence of fibrinolysis shutdown.

LEVEL OF EVIDENCE: Therapeutic, level III.

J Trauma Acute Care Surg. 2018 Feb 13 Epub ahead of print

Red Tides: Mass casualty and whole blood at sea Red Tides.

Miller BT, Lin AH, Clark SC, Cap AP, Dubose JJ

BACKGROUND: The U.S. Navy's casualty-receiving ships provide remote damage control resuscitation (RDCR) platforms to treat injured combatants deployed afloat and ashore. We report a significant mass casualty incident aboard the USS Bataan, and the most warm fresh whole blood (WFWB) transfused at sea for traumatic hemorrhagic shock since the Vietnam War.

METHODS: Casualty-receiving ships have robust medical capabilities, including a frozen blood bank with packed red blood cells (pRBC) and fresh frozen plasma (FFP). The blood supply can be augmented with WFWB collected from a "walking blood bank" (WBB).

RESULTS: Following a helicopter crash, six patients were transported by MV-22 Osprey to the USS Bataan. Patient 1 had a pelvic fracture, was managed with a pelvic binder, and received 4 units of pRBC, 2 units of FFP, and 6 units of WFWB. Patient 2, with a comminuted tibia and fibula fracture, underwent lower extremity four-compartment fasciotomy, and received 4 units of WFWB. Patient 3 underwent several procedures, including left anterior thoracotomy, aortic cross-clamping, exploratory laparotomy, small bowel resection, and tracheostomy. He received 8 units of pRBC, 8 units of FFP, and 28 units of WFWB. Patients 4 and 5 had suspected spine injuries and were managed non-operatively. Patient 6, with open tibia and fibula fractures, underwent lower extremity four-compartment fasciotomy with tibia external fixation and received 1 unit of WFWB. All patients survived aeromedical evacuation to a Role 4 medical facility and subsequent transfer to local hospitals.

DISCUSSION: Maritime military mass casualty incidents are challenging, but the U.S. Navy's casualty-receiving ships are ready to perform RDCR at sea. Activation of the ship's WBB to transfuse WFWB is essential for hemostatic resuscitations afloat.

LEVEL OF EVIDENCE: V STUDY TYPE: Case series.

Mil Med. 2018 Mar 1;183(3-4):e219-e224

Causes of Oral-Maxillofacial Injury of U.S. Military Personnel in Iraq and Afghanistan, 2001-2014.

Mitchener TA, Dickens NE, Simecek JW

Background: Few studies have examined the causes or mechanisms of oral–maxillofacial (OMF) injury among deployed military populations. This study reports causes of OMF injuries to U.S. Department of Defense personnel deployed to Afghanistan in Operation Enduring Freedom (OEF) or to Iraq in Operation Iraqi Freedom (OIF) and Operation New Dawn (OND). This study provides follow-on analysis of a previous report of OMF injury rates among U.S. military personnel in Iraq and Afghanistan from 2001 to 2014.

Methods: The populations studied were military personnel deployed to Afghanistan in OEF or Iraq in OIF and OND, who sought care at a level III military treatment facility for one or more OMF injuries. Injuries were identified in the Department of Defense Trauma Registry using diagnosis codes associated with OMF battle and non-battle injuries. Causes associated with these injuries were identified by evaluation of the data field “dominant injury mechanism.” All OMF injuries incurred from October 19, 2001, to June 30, 2014, were included.

Findings/Results: Approximately 89% of all OMF battle injuries in both OIF/OND and OEF were due to explosives or explosive devices. The three leading causes of OMF non-battle injuries for both OIF/OND and OEF were motor vehicle crashes/accidents (MVCs), falls, and “other blunt” trauma. MVCs as well as other blunt trauma accounted for a greater percentage of OMF non-battle injuries in OIF/OND than in OEF ($p < 0.01$). OMF non-battle injuries due to falls were more likely to occur in OEF ($p = 0.05$). Helicopter/plane crashes were responsible for a significantly higher percentage of OMF non-battle injuries in OEF compared with OIF/OND ($p < 0.01$).

Discussion/Impact/Recommendations: Across both theaters of war, Iraq and Afghanistan, the main causes of OMF battle and non-battle injuries were consistent. Battle injuries were primarily due to explosives or explosive devices and the three main causes of non-battle injuries were MVCs, falls, and other blunt trauma. However, the distribution of causes differed by war theater. Future studies should focus on potential reasons for cause distribution disparities in MVCs and helicopter/plane crashes as they can only be partially explained by topography and infrastructure differences between Iraq and Afghanistan. Further surveillance is needed to understand the scope of OMF injuries in military-armed conflicts and operations.

N Engl J Med. 2018 Mar 1;378(9):862-863.

Patient-Centered Outcomes and Resuscitation Fluids.

Myburgh J

Quotes:

“During the past 50 years, the use of intravenous resuscitation fluids in critically ill patients has been based on physiological principles rather than on evidence from clinical trials.1 None of the current proprietary resuscitation fluids have been formally evaluated for safety and efficacy, and only a handful of the other drugs commonly used in acute care, such as vasopressors, antiarrhythmic drugs, and antibiotics, have been formally evaluated for efficacy and safety despite their established roles in clinical practice.”

“What clinicians need to consider is whether the results of an open-label trial conducted in a single, major U.S. medical center can be generalized to the ways in which their own patients survive, feel, and function. None of the currently used resuscitation fluids are “physiological,” and questions regarding their safety and efficacy will remain, despite the results of these two trials and any randomized, controlled trials that are currently recruiting participants. Considerations remain regarding the effects of different types of resuscitation fluids and the ways they are used in specific, high-risk patient populations.”

Mil Med. 2018 Mar 1;183(suppl_1):169-174

Splenic Trauma in the Israeli Defense Forces - Do Not Underestimate Minor Trauma.

Nachman D, Yehoshua L, Benov A, Glassberg E, Padova H

Background: The spleen is the most commonly damaged abdominal organ following blunt abdominal trauma (BAT), usually involving a major injury mechanism. Several cases of splenic rupture caused by minor BAT in the Israeli Defense Forces (IDF) have recently occurred. This led us to explore the demographics and mechanisms of trauma resulting in splenic injury among IDF personnel.

Methods: All cases of splenic injury between 2007 and 2015 were pulled from the computerized patient records of the IDF. Data regarding patient demographics, injury mechanism, presenting symptoms, treatment, and outcomes were collected. Three independent physicians graded the injury mechanism as major or minor.

Results: Fifty-two cases of splenic injury were identified. Of them, 82.7% resulted from a blunt trauma, 9.6% occurred after a penetrating trauma and 7.7% occurred spontaneously. 37.2% of BAT were unanimously considered as minor. Patients who suffered minor trauma were more likely to experience delayed diagnosis (85.7% vs. 0% $p < 0.0001$) and had significantly less concomitant injuries (12.5% vs. 88.8% $p < 0.0001$). The presentation, treatment, and outcome of the patients were similar, regardless of the severity of trauma mechanism.

Conclusion: Our findings indicate that although minor BAT results from a milder traumatic mechanism, it is a significant cause of splenic injury among active duty personnel. We suggest that military physicians maintain a high level of suspicion while managing minor BAT cases.

Shock. 2018 Apr;49(4):420-428

Endotheliopathy of Trauma is an on-Scene Phenomenon, and is Associated with Multiple Organ Dysfunction Syndrome: A Prospective Observational Study.

Naumann DN, Hazeldine J, Davies DJ, Bishop J, Midwinter MJ, Belli A, Harrison P, Lord JM

BACKGROUND: Trauma patients are vulnerable to coagulopathy and inflammatory dysfunction associated with endotheliopathy of trauma (EoT). In vitro evidence has suggested that tranexamic acid (TXA) may ameliorate endotheliopathy. We aimed to investigate how soon after injury EoT occurs, its association with multiple organ dysfunction syndrome (MODS), and whether TXA ameliorates it.

METHODS: A prospective observational study included 91 trauma patients enrolled within 60 min of injury and 19 healthy controls. Blood was sampled on enrolment and again 4 to 12h later. ELISAs measured serum concentrations of syndecan-1 and thrombomodulin as biomarkers of EoT. MODS was compared between groups according to biomarker dynamics: persistently abnormal; abnormal to normal; and persistently normal. Timing of EoT was estimated by plotting biomarker data against time, and then fitting generalized additive models. Biomarker dynamics were compared between those who did or did not receive prehospital TXA.

RESULTS: Median age was 38 (interquartile range [IQR] 24-55) years; 78 of 91 were male. Median injury severity score (ISS) was 22 (IQR 12-36). EoT was estimated to occur at 5 to 8 min after injury. There were no significant differences in ISS between those with or without prehospital EoT. Forty-two patients developed MODS; 31 of 42 with persistently abnormal; 8 of 42 with abnormal to normal; and 3 of 42 with persistently normal biomarkers; $P<0.05$. There were no significant differences between TXA and non-TXA groups.

CONCLUSIONS: EoT was present at the scene of injury. MODS was more likely when biomarkers of EoT were persistently raised. There were no significant differences between TXA and non-TXA groups. Prehospital interventions aimed at endothelial restoration may represent a clinically meaningful target for prehospital resuscitation.

J Trauma Acute Care Surg. 2018 May;84(5):780-785

Use of French lyophilized plasma transfusion in severe trauma patients is associated with an early plasma transfusion and early transfusion ratio improvement.

Nguyen C, Bordes J, Cungi PJ, Esnault P, Cardinale M, Mathais Q, Cotte J, Beaume S, Sailliol A, Prunet B, Meaudre E.

BACKGROUND: Early transfusion of high ratio of fresh frozen plasma (FFP) and red blood cells (RBC) is associated with mortality reduction. However, time to reach high ratio is limited by the need to thaw the FFP. French lyophilized plasma (FLYP) used by French army and available in military teaching hospital does not need to be thawed and is immediately available. We hypothesize that the use of FLYP may reduce time to reach a plasma/RBC ratio of 1:1.

METHODS: A retrospective study performed in a Level 1 trauma center between January 2012 and December 2015. Severe trauma patients who received 2 U of RBC in the emergency room were included and assigned to two groups according to first plasma transfused: FLYP group and FFP group.

RESULTS: Forty-three severe trauma patients in the FLYP group and 29 in the FFP group were included. The time until first plasma transfusion was shorter in the FLYP group than in the FFP group, respectively 15 min (10-25) versus 95 min (70-145) ($p < 0.0001$). Time until a 1:1 ratio was shorter in the FLYP group than in the FFP group. There were significantly fewer cases of massive transfusion in the FLYP group than in the FFP group with respectively 7% vs. 45% ($p < 0.0001$).

CONCLUSION: The use of FLYP provided significantly faster plasma transfusions than the use of FFP as well as a plasma and RBC ratio superior to 1:2 that was reached more rapidly in severe trauma patients. These results may explain the less frequent need for massive transfusion in the patients who received FLYP. These positive results should be confirmed by a prospective and randomized evaluation.

LEVEL OF EVIDENCE: Therapeutic, level IV.

BMC Emerg Med. 2018 Feb 8;18(1):5

Ultrasound-guided identification of the cricothyroid membrane in a patient with a difficult airway: a case report.

Okano H, Uzawa K, Watanabe K, Motoyasu A, Tokumine J, Lefor AK, Yorozu T

BACKGROUND: Surgical cricothyroidotomy is considered to be the last resort for management of the difficult airway. A major point for a successful surgical cricothyroidotomy is to identify the location of the cricothyroid membrane.

CASE PRESENTATION: We encountered a patient with progressive respiratory distress who was anticipated to have a difficult airway due to a large neck abscess. We prepared for both awake intubation and surgical cricothyroidotomy. The cricothyroid membrane could not be identified by palpation, but was readily identified using ultrasound.

CONCLUSION: Ultrasound-guided identification of the cricothyroid membrane may be useful in a patient with a difficult airway due to neck swelling.

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

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

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

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

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

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

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

TRIAL REGISTRATION: ClinicalTrials.gov IDNCT02659046. Registered January 15th, 2016.

J Spec Oper Med. Spring 2018;18(1):33-36.

Bringing Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) Closer to the Point of Injury.

Pasley JD, Teeter WA, Gamble WB, Wasick P, Romagnoli AN, Pasley AM, Scalea TM, Brenner ML.

BACKGROUND: The management of noncompressible torso hemorrhage remains a significant issue at the point of injury. Resuscitative endovascular balloon occlusion of the aorta (REBOA) has been used in the hospital to control bleeding and bridge patients to definitive surgery. Smaller delivery systems and wirefree devices may be used more easily at the point of injury by nonphysician providers. We investigated whether independent duty military medical technicians (IDMTs) could learn and perform REBOA correctly and rapidly as assessed by simulation.

METHODS: US Air Force IDMTs without prior endovascular experience were included. All participants received didactic instruction and evaluation of technical skills. Procedural times and pretest/posttest examinations were administered after completion of all trials. The Likert scale was used to subjectively assess confidence before and after instruction.

RESULTS: Eleven IDMTs were enrolled. There was a significant decrease in procedural times from trials 1 to 6. Overall procedural time (± standard deviation) decreased from 147.7 ± 27.4 seconds to 64 ± 8.9 seconds ($\rho < .001$). There was a mean improvement of 83.7 ± 24.6 seconds from the first to sixth trial ($\rho < .001$). All participants demonstrated correct placement of the sheath, measurement and placement of the catheter, and inflation of the balloon throughout all trials (100%). There was significant improvement in comprehension and knowledge between the pretest and posttest; average performance improved significantly from 36.4.6% ± 12.3% to 71.1% ± 8.5% ($\rho < .001$). Subjectively, all 11 participants noted significant improvement in confidence from 1.2 to 4.1 out of 5 on the Likert scale ($\rho < .001$).

CONCLUSION: Technology for aortic occlusion has advanced to provide smaller, wirefree devices, making field deployment more feasible. IDMTs can learn the steps required for REBOA and perform the procedure accurately and rapidly, as assessed by simulation. Arterial access is a challenge in the ability to perform REBOA and should be a focus of further training to promote this procedure closer to the point of injury.

J Spec Oper Med. Spring 2018;18(1):77-80.

Ocular Injuries and Cultural Influences in Afghanistan During 5 Months of Operation Enduring Freedom.

Paz DA, Thomas KE, Primakov DG.

ABSTRACT:
In support of Operation Enduring Freedom, American, North American Treaty Organization (NATO) Coalition, and Afghan forces worked together in training exercises and counterinsurgency operations. While serving at the NATO Role 3 Multinational Medical Unit, Kandahar, Afghanistan, numerous patients with explosive blast injuries (Coalition and Afghan security forces, and insurgents) were treated. A disparity was noted between the ocular injury patterns of US and Coalition forces in comparison with their Afghan counterparts, which were overwhelmingly influenced by the use, or lack thereof, of eye protection. Computed tomography imaging coupled, with a correlative clinical examination, demonstrated the spectrum of ocular injuries that can result from an explosive blast. Patient examination was performed by Navy radiologists and an ophthalmologist. A cultural analysis by was performed to understand why eye protection was not used, even if available to Afghan forces, by the injured patients in hope of bridging the gap between Afghan cultural differences and proper operational risk management of combat forces.

Mil Med. 2018 Mar 14. Epub ahead of print

Biological Response to Stress During Battlefield Trauma Training: Live Tissue Versus High-Fidelity Patient Simulator.

Peng HT, Tenn C, Vartanian O, Rhind SG, Jarmasz J, Tien H, Beckett A; LT-SIM study group.

Introduction: Tactical Combat Casualty Care (TCCC) training imposes psychophysiological stress on medics. It is unclear whether these stress levels vary with the training modalities selected. It is also unclear how stress levels could have an impact on medical performance and skill uptake. Materials and Methods: We conducted a pilot study to compare the effects of live tissue (LT) with a high-fidelity patient simulator (SIM) on the level of stress elicited, performance, and skill uptake during battlefield trauma training course in an operating room (OR) and in a simulated battlefield scenario (field). In the report, we studied the effects of training modalities and their changes on stress levels by measuring different biomarkers (salivary amylase, plasma catecholamines, and neuropeptide Y) at various time points during the trauma training course.

Results: We found that the training resulted in significant psychophysiological stress as indicated by elevated levels of various biomarkers relative to baseline immediately after both OR and field assessment ($p < 0.05$). Compared with pre-OR levels, the LT training in the OR resulted in significant increases in the plasma levels of epinephrine, norepinephrine, and neuropeptide ($p = 0.013$, 0.023, 0.004, respectively), whereas the SIM training in the OR resulted in significant increases in the plasma levels of norepinephrine and neuropeptide ($p = 0.003$ and 0.008). Compared with pre-field levels, we found significant increases in plasma epinephrine concentration in the SIM group ($p = 0.016$), plasma norepinephrine concentration in the LT group ($p = 0.015$), and plasma neuropeptide Y concentration in both LT ($p = 0.006$) and SIM groups ($p = 0.029$). No differences in the changes of biomarker levels were found between LT and SIM groups in the OR and field. Compared with pre-field levels, the testing on the same modality as that in the OR in the simulated battlefield resulted in significant increases in norepinephrine and neuropeptide levels ($p = 0.013$ and 0.015), whereas the testing on different modalities resulted in significant increases in amylase, epinephrine, and neuropeptide levels ($p = 0.016$, 0.05, 0.018, respectively). There was a significantly larger increase in plasma norepinephrine concentration ($p = 0.031$) and a trend toward a greater increase in the salivary amylase level ($p = 0.052$) when the field testing involved a different modality than the OR compared with when OR and field testing involved the same modality. Although most of the biomarkers returned to baseline levels after 24 h, plasma norepinephrine levels remained significantly higher regardless of whether field testing occurred on the same or different modality compared with OR ($p = 0.040$ and 0.002).

Conclusion: TCCC training led to significant increase in psychophysiological stress, as indicated by elevated levels of various biomarkers. The training modalities did not result in any differences in stress levels, whereas the switch in training modalities appeared to elicit greater stress as evidenced by changes in specific biomarkers (amylase and norepinephrine). A comparative study with a larger sample size is warranted.

J Spec Oper Med. Spring 2018;18(1):147-148.

You Never Know, Until You Know, and Then You Know: An Interview With COL (Ret) John F. Kragh Jr, MD.

Pennardt A

Quote:

“Q: What motivated you to focus on the use of tourniquets in the tactical environment?

“Palmer died. It was a cold, dark night in the Mojave, 1992. Big operation, live fire, seven hits. Marines, Air Force, Rangers, 160th, Bragg brothers. I was with the main element. Elsewhere, Jeffrey Palmer landed in a Blackhawk helicopter. He was a corporal, a team leader of four Rangers in two pairs of a machine gunner with an assistant. He exited with one pair out the left door and the other pair exited out the right door to jointly lay down crossing fires promptly onto their targets. Soon a bullet went through his thigh above his knee and took out a length of both his bone and artery. A few bloody minutes later, the rescue helicopter and PFC Richard ‘Doc’ Strous were on the ground. He did everything right. He had just finished a Special Forces trauma training course the prior week, so he knew all the right stuff: dressed, splinted, gave 2L of intravenous fluid, packaged, and transported to the base hospital within 30 minutes after injury. Palmer got no damage control, like a tourniquet, because damage control was then just an unproved idea used in a couple of cities. He got a couple more liters of fluid, an external fixation of the thigh bone, an attempted artery repair, and he bled to death. Everyone did everything almost perfectly by the book, but life or death is a close-run thing. It turns out the research then of such fluids was fairly clear that 2L was the limit, and the teaching in ATLS was that. However, an intuition was that if 2 is good, then why is not 3 better?”

J Trauma Acute Care Surg. 2018 Mar;84(3):449-453

Resuscitative endovascular balloon occlusion of the aorta for pelvic blunt trauma and life-threatening hemorrhage: A 20-year experience in a Level I trauma center.

Pieper A, Thony F, Brun J, Rodière M, Boussat B, Arvieux C, Tonetti J, Payen JF, Bouzat P.

BACKGROUND: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is increasingly used as a noninvasive clamp of the aorta after diverse posttraumatic injuries. Balloon inflation in zone 3 (from the lower renal artery to the aortic bifurcation) can be performed to stop ongoing bleeding after severe pelvic trauma with life-threatening hemorrhage. The aim of our study was to describe our 20-year experience with REBOA in terms of efficacy and safety in patients with a suspicion of severe pelvic trauma and extreme hemorrhagic shock.

METHODS: We performed a retrospective study from 1996 to 2017 in a French Level I trauma center. All consecutive patients who underwent a REBOA procedure were included. REBOA indication relied on (1) extreme hemodynamic instability (systolic arterial blood pressure [SBP] < 60 mm Hg on admission, SBP < 90 mm Hg despite initial resuscitation in the trauma bay or posttraumatic cardiac arrest) and (2) positive pelvic X-ray. Efficacy endpoints were vital signs and coagulation parameters before and after balloon inflation. Safety endpoints were REBOA-related complications: vascular events, acute renal failure, and rhabdomyolysis.

RESULTS: Within the study period, 32 patients underwent a REBOA procedure. Only two patients had technical failure and balloon was not inflated in one patient. Nineteen patients did not survive at day 28. The REBOA significantly improved SBP from 60 (35-73) mm Hg to 115 (91-128) mm Hg ($p < 0.001$). We also reported a high rate of vascular complications (19%, $n = 5$ patients) but no amputation. Renal replacement therapy was initiated in 11 patients, and 15 patients had severe rhabdomyolysis.

CONCLUSION: The REBOA is safe and effective in improving hemodynamics after severe pelvic trauma and life-threatening hemorrhage. Our study supports the use of REBOA as a bridge to definitive hemostatic treatment after severe pelvictrauma.

LEVEL OF EVIDENCE: Therapeutic, level IV.

J Trauma Acute Care Surg. 2018 Mar 12

Multicenter study of crystalloid boluses and transfusion in pediatric trauma-when to go to blood?

Polites SF, Nygaard RM, Reddy PN, Zielinski MD, Richardson CJ, Elsbernd TA, Petrun BM, Weinberg SL, Murphy S, Potter DD, Klinkner DB, Moir CR.

BACKGROUND: The 9th edition of ATLS recommends up to three crystalloid boluses in pediatric trauma patients with consideration of transfusion after the second bolus however this approach is debated. We aimed to determine if requirement of more than one fluid bolus predicts the need for transfusion.

METHODS: 2010-2016 highest tier activation patients <15 years of age from two ACS Level I pediatric trauma centers were identified from prospectively maintained trauma databases. Those with a shock index (heart rate/systolic blood pressure) >0.9 were included. Crystalloid boluses (20±10 cc/kg) and transfusions administered prehospital and within 12 hours of hospital arrival were determined. Univariate and multivariable analyses were conducted to determine association between crystalloid volume and transfusion.

RESULTS: Among 208 patients, the mean age was 5±4 years (60% male), 91% sustained blunt injuries, and median (IQR) ISS was 11 (6,25). 29% received one bolus, 17% received two, and 10% received at least three. Transfusion of any blood product occurred in 50 (24%) patients; mean (range) RBC was 23 (0-89) cc/kg, plasma 8 (0-69), and platelets 1 (0,18). The likelihood of transfusion increased logarithmically from 11% to 43% for those requiring ≥2 boluses (Figure 1). This relationship persisted on multivariable analysis that adjusted for institution, age, and shock index with good discrimination (AUROC 0.84). Shock index was also strongly associated with transfusion.

CONCLUSION: Almost half of pediatric trauma patients with elevated shock index require transfusion following two crystalloid boluses and the odds of requiring a transfusion plateau at this point in resuscitation. This supports consideration of blood with the second bolus in conjunction with shock index though prospective studies are needed to confirm this and its impact on outcomes.

LEVEL OF EVIDENCE: III: Therapeutic.

Global Health. 2018 Mar 6;14(1):27

Notes from a field hospital south of Mosul.

Quinn V JM, Amouri OF, Reed P

ABSTRACT:
This short letter from the field is offered as a rapid communiqué of the emergency medical situation in Mosul and surrounding areas on the eve of the final onslaught to liberate the city. This letter is based on emergency medical work at two World Health Organization (WHO) and Ministry of Health (MoH) Iraq lead Role II+ Field Hospital facilities south of Mosul City from April to June 2017; these facilities are currently and temporarily managed and administered by private medical industry until full handover to MoH Iraq, with WHO support and expert facilitation. The prominence of non-state actors in the conflict, using hybrid warfare tactics that maximize casualties, makes health security a particular challenge for the global community. This challenge requires health leaders and other actors in the region to set clear strategic goals that support public health of the many millions displaced, maimed and affected by the war. Whether in clinical medicine, development, peace and stability operations, or global health diplomacy, the shared values and conviction to best serve vulnerable communities and mitigate morbidity must embrace the lessons of evidenced based practice derived from military medical experience. WHO is leading the charge in disaster response for the conflict in Iraq, and many challenges remain. This might also include developing a new process in emergency medical response that utilizes private contracting to improve efficiency in delivery and overall sustainability.

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

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

Rall JM, Redman TT, Ross EM, Morrison JJ, Maddry JK

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

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

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

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

J Head Trauma Rehabil. 2018 Mar/Apr;33(2):123-132

Mortality Following Hospital Admission for US Active Duty Service Members Diagnosed With Penetrating Traumatic Brain Injury, 2004-2014.

Regasa LE, Kaplan DA, Moy Martin EM, Langbein J, Johnson F, Chase LC.

OBJECTIVE: To examine mortality among active duty US military service members (SMs) with the diagnosis of penetrating traumatic brain injury (PTBI) and a hospital admission between 2004 and 2014.

DESIGN: Data on SMs with PTBI and an admission to a military or civilian hospital were obtained from the 2004 to 2014 Military Health System data repository. After applying exclusion criteria, data on 1226 SMs were analyzed.

MAIN MEASURES: The number of observed deaths per 100 identified patients with PTBI and time to death from admission were used as main measures.

RESULTS: Approximately 25% of the 1226 patients with PTBI included in this study died following admission, with 44.6% of the all deaths occurring within a day following hospital admission and 75% occurring within the first week. Severe comorbid conditions and intentionally self-inflicted injuries are associated with higher mortality rate. SMs' gender, age, year of hospital admission, and service were significantly associated with likelihood of death following PTBI hospitalization. Males had a higher likelihood of dying following hospital admission compared with females (odds ratio = 2.7, confidence interval = 1.03-7.9). SMs in the 35- to 44-year-old and 45- to 64-year-old groups had up to a 2.6 times higher odds of death following their admission compared with the 25- to 34-year-old group. Age, admission year, service, and rank were significantly associated with SMs' time to death from hospitalization. Patients between the ages of 45 and 64 years were significantly more likely to die earlier than other age groups. Furthermore, cases in the Navy Afloat group had a higher fatality rate and were more likely to die earlier than patients in other services. PTBI comorbid conditions and injury type did not significantly affect time to death.

CONCLUSION: This study quantifies case fatality rate among hospitalized US SMs with the diagnosis of PTBI. We report a 23.1% crude case fatality rate among the current cohort. Early intensive care for these patients may be the key to improving survival rates.

J Emerg Med. 2018 Mar;54(3):307-314

The Tourniquet Gap: A Pilot Study of the Intuitive Placement of Three Tourniquet Types by Laypersons.

Ross EM, Mapp JG, Redman TT, Brown DJ, Kharod CU, Wampler DA

BACKGROUND: The "Stop the Bleed" campaign in the United States advocates for nonmedical personnel to be trained in basic hemorrhage control and that "bleeding control kits" be available in high-risk areas. However, it is not clear which tourniquets are most effective in the hands of laypersons.

OBJECTIVES: The objective of this pilot study was to determine which tourniquet type was the most intuitive for a layperson to apply correctly.

METHODS: This project is a randomized study derived from a "Stop the Bleed" education initiative conducted between September 2016 and March 2017. Novice tourniquet users were randomized to apply one of three commercially available tourniquets (Combat Action Tourniquet [CAT; North American Rescue, LLC, Greer, SC], Ratcheting Medical Tourniquet [RMT; m2 Inc., Winooski, VT], or Stretch Wrap and Tuck Tourniquet [SWAT-T; TEMS Solutions, LLC, Salida, CO]) in a controlled setting. Individuals with formal medical certification, prior military service, or prior training with tourniquets were excluded. The primary outcome of this study was successful tourniquet placement.

RESULTS: Of 236 possible participants, 198 met the eligibility criteria. Demographics were similar across groups. The rates of successful tourniquet application for the CAT, RMT, and SWAT-T were 16.9%, 23.4%, and 10.6%, respectively ($p = 0.149$). The most common causes of application failure were: inadequate tightness (74.1%), improper placement technique (44.4%), and incorrect positioning (16.7%).

CONCLUSION: Our pilot study on the intuitive nature of applying commercially available tourniquets found unacceptably high rates of failure. Large-scale community education efforts and manufacturer improvements of tourniquet usability by the lay public must be made before the widespread dissemination of tourniquets will have a significant public health effect.

Adv Physiol Educ. 2018 Jun 1;42(2):267-276

Walter B. Cannon's World War I experience: treatment of traumatic shock then and now.

Ryan KL

ABSTRACT:
Walter B. Cannon (1871-1945), perhaps America's preeminent physiologist, volunteered for service with the Army Expeditionary Force (AEF) during World War I. He initially served with Base Hospital No. 5, a unit made up of Harvard clinicians, before moving forward to the front lines to serve at a casualty clearing station run by the British. During his time there, he performed research on wounded soldiers to understand the nature and causes of traumatic shock. Subsequently, Cannon performed animal experimentation on the causes of traumatic shock in the London laboratory of Dr. William Bayliss before being assigned to the AEF Central Medical Laboratory in Dijon, France, where he continued his experimental studies. During this time, he also developed and taught a curriculum on resuscitation of wounded soldiers to medical providers. Although primarily a researcher and teacher, Cannon also performed clinical duties throughout the war, serving with distinction under fire. After the war, Cannon wrote a monograph entitled Traumatic Shock (New York: Appleton, 1923), which encapsulated the knowledge that had been gained during the war, both from direct observation of wounded soldiers, as well as laboratory experimentation on the causes and treatment of traumatic shock. In his monograph, Cannon elucidates a number of principles concerning hemorrhagic shock that were later forgotten, only to be "rediscovered" during the current conflicts in Iraq and Afghanistan. This paper summarizes Cannon's wartime experiences and the knowledge gained concerning traumatic shock during World War I, with a comparison of current combat casualty care practices and knowledge to that which Cannon and his colleagues understood a century ago.

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

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

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

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

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

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

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

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

Wilderness Environ Med. 2018 Mar 22 Epub ahead of print

A Survey of Wilderness Medicine Analgesia Practice Patterns.

Schauer SG, Naylor JF, Brown DJ, Gibbons RV, Syndergaard I, Cushing T

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

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

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

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

Shock. 2017 Oct 18 Epub ahead of print

Comparisons of Traditional Metabolic Markers and Compensatory Reserve as Early Predictors of Tolerance to Central Hypovolemia in Humans.

Schiller AM, Howard JT, Lye KR, Magby CG, Convertino VA.

ABSTRACT:
Circulatory shock remains a leading cause of death in both military and civilian trauma. Early, accurate and reliable prediction of decompensation is necessary for the most efficient interventions and clinical outcomes. Individual tolerance to reduced central blood volume can serve as a model to assess the sensitivity and specificity of vital sign measurements. The compensatory reserve (CRM) is the measurement of this capacity. Measurements of muscle oxygen saturation (SmO2), blood lactate and end tidal CO2 (EtCO2) have recently gained attention as prognostic tools for early assessment of the status of patients with progressive hemorrhage, but lack the ability to adequately differentiate individual tolerance to hypovolemia. We hypothesized that the CRM would better predict hemodynamic decompensation and provide greater specificity and sensitivity than metabolic measures. To test this hypothesis, we employed lower body negative pressure (LBNP) on healthy human subjects until symptoms of pre-syncope were evident. Receiver operating characteristic area under the curve (ROC AUC), sensitivity and specificity were used to evaluate the ability of CRM, pO2, pCO2, SmO2, lactate, EtCO2, pH, base excess and hematocrit (Hct) to predict hemodynamic decompensation. The ROC AUC for CRM (0.94) had a superior ability to predict decompensation compared to pO2 (0.85), pCO2 (0.62), SmO2 (0.72), lactate (0.57), EtCO2 (0.74), pH (0.55), base excess (0.59), and Hct (0.67). Similarly, CRM also exhibited the greatest sensitivity and specificity. These findings support the notion that CRM provides superior detection of hemodynamic compensation compared to commonly used clinical metabolic measures.

N Engl J Med. 2018 Mar 1;378(9):829-839

Balanced Crystalloids versus Saline in Critically Ill Adults.

Semler MW, Self WH, Wanderer JP, Ehrenfeld JM, Wang L, Byrne DW, Stollings JL, Kumar AB, Hughes CG, Hernandez A, Guillamondegui OD, May AK, Weavind L, Casey JD, Siew ED, Shaw AD, Bernard GR, Rice TW; SMART Investigators and the Pragmatic Critical Care Research Group.

Collaborators: Brown RM, Noto MJ, Lindsell CJ, Domenico HJ, Costello WT, Gibson J, Holcombe EW, Pretorius M, McCall AS, Atchison L, Dunlap DF, Felbinger M, Hamblin SE, Knostman M, Rumbaugh KA, Sullivan M, Valenzuela JY, Young JB, Mulherin DP, Hargrove FR, Strawbridge S.

BACKGROUND: Both balanced crystalloids and saline are used for intravenous fluid administration in critically ill adults, but it is not known which results in better clinical outcomes.

METHODS: In a pragmatic, cluster-randomized, multiple-crossover trial conducted in five intensive care units at an academic center, we assigned 15,802 adults to receive saline (0.9% sodium chloride) or balanced crystalloids (lactated Ringer's solution or Plasma-Lyte A) according to the randomization of the unit to which they were admitted. The primary outcome was a major adverse kidney event within 30 days - a composite of death from any cause, new renal-replacement therapy, or persistent renal dysfunction (defined as an elevation of the creatinine level to ≥200% of baseline) - all censored at hospital discharge or 30 days, whichever occurred first.

RESULTS: Among the 7942 patients in the balanced-crystalloids group, 1139 (14.3%) had a major adverse kidney event, as compared with 1211 of 7860 patients (15.4%) in the saline group (marginal odds ratio, 0.91; 95% confidence interval [CI], 0.84 to 0.99; conditional odds ratio, 0.90; 95% CI, 0.82 to 0.99; P=0.04). In-hospital mortality at 30 days was 10.3% in the balanced-crystalloids group and 11.1% in the saline group (P=0.06). The incidence of new renal-replacement therapy was 2.5% and 2.9%, respectively (P=0.08), and the incidence of persistent renal dysfunction was 6.4% and 6.6%, respectively (P=0.60).

CONCLUSIONS: Among critically ill adults, the use of balanced crystalloids for intravenous fluid administration resulted in a lower rate of the composite outcome of death from any cause, new renal-replacement therapy, or persistent renal dysfunction than the use of saline. (Funded by the Vanderbilt Institute for Clinical and Translational Research and others; SMART-MED and SMART-SURG ClinicalTrials.gov numbers, NCT02444988 and NCT02547779 .).

Anesth Essays Res. 2018 Jan-Mar;12(1):288-290

I-gel™ May be the Device of Choice for Controlled Ventilation in Patients with Hemophilia Undergoing Abdominal Laparoscopic Surgery.

Sen S, Mitra K, Ganguli S, Mukherji S

ABSTRACT:
Haemophilia is an inherited bleeding disorder with variable deficiency of Factor VIII in the plasma and is characterised by bleeding into joints, muscles and tissues either spontaneously or in response to trivial trauma. Perioperative care requires multidisciplinary involvement. Perioperative management involves the risk of excessive bleeding from surgical site as well as spontaneous bleeding into the brain in response to surgical stress in patients with previous history of intracerebral haemorrhage. Airway management of such patients during anaesthetic intervention is a challenge and entails the risk of life threatening haemorrhage into the airway. The I gel Supraglottic airway device may be best suited for the purpose considering its soft elastomeric non-inflatable cuff, ease of insertion, availability of gastric suction port and minimal leak fraction on controlled ventilation. The I Gel may be solution to avoiding airway instrumentation in patients with bleeding disorders. It may be an alternative to endotracheal intubation in patients with Haemophilia undergoing surgery.

J Trauma Acute Care Surg. 2018 Mar 12 Epub ahead of print

Preparation of leukoreduced whole blood for transfusion in austere environments; effects of forced filtration, storage agitation, and high temperatures on hemostatic function.

Sivertsen J, Braathen H, Lunde THF, Spinella PC, Dorlac W, Strandenes G, Apelseth TO, Hervig TA, Kristoffersen EK, Diagnostic Study LI.

ABSTRACT

BACKGROUND: Damage Control Resuscitation principles advocate the use of blood to treat traumatic hemorrhage. Hemorrhage is a leading cause of preventable death on the battlefield, but making blood components available far forward presents logistical challenges due to shelf life and storage requirements. Whole blood simplifies logistics and enables collection in the field, but can cause leukocyte-related transfusion reactions. A field-adapted leukoreduction system must be fast and safe, and storage of whole blood should preserve hemostatic function.

METHODS: Blood was collected using Imuflex WB-SP and leukoreduced at 0, 150 or 300 mmHg. Additional bags were stored at 4 °C for 21 days unagitated, mixed daily, agitated or head-over-heel-rotated, at 22 °C for 3 days, or 32 °C for 2 hours. Hematology, coagulation, CD62P/CD42b, TEG/ROTEM and Multiplate was performed.

RESULTS: Filtration time was 35±1, 14±0 and 9±0 minutes at 0, 150 and 300 mmHg, respectively. 1/10 units at 150 mmHg and 4/11 at 300 mmHg had residual whote blood cells (rWBC) >5.0×106/unit. 1/11 at 300 mmHg had platelet recovery <80%. Hemolysis was <0.2%. Filtration decreased TEG/ROTEM and Multiplate aggregation response. Stored at 4 °C, α and MA/MCF moderately decreased regardless of mixing. Significant loss of aggregation response and increased CD62P expression was seen by day 10. By day 3 storage at 22 °C caused loss of most aggregation. Two-hour storage at 32 °C did not significantly affect hemostatic capacity.

CONCLUSION: Forced filtration reduced leukoreduction time, but increased residual WBC and reduced hemostatic function. Aggregation response deteriorated early in storage, while viscoelastic assays decreased more gradually. Mixing showed no benefits.

LEVEL OF EVIDENCE: Level IV, Diagnostic Study

J Spec Oper Med. Spring 2018;18(1):19-22.

Benefit of Critical Care Flight Paramedic-Trained Search and Rescue Corpsmen in Treatment of Severely Injured Aviators.

Snow RW, Papalski W, Siedler J, Drew B, Walrath B.

ABSTRACT:
During routine aircraft start-up procedures at a US Naval Air Station, an aviation mishap occurred, resulting in the pilot suffering a traumatic brain injury and the copilot acquiring bilateral hemopneumothoraces, a ruptured diaphragm, and hepatic and splenic contusions. The care of both patients, including at point of injury and en route to the closest trauma center, is presented. This case demonstrates a benefit from advanced life-saving interventions and critical care skills beyond the required scope of practice of search and rescue medical technicians as dictated by relevant instructions.

West J Emerg Med. 2018 Mar;19(2):224-231

Prehospital Lactate Predicts Need for Resuscitative Care in Non-hypotensive Trauma Patients.

St John AE, McCoy AM, Moyes AG, Guyette FX, Bulger EM, Sayre MR

Introduction: The prehospital decision of whether to triage a patient to a trauma center can be difficult. Traditional decision rules are based heavily on vital sign abnormalities, which are insensitive in predicting severe injury. Prehospital lactate (PLac) measurement could better inform the triage decision. PLac's predictive value has previously been demonstrated in hypotensive trauma patients but not in a broader population of normotensive trauma patients transported by an advanced life support (ALS) unit.

Methods: This was a secondary analysis from a prospective cohort study of all trauma patients transported by ALS units over a 14-month period. We included patients who received intravenous access and were transported to a Level I trauma center. Patients with a prehospital systolic blood pressure ≤ 100 mmHg were excluded. We measured PLac's ability to predict the need for resuscitative care (RC) and compared it to that of the shock index (SI). The need for RC was defined as either death in the emergency department (ED), disposition to surgical intervention within six hours of ED arrival, or receipt of five units of blood within six hours. We calculated the risk associated with categories of PLac.

Results: Among 314 normotensive trauma patients, the area under the receiver operator characteristic curve for PLac predicting need for RC was 0.716, which did not differ from that for SI (0.631) (p=0.125). PLac ≥ 2.5 mmol/L had a sensitivity of 74.6% and a specificity of 53.4%. The odds ratio for need for RC associated with a 1-mmol/L increase in PLac was 1.29 (95% confidence interval [CI] [0.40 - 4.12]) for PLac < 2.5 mmol/L; 2.27 (1.10 - 4.68) for PLac from 2.5 to 4.0 mmol/L; and 1.26 (1.05 - 1.50) for PLac ≥ 4 mmol/L.

Conclusion: PLac was predictive of need for RC among normotensive trauma patients. It was no more predictive than SI, but it has certain advantages and disadvantages compared to SI and could still be useful. Prospective validation of existing triage decision rules augmented by PLac should be investigated.

Crit Care Nurse. 2018 Apr;38(2):e7-e15

En Route Critical Care Transfer From a Role 2 to a Role 3 Medical Treatment Facility in Afghanistan.

Staudt AM, Savell SC, Biever KA, Trevino JD, Valdez-Delgado KK, Suresh M, Gurney JM, Shackelford SA, Maddry JK, Mann-Salinas EA

BACKGROUND: Enroute care is the transfer of patients requiring combat casualty care within the US military evacuation system. No reports have been published about en route care of patients during transfer from a forward surgical facility (role 2) to a combat support hospital (role 3) for comprehensive care.

OBJECTIVE: To describe patients transferred from a role 2 to a role 3 US military treatment facility in Afghanistan.

METHODS: A retrospective review of data from the Joint Trauma System Role 2 Database was conducted. Patient characteristics were described by enroute care medical attendants.

RESULTS: More than one-fourth of patients were intubated at transfer (26.9%), although at transfer fewer than 10% of patients had a base deficit of more than 5 (3.5%), a pH of less than 7.3 (5.2%), an international normalized ratio of more than 2 (0.8%), or temporary abdominal or chest closure (7.4%). The enroute care medical attendant was most often a nurse (35.5%), followed by technicians (14.1%) and physicians (10.0%). Most patients (75.3%) were transported by medical evacuation (on rotary-wing aircraft).

CONCLUSION: This is the first comprehensive review of patients transported from a forward surgical facility to a more robust combat support hospital in Afghanistan. Understanding the epidemiology of these patients will inform provider training and the appropriate skill mix for the transfer of postsurgical patients within a combat setting.

Injury. 2018 Mar 27 Epub ahead of print

The burden of gunshot wounding of UK military personnel in Iraq and Afghanistan from 2003-14.

Stevenson T, Carr DJ, Penn-Barwell JG, Ringrose TJ, Stapley SA

INTRODUCTION: Gunshot wounding (GSW) is the second most common mechanism of injury in warfare after explosive injury. The aim of this study was to define the clinical burden of GSW placed on UK forces throughout the recent Iraq and Afghanistan conflicts.

METHODS: This study was a retrospective review of data from the UK Military Joint Theatre Trauma Registry (JTTR). A JTTR search identified records within the 12 year period of conflict between 19 Mar 2003 and 27 Oct 2014 of all UK military GSW casualties sustained during the complete timelines of both conflicts. Included cases had their clinical timelines and treatment further examined from time of injury up until discharge from hospital or death.

RESULTS: There were 723 casualties identified (177 fatalities, 546 survivors). Median age at the time of injury was 24 years (range 18-46 years), with 99.6% of casualties being male. Most common anatomical locations for injury were the extremities, with 52% of all casualties sustaining extremity GSW, followed by 16% GSW to the head, 15% to the thorax, and 7% to the abdomen. In survivors, the rate of extremity injury was higher at 69%, with head, thorax and abdomen injuries relatively lower at 5%, 11% and 6% respectively. All GSW casualties had a total of 2827 separate injuries catalogued. A total of 545 casualties (523 survivors, 22 fatalities) underwent 2357 recorded surgical procedures, which were carried out over 1455 surgical episodes between admission to a deployed medical facility and subsequent transfer to the Royal Centre for Defence Medicine (RCDM) in the UK. This gave a median of 3 (IQR 2-5) surgical procedures within a median of 2 (IQR 2-3) surgical episodes per casualty. Casualties had a combined length of stay (LoS) of 25 years within a medical facility, with a mean LoS in a deployed facility of 1.9 days and 14 days in RCDM.

CONCLUSION: These findings define the massive burden of injury associated with battlefield GSW and underscore the need for further research to both reduce wound incidence and severity of these complex injuries.

CJEM. 2018 Mar;20(2):167-169

Trauma systems and emergency medical services: The missing link for tranexamic acid utilization in major trauma.

Tallon JM

Quotes:

“The authors report that their mean time to administration of TXA was 47 minutes, measured from the patient’s hospital arrival time in the group (27.1%, n=134) who actually received TXA.7 However, no effort was made to determine and report the total actual time from injury to drug administration. They assume that their time of 47 minutes represents a good, CRASH-2 compliant metric because this surrogate measurement is within 3 hours of injury. However, this time metric is insufficient in the context of actually knowing the time of injury, which should be available through the ambulance/paramedic patient care record. The authors appropriately lament their poor overall compliance with this readily available, inexpensive, evidence-informed medication, which is now listed on the World Health Organization (WHO) essential medication list. 11 They offer reasons for non-compliance, which include inadequate in-house knowledge translation and implementation, the lack of a formal in-house guideline, and lack of formal associated educational initiatives.”

“Not only can TXA be given by EMS, but also it is being given by EMS,13 and its associated evidence virtually demands that this practice be taken up in the context of time of injury, potential long-distance transports, interfacility transports, and that its impact is highest when closest to the time of injury.14, In fact, two further studies may widen indications for timely TXA use. These studies are the Resuscitation Outcomes Consortium (ROC) study of TXA in traumatic brain injury (TBI),15 which is at the analysis stage, and the CRASH-3 trial (still recruiting), which is also being conducted to assess the effect of TXA on risk of death or disability in patients with TBI.16 These two studies may elucidate evidence that the clinical use of TXA in trauma be expanded, an even more important potential reason for its use to be implemented in EMS practice. Treatment delay simply cannot be tolerated, as evidenced and discussed recently in a meta-analysis on the use of TXA in an acute severe hemorrhage.17”

J Am Coll Surg. 2018 May;226(5):769-776

Civilian Prehospital Tourniquet Use Is Associated with Improved Survival in Patients with Peripheral Vascular Injury.

Teixeira PGR, Brown CVR, Emigh B, Long M, Foreman M, Eastridge B, Gale S, Truitt MS, Dissanaike S, Duane T, Holcomb J, Eastman A, Regner J; Texas Tourniquet Study Group.

Collaborators: Vu M, Todd SR, Rainey EE, Allen L, Agrawal V, Walker K, Gandhi R, Podbielski JM.

BACKGROUND: Tourniquet use has been proven to reduce mortality on the battlefield. Although empirically transitioned to the civilian environment, data substantiating survival benefit attributable to civilian tourniquet use is lacking. We hypothesized that civilian prehospital tourniquet use is associated with reduced mortality in patients with peripheral vascular injuries.

STUDY DESIGN: We conducted a multicenter retrospective review of all patients sustaining peripheral vascular injuries admitted to 11 Level I trauma centers (January 2011 through December 2016). The study population was divided into 2 groups based on prehospital tourniquet use. Baseline characteristics were compared and factors associated with mortality identified. Logistic regression, adjusting for demographic, physiologic and injury-related parameters, was used to evaluate the association between prehospital tourniquet use and mortality. Delayed amputation was the secondary end point.

RESULTS: During 6 years, 1,026 patients with peripheral vascular injuries were admitted. Prehospital tourniquets were used in 181 (17.6%) patients. Tourniquet time averaged 77.3 ± 63.3 minutes (interquartile range 39.0 to 92.3 minutes). Traumatic amputations occurred in 98 patients (35.7% had a tourniquet). Mortality was 5.2% in the non-tourniquet group compared with 3.9% in the tourniquet group (odds ratio 1.36; 95% CI 0.60 to 1.65; p = 0.452). After multivariable analysis, the use of tourniquets was found to be independently associated with survival (adjusted odds ratio 5.86; 95% CI 1.41 to 24.47; adjusted p = 0.015). Delayed amputation rates were not significantly different between the 2 groups (1.1% vs 1.1%; adjusted odds ratio 1.82; 95% CI 0.36 to 9.99; adjusted p = 0.473).

CONCLUSIONS: Although still underused, civilian prehospital tourniquet application was independently associated with a 6-fold mortality reduction in patients with peripheral vascular injuries. More aggressive prehospital application of extremity tourniquets in civilian trauma patients with extremity hemorrhage and traumatic amputation is warranted.

Mil Med. 2018 May 1;183(5-6):e207-e215

The Platinum 5 min in TCCC: Analysis of Junctional and Extremity Hemorrhage Scenarios with a Mathematical Model.

Tjardes T, Luecking M

Introduction: To achieve the aim of zero preventable deaths on the battlefield a deeper understanding of uncontrolled hemorrhage from junctional or proximal extremity sources is mandatory. While tourniquet application to the extremities has drastically reduced morbidity and mortality, there is still room for improvement regarding the timing of tourniquet placement as the available evidence clearly points out a tight correlation between timing of tourniquet application and outcome. To save as many lives as possible the "point of no return" regarding the circulatory breakdown due to hemorrhage, colloquially addressed as platinum 5 min, needs to be determined. As clinical analysis or controlled studies are difficult, if not impossible, and animal experiments cannot be translated to bleeding in humans, we present a mathematical modeling approach. The key assumption of the model is that hemodynamics in the early phase of massive hemorrhage are determined by the cardiac function, the passive physical properties of the vascular system, that is, compliances etc., as humoral compensatory mechanisms kick in at a later point in time, and the baroceptor reflex, which constitutes the immediate response to volume loss.

Materials and Methods: A lumped mathematical model based on differential equations describing three distinct arterial and two venous compartments, the heart and the baroceptor mechanism is developed. With this model, different patterns of blood loss (%) and duration of bleeding (s) are simulated: 10%/30 and 60 s, 20%/30 and 60 s, 30%/30, 60 and 120 s, and 35%/30, 120 and 180 s. These bleeding patterns are chosen such that they resemble clinically scenarios following junctional and proximal extremity injuries.

Results: Three hemodynamic patterns can be distinguished. The system stabilizes on a lower blood pressure level (10%/30 and 60 s, 20%/30 and 60 s), the system formally stabilizes on a very low level, which is physiologically not reasonable (30%/30, 60 and 120 s), the system irreversibly breaks down with no signs of restabilization (35%/30, 120 and 180 s).

Conclusion: Thus the immediacy of intervention in terms of application of a tourniquet is clearly emphasized by the simulation, that is, the window of opportunity for a life-saving intervention, especially in a combat setting, is significantly smaller than the symbolic "platinum five minutes" might suggest. With respect to the 3-min window of opportunity identified in the simulations the effective application of these devices in a TCCC setting appears questionable. Given these observations, further research and development into solutions that allow the timely identification of a junctional bleeding problem and application of compression is necessary.

J Trauma Acute Care Surg. 2018 Mar;84(3):505-516

Early identification of patients requiring massive transfusion, embolization or hemostatic surgery for traumatic hemorrhage: A systematic review and meta-analysis.

Tran A, Matar M, Lampron J, Steyerberg E, Taljaard M, Vaillancourt C.

BACKGROUND: Delays in appropriate triage of bleeding trauma patients result in poor outcomes. Clinical gestalt is fallible and objective measures of risk stratification are needed. The objective of this review is to identify and assess prediction models and predictors for the early identification of traumatic hemorrhage patients requiring massive transfusion, surgery, or embolization.

METHODS: We searched electronic databases through to September 31, 2016, for studies describing clinical, laboratory, and imaging predictors available within the first hour of resuscitation for identifying patients requiring major intervention for hemorrhage within the first 24 hours.

RESULTS: We included 84 studies describing any predictor-outcome association, including 47 multivariable models; of these, 26 (55%) were specifically designed for prediction. We identified 35 distinct predictors of which systolic blood pressure, age, heart rate, and mechanism of injury were most frequently studied. Quality of multivariable models was generally poor with only 21 (45%) meeting a commonly recommended sample size threshold of 10 events per predictor. From 21 models meeting this threshold, we identified seven predictors that were examined in at least two models: mechanism of injury, systolic blood pressure, heart rate, hemoglobin, lactate, and focused abdominal sonography for trauma. Pooled odds ratios were obtained from random-effects meta-analyses.

CONCLUSION: The majority of traumatic hemorrhagic prediction studies are of poor quality, as assessed by the Prognosis Research Strategy recommendations and Critical Appraisal and Data Extraction for Systematic Reviews of Modeling Studies checklist. There exists a need for a well-designed clinical prediction model for early identification of patients requiring intervention. The variables of clinical importance identified in this review are consistent with recent expert guideline recommendations and may serve as candidates for future derivation studies.

J Trauma Acute Care Surg. 2018 May;84(5):802-808

Permissive hypotension versus conventional resuscitation strategies in adult trauma patients with hemorrhagic shock: A systematic review and meta-analysis of randomized controlled trials.

Tran A, Yates J, Lau A, Lampron J, Matar M.

BACKGROUND: Aggressive fluid resuscitation in trauma promotes deleterious effects such as clot disruption, dilutional coagulopathy and hypothermia. Animal studies suggest that permissive hypotension maintains appropriate organ perfusion, reduces bleeding and improves mortality. This review assesses the efficacy and safety of permissive hypotension in adult trauma patients with hemorrhagic shock.

METHODS: We searched the MEDLINE and EMBASE databases from inception to May 2017 for randomized controlled trials comparing permissive hypotension vs. conventional resuscitation following traumatic injury. We included preoperative and intraoperative resuscitation strategies. The primary outcome was 30-day or in-hospital mortality. Secondary outcomes included blood product utilization, estimated blood loss and in-hospital complications. Pooling was performed with a random-effects model.

RESULTS: We screened 722 abstracts, from which five randomized trials evaluating 1,158 patients were included. Blood pressure targets in the intervention arms varied from systolic BP 50 mm Hg to 70 mm Hg or mean arterial pressure of 50 mm Hg or higher as compared to systolic BP 65 mm Hg to 100 mm Hg or mean arterial pressure of 65 or higher in the control arms. Two studies evaluated only patients with penetrating injury while the remaining three additionally included blunt injuries. Four trials suggested a survival benefit for 30-day or in-hospital mortality with hypotensive resuscitation, although three studies were insufficiently powered to find statistical significance. Studies were of poor to moderate quality due to poor protocol reporting and lack of blinding. The pooled odds ratio was 0.70 (95% confidence interval, 0.53-0.92), suggesting a survival benefit for permissive hypotension. Those patients received fewer blood products and had lesser estimated blood loss.

CONCLUSION: Permissive hypotension may offer a survival benefit over conventional resuscitation for patients with hemorrhagic injury. It may additionally reduce blood loss and blood product utilization. However, the majority of studies were underpowered, thus reflecting a need for high quality, adequately powered trials.

J Anaesthesiol Clin Pharmacol. 2018 Jan-Mar;34(1):58-61

Effectiveness of Proseal laryngeal mask airway and laryngeal tube suction in elective non-laparoscopic surgeries of up to ninety minutes duration: A prospective, randomized study.

Verma S, Sharma SP

Background and Aims: Proseal laryngeal mask airway (LMA) and laryngeal tube suction (LTS) are both supraglottic devices with an esophageal suction port. In the present prospective, randomized study, the effectiveness of airway seal, hemodynamic variables, ability to pass orogastric tube, and postoperative complications with the two devices were evaluated.

Material and Methods: This was a prospective, randomized, single-blind study conducted in a hospital-based setting. Sixty patients (American Society of Anesthesiologists Grade I and II) undergoing elective general surgery were randomly allocated to Group A (Proseal LMA) or Group B (LTS), and airway seal pressure (primary outcome), peak pressure, hemodynamic parameters (blood pressure, pulse rate and pulse oximetry) during and 5 min after insertion, insertion time, ease of insertion, and postoperative complications (sore throat and hoarseness of voice for a period of 24 hours) (secondary outcomes) were noted. The quantitative data was summarized as mean and standard deviation, and analyzed using Student's t-test. All the qualitative data were summarized as proportions and analyzed using Chi-square test. The levels of significance and α-error were kept 95% and 5%, respectively, for all statistical analyses. $P \leq 0.05$ was considered significant (S).

Results: Proseal LMA had shorter insertion time (16.4 ± 5.6 vs. 20.0 ± 3.9 s), higher seal pressure (27.6 ± 4.6 vs. 24.1 ± 5.6 cm of H_2O), lesser peak pressure (16.3 ± 2.3 vs. 18.5 ± 3.9 cm of H_2O), higher success rate of orogastric tube passage (86.7 vs. 76.7%), and lesser postoperative sore throat (3.3 vs. 10%).

Conclusions: Both Proseal LMA and LTS were acceptable alternatives for airway management in elective surgeries with controlled ventilation, but the quality of ventilation was found to be significantly better with Proseal LMA (in terms of higher seal pressure, lesser peak pressure, lesser insertion time, and lesser complications).

JAMA Surg. 2018 Feb 1;153(2):107-113

Association of Prehospital Mode of Transport with Mortality in Penetrating Trauma: A Trauma System-Level Assessment of Private Vehicle Transportation vs Ground Emergency Medical Services.

Wandling MW, Nathens AB, Shapiro MB, Haut ER.

Importance: Time to definitive care following injury is important to the outcomes of trauma patients. Prehospital trauma care is provided based on policies developed by individual trauma systems and is an important component of the care of injured patients. Given a paucity of systems-level trauma research, considerable variability exists in prehospital care policies across trauma systems, potentially affecting patient outcomes.

Objective: To evaluate whether private vehicle prehospital transport confers a survival advantage vs ground emergency medical services (EMS) transport following penetrating injuries in urban trauma systems.

Design, Setting, and Participants: Retrospective cohort study of data included in the National Trauma Data Bank from January 1, 2010, through December 31, 2012, comprising 298 level 1 and level 2 trauma centers that contribute data to the National Trauma Data Bank that are located within the 100 most populous metropolitan areas in the United States. Of 2 329 446 patients assessed for eligibility, 103 029 were included in this study. All patients were 16 years or older, had a gunshot wound or stab wound, and were transported by ground EMS or private vehicle.

Main Outcome and Measure: In-hospital mortality.

Results: Of the 2 329 446 records assessed for eligibility, 103 029 individuals at 298 urban level 1 and level 2 trauma centers were included in the analysis. The study population was predominantly male (87.6%), with a mean age of 32.3 years. Among those included, 47.9% were black, 26.3% were white, and 18.4% were Hispanic. Following risk adjustment, individuals with penetrating injuries transported by private vehicle were less likely to die than patients transported by ground EMS (odds ratio [OR], 0.38; 95% CI, 0.31-0.47). This association remained statistically significant on stratified analysis of the gunshot wound (OR, 0.45; 95% CI, 0.36-0.56) and stab wound (OR, 0.32; 95% CI, 0.20-0.52) subgroups.

Conclusions and Relevance: Private vehicle transport is associated with a significantly lower likelihood of death when compared with ground EMS transport for individuals with gunshot wounds and stab wounds in urban US trauma systems. System-level evidence such as this can be a valuable tool for those responsible for developing and implementing policies at the trauma system level.

BMC Musculoskelet Disord. 2018 Mar 15;19(1):85

Comparison of oral versus intra-articular tranexamic acid in enhanced-recovery primary total knee arthroplasty without tourniquet application: a randomized controlled trial.

Wang D, Zhu H, Meng WK, Wang HY, Luo ZY, Pei FX, Li Q, Zhou ZK

BACKGROUND: Although randomized controlled trials have confirmed oral tranexamic acid (TXA) can provide similar blood-sparing efficacy compared with intravenous (IV) TXA in total knee arthroplasty (TKA), some concerns do remain about thromboembolic events after such systemic administration. Many studies have confirmed that intra-articular (IA) application of TXA can show similar blood-saving efficacy with minimal levels of systemic absorption compared with IV TXA. However, it remains unclear whether the efficacy and safety of oral TXA administration is equal to or less than that of IA administration in TKA without the use of a tourniquet and drain. Thus, this study was to verify non-inferior efficacy and safety of oral TXA compared with IA TXA in primary TKA.

METHODS: A double-blind, randomized, controlled trial was performed to compare three oral doses of TXA (2 g of TXA 2 h before incision, and 1 g of TXA 6 and 12 h after surgery, respectively) with IA TXA (3 g of TXA in 100 mL of saline solution). One hundred forty-seven patients scheduled for TKA were randomized to one of the two interventions. The primary outcome was total blood loss. The secondary outcomes included reduction of hemoglobin concentration, clinical outcomes, blood coagulation values, thromboembolic complications, and transfusion rates.

RESULTS: The mean total blood loss was 788.8 mL in the oral TXA group compared with 872.4 mL in the IA TXA group, with no statistical significance ($p > 0.05$). There were no significant differences in reduction of hemoglobin level, blood coagulation level, and clinical outcomes. The transfusion rates were 4% in oral group and 5% IA group, respectively. Also, no significant differences were identified in thromboembolic complications.

CONCLUSION: Oral TXA according to the described protocol demonstrated non-inferiority for primary TKA, with no safety concerns and a greatly reduced cost, compared with the IA TXA. This randomized controlled trial supports the oral administration of TXA in TKA.

J Spec Oper Med. Spring 2018;18(1):15-18.

Military Prehospital Use of Low Titer Group O Whole Blood.

Warner N, Zheng J, Nix G, Fisher AD, Johnson JC, Williams JE, Northern DM, Hellums JS.

ABSTRACTS:
The military's use of whole-blood transfusions is not new but has recently received new emphasis by the Tactical Combat Casualty Care Committee. US Army units are implementing a systematic approach to obtain and use whole blood on the battlefield. This case report reviews the care of the first patient to receive low titer group O whole blood (LTOWB) transfusion, using a new protocol**.**

Can J Anaesth. 2018 Mar 26 Epub ahead of print

Comparison of oropharyngeal leak pressure between the Ambu® AuraGain™ and the LMA® Supreme™ supraglottic airways: a randomized-controlled trial.

Wong DT, Ooi A, Singh KP, Dallaire A, Meliana V, Lau J, Chung F, Singh M, Wong J

PURPOSE: Studies comparing the recently introduced Ambu® AuraGain™ (Auragain) with the LMA® Supreme™ (Supreme) supraglottic airway (SGA) have reported conflicting results regarding differences in oropharyngeal leak pressure (OLP). This randomized-controlled trial investigated the OLP of the Auragain compared with the Supreme in patients undergoing ambulatory surgery.

METHODS: Adult patients with a body mass index ≤ 40 kg·m-2 presenting for ambulatory surgery and requiring an SGA were randomized to receive either the Auragain or the Supreme. Anesthesia was induced with lidocaine (1 mg·kg-1), fentanyl (1-2 μg·kg-1), and propofol (2-3 mg·kg-1). The SGA was inserted using a standard technique with the cuff inflated to 60 cmH2O. The groups were compared for the primary outcome of OLP.

RESULTS: One hundred sixty-five patients (n = 81, Auragain; n = 84, Supreme) completed the study. Demographics were similar between the groups. The mean (standard deviation [SD]) OLP was significantly higher in the Auragain than in the Supreme group [26.4 (2.8) cmH2O vs 21.6 (3.4) cmH2O, respectively; difference in means (MD), 4.8 cmH2O; 95% confidence interval (CI), 3.9 to 5.8; P < 0.001]. The mean (SD) insertion time was longer in the Auragain than in the Supreme group [13 (4) sec vs 11 (3) sec, respectively; MD, 2 sec; 95% CI, 1 to 3 sec; P < 0.001].

CONCLUSION: In patients undergoing ambulatory anesthesia, the OLP was higher but took longer to insert with the Auragain than with the Supreme. A higher OLP may allow for SGAs to be utilized in a wider range of patients and procedures.

J Trauma Acute Care Surg 2018;Epub ahead of print.

Trauma hemostasis and oxygenation research network position paper on the role of hypotensive resuscitation as part of remote damage control resuscitation.

Woolley T, Thompson P, Kirkman E, et al:

ABSTRACTS:

The Trauma Hemostasis and Oxygenation Research (THOR) Network has developed a consensus statement on the role of permissive hypotension in remote damage control resuscitation (RDCR).A summary of the evidence on permissive hypotension follows the THOR Network position on the topic. In RDCR, the burden of time in the care of the patients suffering from noncompressible hemorrhage affects outcomes .Despite the lack of published evidence, and based on clinical experience and expertise, it is the THOR Network's opinion that the increase in prehospital time leads to an increased burden of shock, which poses a greater risk to the patient than the risk of rebleeding due to slightly increased blood pressure, especially when blood products are available as part of prehospital resuscitation. The THOR Network's consensus statement is, "In a Casualty with life-threatening hemorrhage, shock should be reversed as soon as possible using a blood-based HR fluid. Whole blood is preferred to blood components. As a part of this HR , the initial systolic blood pressure target should be 100mm Hg. In RDCR, it is vital for higher echelon care providers to receive a casualty with sufficient physiologic reserve to survive definitive surgical hemostasis and aggressive resuscitation. The combined use of blood-based resuscitation and limiting systolic blood pressure is believed to be effective in promoting hemostasis and reversing shock."

Mil Med Res. 2018 Feb 13;5(1):6

Expert consensus on the evaluation and diagnosis of combat injuries of the Chinese People's Liberation Army.

Zong ZW, Zhang LY, Qin H, Chen SX, Zhang L, Yang L, Li XX, Bao QW, Liu DC, He SH, Shen Y, Zhang R, Zhao YF, Zhong XZ; representing the PLA Professional Committee and Youth Committee on Disaster Medicine.

Collaborators: Bao JQ, Bao QW, Chen L, Chen SX, Du GF, Fan HJ, He Z, Huang J, Huang LS, Huo JT, Jing JJ, Kuai LP, Li N, Li XB, Li XD, Li XX, Li GD, Liu H, Liu TT, Niu YF, Qiao ZY, Qin H, Qiu ZW, Ren GH, Shan Y, Shen Y, Shu LX, Su JC, Su BX, Wang GD, Wang DW, Wang JX, Wang Q, Wang ZN, Wu W, Yang L, Yang JZ, Yang J, Yao Y, Yu B, Yue S, Zhang B, Zhang G, Zhang LY, Zhang L, Zhang R, Zhang YX, Zhang YF, Zhang Y, Zhao YF, Zhou SH, Zong ZW, Zuo HY.

ABSTRACT:
The accurate assessment and diagnosis of combat injuries are the basis for triage and treatment of combat casualties. A consensus on the assessment and diagnosis of combat injuries was made and discussed at the second annual meeting of the Professional Committee on Disaster Medicine of the Chinese People's Liberation Army (PLA). In this consensus agreement, the massive hemorrhage, airway, respiration, circulation and hypothermia (MARCH) algorithm, which is a simple triage and rapid treatment and field triage score, was recommended to assess combat casualties during the first-aid stage, whereas the abbreviated scoring method for combat casualty and the MARCH algorithm were recommended to assess combat casualties in level II facilities. In level III facilities, combined measures, including a history inquiry, thorough physical examination, laboratory examination, X-ray, and ultrasound examination, were recommended for the diagnosis of combat casualties. In addition, corresponding methods were recommended for the recognition of casualties needing massive transfusions, assessment of firearm wounds, evaluation of mangled extremities, and assessment of injury severity in this consensus.