Tactical Combat Casualty Care

Journal Article Abstracts

Committee on Tactical Combat Casualty Care

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Abstracts

BMC Surg. 2017 Nov 9;17(1):104

Association of pelvic fracture patterns, pelvic binder use and arterial angio-embolization with transfusion requirements and mortality rates; a 7-year retrospective cohort study.

Agri F, Bourgeat M, Becce F, Moerenhout K, Pasquier M, Borens O, Yersin B, Demartines N, Zingg T

BACKGROUND: Pelvic fractures are severe injuries with frequently associated multi-system trauma and a high mortality rate. The value of the pelvic fracture pattern for predicting transfusion requirements and mortality is not entirely clear. To address hemorrhage from pelvic injuries, the early application of pelvic binders is now recommended and arterial angio-embolization is widely used for controlling arterial bleeding. Our aim was to assess the association of the pelvic fracture pattern according to the Tile classification system with transfusion requirements and mortality rates, and to evaluate the correlation between the use of pelvic binders and arterial angio-embolization and the mortality of patients with pelvic fractures.

METHODS: Single-center retrospective cohort study including all consecutive patients with a pelvic fracture from January 2008 to June 2015. All radiological fracture patterns were independently reviewed and grouped according to the Tile classification system. Data on patient demographics, use of pelvic binders and arterial angio-embolization, transfusion requirements and mortality were extracted from the institutional trauma registry and analyzed.

RESULTS: The present study included 228 patients. Median patient age was 43.5 years and 68.9% were male. The two independent observers identified 105 Tile C (46.1%), 71 Tile B (31.1%) and 52 Tile A (22.8%) fractures, with substantial to almost perfect interobserver agreement (Kappa 0.70-0.83). Tile C fractures were associated with a higher mortality rate ($p = 0.001$) and higher transfusion requirements ($p < 0.0001$) than Tile A or B fractures. Arterial angio-embolization for pelvic bleeding ($p = 0.05$) and prehospital pelvic binder placement ($p = 0.5$) were not associated with differences in mortality rates.

CONCLUSIONS: Tile C pelvic fractures are associated with higher transfusion requirements and a higher mortality rate than Tile A or B fractures. No association between the use of pelvic binders or arterial angio-embolization and survival was observed in this cohort of patients with pelvic fractures.

J Emerg Med. 2017 Dec 16. pii: S0736-4679(17)31094-6.

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.

J Spine Surg. 2017 Dec;3(4):531-540.

Efficacy of tranexamic acid in reducing blood loss and blood transfusion in idiopathic scoliosis: a systematic review and meta-analysis.

Alajmi T, Saeed H, Alfaryan K, Alakeel A, Alfaryan T

Background: Tranexamic acid is a synthetic lysine-analogue antifibrinolytic that competitively inhibits the activation of plasminogen to plasmin, it is a well-documented blood sparing agent. However, its routine use in idiopathic scoliosis surgery is poorly documented. The objective of this meta-analysis was to determine TXA's efficacy in reducing blood loss and blood transfusion in idiopathic scoliosis surgery.

Methods: Five databases (Medline, PubMed, Web of Science, Embase and The Cochrane Central Register of Controlled Trials) were searched to identify the relevant randomized controlled trials (RCTs), prospective cohort control (PCC), and retrospective controlled trails regarding the TXA efficacy in idiopathic scoliosis surgery. Mean differences (MDs) of blood loss and blood transfusions in TXA-treated group compared to control and/or placebo group were extracted and combined using random-effect meta-analysis model.

Results: A total of seven studies comprising 426 patients were included in the meta-analysis according to the pre-defined selection criteria. TXA-treated group had an overall significantly ($P<0.005$) less volume of blood loss [ES (MD) =727.71 mL; CI, 281.86-1,173.56 mL]. Six studies comprising 346 patients TXA-treated group had an overall significantly {$P<0.001$ less transfusion volume [ES (MD) =268.30 mL; CI, 105.19-431.44 mL]}.

Conclusions: Patients treated with TXA had a significantly lower blood loss and lower rates of allogeneic blood transfusion than the control group. Further investigation is required regarding the safety of TXA before it can be generalized in the use of idiopathic scoliosis surgery.

Injury. 2018 Jan;49(1):117-123

Hypothermia indices among severely injured trauma patients undergoing urgent surgery: A single-centred retrospective quality review and analysis.

Alam A, Olarte R, Callum J, Fatahi A, Nascimento B, Laflamme C, Cohen R, Nathens AB, Tien H

BACKGROUND: Hypothermia (<36°C) exacerbates trauma-induced coagulopathy and worsens morbidity and mortality among severely injured trauma patients; there is a paucity of published data describing how well trauma centres adhere tostandards regarding measurement of temperature, and best practices for preventing and treating hypothermia.

METHODS: We completed a retrospective quality audit of all severely injured trauma patients (Injury Severity Score (ISS≥20)) who had urgent surgery at Sunnybrook Health Sciences Centre (SHSC) between 2010 and 2014. Information regarding temperature monitoring was evaluated over the course of the initial resuscitation and admission. Independent risk factors for in-hospital mortality were elucidated through a multivariable regression analysis.

RESULTS: Out of a total of 4492 trauma patients, 495 were severely-injured and went to the operating room (OPR) after being treated in the trauma bay (TB) at SHSC between 2010 and 2014. The majority of the patients were male (n=384, 77.6%) and had a blunt mechanism of injury (n=391, 79.0%). The median ISS score was 29 (interquartile range (IQR) 26, 35). Eighty-nine (17.9%) patients died; 26 (5.2%) of these patients died intra-operatively. Less than one fifth of patients (n=82 16.6%) received a temperature measurement during pre-hospital transport phase. Upon arrival to the TB, almost two-thirds (n=301, 60.8%) of patients had their temperature recorded and a similar proportion (n=175, 58.1%) of those patients were hypothermic (<36°C). In the OPR, close to 80% (n=389, 78.6%) of patients had their temperature measured on both arrival; almost 60% (n=223, 57.3%) were hypothermic on arrival. Almost all patients had their temperature measured upon arrival to the ICU or specialized ward (n=450, 98.3%). Warming initiatives were documented in only 36 (7.3%) patients in the TB, yet documented in almost all patients in OR (n=464, 93.7%). An increased risk of in-hospital mortality was correlated with not taking a temperature measurement in the TB (Odds Ratio (OR) 2.86 (95% Confidence Interval (CI) [1.64-4.99]) or OPR (OR 4.66 (95% CI [2.50-8.69]).

CONCLUSIONS: A majority of severely injured trauma patients are hypothermic well into the perioperative period after initial admission. An absence of having temperature measurement during initial hospitalization is associated with increased in-hospital mortality amongst this patient group. Quality improvement initiatives should aim to strive for ongoing temperature measurement as a key performance indicator and early prevention and treatment of hypothermia during initial resuscitation.

Int J Oral Maxillofac Surg. 2017 Nov 7. pii: S0901-5027(17)31660-0. doi:10.1016/j.ijom.2017.10.007. [Epub ahead of print]

The effect of different dosage regimens of tranexamic acid on blood loss in bimaxillary osteotomy: a randomized, double-blind, placebo-controlled study.

Apipan B, Rummasak D, Narainthonsaenee T.

ABSTRACT:
The purpose of this study was to compare the effects of three dosage regimens of intravenous tranexamic acid and normal saline placebo on blood loss and the requirement for transfusion during bimaxillary osteotomy. A prospective, randomized, double-blind, placebo-controlled study was performed. Eighty patients scheduled for elective bimaxillary osteotomy were divided into four groups: a placebo group and three groups receiving a single dose of tranexamic acid 10, 15, or 20mg/kg body weight after the induction of anaesthesia. Demographic data, the anaesthetic time, the operative time, and the experience of the surgical team were similar in the four groups. Patients receiving placebo had increased blood loss compared to those receiving tranexamic acid. No significant difference in blood loss was found among those who received 10, 15, or 20mg/kg body weight of tranexamic acid. There was no significant difference in transfusion requirement, amount of 24-h postoperative vacuum drainage, length of hospital stay, or complications among the four groups. Prophylactic tranexamic acid decreased bleeding during bimaxillary osteotomy. Of the three dosages of tranexamic acid studied, the most efficacious and cost-effective dose to reduce bleeding was 10mg/kg body weight.

J Spec Oper Med. Winter 2017;17(4):52-55.

The SOF Truths for Army Special Operations Forces Surgical Teams.

Baker JB, Modlin RE, Ong RC, Remick KN.

ABSTRACT:
The US Army Special Operations Command and Army Medical Command are at a critical junction in Army medical training. Army Special Operations Forces (ARSOF) will receive Forward Resuscitative Surgical Teams (FRSTs) in the near future and must establish a training model to enable successful support for ARSOF operations. The military has been directed by Congress through the 2017 National Defense Authorization Act to embed trauma combat casualty care teams in civilian trauma centers. ARSOF FRSTs should be embedded in the nation's leading civilian trauma centers to build and sustain true expertise in delivering trauma care on the battlefield. The SOF Truths provide valuable insights into the required conditions for success of this new training paradigm.

Anaesth Crit Care Pain Med. 2018 Jan 5. pii: S2352-5568(17)30265-5. doi: 10.1016/j.accpm.2017.11.017. [Epub ahead of print]

Application of tourniquet in civilian trauma: Systematic review of the literature.

Beaucreux C, Vivien B, Miles E, Ausset S, Pasquier P

INTRODUCTION: The effectiveness of a tourniquet (TQ) in case of extremity haemorrhages is well recognised to prevent deaths on the battlefield. However, little is known about the usefulness of TQ in civilian trauma settings, including terrorist attack situations. The aim of this systematic review was to analyse the evidence-based medical literature in order to precise the use of TQ in the management of extremity haemorrhages in civilian setting.

METHODS: Analysis of all studies published until 12/31/2016 on the Embase, Medline and Opengrey databases. To be included, studies had to contain descriptions, discussions or experiences of TQ application in civilian setting. The quality of the studies was evaluated using the PRISMA and the STROBE criteria.

RESULTS: Of the 380 studies identified, 24 were included. The overall level of evidence was low. Three thousand and twenty eight TQ placements were reported. Most of them concerned the Combat Application Tourniquet CAT. Haemorrhages implied in the use of TQ were almost exclusively traumatic, most of the time regarding young men (27-44 years old). Effectiveness rates of TQ varied between 78% and 100%. Complications rates associated with the use of TQ remained low, even when used in elderlies or patients with comorbidities. Finally, caregivers reported a common fear of adverse effects, while reported complications were rare (<2%).

CONCLUSION: This systematic review revealed TQ to be an effective tool for the management of extremity haemorrhages in civilian trauma, associated with few complications. Larger studies and dedicated training courses are needed to improve the use of TQ in the civilian standards of care.

J Spec Oper Med. Fall 2017;17(3):46-50.

The Golden Hour Offset Surgical Treatment Team Operational Concept: Experience of the 102nd Forward Surgical Team in Operation Freedom's Sentinel 2015-2016.

Benavides JM, Benavides LC, Hale DF, Lundy JB.

ABSTRACT:
Theater Special Operations Force (SOF) medical planners have begun using Army Forward Surgical Teams (FSTs) to maintain a golden hour for U.S. SOF during Operation Freedom's Sentinel required adaptation in FST training, configuration, personnel, equipment, and employment to form Golden Hour Offset Surgical Treatment Teams (GHOST-Ts). This article describes one such FST's experience in Operation Freedom's Sentinel while deployed for 9 months in support of SOF in southern Afghanistan.

J Bone Joint Surg Am. 2017 Dec 20;99(24):e135

Benefits of Tranexamic Acid Not Debatable but Leave Tourniquet Use to Surgeon's Discretion: Commentary on an article by ZeYu Huang, MD, PhD, et al.: "Intravenous and Topical Tranexamic Acid Alone Are Superior to Tourniquet Use for Primary Total Knee Arthroplasty. A Prospective, Randomized Controlled Trial".

Boettner F, Rueckl K.

Quotes:

“The use of tranexamic acid has revolutionized modern total joint arthroplasty since the turn of the century1. Although the medication has not been approved by the U.S. Food and Drug Administration (FDA) for use in total joint arthroplasty, it has been shown to be a highly effective tool for reducing blood loss and transfusion requirements2. Its low risk profile and cost make it the ideal addition to every primary total joint replacement surgery. Considering that most surgeons use a tourniquet to reduce intraoperative blood loss during total knee arthroplasty, the next logical step appears to be to eliminate the intraoperative tourniquet. In their paper, ZeYu Huang et al. show that applying local and systemic tranexamic acid obviates the need for a tourniquet to reduce overall blood loss, intraoperative blood loss, hidden blood loss, and transfusion rates.”

“The conclusion of the paper suggests that we should all stop using tourniquets when performing total knee arthroplasty. In reality, the reported clinical benefits of doing that are not very impressive, and not using a tourniquet has much less impact on outcomes than the addition of tranexamic acid…..While we believe that the current paper provides strong evidence that adding tranexamic acid has profound benefits with respect to blood management and clinical recovery after total knee arthroplasty, we do not think that it makes a very convincing argument to discontinue the use of tourniquets.”

J Trauma Acute Care Surg. 2018 Jan 24. doi: 10.1097/TA.0000000000001811. [Epub ahead of print]

A Review of the Landscape: Challenges and gaps in trauma response to civilian high threat mass casualty incidents.

Callaway DW.

ABSTRACT:
The ultimate goal of the emergency response and trauma system is to reduce potentially preventable death from trauma. Tremendous advances in trauma care emerged from the past fifteen years of United States' combat engagements around the globe. Unfortunately, combat and insurgency tactics have also metastasized to the civilian world, resulting in increasingly complex and dynamic acts of intentional mass violence. These high threat Active Violent Incidents (AVIs) pose significant preparedness, response and clinical care challenges to the civilian healthcare systems. Currently, there are several operational and policy gaps that limit the successful preparedness and response to AVIs and dynamic MCIs in the United States.

Surg Infect (Larchmt). 2017 Apr;18(3):357-367

Multi-Drug-Resistant Gram-Negative Infections in Deployment-Related Trauma Patients.

Campbell WR, Li P, Whitman TJ, Blyth DM, Schnaubelt ER, Mende K, Tribble DR

BACKGROUND: The contribution of multi-drug-resistant gram-negative bacilli infections (MDRGN-I) in patients with trauma is not well described. We present characteristics of MDRGN-Is among military personnel with deployment-related trauma (2009-2014).

PATIENTS AND METHODS: Data from the Trauma Infectious Disease Outcomes Study were assessed for infectious outcomes and microbial recovery. Infections were classified using standardized definitions. Gram-negative bacilli were defined as multi-drug-resistant if they showed resistance to ≥3 antibiotic classes or were producers of extended-spectrum β-lactamase or carbapenemases.

RESULTS: Among 2,699 patients admitted to participating U.S. hospitals, 913 (33.8%) experienced ≥1 infection event, of which 245 (26.8%) had a MDRGN-I. There were 543 MDRGN-I events (24.6% of unique 2,210 infections) with Escherichia coli (48.3%), Acinetobacter spp. (38.6%), and Klebsiella pneumoniae (8.4%) as the most common MDRGN isolates. Incidence of MDRGN-I was 9.1% (95% confidence interval [CI]: 8.0-10.2). Median time to MDRGN-I event was seven days with 75% occurring within 13 days post-trauma. Patients with MDRGN-Is had a greater proportion of blast injuries (84.1% vs. 62.5%; $p < 0.0001$), traumatic amputations (57.5% vs.16.3%; $p < 0.0001$), and higher injury severity (82.0% had injury severity score ≥25 vs. 33.7%; $p < 0.0001$) compared with patients with either no infections or non-MDRGN-Is. Furthermore, MDRGN-I patients were more frequently admitted to the intensive care unit (90.5% vs. 48.5%; $p < 0.0001$), colonized with a MDRGN before infection (58.0% vs. 14.7%; $p < 0.0001$), and required mechanical ventilation (78.0% vs. 28.8% $p < 0.0001$). Antibiotic exposure before the MDRGN-I event was significantly higher across antibiotic classes except first generation cephalosporins and tetracyclines, which were very commonly used with all patients. Regarding outcomes, patients with MDRGN-Is had a longer length of hospitalization than the comparator group (53 vs. 18 days; $p < 0.0001$).

CONCLUSIONS: We found a high rate of MDRGN-I in our population characterized by longer hospitalization and greater injury severity. These findings inform treatment and infection control decisions in the trauma patient population.

J Trauma Acute Care Surg. 2018 Jan;84(1):170-174

The prevalence of chronic deep venous thrombosis in trauma: Implications for hospitals and patients.

Cannon KA, Badiee J, Wallace JD, Brill JB, Sise MJ, Bansal V, Sise CB, Shackford SR.

INTRODUCTION: Deep venous thrombosis (DVT) is considered a preventable complication in trauma patients. Hospitals risk financial penalties for DVT rates above accepted benchmarks. These penalties do not apply to chronic DVT, which develops before admission. Lower-extremity duplex ultrasound (LEDUS) can detect characteristics of thrombus chronicity, allowing differentiation of chronic from acute DVT. The objective of this study was to determine the prevalence of chronic DVT in hospitalized trauma patients.

METHODS: We performed a retrospective review of trauma patients admitted to our Level I trauma center between July 1, 2006 and October 31, 2016 who had a DVT on initial screening LEDUS. Our center utilizes screening and surveillance LEDUS for patients admitted more than 48 hours. Definitions for chronic and acute DVT were extracted from existing literature. Patients with DVT on initial LEDUS underwent review of that LEDUS to assess clot chronicity and were classified as having acute DVT, chronic DVT, or DVT of indeterminate age. Demographic data, medical history, and injury characteristics were collected. Patients with acute DVT and those with chronic DVT were compared.

RESULTS: The prevalence of chronic DVT among patients with a DVT on initial LEDUS was 29.9%. Chronic DVT occurred in patients who were older and less severely injured. An above-knee component was significantly more common in chronic DVT (65%). Only 34 (41%) of those with chronic DVT reported a history of DVT. Among the patients with chronic DVT, 44 (53%) had a subsequent LEDUS, of whom 4 (9%) showed thrombus progression and 6 (14%) formed a new DVT.

CONCLUSION: Lower-extremity duplex ultrasound can identify chronic DVT, which represents nearly 30% of all DVT found on initial screening LEDUS in trauma patients. Those with chronic DVT should receive pharmacologic and mechanical prophylaxis because of the incidence of progression and new acute DVT. They should also be counseled regarding the possibilities of recurrence and chronic venous insufficiency.

LEVEL OF EVIDENCE: Diagnostic study, level III.

World Neurosurg. 2018 Feb;110:e572-e579.

A Randomized Controlled Trial of Low-Dose Tranexamic Acid versus Placebo to Reduce Red Blood Cell Transfusion During Complex Multilevel Spine Fusion Surgery.

Carabini LM, Moreland NC, Vealey RJ, Bebawy JF, Koski TR, Koht A, Gupta DK, Avram MJ; Northwestern High Risk Spine Group.

Collaborators: Zeeni C, Gould RW, Hemmer LB, Sugrue PA, McClendon J Jr.

BACKGROUND: Multilevel spine fusion surgery for adult deformity correction is associated with significant blood loss and coagulopathy. Tranexamic acid reduces blood loss in high-risk surgery, but the efficacy of a low-dose regimen is unknown.

METHODS: Sixty-one patients undergoing multilevel complex spinal fusion with and without osteotomies were randomly assigned to receive low-dose tranexamic acid (10 mg/kg loading dose, then 1 mg·kg-1·hr-1 throughout surgery) or placebo. The primary outcome was the total volume of red blood cells transfused intraoperatively.

RESULTS: Thirty-one patients received tranexamic acid, and 30 patients received placebo. Patient demographics, risk of major transfusion, preoperative hemoglobin, and surgical risk of the 2 groups were similar. There was a significant decrease in total volume of red blood cells transfused (placebo group median 1460 mL vs. tranexamic acid group 1140 mL; median difference 463 mL, 95% confidence interval 15 to 914 mL, P = 0.034), with a decrease in cell saver transfusion (placebo group median 490 mL vs. tranexamic acid group 256 mL; median difference 166 mL, 95% confidence interval 0 to 368 mL, P = 0.042). The decrease in packed red blood cell transfusion did not reach statistical significance (placebo group median 1050 mL vs. tranexamic acid group 600 mL; median difference 300 mL, 95% confidence interval 0 to 600 mL, P = 0.097).

CONCLUSIONS: Our results support the use of low-dose tranexamic acid during complex multilevel spine fusion surgery to decrease total red blood cell transfusion.

J Card Surg. 2018 Feb;33(2):83-85

Left atrial thrombi following tranexamic acid in a bleeding trauma patient-A word of caution.

Carroll ND, Restrepo CS, Eastridge BJ, Stasik CN

ABSTRACT:
We describe the case of a bleeding trauma patient who received tranexamic acid (TXA) during air transport who subsequently developed multiple intra-cardiac thrombi. The administration of TXA during transport may be associated with this unusual presentation.

J Trauma Acute Care Surg. 2017 Dec 14. doi: 10.1097/TA.0000000000001769. [Epub ahead of print]

Speed isn't 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. HEMS total prehospital time was a median of 13minutes (IQR 6, 22) longer than GEMS. Patients with abnormal respiratory rate (OR 2.39; 95%CI 1.26-4.55, p=0.01), GCS≤8 (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).

CONCLUSIONS: Patients with abnormal respiratory rate, GCS≤8, and hemo/pneumothorax benefit from HEMS transport even when GEMS transport was faster. This may indicate 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: III, Therapeutic.

J Oral Maxillofac Surg. 2018 Jan 9. pii: S0278-2391(18)30005-3. doi: 10.1016/j.joms.2017.12.028. [Epub ahead of print]

Cricothyroid Membrane Puncture-Guided Tracheostomy: A New Technique for Emergency Airway Access.

Chen Y, Han Y, August M, Ferraro NF, Zhang Q, Zhang H

PURPOSE: We sought to compare cricothyroid membrane puncture-guided tracheostomy (CMPGT) with surgical cricothyroidotomy (SC) and percutaneous tracheostomy with Griggs' guidewire dilating forceps (GWDF) for establishing an emergency airway in a porcine model. We hypothesized that CMPGT would be associated with a shorter time to ventilation and more rapid restoration of oxygenation.

MATERIALS AND METHODS: We implemented a small pilot animal study. Eighteen miniature pigs were randomly assigned to undergo CMPGT, SC, or GWDF. The predictor variable was the technique used. The primary outcome variable was time to ventilation. Other outcome variables were efficiency of oxygenation restoration, procedure duration, and procedure-related complications. The data were assessed using 1-way analysis of variance and Bonferroni correction. The oxygen saturation (SpO2) changes over time were graphed using a time-series line plot. Statistical significance was set at $P < .05$.

RESULTS: Airways were successfully established in all 18 pigs. SC (68 ± 4 seconds) showed the shortest procedure duration compared with GWDF (95 ± 3 seconds) and CMPGT (96 ± 4 seconds); however, the time to ventilation using CMPGT (21 ± 2 seconds) was significantly shorter than that with SC (68 ± 4 seconds) and GWDF (95 ± 3 seconds) ($P < .01$). Spo2 in each group increased postoperatively, reaching 95% at 120 seconds, 131 seconds, and 144 seconds in the CMPGT, SC, and GWDF groups, respectively. The slope of the ascending phase of the Spo2 curve was 0.38 for CMPGT, 0.42 for SC, and 0.53 for GWDF ($P < .05$). Two pigs in each group had minor intraoperative bleeding, and 1 pig in the SC group had moderate bleeding.

CONCLUSIONS: The results of this animal study suggest that CMPGT is a time-efficient and safe technique for emergency airway access that allows for a more rapid return of ventilation and obviates conversion to definitive tracheostomy. Further cadaveric study is ongoing.

Injury. 2017 Nov;48(11):2379-2382

In a stable battlefield, avoid using austere surgical units to meet the golden hour of trauma time to care goal.

Childers R, Parker P

Summary

“R2s are an essential tool for operational commanders to provide care to casualties. They are important in dynamic battlefields and are also useful when the risk of casualties is low, number of troops small, or presence transient. However, once R3s and robust evacuation assets are established, care at R3s should be emphasized as care there increases the likelihood of casualty survival. While the evidence for the Golden Hour of Trauma is weak and time to treatment should not be over-emphasized, short transport time is still worth pursuing. The best way to shorten transport time is through robust evacuation resources.”

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Transfusion. 2018 Feb;58(2):313-316

Evaluation of a lateral flow-based technology card for blood typing using a simplified protocol in a model of extreme blood sampling conditions.

Clavier B, Pouget T, Sailliol A

BACKGROUND: Life-threatening situations requiring blood transfusion under extreme conditions or in remote and austere locations, such as the battlefield or in traffic accidents, would benefit from reliable blood typing practices that are easily understood by a nonscientist or nonlaboratory technician and provide quick results.

STUDY DESIGN AND METHODS: A simplified protocol was developed for the lateral flow-based device MDmulticard ABO-D-Rh subgroups-K. Its performance was compared to a reference method (PK7300, Beckman Coulter) in native blood samples from donors. The method was tested on blood samples stressed in vitro as a model of hemorrhage cases (through hemodilution using physiologic serum) and dehydration (through hemoconcentration by removing an aliquot of plasma after centrifugation), respectively.

RESULTS: A total of 146 tests were performed on 52 samples; 126 in the hemodilution group (42 for each native, diluted 1/2, and diluted 1/4 samples) and 20 in the hemoconcentration group (10 for each native and 10% concentrated samples). Hematocrit in the tested samples ranged from 9.8% to 57.6% while hemoglobin levels ranged from 3.2 to 20.1 g/dL. The phenotype profile detected with the MDmulticard using the simplified protocol resulted in 22 A, seven B, 20 O, and three AB, of which nine were D- and five were Kell positive. No discrepancies were found with respect to the results obtained with the reference method.

CONCLUSION: The simplified protocol for MDmulticard use could be considered a reliable method for blood typing in extreme environment or emergency situations, worsened by red blood cell dilution or concentration.

Am J Emerg Med. 2017 Feb;35(2):222-226. doi: 10.1016/j.ajem.2016.10.052. Epub 2016 Oct 24.

Intravenous vs. intraosseous access and return of spontaneous circulation during out of hospital cardiac arrest.

Clemency B, Tanaka K, May P, Innes J, Zagroba S, Blaszak J, Hostler D, Cooney D, McGee K, Lindstrom H

INTRODUCTION: Guidelines endorse intravenous (IV) and intraosseous (IO) medication administration for cardiac arrest treatment. Limited clinical evidence supports this recommendation. A multiagency, retrospective study was performed to determine the association between parenteral access type and return of spontaneous circulation (ROSC) in out of hospital cardiac arrest.

METHODS: This was a structured, retrospective chart review of emergency medical services (EMS) records from three agencies. Data was analyzed from adults who suffered OHCA and received epinephrine through EMS established IV or IO access during the 18-month study period. Per regional EMS protocols, choice of parenteral access type was at the provider's discretion. Non-inferiority analysis was performed comparing the association between first access type attempted and ROSC at time of emergency department arrival.

RESULTS: 1310 subjects met inclusion criteria and were included in the analysis. Providers first attempted parenteral access via IV route in 788 (60.15%) subjects. Providers first attempted parenteral access via IO route in 552 (39.85%) subjects. Rates of ROSC at time of ED arrival were 19.67% when IV access was attempted first and 19.92% when IO access was attempted first. An IO first approach was non-inferior to an IV first approach based on the primary end point ROSC at time of emergency department arrival (p=0.01).

CONCLUSION: An IO first approach was non-inferior to an IV first approach based on the end point ROSC at time of emergency department arrival.

Am J Emerg Med. 2017 Oct 7. pii: S0735-6757(17)30820-3.

A prospective study of ketamine as primary therapy for prehospital profound agitation.

Cole JB, Klein LR, Nystrom PC, Moore JC, Driver BE, Fryza BJ, Harrington J, Ho JD.

OBJECTIVE: We investigated the effectiveness of ketamine as a primary therapy for prehospital profound agitation.

METHODS: This was a prospective observational study of patients receiving 5mg/kg of intramuscular ketamine for profound agitation, defined as a score of +4 on the Altered Mental Status Scale (AMSS), a validated ordinal scale of agitation from -4 (unresponsive) to +4 (most agitated). The primary outcome was time to adequate sedation (AMSS<+1). Secondary outcomes included need for additional sedatives, intubation frequency, complications associated with ketamine, and mortality.

RESULTS: Forty-nine patients were enrolled. Median age was 29years (range 18-66); 76% (37/49) were male. Median time to adequate sedation was 4.2min (95% CI: 2.5-5.9, range 1-25min) and 90% (44/49) had adequate sedation prehospital. Seven patients (14%) received a second sedative prehospital. Intubation occurred in 57% (28/49) of patients. Mechanical ventilation lasted <24h in 82% (23/28) of patients, and <48h in 96% (27/28) of patients. A single physician intubated 36% (10/28) of the patients. Complications related to ketamine included hypersalivation (n=9, 18%), vomiting (n=3, 6%), and emergence reaction (n=2, 4%). One patient died from complications of septic shock on hospital day 29, likely unrelated to ketamine.

CONCLUSIONS: In patients with prehospital profound agitation, ketamine provides rapid effective sedation when used as a primary therapy. Intubation was common but accompanied by a short duration of mechanical ventilation and appears to have been subject to individual physician practice variation.

Adv Emerg Nurs J. 2018 Jan/Mar;40(1):27-35.

Tranexamic Acid: Promise or Panacea: The Impact of Air Medical Administration of Tranexamic Acid on Morbidity, Mortality, and Length of Stay.

Cornelius BG, McCarty K, Hylan K, Cornelius A, Carter K, Smith KWG, Ristic S, Vining D, Cvek U, Trutschl M.

ABSTRACT:
The MATTERs and CRASH-2 studies demonstrate that tranexamic acid (TXA) reduces mortality in patients with traumatic hemorrhage. However, their results, conducted in foreign countries and with U.S. military soldiers, provoke concerns over generalizability to civilian trauma patients in the United States was reported. The evaluation of patient outcomes following treatment with TXA by a civilian air medical program. A retrospective chart review of trauma patients transported by air service to a Level 1 trauma center was conducted. For the purposes of intervention evaluation, patients meeting this criterion for the 2 years (2012-2014) prior to therapy implementation were compared with patients treated during the 2-year study period (2014-2016). Goals were to evaluate morbidity, mortality, and length of stay. During the review, 82 control and 49 study patients were identified as meeting inclusion criteria. Patients in the control group were found to be less acute, which correlated with shorter hospital stays and better discharge outcomes. Multiple patients in the study group who should have expired according to a significantly elevated Trauma Revised Injury Severity Score (TRISS) survived, whereas multiple patients in the control group expired despite a low TRISS calculation. This is the first outcome-based study conducted in a U.S. trauma system. The outcomes in civilian trauma patients in the United States do not follow that of the previous MATTERs and CRASH-2 studies. However, this study still shows benefit to TXA administration and reduced risk for administration to patients with head trauma and occurrence of venous thromboembolism. Randomized control trials are needed to evaluate the role of TXA administration in the United States.

J Spec Oper Med. Winter 2017;17(4):76-79

Expeditionary Resuscitation Surgical Team: The US Army's Initiative to Provide Damage Control Resuscitation and Surgery to Forces in Austere Settings.

D'Angelo M, Losch J, Smith B, Geslak M, Compton S, Wofford K, Seery JM, Morrison M, Wedmore I, Paimore J, Gross K, Cuenca PJ, Welder MD.

ABSTRACT:
Improvements in surgical care on the battlefield have contributed to reduced morbidity and mortality in wounded Servicemembers. 1 Point-of-injury care and early surgical intervention, along with improved personal protective equipment, have produced the lowest casualty statistics in modern warfare, resulting in improved force strength, morale, and social acceptance of conflict. It is undeniable that point-of-care injury, followed by early resuscitation and damage control surgery, saves lives on the battlefield. The US Army's Expeditionary Resuscitation Surgical Team (ERST) is a highly mobile, interprofessional medical team that can perform damage control resuscitation and surgery in austere locations. Its configuration and capabilities vary; however, in general, a typical surgical element can perform one major surgery and one minor surgery without resupply. The critical care element can provide prolonged holding in garrison, but this diminishes in the austere setting with complex and acutely injured patients.

Rheumatol Int. 2017 Dec;37(12):2071-2078

Meloxicam and risk of myocardial infarction: a population-based nested case-control study.

Dalal D, Dubreuil M, Peloquin C, Neogi T, Zhang Y, Choi H, Felson D

ABSTRACT:
Certain non-steroidal anti-inflammatory drugs (NSAIDs) have been associated with an increased risk of myocardial infarction (MI), a risk linked to cyclo-oxygenase-2 inhibition. There are limited studies assessing the risk of MI associated with meloxicam, an increasingly popular drug with COX-2 inhibiting properties. A nested matched case-control study using The Health Improvement Network, a UK population-based database was conducted. NSAID users between 35 and 89 years of age with at least 1 year enrollment in the cohort were included. Incident MI cases were matched on age, sex, practice and event date with up to 4 controls. NSAID exposure was categorized as remote (between 60 days and 1 year), recent (between 1 and 60 days) or current relative to the event date. Current users were further classified as naproxen (negative control), diclofenac (positive control), meloxicam or other NSAID users. Multivariable conditional logistic regression was conducted to determine the risk of MI for each NSAID use categories compared with that of remote users. 9291 MI cases were matched with 30,676 controls. The cases had a higher prevalence of traditional cardiac risk factors, chronic kidney disease and inflammatory arthritis and cardioprotective drug utilization. The adjusted odds ratio of MI for current user compared to remote users were: meloxicam 1.38 (1.17-1.63), naproxen 1.12 (0.96-1.30) and diclofenac 1.37 (1.25-1.50). In this large population-based study, meloxicam increased the risk of MI by 38%. This study warrants cautious use of this increasingly popular drug.

Indian J Anaesth. 2017 Dec;61(12):972-977.

A randomised controlled trial comparing ProSeal laryngeal mask airway, i-gel and Laryngeal Tube Suction-D under general anaesthesia for elective surgical patients requiring controlled ventilation.

Das B, Varshney R, Mitra S

Background and Aims: The ProSeal™ laryngeal mask airway (PLMA), i-gel™ and Laryngeal Tube Suction-D (LTS-D™) have previously been evaluated alone or in pair-wise comparisons but differing study designs make it difficult to compare the results. The aim of this study was to compare the clinical performance of these three devices in terms of efficacy and safety in patients receiving mechanical ventilation during elective surgical procedures.

Methods: This prospective, randomised, double-blind study was conducted on 150 American Society of Anesthesiologists physical status I-II patients, randomly allocated into 3 groups, undergoing elective surgical procedures under general anaesthesia. PLMA, i-gel™ or LTS-D™ appropriate for weight or/and height was inserted. Primary outcome measured was airway sealing pressure. Insertion time, ease of insertion, number of attempts, overall success rate and the incidence of airway trauma and complications were also recorded. Intergroup differences were compared using one-way analysis of variance with post hoc correction for continuous data and Chi-square test for categorical variables.

Results: Overall success rate was comparable between the three devices (i-gel™ 100%, LTS-D™ 94%, PLMA 96%). Airway sealing pressure was lower with i-gel™ (23.38 ± 2.06 cm H2O) compared to LTS-D™ (26.06 ± 2.11 cm H2O) and PLMA (28.5 ± 2.8 cm H2O; $P < 0.0005$). The mean insertion time was significantly more in PLMA (38.77 ± 3.2 s) compared to i-gel™ (27.9 ± 2.53 s) and LTS-D™ (21.66 ± 2.31 s; $P < 0.0005$).

Conclusion: Airway sealing pressure and insertion time were significantly higher in PLMA compared to i-gel™ and LTS-D™.

J Trauma Acute Care Surg. 2018 Jan;84(1):192-202

The pitfalls of resuscitative endovascular balloon occlusion of the aorta: Risk factors and mitigation strategies.

Davidson AJ, Russo RM, Reva VA, Brenner ML, Moore LJ, Ball C, Bulger E, Fox CJ, DuBose JJ, Moore EE, Rasmussen TE; BEST Study Group.

ABSTRACT:
Despite technological advancements, REBOA is associated with significant risks due to complications of vascular access and ischemia-reperfusion. The inherent morbidity and mortality of REBOA is often compounded by coexisting injury and hemorrhagic shock. Additionally, the potential for REBOA-related injuries is exaggerated due to the growing number of interventions being performed by providers who have limited experience in endovascular techniques, inadequate resources, minimal training in the technique, and who are performing this maneuver in emergency situations. In an effort to ultimately improve outcomes with REBOA, we sought to compile a list of complications that may be encountered during REBOA usage. To address the current knowledge gap, we assembled a list of anecdotal complications from high-volume REBOA users internationally. More importantly, through a consensus model, we identify contributory factors that may lead to complications and deliberate on how to recognize, mitigate, and manage such events. An understanding of the pitfalls of REBOA and strategies to mitigate their occurrence is of vital importance to optimize patient outcomes.

Am J Surg. 2018 Feb 2. pii: S0002-9610(17)31625-2. doi: 10.1016/j.amjsurg.2018.01.016. [Epub ahead of print]

Tele-mentored damage-control and emergency trauma surgery: A feasibility study using live-tissue models.

Dawe P, Kirkpatrick A, Talbot M, Beckett A, Garraway N, Wong H, Hameed SM

BACKGROUND: Damage-control and emergency surgical procedures in trauma have the potential to save lives. They may occasionally not be performed due to clinician inexperience or lack of comfort and knowledge.

METHODS: Canadian Armed Forces (CAF) non-surgeon Medical Officers (MOs) participated in a live tissue training exercise. They received tele-mentoring assistance using a secure video-conferencing application on a smartphone/tablet platform. Feasibility of tele-mentored surgery was studied by measuring their effectiveness at completing a set series of tasks in this pilot study. Additionally, their comfort and willingness to perform studied procedures was gauged using pre- and post-study surveys.

RESULTS: With no pre-procedural teaching, participants were able to complete surgical airway, chest tube insertion and resuscitative thoracotomy with 100% effectiveness with no noted complications. Comfort level and willingness to perform these procedures were improved with tele-mentoring. Participants felt that tele-mentored surgery would benefit their performance of resuscitative thoracotomy most.

CONCLUSION: The use of tele-mentored surgery to assist non-surgeon clinicians in the performance of damage-control and emergency surgical procedures is feasible. More study is required to validate its effectiveness.

J Trauma Acute Care Surg. 2018 Mar;84(3):454-458

Is observation for traumatic hemothorax safe?

Demetri L, Martinez Aguilar MM, Bohnen JD, Whitesell R, Yeh DD, King D, de Moya M.

BACKGROUND: Eastern Association for the Surgery of Trauma guidelines suggest tube thoracostomy (TT) be considered for all traumatic hemothoraces. However, previous research has suggested that some traumatic hemothoraces may be observed safely. We sought to (1) determine the safety of selective observation for traumatic hemothorax and (2) identify predictors of failed observation.

METHODS: All patients with traumatic hemothorax from 2000 to 2014 at a Level I trauma center were identified and categorized by size as small (<300 cc) or large (≥300 cc) based on chest computed tomography (CT) scan measurements. Patients with no CT or with TT placement before CT were excluded. Patients were categorized into four intervention groups: (i) early TT (<24 hours after CT), (ii) failed observation (TT ≥24 hours after CT), (iii) successful observation (no TT), and (iv) inevaluable due to early mortality (no TT but died within 7 days). Univariate analyses compared outcomes between groups. Multivariate analyses identified independent predictors of failed observation.

RESULTS: Three hundred forty patients met the inclusion criteria. 156 (46%) patients received early TT. Of the 184 patients that were initially observed, 121 (66%) were successfully observed, 53 (29%) failed observation, and 10 (5%) were inevaluable due to early mortality. Most of the successfully observed hemothoraces were small (119/121, 98%). Four independent predictors of failed observation were identified: older age, fewer ventilation-free days, large hemothorax, concurrent pneumothorax. Patients, who received TT were more likely than non-TT patients to receive tissue plasminogen activator, develop an empyema, have fewer hospital-free days, and are discharged to rehabilitation rather than home. When compared to early TT, failed observation was associated with a higher likelihood of discharge to rehabilitation but no difference in mortality, hospital-free days, or rate of empyema.

CONCLUSION: Initial observation in select patients is safe and may result in better outcomes. The identified predictors of failed observation can help in clinical decision making regarding the need for TT in patients with traumatic hemothorax.

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

Turk J Anaesthesiol Reanim. 2017 Oct;45(5):270-276

Clinical Comparison of I-Gel Supraglottic Airway Device and Cuffed Endotracheal Tube for Pressure-Controlled Ventilation During Routine Surgical Procedures.

Dhanda A, Singh S, Bhalotra AR, Chavali S

Objective: Recently, there has been a trend favouring the use of supraglottic airway devices over endotracheal tubes (ETT) during short surgical procedures. In this study, we are going to assess the suitability of one such supraglottic airway device, i-gel, for pressure-controlled ventilation (PCV) during routine surgical procedures.

Methods: The airway management for 60 patients was done with either i-gel (Group I) or cuffed tracheal tube (Group E) for this prospective, randomised, double-blinded study. Insertion time, number of attempts, ease of insertion and haemodynamic monitoring were recorded before, during and after insertion of these devices. Airway leak tests, leak volume and leak fraction were measured at 15, 20 and 25 cm H2O PCV, and pharyngolaryngeal morbidity was evaluated postoperatively.

Results: I-gel is easier to insert than a tracheal tube ($p=0.0056$). The increase in heart rate and MAP was higher following insertion of tracheal tube in the first few minutes ($p<0.001$) and subsequently became comparable between the two groups. The leak volume and leak fraction between the two groups were comparable at 15 cm H2O PCV, but significant difference was seen at 20 and 25 H2O PCV between the two groups ($p=0.232$, $p<0.001$, $p<0.001$). Thirty minutes later, the leak volume and leak fraction between groups were comparable at 15 cm H2O PCV ($p=0.495$, $p=0.104$) but not at 20 and 25 H2O PCV ($p<0.001$, $p<0.001$). Pharyngolaryngeal morbidity was significantly lesser in the i-gel group.

Conclusion: I-gel provides a reasonable alternative to cuffed ETT for pressure-controlled ventilation provided the pressures can be limited to 15 to 20 cm H2O.

J Trauma Acute Care Surg. 2018 Jan;84(1):75-80.

The temporal response and mechanism of action of tranexamic acid in endothelial glycocalyx degradation.

Diebel ME, Martin JV, Liberati DM, Diebel LN.

BACKGROUND: The endothelial glycocalyx (GCX) plays an important role in vascular barrier function. Damage to the GCX occurs due to a variety of causes including hypoxia, ischemia-reperfusion, stress-related sympathoadrenal activation, and inflammation. Tranexamic acid (TXA) may prevent GCX degradation. The therapeutic window for TXA administration and the mechanism of action has been under review. Membrane-anchored proteases (sheddases) are key components in endothelial cell biology including the regulation of vascular permeability. The effect of TXA administration on stress-related GCX damage, and the role of sheddases in this process was studied in a cell-based model.

METHODS: Confluent human umbilical vein endothelial cells (HUVEC) were exposed to hydrogen peroxide and/or epinephrine (EPI) to stimulate postshock reperfusion. TXA was added at various times after hydrogen peroxide (H2O2) and/or EPI exposure. GCX degradation was indexed by syndecan-1 and hyaluronic acid release. Activation of endothelial sheddases was indexed by A Disintegrin and Metalloproteinase-17 and matrix metalloproteinase-9 activity in culture supernatants.

RESULTS: Exposure of HUVEC to either/both EPI and H2O2 resulted in a cellular stress and GCX disruption demonstrated by increased levels of syndecan-1 shedding, hyaluronic acid release, tumor necrosis factor-α release. Shedding of these GCX components was associated with increased activity of both A Disintegrin and Metalloproteinase-17 and matrix metalloproteinase. Disruption of the GCX was further demonstrated via fluorescent imaging, which demonstrated disruption after exposure to either/both H2O2 and EPI. Early administration of either TXA or doxycycline resulted in preservation of the GCX. Late administration of TXA had no effect, whereas doxycycline had some residual protective effect.

CONCLUSION: Tranexamic acid as a serine protease inhibitor prevented GCX degradation via inhibition of endothelial sheddase activation. This effect was not apparent when TXA was administered greater than 60 minutes after "simulated" reperfusion. Our study supports the clinical practice of early TXA administration in the severely injured patient.

Dory R, Bequette J, Cox D

Evaluation of extremity tourniquet designs during self-application in the hands of military service members.

Naval Medical Research Unit San Antonio;NAMRU-SA Report #2017-54

EXECUTIVE SUMMARY

BACKGROUND: Since doctrinal changes made in 2005, tourniquets have become standard issue equipment for the US warfighter operating in the tactical environment. Previous Joint Operational Evaluation of Field Tourniquets (JOEFT) studies have gathered performance data to compare commercially available tourniquet designs utilizing instrumented mannequin systems, as well as synthetic cadaver models of severe hemorrhage; however, human end-user testing remains critical for identifying those tourniquet designs best suited for use by our military service members.

OBJECTIVE: To compare the performance of three candidate tourniquets, the Combat Application Tourniquet® (CAT), Ratcheting Medical Tourniquet™ (RMT), and Tactical Mechanical Tourniquet (TMT), in the hands of military end-users during selfapplications.

METHODS: Fifty five volunteer participants (*n=55*) were first trained to correctly position and apply each tourniquet design, according to the manufacturers' instructions for use, on instrumented mannequins designed for tourniquet training. Participants then self-applied each tourniquet once to their arm and once to their leg, halting at cessation of the distal pulse. Occlusion was maintained for one minute. Measurements included success/failure rate, applications time, discomfort, and participant preference and feedback. **Results:** Of the three tourniquet designs, the CAT achieved the highest combined success rate across arm and leg applications (97.27%), followed by the RMT (94.55%) and the TMT (90.91%). The CAT had the shortest arm application time (43.6 ± 18.2 sec) and was significantly faster ($p < 0.05$) than the TMT (67.6 ± 30.5 sec) but not the RMT (44.2 ± 22.3 sec). The CAT also had the shortest leg application time (40.4 ± 13.0) and was significantly faster ($p < 0.05$) than the RMT and TMT (47.4 ± 17.9 sec and 48.0 ± 13.2 sec, respectively). The three tourniquets did not differ in reported discomfort levels. The CAT was most often ranked the preferred tourniquet design for arm (51.9%) followed by the RMT (38.9%) and TMT (9.3%). The CAT also ranked most preferred for the leg (41.5%) followed by the RMT (30.2%) and TMT (28.3%).

CONCLUSIONS: Because buddy aid or aid from a medic or corpsman is never guaranteed, it is imperative that tourniquets can be quickly applied by those who must administer self-aid. The results of the present study provide data that differentiate the three tourniquet designs through measures of tourniquet success, application times, and user feedback. These data can be used to identify which current design(s) are best suited for use by our warfighter, and to identify opportunities to improve existing tourniquet features in subsequent generations of tourniquet designs.

Injury. 2018 Feb;49(2):284-289.

The value of 'binder-off' imaging to identify occult and unexpected pelvic ring injuries.

Fagg JAC, Acharya MR, Chesser TJS, Ward AJ

AIMS: To determine the effectiveness of 'binder-off' plain pelvic radiographs in the assessment of pelvic ring injuries.

PATIENTS AND METHODS: All patients requiring operative intervention at our tertiary referral pelvic unit/major trauma centre for high-energy pelvic injuries between April 2012 and December 2014 were retrospectively identified. Pre-operative pelvic imaging with and without pelvic binder was reviewed with respect to fracture pattern and pelvic stability. The frequency with which the imaging without pelvic binder changed the opinion of the pelvic stability and need for operative intervention, when compared with the computed tomography (CT) scans and anteroposterior (AP) radiographs with the binder on, was assessed.

RESULTS: Seventy-three percent (71 of 97) of patients had initial imaging with a pelvic binder in situ. Of these, 76% (54 of 71) went on to have 'binder-off' imaging. Seven percent (4 of 54) of patients had unexpected unstable pelvic ring injuries identified on 'binder-off' imaging that were not identified on CT imaging in binder.

CONCLUSIONS: Trauma CT imaging of the pelvis with a pelvic binder in place is inadequate at excluding unstable pelvic ring injuries, and, based on the original findings in this paper, we recommend additional plain film 'binder-off' radiographs, when there is any clinical concern.

J Trauma Acute Care Surg. 2017 Dec;83(6):1205-1212

For the patient - Evolution in the management of vascular trauma.

Feliciano DV

ABSTRACT:
There has been an evolution in the diagnosis and management of vascular trauma over the past 100 years. The primary stimulus to these changes has been the increased volume of patients with cervical, truncal, and peripheral vascular injuries during military conflicts and in civilian life. Patients with "hard" signs of a vascular injury are taken to surgery emergently with a few exceptions to be described. In contrast, patients with "soft" signs of a vascular injury undergo a careful physical examination including measurement of vascular index to determine if radiologic imaging is necessary. Computed tomography arteriography has become the most commonly used method of imaging, whereas duplex ultrasonography is used in some centers. Non-operative management is now common for nonocclusive injuries diagnosed on computed tomography arteriography. Proximal tourniquets are commonly used to control exsanguinating hemorrhage from injuries to extremities, whereas balloons can be used to control hemorrhage from difficult to expose areas at operation. Temporary intraluminal shunts are now used in 3% to 9% of arterial injuries. Operative techniques of repair have been refined and contribute to the excellent results noted in modern trauma centers.

Tex Med. 2018;114(1):12–14.

Mandatory Hemorrhage Control Training for Health Care Professionals: A Solution to Inadequate Bystander Participation Commentary — January 2018

Fisher A

Quote:

“Evidence that tourniquets save lives in combat and the preventable death studies from the wars in Iraq and Afghanistan influenced efforts to do the same in civilian settings. This began with emergency services, including emergency medical technicians, paramedics, and firefighters, and now has expanded to police departments.

Collaborations between the American College of Surgeons and the Department of Homeland Security have helped create programs like "Stop the Bleed" and bleedingcontrol.org, which teach bystanders how to identify and treat life-threatening hemorrhage with direct pressure, tourniquets, and wound packing.

Unfortunately, there is little expectation for civilian medical professionals to learn these skills. Hemorrhage control is not mandatory training in the majority of medical schools, but cardiopulmonary resuscitation/basic life support (CPR/BLS) training is often required before matriculating. When physicians apply for privileges, hospitals typically do not require hemorrhage control training; again, many require CPR/BLS training.

Why does the health care system expect bystanders to control hemorrhage but doesn’t have similar expectations for the people who make up the same system?

The solution starts with hospitals mandating hemorrhage control training as a condition of employment. Physician credentialing should include mandatory training to identify and treat life-threatening hemorrhage.

The next logical step is to teach hemorrhage control early in medical school, which can be accomplished with the assistance of emergency medical services and other emergency health care professionals until an adequate number of physicians and medical students are trained. At that point, we can take ownership and train medical students. These efforts will give the medical students a real-life skill and help them understand the importance of preventable death from hemorrhage.

Eventually, these students could teach hemorrhage control to the community. In turn, we will help create community outreach projects that will benefit bystanders and future medical leaders alike. We as health care professionals cannot expect the bystander to learn the importance of hemorrhage control and trauma care while continuing to ignore the importance of these skills for ourselves. Truly addressing the impact of trauma and accidents on our population starts with the health care professional.”

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

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

Floyd CT(1), Padua RA(2), Olson CE(2).

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

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

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

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

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

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

J Trauma Acute Care Surg. 2018 Jan;84(1):150-156

Measuring US Army medical evacuation: Metrics for performance improvement.

Galvagno SM Jr, Mabry RL, Maddry J, Kharod CU, Walrath BD, Powell E, Shackelford S.

BACKGROUND: The US Army medical evacuation (MEDEVAC) community has maintained a reputation for high levels of success in transporting casualties from the point of injury to definitive care. This work served as a demonstration project to advance a model of quality assurance surveillance and medical direction for prehospital MEDEVAC providers within the Joint Trauma System.

METHODS: A retrospective interrupted time series analysis using prospectively collected data was performed as a process improvement project. Records were reviewed during two distinct periods: 2009 and 2014 to 2015. MEDEVAC records were matched to outcomes data available in the Department of Defense Trauma Registry. Abstracted deidentified data were reviewed for specific outcomes, procedures, and processes of care. Descriptive statistics were applied as appropriate.

RESULTS: A total of 1,008 patients were included in this study. Nine quality assurance metrics were assessed. These metrics were: airway management, management of hypoxemia, compliance with a blood transfusion protocol, interventions for hypotensive patients, quality of battlefield analgesia, temperature measurement and interventions, proportion of traumatic brain injury (TBI) patients with hypoxemia and/or hypotension, proportion of traumatic brain injury patients with an appropriate assessment, and proportion of missing data. Overall survival in the subset of patients with outcomes data available in the Department of Defense Trauma Registry was 97.5%.

CONCLUSION: The data analyzed for this study suggest overall high compliance with established tactical combat casualty care guidelines. In the present study, nearly 7% of patients had at least one documented oxygen saturation of less than 90%, and 13% of these patients had no documentation of any intervention for hypoxemia, indicating a need for training focus on airway management for hypoxemia. Advances in battlefield analgesia continued to evolve over the period when data for this study was collected. Given the inherent high-risk, high-acuity nature of prehospital advanced life support and emphasis on the use of nonphysician practitioners in an out-of-hospital setting, the need for ongoing medical oversight and quality improvement assessment is crucial.

LEVEL OF EVIDENCE: Care management, level IV.

Ann Surg. 2018 Jan 25. doi: 10.1097/SLA.0000000000002691. [Epub ahead of print]

A Framework for a Battlefield Trauma System for Civilians.

Garber K, Stewart BT, Burkle FM Jr, Kushner AL, Wren SM

Quotes:

"Trauma systems are proven to reduce death and disability from injuries.1 Since 2001, the development of a frontline battlefield trauma system for United States and other NATO military forces in Afghanistan and Iraq has led to a historic reduction in battlefield deaths.2 This system now cares for wounded soldiers from the site of injury through definitive care and rehabilitation thousands of miles away. Important components include basic first aid for each soldier, widespread teaching and use of Tactical Combat Casualty Care (TCCC) including personal tourniquets and training in their use, rapid evacuation, early resuscitation, damage control surgery, integrated communication and coordination, and robust data collection and quality improvement programming. Combined these interventions have helped reduce deaths and disabilities."

"To assist WHO and other humanitarian organizations working to establish a coordinated and more functional battlefield trauma system for civilian care in the future, we propose a framework based on the widely-accepted WHO Emergency Care Systems Framework.10 The framework has 2 parts. First, an overarching schema including: coordination, communications, transportation, health information systems, education and training, and research (Table 1). Each of these components play a vital role in ensuring optimal battlefield care for injured civilians and should be explicitly addressed by planners. The second schema includes specifics for locations, providers, and activities within the system and approximates NATO roles of care (Table 2). It is important to recognize 2 distinctions between military and civilian trauma care: civilians injured on the battlefield may not always receive the same immediate first aid or TCCC as soldiers; they do not have the personal protective gear such as body armor or eye shields that even the most rudimentary military forces use and injured civilians are often vulnerable populations. Additionally, civilians are often children, elderly, pregnant or have more medical co-morbidities than healthy, young, fit soldiers. These distinctions should be considered during battlefield civilian trauma care system planning. As the nature of war has changed and civilians are increasingly subject to injuries,11,12 it is our hope that this framework helps to change the way civilian trauma care is administered on the battlefield and be considered by WHO and other stakeholders that provide such care. Applying a comprehensive systems approach to civilian battlefield care will strengthen such efforts."

J Thromb Haemost. 2018 Mar;16(3):481-489

French lyophilized plasma versus fresh frozen plasma for the initial management of trauma-induced coagulopathy: a randomized open-label trial.

Garrigue D, Godier A, Glacet A, Labreuche J, Kipnis E, Paris C, Duhamel A, Resch E, Bauters A, Machuron F, Renom P, Goldstein P, Tavernier B, Sailliol A, Susen S

ESSENTIALS: An immediate supply of plasma in case of trauma-induced coagulopathy is required. The Traucc trial compared French Lyophilised Plasma (FLyP) and Fresh Frozen Plasma (FFP). FLyP achieved higher fibrinogen concentrations compared with FFP. FLyP led to a more rapid coagulopathy improvement than FFP.SUMMARY:

BACKGROUND: Guidelines recommend beginning hemostatic resuscitation immediately in trauma patients. We aimed to investigate if French lyophilized plasma (FLyP) was more effective than fresh frozen plasma (FFP) for the initial management of trauma-induced coagulopathy.

METHODS: In an open-label, phase 3, randomized trial (NCT02750150), we enrolled adult trauma patients requiring an emergency pack of 4 plasma units within 6 h of injury. We randomly assigned patients to receive 4-FLyP units or 4-FFP units. The primary endpoint was fibrinogen concentration at 45 min after randomization. Secondary outcomes included time to transfusion, changes in hemostatic parameters at different time-points, blood product requirements and 30-day in-hospital mortality.

RESULTS: Forty-eight patients were randomized (FLyP, n = 24; FFP, n = 24). FLyP reduced the time from randomization to transfusion of first plasma unit compared with FFP (median[IQR],14[5-30] vs. 77[64-90] min). FLyP achieved a higher fibrinogen concentration 45 min after randomization compared with FFP (baseline-adjusted mean difference, 0.29 g L-1 ; 95% confidence interval [CI], 0.08-0.49) and a greater improvement in prothrombin time ratio, factor V and factor II. The between-group differences in coagulation parameters remained significant at 6 h. FLyP reduced fibrinogen concentrate requirements. Thirty-day in-hospital mortality rate was 22% with FLyP and 29% with FFP.

CONCLUSION: FLyP led to a more rapid, pronounced and extended increase in fibrinogen concentrations and coagulopathy improvement compared with FFP in the initial management of trauma patients. FLyP represents an attractive option for trauma management, especially when facing logistical issues such as combat casualties or mass casualties related to terror attacks or disasters.

J Cardiothorac Vasc Anesth. 2017 Dec 5. pii: S1053-0770(17)30986-2. doi: 10.1053/j.jvca.2017.12.001. [Epub ahead of print]

Tranexamic Acid Use in Cardiac Surgery: Hemostasis, Seizures, or a Little of Both.

Gerstein NS, Deriy L, Patel PA

Quote:

"In summary, Maeda et al demonstrate and corroborate that TXA's use in cardiac surgery reduces bleeding risk without a concomitant increase in thromboembolic complications or an increase in mortality. These benefits should be tempered carefully by the extant seizure risk. However, the seizure risk with TXA in cardiac surgery can be approached rationally and mitigated. For the highest risk patients (ie, elderly, preexisting renal insufficiency or seizure disorder, or prolonged open procedures), a lower dose of TXA should be considered, epsilon-aminocaproic acid should be considered as an alternative agent, and additional blood conservation techniques should be used. Lastly, although not supported by the current literature, consideration should be given to the prophylactic administration of an anti-seizure agent (ie, phenytoin or levetiracetam) and/or the use of postoperative propofol sedation if higher doses of TXA are needed and the risk of postoperative seizures is significant."

Surgery. 2017 Nov;162(5):1055-1062

Crystalloid versus colloid fluids for reduction of postoperative ileus after abdominal operation under combined general and epidural anesthesia.

Ghodraty MR, Rokhtabnak F, Dehghan HR, Pournajafian A, Baghaee Vaji M, Koleini ZS, Porhomayon J, Nader ND

BACKGROUND: The main objective of this study was to compare the effect of perioperative administration of crystalloid versus colloid solutions and its impact on reversal of ileus after resection with primary anastomosis of intestine. We hypothesized that inclusion of colloids will improve the return of intestinal motility.

METHODS: In a double-blinded clinical trial, 91 the American Society of Anesthesiologists I to III patients undergoing abdominal operation for resection with anastomosis of small or large intestine were randomized to receive either lactated Ringer solution crystalloid group or 6% hydroxyethyl starch colloid group to replace intraoperative fluid loss (blood loss + third space). The time to resume normal intestinal motility was the primary end point and the prevalence of composite postoperative complications was the secondary end point.

RESULTS: Average duration of ileus was 86.7 ± 23.6 hours in crystalloid group and it lasted 73.4 ± 20.8 hours in colloid group (P = .006). While there was no difference in the frequency of postoperative nausea and vomiting between the 2 groups (P = .3), the actual vomiting occurred less frequently in colloid group (P = .02). Serum concentrations of potassium ion decreased significantly in both groups, whereas the degree of potassium changes was more remarkable in colloid group compared with crystalloid group (P = .03). Postoperative ileus did not correlate with sex, age, and the duration of operation. Duration of hospital stay was similar between the 2 groups.

CONCLUSION: We concluded that administration of colloids as a part of perioperative fluid management improves intestinal motility and shortens the duration of ileus after gastrointestinal operations. This may improve the tolerance for enteral feeding and reduce ileus-related symptoms.

J Antimicrob Chemother. 2017 Dec 13. doi: 10.1093/jac/dkx477. [Epub ahead of print]

Population pharmacokinetics and probability of target attainment of ertapenem administered by subcutaneous or intravenous route in patients with bone and joint infection.

Goutelle S, Valour F, Gagnieu MC(6), Laurent F(3)(5), Chidiac C(3)(4)(5), Ferry T(3)(4)(5); Lyon Bone and Joint Infection Study Group.

Collaborators: Ferry T, Valour F, Perpoint T, Boibieux A, Biron F, Miailhes P, Ader F, Becker A, Roux S, Triffault-Fillit C, Daoud F, Lippman J, Braun E, Chidiac C, Gillet Y, Hees L, Lustig S, Servien E, Herry Y, Gaillard R, Schneider A, Fessy MH, Viste A, Chaudier P, Desmarchelier R, Mouton T, Courtin C, Louboutin L, Martres S, Trouillet F, Barrey C, Signorelli F, Jouanneau E, Jacquesson T, Mojallal A, Boucher F, Shipkov H, Ismail M, Chateau J, Aubrun F, Bobineau I, Macabéo C, Laurent F, Vandenesch F, Rasigade JP, Dupieux C, Craighero F, Boussel L, Pialat JB, Morelec I, Janier M, Giammarile F, Tod M, Gagnieu MC, Goutelle S, Gerbier-Colomban S, Benet T, Mabrut E.

Background: Ertapenem is a therapeutic option in patients with Gram-negative bone and joint infection (BJI). The subcutaneous (sc) route of administration is convenient in the outpatient setting and has shown favourable pharmacokinetics (PK), but available data on ertapenem are limited.

Objectives: To perform population PK analysis and pharmacokinetic/pharmacodynamics (PK/PD) simulation of ertapenem administered by the intravenous (iv) or sc route to patients with BJI.

Patients and methods: This was a retrospective analysis of PK data collected in patients with BJI who received iv or sc ertapenem. Measured ertapenem concentrations were analysed with a non-parametric population approach. Then, simulations were performed based on the final model to investigate the influence of ertapenem route of administration, dosage and renal function on the probability of achieving a pharmacodynamic (PD) target, defined as the percentage of time for which free plasma concentrations of ertapenem remained above the MIC (fT>MIC) of 40%.

Results: Forty-six PK profiles (13 with iv and 33 with sc ertapenem) with a total of 133 concentrations from 31 subjects were available for the analysis. A two-compartment model with linear sc absorption and linear elimination best fitted the data. Creatinine clearance was found to significantly influence ertapenem plasma clearance. Simulations showed that twice daily dosing, sc administration and renal impairment were associated with an increase in fT>MIC and target attainment.

Conclusions: Our results indicate that 1 g of ertapenem administered twice daily, by the iv or sc route, may optimize ertapenem exposure and achievement of PK/PD targets in patients with BJI.

Am J Obstet Gynecol. 2018 Feb;218(2):219.e1-219.e4

How shall we transfuse Hippolyta?

Graham BC, Graham LJ, Rose CH, Winters JL

ABSTRACT:
The US Department of Defense recently made the decision to open direct ground combat roles to women. Blood product transfusion is an essential component of the US Military guidelines for tactical combat casualty care and damage control resuscitation, but blood transfusion carries with it the specific side effect of alloimmunization-a uniquely significant side effect for young women who may desire subsequent pregnancies. Presently to be considered are the changes that may need to be made to blood transfusion in the setting of battlefield medicine to optimally care for combat-injured women, as a majority of the existing data regarding the risks of transfusion in the trauma setting involve predominantly men. This article delves into the possibility of a new cohort of women at risk for hemolytic disease of the fetus and newborn, the need for women's health professionals to appropriately counsel women considering serving in direct ground combat roles about this specific risk, and the appropriate steps that should be considered to provide these women optimal medical care.

J Clin Diagn Res. 2017 Sep;11(9):PD12-PD13

Delayed Tension Pneumothorax - Identification and Treatment in Traumatic Bronchial Injury: An Interesting Presentation.

Gupta A, Rattan A, Kumar S, Rathi V

ABSTRACT:
A 13-year-old girl, who did not receive any treatment for few hours following Road Traffic Injury (RTI), reported to the Casualty Department and found to have patent airway with clinically normal C spine, air-hunger (RR 42/minute), trachea deviated to left, distended neck veins and absent breath sounds on the right side. The chest X-ray she carried, done immediately after the injury, showed right sided tension pneumothorax. She was put on oxygen at 11 L/minute and an Intercostal chest tube drainage (ICD) was inserted on right side. Her oxygen saturation (40%) failed to improve. ICD bag showed continuous bubbling and air entry remained absent on the right side. An urgent right thoracotomy was done which revealed right main bronchus tear; the tear was repaired using interrupted Prolene® sutures. Patient recovered well and was discharged 10 days later in a stable condition.

Acad Emerg Med. 2018 Feb;25(2):148-167

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

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

INTRODUCTION: Optimal teaching and assessment methods and models for emergency airway, breathing, and hemorrhage interventions are not currently known. The University of Minnesota Combat Casualty Training consortium (UMN CCTC) was formed to explore the strengths and weaknesses of synthetic training models (STMs) versus live tissue (LT) models. In this study, we compare the effectiveness of best in class STMs versus an anesthetized caprine (goat) model for training and assessing seven procedures: junctional hemorrhage control, tourniquet (TQ) placement, chest seal, needle thoracostomy (NCD), nasopharyngeal airway (NPA), tube thoracostomy, and cricothyrotomy (Cric).

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

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

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

Crit Care Med. 2017 Dec;45(12):e1270-e1279

Effects of Hyperoxia During Resuscitation From Hemorrhagic Shock in Swine With Preexisting Coronary Artery Disease.

Hartmann C, Loconte M, Antonucci E, Holzhauser M, Hölle T, Katzsch D, Merz T, McCook O, Wachter U, Vogt JA, Hoffmann A, Wepler M, Gröger M, Matejovic M, Calzia E, Georgieff M, Asfar P, Radermacher P, Nussbaum BL

OBJECTIVES: Investigation of the effects of hyperoxia during resuscitation from hemorrhagic shock in swine with preexisting coronary artery disease.

DESIGN: Prospective, controlled, randomized trial.

SETTING: University animal research laboratory.

SUBJECTS: Nineteen hypercholesterolemic pigs with preexisting coronary artery disease.

INTERVENTIONS: Anesthetized, mechanically ventilated, and surgically instrumented pigs underwent 3 hours of hemorrhagic shock (removal of 30% of the calculated blood volume and subsequent titration of mean arterial blood pressure ≈40 mm Hg). Postshock resuscitation (48 hr) comprised retransfusion of shed blood, crystalloids (balanced electrolyte solution), and norepinephrine support. Pigs were randomly assigned to "control" (FIO2 0.3, adjusted for arterial oxygen saturation ≥ 90%) and "hyperoxia" (FIO2 1.0 for 24 hr) groups.

MEASUREMENTS AND MAIN RESULTS: Before, at the end of shock and every 12 hours of resuscitation, datasets comprising hemodynamics, calorimetry, blood gases, cytokines, and cardiac and renal function were recorded. Postmortem, organs were sampled for immunohistochemistry, western blotting, and mitochondrial high-resolution respirometry. Survival rates were 50% and 89% in the control and hyperoxia groups, respectively ($p = 0.077$). Apart from higher relaxation constant τ at 24 hours, hyperoxia did not affect cardiac function. However, troponin values were lower (2.2 [0.9-6.2] vs 6.9 [4.8-9.8] ng/mL; $p < 0.05$) at the end of the experiment. Furthermore, hyperoxia decreased cardiac 3-nitrotyrosine formation and increased inducible nitric oxide synthase expression. Plasma creatinine values were lower in the hyperoxia group during resuscitation coinciding with significantly improved renal mitochondrial respiratory capacity and lower 3-nitrotyrosine formation.

CONCLUSIONS: Hyperoxia during resuscitation from hemorrhagic shock in swine with preexisting coronary artery disease reduced renal dysfunction and cardiac injury, potentially resulting in improved survival, most likely due to increased mitochondrial respiratory capacity and decreased oxidative and nitrosative stress. Compared with our previous study, the present results suggest a higher benefit of hyperoxia in comorbid swine due to an increased susceptibility to hemorrhagic shock.

Dtsch Arztebl Int. 2017 Nov 17;114(46):785-792

Analgesia in Patients with Trauma in Emergency Medicine.

Häske D, Böttiger BW, Bouillon B, Fischer M, Gaier G, Gliwitzky B, Helm M, Hilbert-Carius P, Hossfeld B, Meisner C, Schempf B, Wafaisade A, Bernhard M.

BACKGROUND: Suitable analgesic drugs and techniques are needed for the acute care of the approximately 18 200-18 400 seriously injured patients in Germany each year.

METHODS: This systematic review and meta-analysis of analgesia in trauma patients was carried out on the basis of randomized, controlled trials and observational studies. A systematic search of the literature over the 10-year period ending in February 2016 was carried out in the PubMed, Google Scholar, and Springer Link Library databases. Some of the considered trials and studies were included in a meta-analysis. Mean differences (MD) of pain reduction or pain outcome as measured on the Numeric Rating Scale were taken as a summarizing measure of treatment efficacy.

RESULTS: Out of 685 studies, 41 studies were considered and 10 studies were included in the meta-analysis. Among the drugs and drug combinations studied, none was clearly superior to another with respect to pain relief. Neither fentanyl versus morphine (MD -0.10 with a 95% confidence interval of [-0.58; 0.39], p = 0.70) nor ketamine versus morphine (MD -1.27 [-3.71; 1.16], p = 0.31), or the combination of ketamine and morphine versus morphine alone (MD -1.23 [-2.29; -0.18], p = 0.02) showed clear superiority regarding analgesia.

CONCLUSION: Ketamine, fentanyl, and morphine are suitable for analgesia in spontaneously breathing trauma patients. Fentanyl and ketamine have a rapid onset of action and a strong analgesic effect. Our quantitative meta-analysis revealed no evidence for the superiority of any of the three substances over the others. Suitable monitoring equipment, and expertise in emergency procedures are prerequisites for safe and effective analgesia by healthcare professionals.

Am J Emerg Med. 2018 Jan 4. pii: S0735-6757(18)30020-2

Is topical tranexamic acid a better alternative for selected cases of anterior epistaxis management in the Emergency Department?

Hassen GW, Clemons P, Kaplun M, Kalantari H

ABSTRACT:
Epistaxis is a well-known problem that is mostly self-limited. In certain cases it requires packing or cauterization. Tranexamic acid has been tried and has shown promising results. Here we report a case of prolonged epistaxis in a patient on dual anti-platelet agent therapy.

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 Jan;84(1):139-145

The "mortality ascent": Hourly risk of death for hemodynamically unstable trauma patients at Level II versus Level I trauma centers.

Herrera-Escobar JP(1), Rios-Diaz AJ, Zogg CK, Wolf LL, Harlow A, Schneider EB, Cooper Z, Ordonez CA, Salim A, Haider AH.

BACKGROUND: Severely injured trauma patients have higher in-hospital mortality at Level II versus Level I trauma centers (TCs). To better understand these differences, we sought to determine if there were any periods during which hemodynamically unstable trauma patients are at higher risk of death at Level II versus Level I TCs within the first 24 hours postadmission.

STUDY DESIGN: Trauma patients aged 18 years to 64 years, with Injury Severity Score of 15 or greater, systolic blood pressure less than 90 mm Hg at admission, and treated at Level II or Level I TCs, were identified using the 2007 to 2012 National Trauma Data Bank. Burn patients, transfers, and patients dead on arrival were excluded. Log-binomial regression models, adjusted for patient- and hospital-level confounders, were used to compare mortality at Level II versus Level I TCs over the first 24 hours postadmission.

RESULTS: Of 13,846 hemodynamically unstable patients, 4,212 (30.4%) were treated at 149 Level II TCs, and 9,634 (69.6%) at 116 Level I TCs. Within the first 24 hours, 3,059 (22.1%) patients died. In risk-adjusted models, mortality risk was significantly elevated at Level II versus Level I TCs during the 24 hours postadmission (relative risk, 1.08; 95% confidence interval, 1.01-1.16). Hourly mortality risk was significantly different between Level II and Level I TCs during 4 hours to 7 hours postadmission, with a maximal difference at 7 hours (relative risk, 1.70; 95% confidence interval, 1.23-2.36) and comparable mortality risk beyond 7 hours postadmission.

CONCLUSION: The 4-hour to 7-hour time window postadmission is critical for hemodynamically unstable trauma patients. Variations in available treatment modalities may account for higher relative mortality at Level II TCs during this time. Further investigation to elucidate specific risk factors for mortality during this period may lead to reductions in in-hospital mortality among hemodynamically unstable trauma patients.

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

Emerg Med Australas. 2017 Nov 17. doi: 10.1111/1742-6723.12910. [Epub ahead of print]

Prehospital transfusion of red cell concentrates in a paramedic-staffed helicopter emergency medical service.

Heschl S, Andrew E, de Wit A, Bernard S, Kennedy M, Smith K; Study Investigators.

OBJECTIVE: The optimal volume and type of intravenous fluid for the treatment of blood loss in the prehospital setting is controversial. The use of red cell concentrates (RCCs) may be associated with improved outcomes; however, the administration of blood products is limited to physicians in many jurisdictions. We sought to describe the characteristics of RCC transfusions in a paramedic-staffed helicopter emergency medical system in Victoria, Australia.

METHODS: We performed a retrospective analysis of all cases where paramedics consulted the responsible physician for approval of RCC transfusion between July 2011 and December 2015 in Victoria, Australia. Ambulance data was retrieved from electronic patient care records and hospital and outcome data was retrieved from a state-wide trauma registry.

RESULTS: A total of 180 primary missions was identified where paramedics requested approval for transfusion of RCCs during the study period. A total of 150 patients received prehospital RCCs, of which 136 had suffered trauma. The majority of these patients were male (66.7%) and were involved in a car accident (62.5%). Most (97.4%) patients had an Injury Severity Score ≥12. There were improvements in median systolic blood pressure (80 mmHg vs 94 mmHg, $P < 0.001$) and shock index (1.50 vs 1.23, $P < 0.001$) between time of consultation and arrival at hospital. Overall, mortality for trauma patients was 37.7%. There were no transfusion-related complications identified.

CONCLUSION: Prehospital transfusion of RCC by paramedics is feasible. Future studies should compare the outcomes of patients receiving prehospital RCCs with outcomes for patients in which RCCs are administered in hospital.

Transfusion. 2018 Feb;58(2):480-484. doi: 10.1111/trf.14443. Epub 2017 Dec 13.

Quality management of a massive transfusion protocol.

Hess JR, Ramos PJ, Sen NE, Cruz-Cody VG, Tuott EE, Louzon MJ, Bulger EM, Arbabi S, Pagano MB, Metcalf RA.

BACKGROUND: Massive transfusion is a response to massive uncontrolled hemorrhage. To be effective, it must be timely and address the patient's needs for blood volume, oxygen transport, and hemostasis.

STUDY DESIGN AND METHODS: A review was performed on all activations of the massive transfusion protocol (MTP) in a hospital with large emergency medicine, trauma, and vascular surgery programs. Indications, transfused amounts, and outcomes were determined for each MTP event to determine appropriateness of MTP use. Results are presented as descriptive statistics, categorical associations, and simple linear trend relationships.

RESULTS: The MTP was activated 309 times in 2016. Of these episodes, 237 were for trauma, 29 for gastrointestinal bleeding, 16 for ruptured abdominal aortic aneurisms, and 25 for a variety of other causes. Trauma-related MTP activations had a mean injury severity score of 32. Blood use averaged 6.6 units of red blood cells (RBCs), 6.5 units of plasma, and 1.2 units of apheresis platelets. Fourteen activations ended without the administration of any blood products, and 45 (14%) did not meet the critical administration threshold of three components. Only 60 (19%) activations met the historic definition of massive with at least 10 units of RBCs administered. Mortality was 15% for the trauma-related activations.

CONCLUSIONS: Massive transfusion protocol activations were frequent and conducted with high fidelity to the 1:1:1 unit ratio standard. Making blood components available quickly was associated with low rates of total component usage and low mortality for trauma patients and was not associated with overuse.

Adv Mater. 2018 Jan;30(4). doi: 10.1002/adma.201700859. Epub 2017 Nov 22.

Biomaterials and Advanced Technologies for Hemostatic Management of Bleeding.

Hickman DA, Pawlowski CL, Sekhon UDS, Marks J, Gupta AS

ABSTRACT:
Bleeding complications arising from trauma, surgery, and as congenital, disease-associated, or drug-induced blood disorders can cause significant morbidities and mortalities in civilian and military populations. Therefore, stoppage of bleeding (hemostasis) is of paramount clinical significance in prophylactic, surgical, and emergency scenarios. For externally accessible injuries, a variety of natural and synthetic biomaterials have undergone robust research, leading to hemostatic technologies including glues, bandages, tamponades, tourniquets, dressings, and procoagulant powders. In contrast, treatment of internal noncompressible hemorrhage still heavily depends on transfusion of whole blood or blood's hemostatic components (platelets, fibrinogen, and coagulation factors). Transfusion of platelets poses significant challenges of limited availability, high cost, contamination risks, short shelf-life, low portability, performance variability, and immunological side effects, while use of fibrinogen or coagulation factors provides only partial mechanisms for hemostasis. With such considerations, significant interdisciplinary research endeavors have been focused on developing materials and technologies that can be manufactured conveniently, sterilized to minimize contamination and enhance shelf-life, and administered intravenously to mimic, leverage, and amplify physiological hemostatic mechanisms. Here, a comprehensive review regarding the various topical, intracavitary, and intravenous hemostatic technologies in terms of materials, mechanisms, and state-of-art is provided, and challenges and opportunities to help advancement of the field are discussed.

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.

Brain Inj. 2018;32(3):325-330

Platelet transfusion does not improve outcomes in patients with brain injury on antiplatelet therapy.

Holzmacher JL, Reynolds C, Patel M, Maluso P, Holland S, Gamsky N, Moore H, Acquista E, Carrick M, Amdur R, Hancock H, Metzler M, Dunn J, Sarani B

INTRODUCTION: Platelet dysfunction following traumatic brain injury (TBI) is associated with worse outcomes. The efficacy of platelet transfusion to reverse antiplatelet medication (APM) remains unknown. Thrombelastography platelet mapping (TEG-PM) assesses platelet function. We hypothesize that platelet transfusion can reverse the effects of APM but does not improve outcomes following TBI.

METHODS: An observational study at six US trauma centres was performed. Adult patients on APM with CT evident TBI after blunt injury were enrolled. Demographics, brain CT and TEG-PM results before/after platelet transfusion, length of stay (LOS), and injury severity score (ISS) were abstracted.

RESULTS: Sixty six patients were enrolled (89% aspirin, 50% clopidogrel, 23% dual APM) with 23 patients undergoing platelet transfusion. Transfused patients had significantly higher ISS and admission CT scores. Platelet transfusion significantly reduced platelet inhibition due to aspirin (76.0 ± 30.2% to 52.7 ± 31.5%, $p < 0.01$), but had a non-significant impact on clopidogrel-associated inhibition ($p = 0.07$). Platelet transfusion was associated with longer length of stay (7.8 vs. 3.5 days, $p < 0.01$), but there were no differences in mortality.

CONCLUSION: Platelet transfusion significantly decreases platelet inhibition due to aspirin but is not associated with change in outcomes in patients on APM following TBI.

J Trauma Acute Care Surg. 2018 Jan;84(1):11-18

Reexamination of a Battlefield Trauma Golden Hour Policy.

Howard JT, Kotwal RS, Santos-Lazada AR, Martin MJ, Stockinger ZT.

BACKGROUND: Most combat casualties who die, do so in the prehospital setting. Efforts directed toward alleviating prehospital combat trauma death, known as killed in action (KIA) mortality, have the greatest opportunity for eliminating preventable death.

METHODS: Four thousand five hundred forty-two military casualties injured in Afghanistan from September 11, 2001, to March 31, 2014, were included in this retrospective analysis to evaluate proposed explanations for observed KIA reduction after a mandate by Secretary of Defense Robert M. Gates that transport of injured service members occur within 60 minutes. Using inverse probability weighting to account for selection bias, data were analyzed using multivariable logistic regression and simulation analysis to estimate the effects of (1) gradual improvement, (2) damage control resuscitation, (3) harm from inadequate resources, (4) change in wound pattern, and (5) transport time on KIA mortality.

RESULTS: The effect of gradual improvement measured as a time trend was not significant (adjusted odds ratio [AOR], 0.99; 95% confidence interval [CI], 0.94-1.03; p = 0.58). For casualties with military Injury Severity Score of 25 or higher, the odds of KIA mortality were 83% lower for casualties who needed and received prehospital blood transfusion (AOR, 0.17; 95% CI, 0.06-0.51; p = 0.002); 33% lower for casualties receiving initial treatment by forward surgical teams (AOR, 0.67; 95% CI, 0.58-0.78; p < 0.001); 70%, 74%, and 87% lower for casualties with dominant injuries to head (AOR, 0.30; 95% CI, 0.23-0.38; p < 0.001), abdomen (AOR, 0.26, 95% CI, 0.19-0.36; p < 0.001) and extremities (AOR, 0.13; 95% CI, 0.09-0.17; p < 0.001); 35% lower for casualties categorized with blunt injuries (AOR, 0.65; 95% CI, 0.46-0.92; p = 0.01); and 39% lower for casualties transported within one hour (AOR, 0.61; 95% CI, 0.51-0.74; p < 0.001). Results of simulations in which transport times had not changed after the mandate indicate that KIA mortality would have been 1.4% higher than observed, equating to 135 more KIA deaths (95% CI, 105-164).

CONCLUSION: Reduction in KIA mortality is associated with early treatment capabilities, blunt mechanism, select body locations of injury, and rapid transport.

LEVEL OF EVIDENCE: Therapy, level III.

J Bone Joint Surg Am. 2017 Dec 20;99(24):2053-2061

Intravenous and Topical Tranexamic Acid Alone Are Superior to Tourniquet Use for Primary Total Knee Arthroplasty: A Prospective, Randomized Controlled Trial.

Huang Z, Xie X, Li L, Huang Q, Ma J, Shen B, Kraus VB, Pei F

BACKGROUND: Tourniquet use during primary total knee arthroplasty is thought to reduce intraoperative blood loss and improve visibility. Our goal was to investigate whether tourniquet use is necessary for controlling intraoperative blood loss when alternatives such as tranexamic acid (TXA) are available.

METHODS: One hundred and fifty patients were equally randomized to 3 groups. Group A was treated with a tourniquet as well as multiple doses of intravenous TXA (20 mg/kg 5 to 10 minutes before the skin incision and 10 mg/kg 3, 6, 12, and 24 hours later) along with 1 g of topical TXA, Group B was treated the same as Group A but without the tourniquet, and Group C was treated with the tourniquet only.

RESULTS: The amount of intraoperative blood loss was similar for the 3 groups. Group B had significantly less hidden blood loss than Group A ($p = 0.018$) and Group C ($p < 0.001$). No significant differences ($p > 0.05$) were observed between Group A and Group B with regard to total blood loss, drainage volume, intraoperative blood loss, transfusion rate, or maximum change in the hemoglobin (Hb) level. We also found significantly more benefits for Group B compared with Groups A and C with regard to postoperative swelling ratio, levels of inflammatory biomarkers, visual analog scale (VAS) pain scores, range of motion at discharge, Hospital for Special Surgery (HSS) score, and patient satisfaction. There were no significant differences ($p > 0.05$) in the deep venous thrombosis or pulmonary embolus rates among the 3 groups. More wound secretion was observed in the groups in which a tourniquet was used.

CONCLUSIONS: Patients treated with multiple doses of intravenous and topical TXA without a tourniquet had less hidden blood loss, a lower ratio of postoperative knee swelling, less postoperative knee pain, lower levels of inflammatory biomarkers, better early knee function, and even better early satisfaction than those treated with a tourniquet. Long-term follow-up should be performed to evaluate the effects on prosthetic fixation and long-term survival of total knee arthroplasty performed without a tourniquet.

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

Am J Emerg Med. 2017 Nov;35(11):1630-1635

Does the novel lateral trauma position cause more motion in an unstable cervical spine injury than the logroll maneuver?

Hyldmo PK, Horodyski M, Conrad BP, Aslaksen S, Røislien J, Prasarn M, Rechtine GR, Søreide E

OBJECTIVE: Prehospital personnel who lack advanced airway management training must rely on basic techniques when transporting unconscious trauma patients. The supine position is associated with a loss of airway patency when compared to lateral recumbent positions. Thus, an inherent conflict exists between securing an open airway using the recovery position and maintaining spinal immobilization in the supine position. The lateral trauma position is a novel technique that aims to combine airway management with spinal precautions. The objective of this study was to compare the spinal motion allowed by the novel lateral trauma position and the well-established log-roll maneuver.

METHODS: Using a full-body cadaver model with an induced globally unstable cervical spine (C5-C6) lesion, we investigated the mean range of motion (ROM) produced at the site of the injury in six dimensions by performing the two maneuvers using an electromagnetic tracking device.

RESULTS: Compared to the log-roll maneuver, the lateral trauma position caused similar mean ROM in five of the six dimensions. Only medial/lateral linear motion was significantly greater in the lateral trauma position (1.4mm (95% confidence interval [CI] 0.4, 2.4mm)).

CONCLUSIONS: In this cadaver study, the novel lateral trauma position and the well-established log-roll maneuver resulted in comparable amounts of motion in an unstable cervical spine injury model. We suggest that the lateral trauma position may be considered for unconscious non-intubated trauma patients.

Acute Med Surg. 2017 Apr 2;4(3):271-277. doi: 10.1002/ams2.268. eCollection 2017 Jul.

Early administration of fibrinogen concentrates improves the short-term outcomes of severe pelvic fracture patients.

Inokuchi K, Sawano M, Yamamoto K, Yamaguchi A, Sugiyama S

Aim: Hemorrhage from pelvic fracture is a major cause of mortality after blunt trauma. Several studies have suggested that early fibrinogen supplementation improves outcomes of traumatic hemorrhage. Thus, we revised our massive transfusion protocol (MTP) in April 2013 to include early off-label administration of fibrinogen concentrate. The objective of this study was to evaluate the impact of the revision on the short-term outcomes of pelvic fracture patients.

Methods: This was a single-center, retrospective, cohort study. A total of 224 consecutive pelvic fracture patients hospitalized in Saitama Medical Center (Saitama, Japan), 115 before the revision (Group E) and 109 after (Group L), were enrolled. Characteristics of the patients were compared between the groups. Impacts of the revision were evaluated by hazard ratios adjusted for characteristics, injury severity, and coagulation status using Cox's multivariate proportional hazard model. The impact was also evaluated by log-rank test and relative risk of 28-day mortality between the groups.

Results: The characteristics were equivalent between the groups. The multivariate analysis revealed that the revision of MTP was significantly related to improved survival with an adjusted hazard ratio (95% confidence interval) of 0.45 (0.07-0.97). The log-rank test gave $\chi 2$-test values of 5.2 (P = 0.022) and 6.7 (P = 0.009), and the relative risks were 0.37 (0.15-0.91) and 0.33 (0.13-0.84), in patients with all Injury Severity Scores and Injury Severity Score ≥21, respectively.

Conclusion: The revision of MTP to include aggressive off-label treatment with fibrinogen concentrate was related to improved short-term outcomes of severe pelvic fracture patients. However, due to the limitations of the study, the improvement could not be attributed totally to the revision.

JAMA Surg. 2018 Feb 21. doi: 10.1001/jamasurg.2017.6105. [Epub ahead of print]

Comparison of Military and Civilian Methods for Determining Potentially Preventable Deaths: A Systematic Review.

Janak JC, Sosnov JA, Bares JM, Stockinger ZT, Montgomery HR, Kotwal RS, Butler FK, Shackelford SA, Gurney JM, Spott MA, Finelli LN, Mazuchowski EL, Smith DJ

Importance: Military and civilian trauma experts initiated a collaborative effort to develop an integrated learning trauma system to reduce preventable morbidity and mortality. Because the Department of Defense does not currently have recommended guidelines and standard operating procedures to perform military preventable death reviews in a consistent manner, these performance improvement processes must be developed.

Objectives: To compare military and civilian preventable death determination methods to understand the existing best practices for evaluating preventable death.

Evidence Review: This systematic review followed the PRISMA reporting guidelines. English-language articles were searched from inception to February 15, 2017, using the following databases: MEDLINE (Ovid), Evidence-Based Medicine Reviews (Ovid), PubMed, CINAHL, and Google Scholar. Articles were initially screened for eligibility and excluded based on predetermined criteria. Articles reviewing only prehospital deaths, only inhospital deaths, or both were eligible for inclusion. Information on study characteristics was independently abstracted by 2 investigators. Reported are methodological factors affecting the reliability of preventable death studies and the preventable death rate, defined as the number of potentially preventable deaths divided by the total number of deaths within a specific patient population.

Findings: Fifty studies (8 military and 42 civilian) met the inclusion criteria. In total, 1598 of 6500 military deaths reviewed and 3346 of 19 108 civilian deaths reviewed were classified as potentially preventable. Among military studies, the preventable death rate ranged from 3.1% to 51.4%. Among civilian studies, the preventable death rate ranged from 2.5% to 85.3%. The high level of methodological heterogeneity regarding factors, such as preventable death definitions, review process, and determination criteria, hinders a meaningful quantitative comparison of preventable death rates.

Conclusions and Relevance: The reliability of military and civilian preventable death studies is hindered by inconsistent definitions, incompatible criteria, and the overall heterogeneity in study methods. The complexity, inconsistency, and unpredictability of combat require unique considerations to perform a methodologically sound combat-related preventable death review. As the Department of Defense begins the process of developing recommended guidelines and standard operating procedures for performing military preventable death reviews, consideration must be given to the factors known to increase the risk of bias and poor reliability.

Arch Craniofac Surg. 2017 Dec;18(4):223-229

Advantages, Disadvantages, Indications, Contraindications and Surgical Technique of Laryngeal Airway Mask.

Jannu A, Shekar A, Balakrishna R, Sudarshan H, Veena GC, Bhuvaneshwari S

ABSTRACT:
The beauty of the laryngeal mask is that it forms an air tight seal enclosing the larynx rather than plugging the pharynx, and avoid airway obstruction in the oropharynx. The goal of its development was to create an intermediate form of airway management face mask and endotracheal tube. Indication for its use includes any procedure that would normally involve the use of a face mask. The laryngeal mask airway was designed as a new concept in airway management and has been gaining a firm position in anesthetic practice. Despite wide spread use the definitive role of the laryngeal mask airway is yet to be established. In some situations, such as after failed tracheal intubation or in oral surgery its use is controversial. There are several unresolved issues, for example the effect of the laryngeal mask on regurgitation and whether or not cricoids pressure prevents placement of mask. We review the techniques of insertion, details of misplacement, and complications associated with use of the laryngeal mask. We then attempt to clarify the role of laryngeal mask in air way management during anesthesia, discussing the advantages and disadvantages as well as indications and contraindications of its use in oral and maxillofacial surgery.

J Pediatr Orthop. 2017 Dec;37(8):e552-e557

High-dose Versus Low-dose Tranexamic Acid to Reduce Transfusion Requirements in Pediatric Scoliosis Surgery.

Johnson D, Johnson C, Goobie S, Nami N, Wetzler JA, Sponseller PD, Frank SM.

BACKGROUND: Our objective was to quantify blood loss and transfusion requirements for high-dose and low-dose tranexamic acid (TXA) dosing regimens in pediatric patients undergoing spinal fusion for correction of idiopathic scoliosis. Previous investigators have established the efficacy of TXA in pediatric scoliosis surgery; however, the dosing regimens vary widely and the optimal dose has not been established.

METHODS: We retrospectively analyzed electronic medical records for 116 patients who underwent spinal fusion surgery for idiopathic scoliosis by a single surgeon and were treated with TXA. In total, 72 patients received a 10 mg/kg loading dose with a 1 mg/kg/h maintenance dose (low-dose) and 44 patients received 50 mg/kg loading dose with a 5 mg/kg/h maintenance dose (high-dose). Estimated blood loss and transfusion requirements were compared between dosing groups.

RESULTS: Patient characteristics were nearly identical between the 2 groups. Compared with the low-dose TXA group, the high-dose TXA group had decreased estimated blood loss (695 vs. 968 mL, P=0.01), and a decrease in both intraoperative (0.3 vs. 0.9 units, P=0.01) and whole hospitalization (0.4 vs. 1.0 units, P=0.04) red blood cell transfusion requirements. The higher-dose TXA was associated with decreased intraoperative (P=0.01), and whole hospital transfusion (P=0.01) requirements, even after risk-adjustment for potential confounding variables.

CONCLUSIONS: High-dose TXA is more effective than low-dose TXA in reducing blood loss and transfusion requirements in pediatric idiopathic scoliosis patients undergoing surgery.

LEVEL OF EVIDENCE: Level-III, retrospective cohort study.

Surg Clin North Am. 2017 Dec;97(6):1307-1321

Resuscitation for Hypovolemic Shock.

Kalkwarf KJ, Cotton BA

ABSTRACT:
Hemorrhage is the leading cause of preventable deaths in trauma patients. After presenting a brief history of hemorrhagic shock resuscitation, this article discusses damage control resuscitation and its adjuncts. Massively bleeding patients in hypovolemic shock should be treated with damage control resuscitation principles including limited crystalloid, whole blood or balance blood component transfusion to permissive hypotension, preventing hypothermia, and stopping bleeding as quickly as possible.

Emerg Med J. 2017 Dec;34(12):A869

Prophylactic antibiotics for penetrating injury: a review of practice at a major trauma centre, literature review and recommendations.

Kamarova M, Kendall R

BACKGROUND: There is a lack of clarity regarding the use of prophylactic antibiotics for patients presenting with penetrating injuries. A structured literature review and review of penetrating injury records in an MTC was undertaken with a view to help guide clinical practice.

METHOD: Searches were conducted on Medline (1946-2017), Embase (1974-2017), and Cochrane (up to 2017) using key words pertaining to penetrating trauma, prophylactic antibiotics and infection. Cases of penetrating injury presenting to one MTC during 2015-2016 were extracted from the TARN database. Patient information (age, sex), injury details (ISS score, anatomical site, nature), antibiotic use in ED, and infectious outcomes were analysed.

RESULTS: A 2012 systematic review by Bosman et al. included 11 RCTs, totaling 1234 patients with blunt and penetrating chest injuries requiring tube thoracostomy. Those that were given prophylactic antibiotics were less likely to develop empyema (OR:0.32), pneumonia (OR:0.51) and wound infections (OR:0.41) compared to placebo. A 2013 Cochrane meta-analysis on penetrating abdominal trauma found no RCTs comparing infection outcomes for prophylactic antibiotics vs placebo. No further trials have since been done. EAST guidelines (2012) recommend a single dose of prophylactic antibiotics for penetrating abdominal trauma. No relevant trials were found for penetrating soft tissue injuries.70 penetrating injuries for 2015-2016 were recorded on TARN, 40 of which were transfers from other hospitals. Half of the total injuries were stabbings, with the rest being shootings, falls and crush injuries. 62.5% of patients were given prophylactic antibiotics in ED. 83% of the remaining patients received antibiotics for another indication.

CONCLUSIONS: Strong evidence exists for the use of prophylactic antibiotics for chest wounds requiring tube thoracostomy. The Cochrane review concluded that there is no evidence base for prophylactic antibiotic use for penetrating abdominal trauma, with EAST recommendations based on weaker evidence. Drawing conclusions about infectious outcomes from TARN data is difficult due to low total numbers, differences in record-keeping for secondary transfers and a high proportion of patients with another requirement for antibiotics.For penetrating thoracic injury requiring chest drain there is evidence of benefit for prophylactic antibiotics, in other patients with penetrating injury due to the current lack of evidence, clinical judgement based on the circumstances of penetrating injury is recommended.

Am J Emerg Med. 2017 Nov 7. pii: S0735-6757(17)30923-3. doi: 0.1016/j.ajem.2017.11.015. [Epub ahead of print]

Intranasal fentanyl improves time to analgesic delivery in sickle cell pain crises.

Kelly GS, Stewart RW, Strouse JJ, Anders JF

Quotes:

"Sickle cell disease (SCD) affects approximately 90,000Americans [1]. These individuals are perennially at risk for complications of SCD with intermittent, painful vasoocclusive events (VOE) being the most common acute morbidity [2]. A third of children with SCD will experience a VOE in their first year of life, and most will have experienced a VOE by 4 years of age [3]. Accordingly, acute pain management is the most common reason for children with SCD to seek care in pediatric emergency departments (PEDs) [4]."

"During the study period, 487 visits made by 105 distinct patients met inclusion criteria. 376 (77%) patientswere treatedwith the INF protocol and 111 (23%) were treated with routine care. The baseline characteristics of both groups are summarized in Table 1. "

"The performance characteristics of both groups are summarized in Table 2. There was a significantly reduced mean time to first opiate administration in the INF group (29 vs 78 min, $P < 0.001$). The percentage of patients receiving their first medication within the NHLBI-recommended 30 min was significantly higher with INF as well (67% vs 5%, $P < 0.001$). Median pain scores differed significantly between the two groups at the time of the first and second pain reassessments, however changes in pain scores at each interval were not significantly different. Pain trajectories through the course of the ED visit for each groupwere similar and are depicted in Fig. 1. Both median time to disposition decision (237 vs 276 min, $P < 0.001$) and overall LOS (316 vs 363 min, $P = 0.003$) were significantly shorter in the INF group."

"Our retrospective study demonstrated a significantly reduced time to initiation of opioid analgesic therapy when using INF compared to routine care. Several important operational measures for VOE treatment are superior in the INF group including time to pain reassessments, time to disposition decision, and overall ED LOS. INF is an effective medication to use in the treatment of pediatric VOEs and its use should be routine unless a specific contraindication exists."

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

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

Keneally RJ, Szpisjak DF, Hoffmann PJ, Park EJ, Albergo MS

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

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

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

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

J Spec Oper Med. Winter 2017;17(4):80-84.

Efficacy of the Mnemonic Device "MARCH PAWS" as a Checklist for Pararescuemen During Tactical Field Care and Tactical Evacuation.

Kosequat J, Rush SC, Simonsen I, Gallo I, Scott A, Swats K, Gray CC, Mason B.

BACKGROUND: The application of Tactical Combat Casualty Care (TCCC) represents evidence-based medicine to improve survival in combat. Over the past several years, US Air Force Pararescuemen (PJs) have expanded the mnemonic device "MARCH" to "MARCH PAWS" for use during tactical field care and tactical evacuation (TACEVAC). The mnemonic stands for massive bleeding, airway, respiration, circulation, head and hypothermia, pain, antibiotics, wounds, and splinting. We undertook this performance improvement project to determine the efficacy of this device as a treatment checklist.

METHODS: The mission reports of a 16-PJ combat rescue deployment to Operation Enduring Freedom (OEF) from January through June 2012 were reviewed. The triage category, mechanism of injury, injury, and treatments were noted. The treatments were then categorized to determine if they were included in MARCH PAWS.

RESULTS: The recorded data for missions involving 465 patients show that 45%, 48%, and 7%, were in category A, B, and C, respectively (urgent, priority, routine); 55% were battle injuries (BIs) and 45% were nonbattle injuries (NBIs). All treatments for BI were accounted for in MARCH PAWS. Only 9 patients' treatments with NBI were not in MARCH PAWS.

CONCLUSION: This simple mnemonic device is a reliable checklist for PJs, corpsmen, and medics to perform TACEVAC during combat Operations, as well as care for noncombat trauma patients.

J Spec Oper Med. Winter 2017;17(4):29-36.

Assessment of User, Glove, and Device Effects on Performance of Tourniquet Use in Simulated First Aid.

Kragh JF Jr, Aden JK 3rd, Lambert CD, Moore VK 3rd, Dubick MA.

BACKGROUND: The effects of users, glove types, and tourniquet devices on the performance of limb tourniquet use in simulated first aid were measured.

MATERIALS AND METHODS: Four users conducted 180 tests of tourniquet performance in eight glove groups compared with bare hands as a control.

RESULTS: Among tests, 99% (n = 179) had favorable results for each of the following: effectiveness (i.e., bleeding control), distal pulse stoppage, and tourniquet placement at the correct site. However, only 90% of tests ended with a satisfactory result, which is a composite outcome of aggregated metrics if all (patient status is stable, tourniquet placement is good, and pressure is good) are satisfactory. Of 18 unsatisfactory results, 17 (94%) were due to pressure problems. Most of the variance of the majority of continuous metrics (time to determination of bleeding control, trial time, overall time, pressure, and blood loss) could be attributed to the users (62%, 55%, 61%, 8%, and 68%, respectively). Glove effects impaired and slowed performance; three groups (cold gloves layered under mittens, mittens, and cold gloves) consistently had significant effects and five groups (examination gloves, flight gloves, leather gloves, glove liners, and glove liners layered under leather gloves) did not. For time to bleeding control and blood loss, performance using these same three glove groups had worse results compared with bare hands by 26, 18, and 17 seconds and by 188, 116, and 124mL, respectively. Device effects occurred only with continuous metrics and were often dominated by user effects.

CONCLUSION: In simulated first aid with tourniquets used to control bleeding, users had major effects on most performance metrics. Glove effects were significant for three of eight glove types. Tourniquet device effects occurred only with continuous metrics and were often dominated by user effects.

Am J Surg. 2018 Jan 5. pii: S0002-9610(17)31602-1. doi: 10.1016/j.amjsurg.2017.12.014. [Epub ahead of print]

Evaluation of a novel thoracic entry device versus needle decompression in a tension pneumothorax swine model.

Kuckelman J, Derickson M, Phillips C, Barron M, Marko S, Eckert M, Martin M

INTRODUCTION: Tension pneumothorax (tPTX) remains a major cause of preventable death in trauma. Needle decompression (ND) has up to a 60% failure rate.

METHODS: Post-mortem swine used. Interventions were randomized to 14G-needle decompression (ND, n = 25), bladed trocar with 36Fr cannula (BTW, n = 16), bladed trocar alone (BTWO, n = 16) and surgical thoracostomy (ST = 11). Simulated tPTX was created to a pressure(p) of 20 mmHg.

RESULTS: Success (p < 5 mmHg by 120 s) was seen in 41 of 68 (60%) interventions. BTW and BTWO were consistently more successful than ND with success rates of 88% versus 48% in ND (p < .001). In successful deployments, ND was slower to reach p < 5 mmHg, average of 82s versus 26s and 28s for BTW and BTWO respectively (p < .001). Time to implement procedure was faster for ND with an average of 3.6s versus 16.9s and 15.3s in the BTW and BTWO (p < .001). Final pressure was significantly less in BTW and BTWO at 1.7 mmHg versus 7 mmHg in ND animals (p < .001).

CONCLUSION: Bladed trocars can safely and effectively tPTX with a significantly higher success rates than needle decompression.

J Craniofac Surg. 2018 Jan;29(1):96-98

Craniosynostosis Surgery and the Impact of Tranexamic Acid Dosing.

Kurnik NM, Pflibsen LR, Do A, Bristol R, Singh DJ

ABSTRACT:
Consensus does not exist regarding the best dosage regimen for using tranexamic acid (TXA) for patients undergoing open calvarial vault remodeling in craniosynostosis surgery. The purpose of this study was to evaluate 2 dosing protocols, as well as the cost of using TXA. Previously, the institutional protocol was to give patients undergoing open calvarial vault remodeling a loading infusion of TXA (10 mg/kg) at the start of their procedure, after which intravenous TXA (5 mg/kg/h) was given throughout surgery and for 24 hours postoperatively. In July 2015, the protocol changed to a reduced postoperative infusion time of 4 hours. A retrospective review was conducted of records of 30 patients who had surgery before the protocol change (24-hour group) and 23 patients whose surgery occurred after the protocol change (4-hour group). The following data were collected: blood volume transfused, hemoglobin levels, estimated blood loss, and intensive care days; and costs of TXA and blood transfusion. Results showed a 4-hour infusion was as effective as a 24-hour infusion for reducing blood loss in patients undergoing craniosynostosis. Transfusion requirements, hemoglobin and hematocrit levels, and estimated blood loss were not significantly different for the groups. The cost of TXA and transfusion in the 4-hour group was significantly less ($P<0.001$) than in the 24-hour group. No significant difference in cost existed for patients who received blood transfusion alone versus patients who received the 4-hour TXA infusion.

Emerg Med J. 2018 Mar;35(3):176-179

Ionized calcium levels in major trauma patients who received blood en route to a military medical treatment facility.

Kyle T, Greaves I, Beynon A, Whittaker V, Brewer M, Smith J

BACKGROUND: Hypocalcaemia is a common metabolic derangement in critically ill patients. Blood transfusion can also contribute to depleted calcium levels. The aims of this study were to identify the incidence of hypocalcaemia in military trauma patients receiving blood products en route to a deployed hospital facility and to determine if intravenous calcium, given during the prehospital phase, has an effect on admission calcium levels.

METHODS: This was a retrospective review of patients transported by the UK Medical Emergency Response Team in Afghanistan between January 2010 and December 2014 who were treated with blood products in the prehospital setting. Total units of blood products administered, basic demographics, Injury Severity Score and trauma type were collected. Ionized serum calcium levels on admission to hospital were compared between those who received blood products without prehospital intravenous calcium supplemental therapy (non-treatment) and patients who were treated with 10 mL of intravenous calcium chloride (10%) concurrently with blood products (treatment).

RESULTS: The study included 297 patients; 237 did not receive calcium and 60 did. The incidence of hypocalcaemia in the non-treatment group was 70.0% (n=166) compared with 28.3% (n=17) in the treatment group. Serum calcium levels were significantly different between the groups (1.03 mmol/L vs 1.25 mmol/L, difference 0.22 mmol/L, 95% CI 0.15 to 0.27). In the non-treatment group, 26.6% (n=63) had calcium levels within the normal range compared with 41.7% (n=25) in those who received calcium. There was a dose response of calcium level to blood products with a significant decrease in calcium levels as the volume of blood products increased.

CONCLUSION: Trauma patients who received blood products were at high risk of hypocalcaemia. Aggressive management of these patients with intravenous calcium during transfusion may be required.

J Trauma Acute Care Surg. 2018 Feb;84(2):379-385

No intravenous access, no problem: Intraosseous administration of tranexamic acid is as effective as intravenous in a porcine hemorrhage model.

Lallemand MS, Moe DM, McClellan JM, Loughren M, Marko S, Eckert MJ, Martin MJ.

BACKGROUND: The acute coagulopathy of trauma is often accompanied by hyperfibrinolysis. Tranexamic acid (TXA) can reverse this phenomenon, and, when given early, decreases mortality from bleeding. Establishing intravenous (IV) access can be difficult in trauma and intraosseous (IO) access is often preferred for drug administration. Currently, there are no data on the efficacy of IO administered TXA. Our objectives were to compare serum concentrations of TXA when given IV and IO and to compare the efficacy of IO administered TXA to IV at reversing hyperfibrinolysis.

METHODS: Using a porcine hemorrhage and ischemia-reperfusion model, 18 swine underwent hemorrhagic shock followed by a tissue plasminogen activator infusion to induce hyperfibrinolysis. Animals then received an IV or tibial IO infusion of TXA over 10 minutes. Blood was then analyzed using rotational thromboelastometry to monitor reversal of hyperfibrinolysis. Serum was analyzed for drug concentrations.

RESULTS: After hemorrhage and ischemia-reperfusion, there were no significant differences in mean arterial pressure (48 vs. 49.5), lactate (11.1 vs. 10.8), and pH (7.20 vs. 7.22) between groups. Intraosseous TXA corrected the lysis index at 30 minutes in EX-TEM and IN-TEM, like IV infusion. Peak serum levels of TXA after IV and IO administration show concentrations of 160.9 μg/mL and 132.57 μg/mL respectively ($p = 0.053$). Peak levels occurred at the completion of infusion. Drug levels were tracked for four hours. At the end of monitoring, plasma concentrations of TXA were equivalent.

CONCLUSION: Intraosseous administration of TXA is as effective as IV in reversing hyperfibrinolysis in a porcine model of hemorrhagic shock. Intraosseous administration was associated with a similar peak levels, pharmacokinetics, and clearance. Intraosseous administration of TXA can be considered in hemorrhagic shock when IV access cannot be established.

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.

J Emerg Nurs. 2017 Dec 1. pii: S0099-1767(17)30256-8. doi: 10.1016/j.jen.2017.10.013. [Epub ahead of print]

The Use of Clinical Cervical Spine Clearance in Trauma Patients: A Literature Review.

Larson S, Delnat AU, Moore J

INTRODUCTION: Five million patients in America are placed in spinal immobilization annually, with only 1% to 2% of these patients suffering from an unstable cervical spine injury. Prehospital agencies are employing selective and limited immobilization practices, but there is concern that this practice misses cervical spine injuries and therefore possibly predisposes patients to worsening injuries.

METHODS: A systematic review was conducted that examined literature from the last 5 years that reviewed cervical spine immobilization application and/or clearance in alert trauma patients.

RESULTS: Prehospital selective immobilization protocols and bedside clinical clearance examinations are becoming more commonplace, with few missed injuries or poor outcomes. Prehospital providers can evaluate patients in the field safely to assess who needs or does not need cervical collars; similar criteria can be used in the emergency department. Harm from cervical collars is increasingly documented, with concerns that risks exceed possible benefits.

DISCUSSION: The literature suggests that alert trauma patients can be cleared from cervical spine immobilization safely through a structured algorithm in either the prehospital or ED setting. The evidence is primarily observational. Thus, many providers who fear missing cervical injuries may be reluctant to follow the recommendations despite few or no published cases of sudden deterioration from missed cervical spine injuries.

Eur J Trauma Emerg Surg. 2018 Jan 17. doi: 10.1007/s00068-018-0908-9. [Epub ahead of print]

Treatment of combined traumatic brain injury and hemorrhagic shock with fractionated blood products versus fresh whole blood in a rat model.

Leibowitz A, Brotfain E, Koyfman L, Klein M, Hess S, Zlotnik A, Boyko M

INTRODUCTION: Treatment of combined traumatic brain injury and hemorrhagic shock, poses a particular challenge due to the possible conflicting consequences. While restoring diminished volume is the treatment goal for hypovolemia, maintaining adequate cerebral perfusion pressure and avoidance of secondary damage remains a treatment goal for the injured brain. Various treatment modalities have been proposed, but the optimal resuscitation fluid and goals have not yet been clearly defined. A growing body of evidence suggests that in hypovolemic shock, resuscitation with fresh whole blood (FWB) may be superior to component therapy without platelets (which are likely to be unavailable in the pre-hospital setting). Nevertheless, the effects of this approach have not been studied in the combined injury. Previously, in a rat model of combined injury we have found that mild resuscitation to MABP of 80 mmHg with FWB is superior to fluid resuscitation or aggressive resuscitation with FWB. In this study, we investigate the physiological and neurological outcomes in a rat model of combined traumatic brain injury (TBI) and hypovolemic shock, submitted to treatment with varying amounts of FWB, compared to similar resuscitation goals with fractionated blood products-red blood cells (RBCs) and plasma in a 1:1 ratio regimen.

MATERIALS AND METHODS: 40 male Lewis rats were divided into control and treatment groups. TBI was inflicted by a free-falling rod on the exposed cranium. Hypovolemia was induced by controlled hemorrhage of 30% blood volume. Treatment groups were treated either with fresh whole blood or with RBC + plasma in a 1:1 ratio, achieving a resuscitation goal of a mean arterial blood pressure (MAP) of 80 mmHg at 15 min. MAP was assessed at 60 min, and neurological outcomes and mortality in the subsequent 24 h.

RESULTS: At 60 min, hemodynamic parameters were improved compared to controls, but not significantly different between treatment groups. Survival rates at 48 h were 100% for both of the mildly resuscitated groups (MABP 80 mmHg) with FWB and RBC + plasma. The best neurological outcomes were found in the group mildly resuscitated with FWB and were better when compared to resuscitation with RBC + plasma to the same MABP goal (FWB: Neurological Severity Score (NSS) 6 ± 2, RBC + plasma: NSS 10 ± 2, $p = 0.02$).

CONCLUSIONS: In this study, we find that mild resuscitation with goals of restoring MAP to 80 mmHg (which is lower than baseline) with FWB, provided better hemodynamic stability and survival. However, the best neurological outcomes were found in the group resuscitated with FWB. Thus, we suggest that resuscitation with FWB is a feasible modality in the combined TBI + hypovolemic shock scenario, and may result in improved outcomes compared to platelet-free component blood products.

J Trauma Acute Care Surg. 2018 Feb;84(2):234-244

Beta blockers in critically ill patients with traumatic brain injury: Results from a multicenter, prospective, observational American Association for the Surgery of Trauma study.

Ley EJ, Leonard SD, Barmparas G, Dhillon NK, Inaba K, Salim A, O'Bosky KR, Tatum D, Azmi H, Ball CG, Engels PT, Dunn JA, Carrick MM, Meizoso JP, Lombardo S, Cotton BA, Schroeppel TJ, Rizoli S, Chang DSJ, de León LA, Rezende-Neto J, Jacome T, Xiao J, Mallory G, Rao K, Widdel L, Godin S, Coates A, Benedict LA, Nirula R, Kaul S, Li T; Beta Blockers TBI Study Group Collaborators.

BACKGROUND: Beta blockers, a class of medications that inhibit endogenous catecholamines interaction with beta adrenergic receptors, are often administered to patients hospitalized after traumatic brain injury (TBI). We tested the hypothesis that beta blocker use after TBI is associated with lower mortality, and secondarily compared propranolol to other beta blockers.

METHODS: The American Association for the Surgery of Trauma Clinical Trial Group conducted a multi-institutional, prospective, observational trial in which adult TBI patients who required intensive care unit admission were compared based on beta blocker administration.

RESULTS: From January 2015 to January 2017, 2,252 patients were analyzed from 15 trauma centers in the United States and Canada with 49.7% receiving beta blockers. Most patients (56.3%) received the first beta blocker dose by hospital day 1. Those patients who received beta blockers were older (56.7 years vs. 48.6 years, $p < 0.001$) and had higher head Abbreviated Injury Scale scores (3.6 vs. 3.4, $p < 0.001$). Similarities were noted when comparing sex, admission hypotension, mean Injury Severity Score, and mean Glasgow Coma Scale. Unadjusted mortality was lower for patients receiving beta blockers (13.8% vs. 17.7%, $p = 0.013$). Multivariable regression determined that beta blockers were associated with lower mortality (adjusted odds ratio, 0.35; $p < 0.001$), and propranolol was superior to other beta blockers (adjusted odds ratio, 0.51, $p = 0.010$). A Cox-regression model using a time-dependent variable demonstrated a survival benefit for patients receiving beta blockers (adjusted hazard ratio, 0.42, $p < 0.001$) and propranolol was superior to other beta blockers (adjusted hazard ratio, 0.50, $p = 0.003$).

CONCLUSION: Administration of beta blockers after TBI was associated with improved survival, before and after adjusting for the more severe injuries observed in the treatment cohort. This study provides a robust evaluation of the effects of beta blockers on TBI outcomes that supports the initiation of a multi-institutional randomized control trial.

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

Mil Med. 2018 Jan 1;183(1-2):e40-e44

Skills Decay in Military Medical Training: A Meta-synthesis of Research Outcomes.

Linde AS, Caridha J, Kunkler KJ

Background: In fiscal year 2012, the Medical Simulation and Information Sciences Research Program released two Skills Decay (SD) research program announcements (PAs) under the Medical Readiness Initiative entitled "Medical Practice Initiative Breadth of Medical Practice & Disease Frequency Exposure (MPI-BMP)" and the "Medical Practice Initiative Procedural Skill Decay and Maintenance (MPI-PSD)." The Office of Naval Research also released a PA entitled "Medical Modeling and Simulation (MM&S) for Military Training and Education." A total investment of $12 M was made. This article provides a meta-synthesis of the Skills Decay research conducted under these efforts.

Methods: The MSIRRP Medical Simulation Portfolio collected, reviewed, and analyzed the final reports of the Skills Decay research efforts from the three PAs. This paper provides a meta-synthesis of the outcomes of those studies. Focus of this study was to determine if the anticipated goals of the Skills Decay Pas were met as well as to provide a summary of lessons learned to the research community.

Discussion: Fourteen research questions posed by the PAs were structured into four main goals: (1) Skills Decay identification, (2) creation/validity of Skills Decay tools and feasibility and viability of data extraction project, (3) refreshment training to prevent or alleviate Skills Decay project, and (4) Skills Decay education content.

Conclusion: Using a combination of training styles, choosing variables known to have Skills Decay predication value, and developing better ways of mining available data that can, in turn, provide feedback to training needs, it is possible for accurate Skills Decay models to be developed. These technologies have the ability not only capture the learner's reaction during the simulation, but to capture the simulation outcomes to predict a medical professional's level of experience and background. Lessons learned from the investments made by the government are extremely important in order to ensure that the outcomes of the research touch the lives of the warfighter.

Pharmacotherapy. 2018 Jan;38(1):139-151

Ketamine for the Acute Management of Excited Delirium and Agitation in the Prehospital Setting.

Linder LM, Ross CA, Weant KA

ABSTRACT:
Traditional first-line therapy in the prehospital setting for the acutely agitated patient includes an antipsychotic in combination with a benzodiazepine. Recently, interest has grown regarding the use of ketamine in the prehospital setting as an attempt to overcome the limitations of the traditional medications and provide a more safe and effective therapy. This review provides an overview of the pharmacology of ketamine, evaluates the literature regarding ketamine use for prehospital agitation, and proposes an algorithm that may be used within the prehospital setting. A literature review was conducted to identify articles utilizing ketamine in the prehospital setting. The review was limited to English-language articles identified in Embase (1988-June 2017) and the U.S. National Library of Medicine (1970-June 2017). References of all pertinent articles were also reviewed. Ten articles were identified including 418 patients receiving ketamine for agitation. The most commonly utilized route for administration was intramuscular (IM), with five of the seven IM administration studies using a ketamine dose of 5 mg/kg. Ketamine administered in this fashion was efficacious to achieve proper sedation during transport and did not require repeat dosing. Three studies applied a ketamine protocol to outline dosing and the management of ketamine adverse events. The most common adverse events identified were respiratory-related events and hypersalivation. Ketamine has a role for agitation management in the prehospital setting; however, emergency personnel education and ketamine protocols should be utilized to aid in safe and effective pharmacotherapy and provide guidance on the management of adverse events. Future prospective comparative studies, with protocolized standard ketamine regimens, are needed to further delineate the role of ketamine in agitation management and identify accurate adverse event incidence rates.

Mil Med. 2018 Jan 1;183(1-2):e40-e44

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

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

Maher P, Utarnachitt R, Louzon MJ, Gary R, Sen N, Hess JR

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

J Visc Surg. 2017 Dec;154 Suppl 1:S19-S29

Damage control: Concept and implementation.

Malgras B, Prunet B, Lesaffre X, Boddaert G, Travers S, Cungi PJ, Hornez E, Barbier O, Lefort H, Beaume S, Bignand M, Cotte J, Esnault P, Daban JL, Bordes J, Meaudre E, Tourtier JP, Gaujoux S, Bonnet S

ABSTRACT:
The concept of damage control (DC) is based on a sequential therapeutic strategy that favors physiological restoration over anatomical repair in patients presenting acutely with hemorrhagic trauma. Initially described as damage control surgery (DCS) for war-wounded patients with abdominal penetrating hemorrhagic trauma, this concept is articulated in three steps: surgical control of lesions (hemostasis, sealing of intestinal spillage), physiological restoration, then surgery for definitive repair. This concept was quickly adapted for intensive care management under the name damage control resuscitation (DCR), which refers to the modalities of hospital resuscitation carried out in patients suffering from traumatic hemorrhagic shock within the context of DCS. It is based mainly on specific hemodynamic resuscitation targets associated with early and aggressive hemostasis aimed at prevention or correction of the lethal triad of hypothermia, acidosis and coagulation disorders. Concomitant integration of resuscitation and surgery from the moment of admission has led to the concept of an integrated DCR-DCS approach, which enables initiation of hemostatic resuscitation upon arrival of the injured person, improving the patient's physiological status during surgery without delaying surgery. This concept of DC is constantly evolving; it stresses management of the injured person as early as possible, in order to initiate hemorrhage control and hemostatic resuscitation as soon as possible, evolving into a concept of remote DCR (RDCR), and also extended to diagnostic and therapeutic radiological management under the name of radiological DC (DCRad). DCS is applied only to the most seriously traumatized patients, or in situations of massive influx of injured persons, as its universal application could lead to a significant and unnecessary excess-morbidity to injured patients who could and should undergo definitive treatment from the outset. DCS, when correctly applied, significantly improves the survival rate of war-wounded.

Malays Orthop J. 2016 Nov;10(3):49-51

Calf Compartment Syndrome associated with the Use of an Intra-osseous Line in an Adult Patient: A Case Report.

Malhotra R, Chua WL, O'Neill G

ABSTRACT:
We present a case of a lower limb compartment syndrome associated with the use of an intra-osseous line inserted into the proximal tibia in an adult patient. An unconscious 59-year old male with multiple injuries presented to our Emergency Department after a road traffic accident. Bilateral proximal tibial intra osseous-lines were inserted due to poor venous access. After resuscitation his left leg was noted to be tense and swollen with absent pulses. Acute compartment syndrome was diagnosed both clinically and with compartment pressure measurement. Two incision fasciotomy on his left lower leg was performed. Intra osseous-lines in the proximal tibia are increasingly used in adult patients in the pre-hospital setting by paramedics and emergency physicians. Their use, along with the possible complications of these devices, such as the development of compartment syndrome or osteomyelitis leading to amputation, is well reported in the paediatric literature. To the best of our knowledge, there have not been any previous reports of complications in the adult patient. We present a case of lower leg compartment syndrome developing from the use of an intra-osseous line in the proximal tibia in an adult patient. With the increasing use of intra-osseous lines in adult patients, clinicians should be aware of the possibility of developing compartment syndrome which may lead to disability or amputation in severe cases.

Prehosp Emerg Care. 2018 Jan 24:1-5

Comparison Of The I-Gel Supraglottic And King Laryngotracheal Airways In A Simulated Tactical Environment.

March JA, Tassey TE, Resurreccion NB, Portela RC, Taylor SE.

BACKGROUND: When working in a tactical environment there are several different airway management options that exist. One published manuscript suggests that when compared to endotracheal intubation, the King LT laryngotracheal airway (KA) device minimizes time to successful tube placement and minimizes exposure in a tactical environment. However, comparison of two different blind insertion supraglottic airway devices in a tactical environment has not been performed. This study compared the I-Gel airway (IGA) to the KA in a simulated tactical environment, to determine if one device is superior in minimizing exposure and minimizing time to successful tube placement.

METHODS: This prospective randomized cross over trial was performed using the same methods and tactical environment employed in a previously published study, which compared endotracheal intubation versus the KA in a tactical environment. The tactical environment was simulated with a one-foot vertical barrier. The participants were paramedic students who wore an Advanced Combat Helmet (ACH) and a ballistic vest (IIIA) during the study. Participants were then randomized to perform tactical airway management on an airway manikin with either the KA or the IGA, and then again using the alternate device. The participants performed a low military type crawl and remained in this low position during each tube placement. We evaluated the time to successful tube placement between the IGA and KA. During attempts, participants were videotaped to monitor their height exposure above the barrier. Following completion, participants were asked which airway device they preferred. Data was analyzed using Student's t-test across the groups for time to ventilation and height of exposure.

RESULTS: In total 19 paramedic students who were already at the basic EMT level participated. Time to successful placement for the KA was 39.7 seconds (95%CI: 32.7-46.7) versus 14.4 seconds (95%CI: 12.0-16.9) for the IGA, $p < 0.001$. Maximum height exposure of the helmet above a one foot vertical barrier for the KA resulted in 1.42 inches of exposure (95%CI: 0.38-0.63) compared to the IGA with 1.42 inches, 95%CI:0.32-0.74, $p = 0.99$. On questioning 100% of the participants preferred the IGA device over the KA.

CONCLUSION: In a simulated tactical environment placement of the IGA for airway management was faster than with the KA, but there was no difference in regard to exposure. Additionally, all the participants preferred using the IGA device over the KA.

Injury. 2018 Feb;49(2):184-190

Prediction of massive blood transfusion in battlefield trauma: Development and validation of the Military Acute Severe Haemorrhage (MASH) score.

Mclennan JV, Mackway-Jones KC, Smith JE

BACKGROUND: The predominant cause of preventable trauma death is bleeding, and many of these patients need resuscitation with massive blood transfusion. In resource-constrained environments, early recognition of such patients can improve planning and reduce wastage of blood products. No existing decision rule is sufficiently reliable to predict those patients requiring massive blood transfusion. This study aims to produce a decision rule for use on arrival at hospital for patients sustaining battlefield trauma.

METHODS: A retrospective database analysis was undertaken using the UK Joint Theatre Trauma Registry to provide a derivation and validation dataset. Regression analysis of potential predictive factors was performed. Predictive factors were analysed through multi-logistic regression analysis to build predictive models; sensitivity and specificity of these models was assessed, and the best fit models were analysed in the validation dataset.

RESULTS: A decision rule was produced using a combination of injury pattern, clinical observations and pre-hospital data. The proposed rule, using a score of 3 or greater, demonstrated a sensitivity of 82.7% and a specificity of 88.8% for prediction of massive blood transfusion, with an AUROC of 0.93 (95% CI 0.91-0.95).

CONCLUSIONS: We have produced a decision tool with improved accuracy compared to any previously described tools that can be used to predict blood transfusion requirements in the military deployed hospital environment.

Br J Anaesth. 2017 Dec 1;119(suppl_1):i154-i166

The evolution of airway management - new concepts and conflicts with traditional practice.

McNarry AF, Patel A

ABSTRACT:
In the last 25 yr, there have been several advances in the safe management of the airway. Videolaryngoscopes and supraglottic airways, now in routine use by new trainees in anaesthesia, have had their genesis in the recent past. The 4th National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society published in 2011 a seminal report that has influenced airway management worldwide. Understanding how the report's recommendations were constructed and how clinical guidelines compliment rather than contradict them is important in understanding the tenets of safe airway management. Over the last 25 yr there has been an increasing understanding of the effects of human factors in anaesthesiology: we may not perform in a predictable or optimal manner when faced with unusual and threatening challenges. The place of cricoid pressure in anaesthetic practice has also evolved. Current recommendations are that it be applied, but it should be released rapidly should airway difficulty be encountered. The need to prevent hypoxaemia by preoxygenation has long been recognized, but the role of high-flow nasal oxygen in anaesthesia is now being realized and developed. Clinicians must decide how novel therapies and long-standing practices are adapted to best meet the needs of our patients and prevent harm during airway management.

Transfus Med Rev. 2018 Jan;32(1):6-15

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

McQuilten ZK, Crighton G, Brunskill S, Morison JK, Richter TH, Waters N, Murphy MF, Wood EM

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

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.

Ann Emerg Med. 2017 Dec;70(6):910-911

Is Antiplatelet Therapy an Independent Risk Factor for Traumatic Intracranial Hemorrhage in Patients With Mild Traumatic Brain Injury?

Melville LD, Shah K

Quotes:

“Despite significant heterogeneity, the authors identified antiplatelet therapy to be a modest independent risk factor for intracranial bleeding after traumatic brain injury, increasing the risk of bleeding approximately two-fold. This findingwasmore robust for the mild traumatic brain injury group.”

“The majority of the patients included in this meta-analysis were receiving clopidogrel; therefore, it is reasonable to consider that preinjury use of clopidogrel confers an increased risk of traumatic intracranial hemorrhage similar to that of warfarin. There were not enough data to quantify the risk associated with aspirin monotherapy or other antiplatelet drugs.”

Am J Forensic Med Pathol. 2018 Mar;39(1):61-68

A Case of Fatal Cerebral Air Embolism After Blunt Lung Trauma: Postmortem Computed Tomography and Autopsy Findings.

Mercurio I, Capano D, Torre R, Taddei A, Troiano G, Scialpi M, Gabbrielli M.

ABSTRACT:
Cerebral air embolism is caused by gas bubbles in the vascular system. These bubbles can cause cerebral ischemia by obstructing encephalic blood vessels. It is frequently associated with blunt and penetrating chest trauma as well as iatrogenic interventions. Lung trauma involving laceration of the respiratory tract, lung parenchyma, and blood vessels may result in direct communication of these structures, driving air or gas into the pulmonary venous system. We report a case of a blunt chest trauma that led to massive arterial air embolism that was possible to recognize with the help of postmortem computed tomographic scan examination.

J Trauma Acute Care Surg. 2017 Dec;83(6):1114-1123

Three- versus four-factor prothrombin complex concentrates for "factor-based" resuscitation in a porcine hemorrhagic shock model.

Moe DM, Lallemand MS, McClellan JM, Smith JP, Marko ST, Eckert MJ, Martin MJ.

BACKGROUND: Bleeding is a leading cause of preventable death after severe injury. Prothrombin complex concentrates (PCC) treat inborn coagulation disorders and reverse oral anticoagulants, but are proposed for use in "factor-based" resuscitation strategies. Few studies exist for this indication in acidosis, or that compare 3-factor PCC (3PCC) versus 4-factor PCC (4PCC) products. We aimed to assess and compare their safety and efficacy in a porcine model of severe hemorrhagic shock and coagulopathy.

METHODS: Twenty-five adult Yorkshire swine underwent 35% volume hemorrhage, ischemia-reperfusion injury, and protocolized crystalloid resuscitation. Seventeen animals were randomized at 4 hours after model creation to receive a 45-IU/kg dose of either 3PCC or 4PCC. An additional eight animals received autologous plasma transfusion before 4PCC to better characterize response to PCC. Individual factor levels were drawn at 4 hours and 6 hours.

RESULTS: The model created significant acidosis with mean pH of 7.21 and lactate of 9.6 mmol/L. After PCC, 66.7% of 3PCC animals and 25% of 4PCC animals (regardless of plasma administration) developed consumptive coagulopathy. The animals that developed consumptive coagulopathy had manifested the "lethal triad" with lower temperatures (36.3°C vs. 37.8°C), increased acidosis (pH, 7.14 vs. 7.27; base excess, -12.1 vs. -6.5 mEq/L), and worse coagulopathy (prothrombin time, 17.1 vs. 14.6 seconds; fibrinogen, 87.9 vs. 124.1 mg/dL) (all $p < 0.05$). In the absence of a consumptive coagulopathy, 3PCC and 4PCC improved individual clotting factors with transient improvement of prothrombin time, but there was significant depletion of fibrinogen and platelets with no lasting improvement of coagulopathy.

CONCLUSION: PCC failed to correct coagulopathy and was associated with fibrinogen and platelet depletion. Of greater concern, PCC administration resulted in consumptive coagulopathy in the more severely ill animals. The incidence of consumptive coagulopathy was markedly increased with 3PCC versus 4PCC, and these products should be used with caution in this setting.

Chest. 2017 Nov;152(5):1015-1020

Needle Decompression of Tension Pneumothorax with Colorimetric Capnography.

Naik ND, Hernandez MC, Anderson JR, Ross EK, Zielinski MD, Aho JM

BACKGROUND: The success of needle decompression for tension pneumothorax is variable, and there are no objective measures assessing effective decompression. Colorimetric capnography, which detects carbon dioxide present within the pleural space, may serve as a simple test to assess effective needle decompression.

METHODS: Three swine underwent traumatically induced tension pneumothorax (standard of care, n = 15; standard of care with needle capnography, n = 15). Needle thoracostomy was performed with an 8-cm angiocatheter. Similarly, decompression was performed with the addition of colorimetric capnography. Subjective operator assessment of decompression was recorded and compared with true decompression, using thoracoscopic visualization for both techniques. Areas under receiver operating curves were calculated and pairwise comparison was performed to assess statistical significance ($P < .05$).

RESULTS: The detection of decompression by needle colorimetric capnography was found to be 100% accurate (15 of 15 attempts), when compared with thoracoscopic assessment (true decompression). Furthermore, it accurately detected the lack of tension pneumothorax, that is, the absence of any pathologic/space-occupying lesion, in 100% of cases (10 of 10 attempts). Standard of care needle decompression was detected by operators in 9 of 15 attempts (60%) and was detected in 3 of 10 attempts when tension pneumothorax was not present (30%). True decompression, under direct visualization with thoracoscopy, occurred 15 of 15 times (100%) with capnography, and 12 of 15 times (80%) without capnography. Areas under receiver operating curves were 0.65 for standard of care and 1.0 for needle capnography ($P = .002$).

CONCLUSIONS: Needle decompression with colorimetric capnography provides a rapid, effective, and highly accurate method for eliminating operator bias for tension pneumothorax decompression. This may be useful for the treatment of this life-threatening condition.

BMJ Open. 2018 Jan 23;8(1):e019627

What fluids are given during air ambulance treatment of patients with trauma in the UK, and what might this mean for the future? Results from the RESCUER observational cohort study.

Naumann DN, Hancox JM, Raitt J, Smith IM, Crombie N, Doughty H, Perkins GD, Midwinter MJ; RESCUER Collaborators.

Collaborators: Evans D, Conway J, Leech C, Lewis S, Church N, Mickwitz CV, Pountney A, Bell F, Shewan J, Hyde P, Eddie M, Walker M, Hindson R, Wilson A, Elms S, Hood C, Blackham J, Grier S, Brown V, Irwin R, Clarke N, Corfield A, Cadman A, Evans D, Conway J, Leech C, Lewis S, Church N, Mickwitz CV, Pountney A, Bell F, Shewan J, Hyde P, Eddie M, Walker M, Hindson R, Wilson A, Elms S, Hood C, Blackham J, Grier S, Brown V, Irwin R, Clarke N, Corfield A, Cadman A.

OBJECTIVES: We investigated how often intravenous fluids have been delivered during physician-led prehospital treatment of patients with hypotensive trauma in the UK and which fluids were given. These data were used to estimate the potential national requirement for prehospital blood products (PHBP) if evidence from ongoing trials were to report clinical superiority.

SETTING: The Regional Exploration of Standard Care during Evacuation Resuscitation (RESCUER) retrospective observational study was a collaboration between 11 UK air ambulance services. Each was invited to provide up to 5 years of data and total number of taskings during the same period.

PARTICIPANTS: Patients with hypotensive trauma (systolic blood pressure <90 mm Hg or absent radial pulse) attended by a doctor.

PRIMARY AND SECONDARY OUTCOME MEASURES: The primary outcome was the number of patients with hypotensive trauma given prehospital fluids. Secondary outcomes were types and volumes of fluids. These data were combined with published data to estimate potential national eligibility for PHBP.

RESULTS: Of 29 037 taskings, 729 (2.5%) were for patients with hypotensive trauma attended by a physician. Half were aged 21-50 years; 73.4% were male. A total of 537 out of 729 (73.7%) were given fluids. Five hundred and ten patients were given a single type of fluid; 27 received >1 type. The most common fluid was 0.9% saline, given to 486/537 (90.5%) of patients who received fluids, at a median volume of 750 (IQR 300-1500) mL. Three per cent of patients received PHBP. Estimated projections for patients eligible for PHBP at these 11 services and in the whole UK were 313 and 794 patients per year, respectively.

CONCLUSIONS: One in 40 air ambulance taskings were manned by physicians to retrieve patients with hypotensive trauma. The most common fluid delivered was 0.9% saline. If evidence justifies universal provision of PHBP, approximately 800 patients/year would be eligible in the UK, based on our data combined with others published. Prospective investigations are required to confirm or adjust these estimations.

J Trauma Acute Care Surg. 2018 Jan 12. doi: 10.1097/TA.0000000000001801. [Epub ahead of print]

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 units of RBC in the emergency room were included and assigned to two groups according to first plasma transfused: FLYP group and FFP group.

RESULTS: 43 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) vs. 95 min (70-145) ($P < 0.0001$). Time until a 1/1 ratio was shorter in FLYP group than if 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.

Crit Care Med. 2018 Jan;46(1):e59-e66

Improvement of Blood-Brain Barrier Integrity in Traumatic Brain Injury and Hemorrhagic Shock Following Treatment With Valproic Acid and Fresh Frozen Plasma.

Nikolian VC, Dekker SE, Bambakidis T, Higgins GA, Dennahy IS, Georgoff PE, Williams AM, Andjelkovic AV, Alam HB

OBJECTIVE: Combined traumatic brain injury and hemorrhagic shock are highly lethal. Following injuries, the integrity of the blood-brain barrier can be impaired, contributing to secondary brain insults. The status of the blood-brain barrier represents a potential factor impacting long-term neurologic outcomes in combined injuries. Treatment strategies involving plasma-based resuscitation and valproic acid therapy have shown efficacy in this setting. We hypothesize that a component of this beneficial effect is related to blood-brain barrier preservation.

DESIGN: Following controlled traumatic brain injury, hemorrhagic shock, various resuscitation and treatment strategies were evaluated for their association with blood-brain barrier integrity. Analysis of gene expression profiles was performed using Porcine Gene ST 1.1 microarray. Pathway analysis was completed using network analysis tools (Gene Ontology, Ingenuity Pathway Analysis, and Parametric Gene Set Enrichment Analysis).

SUBJECTS: Female Yorkshire swine were subjected to controlled traumatic brain injury and 2 hours of hemorrhagic shock (40% blood volume, mean arterial pressure 30-35 mmHg).

INTERVENTIONS: Subjects were resuscitated with 1) normal saline, 2) fresh frozen plasma, 3) hetastarch, 4) fresh frozen plasma + valproic acid, or 5) hetastarch + valproic acid (n = 5 per group). After 6 hours of observation, brains were harvested for evaluation.

MEASUREMENTS AND MAIN RESULTS: Immunofluoroscopic evaluation of the traumatic brain injury site revealed significantly increased expression of tight-junction associated proteins (zona occludin-1, claudin-5) following combination therapy (fresh frozen plasma + valproic acid and hetastarch + valproic acid). The extracellular matrix protein laminin was found to have significantly improved expression with combination therapies. Pathway analysis indicated that valproic acid significantly modulated pathways involved in endothelial barrier function and cell signaling.

CONCLUSIONS: Resuscitation with fresh frozen plasma results in improved expression of proteins essential for blood-brain barrier integrity. The addition of valproic acid provides significant improvement to these protein expression profiles. This is likely secondary to activation of key pathways related to endothelial functions.

J Trauma Acute Care Surg. 2017 Dec;83(6):1066-1073

Valproic acid decreases brain lesion size and improves neurologic recovery in swine subjected to traumatic brain injury, hemorrhagic shock, and polytrauma.

Nikolian VC, Georgoff PE, Pai MP, Dennahy IS, Chtraklin K, Eidy H, Ghandour MH, Han Y, Srinivasan A, Li Y, Alam HB.

BACKGROUND: We have previously shown that treatment with valproic acid (VPA) decreases brain lesion size in swine models of traumatic brain injury (TBI) and controlled hemorrhage. To translate this treatment into clinical practice, validation of drug efficacy and evaluation of pharmacologic properties in clinically realistic models of injury are necessary. In this study, we evaluate neurologic outcomes and perform pharmacokinetic analysis of a single dose of VPA in swine subjected to TBI, hemorrhagic shock, and visceral hemorrhage.

METHODS: Yorkshire swine (n = 5/cohort) were subjected to TBI, hemorrhagic shock, and polytrauma (liver and spleen injury, rib fracture, and rectus abdominis crush). Animals remained in hypovolemic shock for 2 hours before resuscitation with isotonic sodium chloride solution (ISCS; volume = 3× hemorrhage) or ISCS + VPA (150 mg/kg). Neurologic severity scores were assessed daily for 30 days, and brain lesion size was measured via magnetic resonance imaging on postinjury days (PID) 3 and 10. Serum samples were collected for pharmacokinetic analysis.

RESULTS: Shock severity and response to resuscitation were similar in both groups. Valproic acid-treated animals demonstrated significantly less neurologic impairment between PID 1 to 5 and smaller brain lesions on PID 3 (mean lesion size ± SEM, mm: ISCS = 4,956 ± 1,511 versus ISCS + VPA = 828 ± 279; p = 0.047). No significant difference in lesion size was identified between groups at PID 10 and all animals recovered to baseline neurologic function during the 30-day observation period. Animals treated with VPA had faster neurocognitive recovery (days to initiation of testing, mean ± SD: ISCS = 6.2 ± 1.6 vs ISCS + VPA = 3.6 ± 1.5; p = 0.002; days to task mastery: ISCS = 7.0 ± 1.0 vs ISCS + VPA = 4.8 ± 0.5; p = 0.03). The mean ± SD maximum VPA concentrations, area under the curve, and half-life were 145 ± 38.2 mg/L, 616 ± 150 hour·mg/L, and 1.70 ± 0.12 hours.

CONCLUSIONS: In swine subjected to TBI, hemorrhagic shock, and polytrauma, VPA treatment is safe, decreases brain lesion size, and reduces neurologic injury compared to resuscitation with ISCS alone. These benefits are achieved at clinically translatable serum concentrations of VPA.

LEVEL OF EVIDENCE: Therapeutic (preclinical study).

Shock. 2017 Dec 15. doi: 10.1097/SHK.0000000000001082. [Epub ahead of print]

Effects of Sanguinate® on Systemic and Microcirculatory Variables in a Model of Prolonged Hemorrhagic Shock.

Nugent WH, Cestero RF, Ward K, Jubin R, Abuchowski A, Song BK

BACKGROUND: Hemorrhage and its complications are the leading cause of preventable death from trauma in young adults, especially in remote locations. To address this, deliverable, shelf-stable resuscitants that provide therapeutic benefits throughout the time course of hemorrhagic shock and the progressive ischemic injury it produces are needed. SANGUINATE is a novel bovine PEGylated carboxyhemoglobin-based oxygen carrier, which has desirable oxygen-carrying and oncotic properties as well as a CO moiety to maintain microvascular perfusion.

OBJECTIVES: To compare the crystalloid (Lactated Ringer's Solution; LRS), and the colloid (Hextend) standards of care with SANGUINATE in a post "golden hour" resuscitation model.

METHODS: Rats underwent a controlled, stepwise blood withdrawal (45% by volume), were maintained in untreated hemorrhagic shock state for>60 min, resuscitated with a 20% bolus of one of the three test solutions, and observed till demise. Parameters of tissue oxygenation (PISFO2), arteriolar diameters, and mean arterial pressure (MAP) were collected.

RESULTS: SANGUINATE-treated animals survived significantly longer than those treated with Hextend and LRS. SANGUINATE also significantly increased tissue PISFO2 two hours after resuscitation, whereas LRS and Hextend did not. SANGUINATE also produced a significantly higher MAP, which was hypotensive compared to baseline, that endured until demise.

CONCLUSIONS: Resuscitation with SANGUINATE after PHS improves survival, MAP, and PISFO2 compared to standard of care plasma expanders. Since the pathologies of hemorrhagic shock and the associated systemic ischemia are progressive, preclinical studies of this nature are essential to determine efficacy of new resuscitants across the range of possible times to treatment.

J Spec Oper Med. Winter 2017;17(4):19-28.

Extraglottic Airways in Tactical Combat Casualty Care: TCCC Guidelines Change 17-01 28 August 2017.

Otten EJ, Montgomery HR, Butler FK Jr.

ABSTRACT:
Extraglottic airway (EGA) devices have been used by both physicians and prehospital providers for several decades. The original TCCC Guidelines published in 1996 included a recommendation to use the laryngeal mask airway (LMA) as an option to assist in securing the airway in Tactical Evacuation (TACEVAC) phase of care. Since then, a variety of EGAs have been used in both combat casualty care and civilian trauma care. In 2012, the Committee on TCCC (CoTCCC) and the Defense Health Board (DHB) reaffirmed support for the use of supraglottic airway (SGA) devices in the TACEVAC phase of TCCC, but did not recommend a specific SGA based on the evidence available at that point in time. This paper will use the more inclusive term "extraglottic airway" instead of the term "supragottic airway" used in the DHB memo. Current evidence suggests that the i-gel® (Intersurgical Complete Respiratory Systems; http://www.intersurgical.com/info/igel) EGA performs as well or better than the other EGAs available and has other advantages in ease of training, size and weight, cost, safety, and simplicity of use. The gel-filled cuff in the i-gel both eliminates the need for cuff pressure monitoring during flight and reduces the risk of pressure-induced neuropraxia to cranial nerves in the oropharynx and hypopharynx as a complication of EGA use. The i-gel thus makes the medic's tasks simpler and frees him or her from the requirement to carry a cuff manometer as part of the medical kit. This latest change to the TCCC Guidelines as described below does the following things: (1) adds extraglottic airways (EGAs) as an option for airway management in Tactical Field Care; (2) recommends the i-gel as the preferred EGA in TCCC because its gel-filled cuff makes it simpler to use than EGAs with air-filled cuffs and also eliminates the need for monitoring of cuff pressure; (3) notes that should an EGA with an air-filled cuff be used, the pressure in the cuff must be monitored, especially during and after changes in altitude during casualty transport; (4) emphasizes COL Bob Mabry's often-made point that extraglottic airways will not be tolerated by a casualty unless he or she is deeply unconscious and notes that an NPA is a better option if there is doubt about whether or not the casualty will tolerate an EGA; (5) adds the use of suction as an adjunct to airway management when available and appropriate (i.e., when needed to remove blood and vomitus); (6) clarifies the wording regarding cervical spine stabilization to emphasize that it is not needed for casualties who have sustained only penetrating trauma (without blunt force trauma); (7) reinforces that surgical cricothyroidotomies should not be performed simply because a casualty is unconscious; (8) provides a reminder that, for casualties with facial trauma or facial burns with suspected inhalation injury, neither NPAs nor EGAs may be adequate for airway management, and a surgical cricothyroidotomy may be required; (9) adds that pulse oximetry monitoring is a useful adjunct to assess airway patency and that capnography should also be used in the TACEVAC phase of care; and (10) reinforces that a casualty's airway status may change over time and that he or she should be frequently reassessed.

Can J Anaesth. 2017 Dec 4. doi: 10.1007/s12630-017-1030-x. [Epub ahead of print]

Focused assessment with sonography in trauma: a review of concepts and considerations for anesthesiology.

Pace J, Arntfield R

ABSTRACT:
The use of point-of-care ultrasound in trauma provides diagnostic clarity and routinely influences management. A scanning protocol known as the Focused Assessment with Sonography in Trauma (FAST) has been widely adopted by trauma providers of all specialties. The FAST exam addresses a broad array of pathologic conditions capable of causing instability, including hemoperitoneum, hemopericardium, hemothorax, and pneumothorax. The exam is an integral component to the primary assessment of injured patients and an iconic application of point-of-care ultrasound.This review article aims to summarize the application of the FAST exam with special consideration, where relevant, to anesthesiologists. The scope of the FAST exam, technical considerations, and clinical decision-making in trauma are explored.

J Spec Oper Med. Winter 2017;17(4):133-137.

"Evita Una Muerte, Esta en Tus Manos" Program: Bystander First Aid Training for Terrorist Attacks.

Pajuelo Castro JJ, Meneses Pardo JC, Salinas Casado PL, Hernandez Martin P, Montilla Canet R, Del Campo Cuesta JL, Incera Bustio G, Martin Ayuso D.

BACKGROUND: The latest terrorist attacks in Europe and in the rest of the world, and the military experience in the most recent conflicts leave us with several lessons learned. The most important is that the fate of the wounded rests in the hands of the one who applies the first dressing, because the victims usually die within the first 10 minutes, before professional care providers or police personnel arrive at the scene. A second lesson is that the primary cause of preventable death in these types of incidents involving explosives and firearms is massive hemorrhage.

OBJECTIVE: There is a need to develop a training oriented to citizens so they can identify and use available resources to avoid preventable deaths that occur in this kind of incidents, especially massive hemorrhage.

METHODS: A 7-hour training intervention program was developed and conducted between January and May 2017. Data were collected from participants' answers on a multiple-choice test before and after undertaking the training. Improved mean score for at least 75% of a group's members on the post-training test was considered reflective of adequate knowledge.

RESULTS: A total of 173 participants (n = 74 men [42.8%]; n = 99 women [57.2%]) attended the training. They were classified into three groups: a group of citizens/ first responders with no prior health training, a group of health professionals, and a group of nursing students. Significant differences ($\rho < .05$) between mean pre- and post-training test scores occurred in each of the three groups.

CONCLUSION: There was a clear improvement in the knowledge of the students after the training when pre- and post-training test scores were compared within the three groups. The greatest improvement was seen in the citizens/first responders group.

Anesth Essays Res. 2017 Oct-Dec;11(4):958-963

ProSeal Laryngeal Mask Airway versus Cuffed Endotracheal Tube for Laparoscopic Surgical Procedures under General Anesthesia: A Random Comparative Study.

Parikh SS, Parekh SB, Doshi C, Vyas V

Context: The Proseal LMA(PLMA), which has been designed especially for positive pressure ventilation and protection against aspiration can act as an alternative to Endotracheal Tube (ETT) as an effective airway device for patients undergoing elective Laparoscopic surgeries.

Aims: To compare the efficacy and safety of PLMA with ETT in patients undergoing Laparoscopic surgeries under general anaesthesia.

Settings and Design: A prospective, randomized study was conducted in a tertiary care teaching hospital with 60 patients of ASA grade I/II undergoing elective Laparoscopic surgery under general anaesthesia. Ethical committee clearance and written consent taken. The patients were randomly divided into two equal groups to the PLMA group (Group S) and to the ETT group (Group C) Heart rate (HR), mean blood pressure (MAP), ETCO2 values, intraoperative complications such as regurgitation- aspiration, and Postoperative complications such as nausea or vomiting, throat soreness and oral injuries were monitored.

Results: There was no difference demographically. Insertion success rate was 100% for both the groups. The mean increase in HR was seen all throughout the duration of the surgery to 8 % above the baseline in Group C and to 3% above the baseline in Group S. On comparing the MAP in Group C, there was a increased by 2.5% to 78.300 ± 14.2615 mmHg as compared to an increase by 5% to 76.233 ± 6.2072 mmHg in Group S. EtCO2 showed a rise in both groups after pneumoperitoneum, which returned to baseline values after completion of surgery. Gastric aspirate values showed no difference in each group. Post op complications were seen mainly in Group C with statistical significance.

Conclusions: A properly positioned PLMA is a suitable and safe alternative to ETT for airway management in adequately fasted, adult patients undergoing elective Laparoscopic surgeries.

Air Med J. 2017 Nov - Dec;36(6):315-319

Prehospital Transfusion for Gastrointestinal Bleeding.

Parker ME, Khasawneh MA, Thiels CA, Berns KS, Stubbs JR, Jenkins DH, Zietlow SP, Zielinski MD

OBJECTIVE: Gastrointestinal (GI) bleeding is a common medical emergency with significant morbidity and mortality. Many patients are coagulopathic, which may perpetuate bleeding. Remote damage control resuscitation, including early correction of coagulopathy and anemia, may benefit exsanguinating patients with GI bleeding.

METHODS: We conducted a retrospective review of patients with acute GI bleeding who received packed red blood cells (pRBC) and/or plasma during transportation to our institution between 2010 and 2014. A comparison group of patients who were not transfused en route was selected, and demographics, outcomes, and response to resuscitation were compared.

RESULTS: A total of 112 patients with GI bleeding received pRBC (82%, n = 92 pRBC, mean 1.7 ± 0.9 units), plasma (62%, n = 69, mean 1.7 ± 0.8 units) or both (44%, n = 49) en-route. The comparison group comprised 49 patients transported by helicopter who were not transfused en-route. Demographics, crystalloid resuscitation, transfusion prior to transfer, rate of intervention, ICU days, length of stay, and mortality were similar between groups. Patients transfused en route had a significant increase in hemoglobin from 8.3 ± 2.2 to 8.9 ± 2.1 (P = .03) and decrease in INR from 2.0 ± 1.0 to 1.6 ± 1.4 (P = .01), whereas those not transfused en route experienced stable hemoglobin (8.7 ± 2.8 to 9.4 ± 2.5; P = .21) and INR values (1.9 ± 1.0 to 1.6 ± 1.4; P = .32). Both groups had a significant improvement in hemodynamic parameters with resuscitation.

CONCLUSION: Prehospital damage control resuscitation with pRBC and/or plasma resulted in the improvement of hemodynamic instability, coagulopathy and anemia in patients with acute GI bleeding. Almost all patients required additional inpatient interventions and/or transfusions, suggesting that pre-hospital transfusion is being utilized for appropriately selected patients.

PLoS One. 2018 Feb 2;13(2):e0192363

Lyophilized plasma attenuates vascular permeability, inflammation and lung injury in hemorrhagic shock.

Pati S, Peng Z, Wataha K, Miyazawa B, Potter DR, Kozar RA

ABSTRACT:
In severe trauma and hemorrhage the early and empiric use of fresh frozen plasma (FFP) is associated with decreased morbidity and mortality. However, utilization of FFP comes with the significant burden of shipping and storage of frozen blood products. Dried or lyophilized plasma (LP) can be stored at room temperature, transported easily, reconstituted rapidly with ready availability in remote and austere environments. We have previously demonstrated that FFP mitigates the endothelial injury that ensues after hemorrhagic shock (HS). In the current study, we sought to determine whether LP has similar properties to FFP in its ability to modulate endothelial dysfunction in vitro and in vivo. Single donor LP was compared to single donor FFP using the following measures of endothelial cell (EC) function in vitro: permeability and transendothelial monolayer resistance; adherens junction preservation; and leukocyte-EC adhesion. In vivo, using a model of murine HS, LP and FFP were compared in measures of HS-induced pulmonary vascular inflammation and edema. Both in vitro and in vivo in all measures of EC function, LP demonstrated similar effects to FFP. Both FFP and LP similarly reduced EC permeability, increased transendothelial resistance, decreased leukocyte-EC binding and persevered adherens junctions. In vivo, LP and FFP both comparably reduced pulmonary injury, inflammation and vascular leak. Both FFP and LP have similar potent protective effects on the vascular endothelium in vitro and in lung function in vivo following hemorrhagic shock. These data support the further development of LP as an effective plasma product for human use after trauma and hemorrhagic shock.

Eur J Emerg Med. 2017 Nov 17. doi: 10.1097/MEJ.0000000000000516. [Epub ahead of print]

Are on-scene blood transfusions by a helicopter emergency medical service useful and safe? a multicentre case-control study.

Peters JH, Smulders PSH, Moors XRJ, Bouman SJM, Meijs CMEM, Hoogerwerf N, Edwards MJR

INTRODUCTION: In the prehospital setting, crystalloid fluids are frequently used, but only erythrocytes are capable of transporting oxygen to tissues. The aim of this study was to establish the efficacy and safety of the prehospital use of uncross matched type O rhesus-negative packed red blood cells (URBC) by the Dutch physician-staffed helicopter emergency medical service. We hypothesized that prehospital URBC transfusions are safe and more effective with respect to survival than resuscitations with crystalloids.

METHODS: The effects of prehospital URBC transfusions were studied by comparing a cohort of patients (>18 years) who were treated with a combination of URBC and crystalloid fluids with a matched control group of patients who received crystalloid fluids alone.

RESULTS: Among 73 adults who received prehospital URBC transfusions, 50 (68%) patients were included. No transfusion reactions were observed. No effect of prehospital transfusion on 24-h or 30-day survival was found. Haemoglobin levels at presentation to the emergency department were higher in the URBC cohort. The two groups had similar cumulative erythrocyte requirements within the first 24 h.

CONCLUSION: Neither survival benefits nor a decreased incidence of shock on admission were observed after prehospital helicopter emergency medical service URBC transfusions. There were no prehospital transfusion reactions in this study; therefore, URBC transfusions were deemed to be safe. A prospective randomized study is warranted to evaluate the effect of early URBC transfusions and transfusions with preheated URBC on the survival of patients with severe prehospital haemorrhagic shock.

Front Surg. 2017 Dec 19;4:73. doi: 10.3389/fsurg.2017.00073. eCollection 2017.

Damage Control for Vascular Trauma from the Prehospital to the Operating Room Setting.

Pikoulis E, Salem KM, Avgerinos ED, Pikouli A, Angelou A, Pikoulis A, Georgopoulos S, Karavokyros I

ABSTRACT:
Early management of vascular injury, starting at the field, is imperative for survival no less than any operative maneuver. Contemporary prehospital management of vascular trauma, including appropriate fluid and volume infusion, tourniquets, and hemostatic agents, has reversed the historically known limb hemorrhage as a leading cause of death. In this context, damage control (DC) surgery has evolved to DC resuscitation (DCR) as an overarching concept that draws together preoperative and operative interventions aiming at rapidly reducing bleeding from vascular disruption, optimizing oxygenation, and clinical outcomes. This review addresses contemporary DCR techniques from the prehospital to the surgical setting, focusing on civilian vascular injuries.

J Trauma Acute Care Surg. 2018 Jan;84(1):37-49

Monitoring modalities and assessment of fluid status: A practice management guideline from the Eastern Association for the Surgery of Trauma.

Plurad DS, Chiu W, Raja AS, Galvagno SM, Khan U, Kim DY, Tisherman SA, Ward J, Hamill ME, Bennett V, Williams B, Robinson B.

BACKGROUND: Fluid administration in critically ill surgical patients must be closely monitored to avoid complications. Resuscitation guided by invasive methods are not consistently associated with improved outcomes. As such, there has been increased use of focused ultrasound and Arterial Pulse Waveform Analysis (APWA) to monitor and aid resuscitation. An assessment of these methods using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) framework is presented.

METHODS: A subsection of the Surgical Critical Care Task Force of the Practice Management Guideline Committee of EAST conducted two systematic reviews to address the use of focused ultrasound and APWA in surgical patients being evaluated for shock. Six population, intervention, comparator, and outcome (PICO) questions were generated. Critical outcomes were prediction of fluid responsiveness, reductions in organ failures or complications and mortality. Forest plots were generated for summary data and GRADE methodology was used to assess for quality of the evidence. Reviews are registered in PROSPERO, the International Prospective Register of Systematic Reviews (42015032402 and 42015032530).

RESULTS: Twelve focused ultrasound studies and 20 APWA investigations met inclusion criteria. The appropriateness of focused ultrasound or APWA-based protocols to predict fluid responsiveness varied widely by study groups. Results were mixed in the one focused ultrasound study and 9 APWA studies addressing reductions in organ failures or complications. There was no mortality advantage of either modality versus standard care. Quality of the evidence was considered very low to low across all PICO questions.

CONCLUSION: Focused ultrasound and APWA compare favorably to standard methods of evaluation but only in specific clinical settings. Therefore, conditional recommendations are made for the use of these modalities in surgical patients being evaluated for shock.

LEVEL OF EVIDENCE: Systematic Review, level II.

Injury. 2017 Dec;48(12):2890-2892

Do austere surgical units belong on a mature battlefield? A critique of the evidence.

Reade MC, Brennan LB

Quotes:

“In the October 2017 issue of Injury, Childers and Parker contend that inferior clinical results achieved by austere military Role 2 (R2) surgical facilities means that they should only be used where mobility is more important than capability, when risk is low, or during the initial phases of a major combat operation before the trauma system matures and larger Role 3 (R3) hospitals can be established [1]. Further, they argue shortening delay to initial surgery at a closer R2 facility is unlikely to outweigh the detrimental effect of not receiving initial treatment in a more capable R3 hospital. This argument is superficially attractive: capable multidisciplinary civilian trauma centres are known to have outcomes superior to those achieved when major trauma patients are transported to the closest non-trauma hospital [2]. However, their editorial ignores several points of complexity, with substantial consequent risk that military planners might degrade rather than improve the standard of trauma care on military operations.”

“Many “Middle Power” countries, such as Australia and the Netherlands, have well-developed capabilities for expeditionary military operations. However, many including Australia (with permanent armed forces 1/3 the size of the UK and 1/20 the size of the US) currently have no capability to generate a deployed Role 3 hospital. To the uninformed, Childers and Parker appear to state there is evidence such countries provide inadequate medical support. The evidence does not support this conclusion. While austere R2 forward surgical teams might indeed provide a less capable service than R3 hospitals, well-equipped, trauma-focussed R2Es make a valuable contribution to the military trauma system. Highlighting this point will hopefully allow such countries to continue to contribute medical facilities to coalition operations.”

J Trauma Acute Care Surg. 2017 Dec;83(6):1041-1046

REBOA for the IVC? Resuscitative balloon occlusion of the inferior vena cava (REBOVC) to abate massive hemorrhage in retrohepatic vena cava injuries.

Reynolds CL, Celio AC, Bridges LC, Mosquera C, O'Connell B, Bard MR, DeLa'o CM, Toschlog EA.

BACKGROUND: The use of resuscitative endovascular balloon occlusion as a maneuver for occlusion of the aorta is well described. This technique has life-saving potential in other cases of traumatic hemorrhage. Retrohepatic inferior vena cava (IVC) injuries have a high rate of mortality, in part, due to the difficulty in achieving total vascular isolation. The purpose of this study was to investigate the ability of resuscitative balloon occlusion of the IVC to control suprahepatic IVC hemorrhage in a swine model of trauma.

METHODS: Thirteen swine were randomly assigned to control (seven animals) versus intervention (six animals). In both groups, an injury was created to the IVC. Hepatic inflow control was obtained via clamping of the hepatoduodenal ligament and infrahepatic IVC. In the intervention group, suprahepatic IVC control was obtained via a resuscitative balloon occlusion of the IVC placed through the femoral vein. In the control group, no suprahepatic IVC control was established. Vital signs, arterial blood gases, and lactate were monitored until death. Primary end points were blood loss and time to death. Lactate, pH, and vital signs were secondary end points. Groups were compared using the χ and the Student t test with significance at $p < 0.05$.

RESULTS: Intervention group's time to death was significantly prolonged: 59.3 ± 1.6 versus 33.4 ± 12.0 minutes ($p = 0.001$); and total blood loss was significantly reduced: 333 ± 122 vs 1,701 ± 358 mL ($p = 0.001$). In the intervention group, five of the six swine (83.3%) were alive at 1 hour compared to zero of seven (0%) in the control group ($p = 0.002$). There was a trend toward worsening acidosis, hypothermia, elevated lactate, and hemodynamic instability in the control group.

CONCLUSIONS: Resuscitative balloon occlusion of the IVC demonstrates superior hemorrhage control and prolonged time to death in a swine model of liver hemorrhage. This technique may be considered as an adjunct to total hepatic vascular isolation in severe liver hemorrhage and could provide additional time needed for definitive repair.

LEVEL OF EVIDENCE: Therapeutic study, level II.

Best Pract Res Clin Anaesthesiol. 2017 Sep;31(3):345-352

Impact of volume status and volume therapy on the kidney.

Roberts DA, Shaw AD

ABSTRACT:
Volume resuscitation to correct hypotension in surgical and critically ill patients is a common practice. Available evidence suggests that iatrogenic volume overload is associated with worse outcomes in established acute kidney injury. Intraoperative arterial hypotension is associated with postoperative renal dysfunction, and prompt correction with fluid management protocols that combine inotrope infusions with volume therapy targeted to indices of volume responsiveness should be considered. From the perspective of renal function, the minimum amount of intravenous fluid required to maintain perfusion and oxygen delivery is desirable. Available evidence and expert opinion suggest that balanced crystalloid solutions are preferable to isotonic saline for volume resuscitation. Moreover, albumin has a similar safety profile as crystalloids. Hetastarch-containing colloids have a clear association with acute kidney injury.

Shock. 2017 Nov 30

Risk Factors for the Development of Acute Respiratory Distress Syndrome Following Hemorrhage.

Robinson BRH, Cohen MJ, Holcomb JB, Pritts TA, Gomaa D, Fox EE, Branson RD, Callcut RA, Cotton BA, Schreiber MA, Brasel KJ, Pittet JF, Inaba K, Kerby JD, Scalea TM, Wade CE, Bulger EM; PROPPR Study Group.

BACKGROUND: The Pragmatic Randomized Optimal Platelet and Plasma Ratios (PROPPR) study evaluated the effects of plasma and platelets on hemostasis and mortality after hemorrhage. The pulmonary consequences of resuscitation strategies that mimic whole blood, remain unknown.

METHODS: A secondary analysis of the PROPPR study was performed. Injured patients predicted to receive a massive transfusion were randomized to 1:1:1 vs. 1:1:2 plasma-platelet-RBC ratios at 12 Level I North American trauma centers. Patients with survival >24 hours, an ICU stay, and a recorded PaO2/FiO2 (P/F) ratio were included. ARDS was defined as a P/F ratio <200, with bilateral pulmonary infiltrates, and adjudicated by investigators.

RESULTS: 454 patients were reviewed (230 received 1:1:1, 224 1:1:2). Age, sex, injury mechanism, and regional abbreviated injury scale (AIS) scores did not differ between cohorts. Tidal volume, PEEP, and lowest P/F ratio did not differ. No significant differences in ARDS rates (14.8 vs. 18.4%), ventilator-free (24 vs. 24) or ICU-free days (17.5 vs. 18), hospital length of stay (22 vs. 18 days), or 30-day mortality were found (28 vs. 28%). ARDS was associated with blunt injury (OR 3.61 [1.53-8.81] $p<0.01$) and increasing chest AIS (OR 1.40 [1.15-1.71] $p<0.01$). Each 500 mL of crystalloid infused during hours 0-6 was associated with a 9% increase in the rate of ARDS (OR 1.09 [1.04-1.14] $p<0.01$). Blood given at 0-6 or 7-24 hours were not risk factors for lung injury.

CONCLUSION: Acute crystalloid exposure, but not blood products, is a potentially modifiable risk factor for the prevention of ARDS following hemorrhage.

J Emerg Med. 2017 Nov 24. pii: S0736-4679(17)30867-3. doi: 10.1016/j.jemermed.2017.09.011. [Epub ahead of print]

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.

J Neurotrauma. 2018 Feb 1;35(3):461-466

Incidence and Natural Progression of Neurogenic Shock after Traumatic Spinal Cord Injury.

Ruiz IA, Squair JW, Phillips AA, Lukac CD, Huang D, Oxciano P, Yan D, Krassioukov AV

ABSTRACT:
Neurogenic shock, a distributive type of circulatory shock after spinal cord injury (SCI), results in profound hypotension. The consequent hemodynamic instability complicates clinical management, delays surgical intervention, and impacts neurological outcome. Moreover, the reported incidence of this condition varies significantly. We establish the true incidence of neurogenic shock by comparing the most common clinical definitions used to diagnose the condition. Further, we characterize the acute progression and recovery of neurogenic shock. Daily blood pressure, heart rate, and fluid management as well as vasopressor therapy and neurologic status were collected over 30 days from 84 adults admitted to our tertiary trauma center after cervical (n = 56) and thoracic (n = 28) SCI. We found that the reported incidence of neurogenic shock varied greatly depending on which clinical definition was applied. By using a novel combination of hemodynamic and laboratory criteria to define neurogenic shock, the calculated incidence (29% cervical SCI) in our sample most appropriately reflects the true incidence, finding that hypovolemia was the primary factor responsible for the inconsistency in incidence reports between studies. In addition, we found a characteristic decline in blood pressure after the first week post-injury and that fluid management is not currently an integral aspect of clinical management (all persons were treated at a net fluid intake ≤ zero). The results demonstrate the need for accurate identification of neurogenic shock through consistent and appropriate criteria, which is not only important from a clinical point of view, but also in establishing accurate epidemiology to responsibly allocate resources to its management.

Chirurgia (Bucur). 2017 Sept-Oct;112(5):514-523

Damage Control Resuscitation.

Samuels JM, Moore HB, Moore EE.

ABSTRACT:
Damage control surgery is a combination of temporizing surgical interventions to arrest hemorrhage and control infectious source, with goal directed resuscitation to restore normal physiology. The convention of damage control surgery largely arose following the discovery of the lethal triad of hypothermia, acidosis, and coagulopathy, with the goal of Damage Control Surgery (DCS) is to avoid the initiation of this "bloody vicious cycle" or to reverse its progression. While hypothermia and acidosis are generally corrected with resuscitation, coagulopathy remains a challenging aspect of DCS, and is exacerbated by excessive crystalloid administration. This chapter focuses on resuscitative principles in the four settings of trauma care: the prehospital setting, emergency department, operating room, and intensive care unit including historical perspectives, resuscitative methods, controversies, and future directions. Each setting provides unique challenges with specific goals of care.

Ulus Travma Acil Cerrahi Derg. 2018 Jan;24(1):9-15

Evaluation of tourniquet application in a simulated tactical environment.

Sanak T, Brzozowski R, Dabrowski M, Kozak M, Dabrowska A, Sip M, Naylor K, Torres K.

BACKGROUND: Application of a tourniquet in a tactical environment is implemented in two ways: the so-called self-aid, which is the application of a tourniquet by the injured, and the so-called buddy aid, which is the application of a tourniquet by the person provide aid. This study aimed to test the quality of tourniquet use in a simulated situation, close quarter battle.

METHODS: The study involved 24 injured operators and 72 operators in the whole simulation, implying 12 sections of six individuals. To validate the application of tourniquets, the recommendations of the Committee of Tactical Combat Care of the Injured were used, and ultrasound with Doppler function was employed to assess the hemodynamic effect of applying tourniquets.

RESULTS: Native flow was observed in 15 operators; in three people, a trace flow was noticed, whereas in six people, a full flow was observed. No significant difference was found between the qualities of tourniquet application by theoperators themselves compared with those of tourniquet application by another person. The median distance of tourniquet application from the armpit was 9.5 cm for self-aid and buddy aid. In 16 participants the outer arrangement of tourniquets was observed, and in only eight participants tourniquets were correctly located on the internal part of the arm. In 18 participants, tourniquets were not correctly prepared for use in the tactical environment, whereas in only six participants, they were correctly prepared. Most operators with a negative ultrasound flow revealed negative distal observed pulse (DOP). Positive DOP occurred in the majority of operators with full ultrasound flow.

CONCLUSION: The application of tourniquets poses a challenge even in case of specialized units; therefore, there is a need to provide regular training for implementing that procedure.

Mil Med. 2018 Jan 1;183(1-2):e45-e50

Fibrinogen Concentrate in the Special Operations Forces Environment.

Sanders S, Tien H, Callum J, Nascimento B, Peng H, Funk C, Schmid J, Rizoli S, Rhind S, Beckett A

Introduction: Hemorrhage is the most common cause of death among Special Operations Force (SOF) soldiers. Bringing remote damage control resuscitation into the far-forward combat environment is logistically challenging, as it requires blood products that generally require a robust cold chain. Alternatively, lyophilized products such as fibrinogen concentrate, which does not require thawing or blood group compatibility testing before use, might be advantageous in damage control resuscitation in the battlefield. In this report, we review the evidence for the use of fibrinogen concentrate in the Canadian SOF environment.

Materials and Methods: The literature on the use of fibrinogen concentrate in the trauma setting was reviewed by Canadian Forces Services Working Group, in three separate meetings. Multiple stakeholders were consulted to obtain authoritative perspectives from subject matter experts on the use of fibrinogen concentrate in the Canadian SOF environment. We also conducted a comparison review of fibrinogen content, pathogen risk, shelf life, and methods required for use for fresh frozen plasma, cryoprecipitate, and fibrinogen concentrate relevant to their application in the far-forward combat environment.

Results: Indications and a protocol for the use of fibrinogen as an adjunct to fresh whole blood were formulated based on a literature review and clinical expert opinion. Alternative strategies and other lyophilized blood products were considered before selecting fibrinogen concentrate as the lyophilized blood product of choice. Fibrinogen concentrate is an ABO-universal blood product with an excellent safety profile. Training was conducted by subject matter experts within civilian trauma centers and at military training facilities. The clinical efficacy and safety were confirmed by monitoring the use of fibrinogen concentrate in deployed combat settings.

Conclusion: Fibrinogen concentrate is a useful adjunct to remote damage control resuscitation in the SOF environment. Fibrinogen concentrate was found to be robust for transport into the SOF environment and is widely accepted among SOF operators and medics.

Carbohydr Polym. 2018 Mar 15;184:408-417

Freeze dried chitosan acetate dressings with glycosaminoglycans and traxenamic acid.

Saporito F, Sandri G, Rossi S, Bonferoni MC, Riva F, Malavasi L, Caramella C, Ferrari F

ABSTRACT:
Bleeding control plays an important role to increase survival in the early phase after a traumatic event. The aim of present work was the development of hemostatic sponge-like dressings based on chitosan, in association with glycosaminoglycans (GAG) (chondroitin sulfate or hyaluronic acid) and the improvement of their hemostatic performance by loading tranexamic acid (TA). The dressings were prepared by lyophilizazion and were characterized for mechanical, hydration, bioadhesion properties and morphology. Moreover, FTIR analysis was performed to understand the interactions between the different polyelectrolytes present in the dressings. Clotting was investigated in vitro by using rat whole blood. Moreover, in vitro biocompatibility and proliferation were evaluated towards fibroblasts. Ex vivo proliferation properties were assessed by using human skin. All the dressings were characterized by mechanical, hydration and bioadhesion properties suitable to be applied on bleeding wounds and to absorb bleeding or wound exudate, avoiding tissue dehydration. TA release was fast; TA and chitosan showed a synergic effect to speed up clotting. The dressings were biocompatible and able to sustain cell proliferation in vitro and ex vivo in human skin. In conclusion, sponge-like dressings based on chitosan and GAG and loaded with TA are an effective tool to enhance hemostasis and healing in bleeding wounds.

J Pain Res. 2017 Nov 6;10:2595-2599

Project for the introduction of prehospital analgesia with fentanyl and morphine administered by specially trained paramedics in a rural service area in Germany.

Scharonow M, Alberding T, Oltmanns W, Weilbach C

Background: In patients with serious illness or trauma, reduction of severe pain is a key therapeutic goal of emergency medical service (EMS) teams. In Germany, only physicians are allowed to use opioid analgesics. In the rural EMS area studied, the mean arrival time for paramedics is 8 minutes, 23 seconds, and for the rescue physician between 10 minutes, 30 seconds and 16 minutes, 59 seconds, depending on EMS site. In cases of parallel callouts, rescue-physician arrival times may be considerably longer.

Objective: During this project, we assessed the administration of the opioid analgesics morphine and fentanyl by specially trained paramedics with regard to analgesia quality and patient safety.

Materials and methods: During the 18-month study period, specially trained paramedics administered morphine or fentanyl to patients with severe pain if indicated and if a rescue physician was not available in time. Besides basic documentation, pain intensity (using a numeric rating scale) and oxygen saturation were measured initially and at hospital handover.

Results: During the 18 months, 4,285 emergency callouts were attended to by the 13 specially trained paramedics of the district (total callouts during this period 21,423). In 77 patients (1.8%), fentanyl (n=53/68.8%) or morphine (n=24/31.2%) was administered. Based on the measurements obtained with the numeric rating scale at the start of treatment (7.9) and upon hospital handover (3.3), pain reduction was 4.52 overall (41.5%, P<0.001): 4.64 with fentanyl (42.9%, P<0.001) and 4.25 with morphine (43.2%, P<0.001). None of the patients had an oxygen saturation <95% at the time of handover, and no patient developed opioid-induced respiratory depression requiring treatment.

Conclusion: The results of this study indicate that the administration of opioid analgesics by specially trained and qualified paramedics is safe and effective.

Am J Emerg Med. 2017 Nov 27. pii: S0735-6757(17)30972-5. doi: 10.1016/j.ajem.2017.11.062. [Epub ahead of print]

A randomized cross-over study comparing surgical cricothyrotomy techniques by combat medics using a synthetic cadaver model.

Schauer SG, D Fernandez JR, L Roper J, Brown D, L Jeffers K, Srichandra J, Davids NB, April MD

OBJECTIVE: Cricothyrotomy is a complex procedure with a high rate of complications including failure to cannulate and injury to adjacent anatomy. The Control-Cric™ System and QuickTrach II™ represent two novel devices designed to optimize success and minimize complications with this procedure. This study compares these two devices against a standard open surgical technique.

METHODS: We conducted a randomized crossover study of United States Army combat medics using a synthetic cadaver model. Participants performed a surgical cricothyrotomy using the standard open surgical technique, Control-Cric™ System, and QuickTrach II™ device in a random order. The primary outcome was time to successful cannulation. The secondary outcome was first-attempt success. We also surveyed participants after performing the procedures as to their preferences.

RESULTS: Of 70 enrolled subjects, 65 completed all study procedures. Of those that successfully cannulated, the mean times to cannulation were comparable for all three methods: standard 51.0s (95% CI 45.2-56.8), QuickTrach II™ 39.8s (95% CI 31.4-48.2) and the Cric-Control™ 53.6 (95% CI 45.7-61.4). Cannulation failure rates were not significantly different: standard 6.2%, QuickTrach II™ 13.9%, Cric-Control™ 18.5% (p=0.106). First pass success rates were also similar (93.4%, 91.1%, 88.7%, respectively, p=0.670). Of respondents completing the post-study survey, a majority (52.3%) preferred the QuickTrach II™ device.

CONCLUSIONS: We identified no significant differences between the three cricothyrotomy techniques with regards to time to successful cannulation or first-pass success.

Am J Emerg Med. 2017 Dec 1. pii: S0735-6757(17)30981-6

Association of prehospital intubation with decreased survival among pediatric trauma patients in Iraq and Afghanistan.

Schauer SG, Naylor JF, Hill GJ, Arana AA, Roper JL, April MD

INTRODUCTION: Airway compromise is the second leading cause of preventable death on the battlefield among US military casualties. Airway management is an important component of pediatric trauma care. Yet, intubation is a challenging skill with which many prehospital providers have limited pediatric experience. We compare mortality among pediatric trauma patients undergoing intubation in the prehospital setting versus a fixed-facility emergency department.

METHODS: We queried the Department of Defense Trauma Registry (DODTR) for all pediatric encounters in Iraq and Afghanistan from January 2007 to January 2016. We compared outcomes of pediatric subjects undergoing intubation in the prehospital setting versus the emergency department (ED) setting.

RESULTS: During this period, there were 3439 pediatric encounters (8.0% of DODTR encounters during this time). Of those, 802 (23.3%) underwent intubation (prehospital=211, ED=591). Compared to patients undergoing ED intubation, patients undergoing prehospital intubation had higher median composite injury severity scores (17 versus 16) and lower survival rates (66.8% versus 79.9%, $p<0.001$). On univariable logistic regression analysis, prehospital intubation increased mortality odds (OR 1.97, 95% CI 1.39-2.79). After adjusting for confounders, the association between prehospital intubation and death remained significant (OR 2.03, 95% CI 1.35-3.06).

CONCLUSIONS: Pediatric trauma subjects intubated in the prehospital setting had worse outcomes than those intubated in the ED. This finding persisted after controlling for measurable confounders.

Emerg Med Clin North Am. 2018 Feb;36(1):135-147

Critical Decisions in the Management of Thoracic Trauma.

Schellenberg M, Inaba K

ABSTRACT:
Traumatic injuries to the thorax are common after both blunt and penetrating trauma. Emergency medicine physicians must be able to manage the initial resuscitation and diagnostic workup of these patients. This involves familiarity with a range of radiologic investigations and invasive bedside procedures, including resuscitative thoracotomy. This knowledge is critical to allow for rapid decision making when life-threatening injuries are encountered. This article explores the initial resuscitation and assessment of patients after thoracic trauma, discusses available imaging modalities, reviews frequently performed procedures, and provides an overview of the indications for operative intervention, while emphasizing the critical decision making throughout.

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 .).

Clin Exp Emerg Med. 2017 Dec 30;4(4):250-253

Management of right main bronchial rupture with a double lumen endotracheal tube in a patient with blunt chest trauma.

Seol SH, Lee WJ, Woo SH, Kim DH, Suh JH

ABSTRACT:
Tracheobronchial disruption is one of the most severe injuries caused by blunt chest trauma. It may cause airway obstruction and resulting life-threatening respiratory deficiency. However, the clinical presentations are variable and frequently difficult to diagnose. We report a case of a previously healthy 16-year-old man with complete right main bronchial transection sustained after a vehicular accident, who had progressive dyspnea, subcutaneous emphysema in the neck and anterior chest wall, and bilateral tension pneumothorax. Prompt chest tube drainage for suspected bilateral tension pneumothorax and a tracheal intubation were performed. Shortly after the positive pressure ventilation, severe subcutaneous emphysema developed and he was at risk for developing shock. Additional chest tubes were inserted. An emergency bronchoscopy showed rupture of the right main bronchus. After changing to a double lumen endotracheal tube, the patient's condition improved. A surgical closure was performed and postoperative bronchoscopy showed good repair. The patient was discharged without complications.

J Trauma Acute Care Surg. 2017 Dec 20

Whole Blood and Hextend: Bookends of Modern Tactical Combat Casualty Care Field Resuscitation and Starting Point For Multi-functional Resuscitation Fluid Development.

Sheppard FR, Mitchell TA, Macko AR, Fryer DM, Schaub LJ, Ozuna KM, Glaser JJ

BACKGROUND: Hemorrhage is the leading cause of preventable death in traumatically injured civilian and military populations. Pre-hospital resuscitation largely relies on crystalloid and colloid intra-vascular expansion, as whole blood and component blood therapy are logistically arduous. In this experiment, we evaluated the bookends of Tactical Combat Casualty Care Guidelines recommendations of pre-hospital resuscitation with Hextend and whole blood in a controlled hemorrhagic shock model within non-human primates, as means of a multi-functional resuscitative fluid development.

METHODS: In the non-human primate, a poly-trauma model was utilized, consisting of a musculoskeletal injury (femur fracture), soft tissue injury (15cm laparotomy), and controlled hemorrhage to a mean arterial pressure of 20 mmHg, demarcating the beginning of the shock period. Animals were randomized to pre-hospital interventions of whole blood or Hextend at T=0 minutes, and at T=90 minutes definitive surgical interventions and balanced sanguineous damage control resuscitation could be implemented. All animals were euthanized at T=480 minutes. Data are expressed as mean ± SEM; significance, $p<0.05$.

RESULTS: No significant differences in survival, 83% vs. 100%, p=0.3), tissue perfusion ($EtCO_2$ & StO_2) or endpoints of resuscitation (base deficit, lactate, pH) between Hextend and whole blood were identified. Secondly, whole blood compared to Hextend demonstrated significantly earlier normalization of clot formation time, maximal clot firmness, and α angle.

CONCLUSION: A future multi-functional resuscitative fluid including an asanguineous, oncotic, non-oxygen carrying component to facilitate intra-vascular volume expansion and a component with synthetic coagulation factors and fibrinogen to deter coagulopathy may show equivalence to whole blood.

STUDY TYPE: Translational animal model

LEVEL OF EVIDENCE: N/A

J Am Coll Surg. 2018 Feb;226(2):160-164

Efficient Hemorrhage Control Skills Training for Healthcare Employees.

Sidwell RA, Spilman SK, Huntsman RS, Pelaez CA

BACKGROUND: Several national initiatives are aimed at training citizens to assist bleeding victims. The purpose of this study was to evaluate an effort to quickly and efficiently teach basic bleeding control techniques to a clinical and nonclinical workforce.

STUDY DESIGN: The research study was conducted at 4 hospitals in a mid-sized metropolitan area. In spring 2017, the trauma department at a Level I trauma center set an ambitious goal to provide hands-on training to 1,000 employees during the course of 6 weeks. Trainings occurred in small groups and lasted approximately 6 to 10 minutes, during which time participants were taught and practiced 2 skills: packing a wound and holding direct pressure, and applying a stretch-wrap-and-tuck tourniquet. Participants completed pre- and post-surveys indicating their likelihood to use these skills.

RESULTS: More than 1,000 individuals were trained, and there were survey data for 870 participants. More than 40% of participants worked in nonclinical roles and 29% had no first aid or medical training. After completing skills training, 98% of participants indicated that they would be likely to take action to assist a bleeding victim and that they could correctly apply direct pressure or a tourniquet to control severe bleeding.

CONCLUSIONS: Results demonstrate that basic hemorrhage control skills can be taught to clinical and nonclinical people in brief, hands-on training. Efforts like this can be deployed across large workplace environments to prepare the maximum number of employees to take action to assist bleeding victims.

Indian J Crit Care Med. 2017 Nov;21(11):783-785

Cerebral Air Embolism Secondary to Lung Laceration.

Singh AK, Verma J, Kumar S

ABSTRACT:
Cerebral air embolism is a rare clinical entity in day-to-day practice. The introduction of air into the venous or the arterial system can cause cerebral air embolism leading to severe neurological deficits. The common causes reported in the literature are iatrogenic; it can be caused by positive pressure maneuvers performed during cardiac resuscitation, lung biopsy, and the placement of venous catheters in the presence of a patent foramen ovale. We report a case of cerebral air embolism which has occurred secondary to lung laceration. The patient underwent intercostal drainage for hydro-pneumothorax and developed forceful cough and suddenly changed in consciousness. Air embolism was diagnosed by computed tomography brain and was managed by high-concentration oxygen therapy and other supportive measures and is being discharged in satisfactory condition.

J Trauma Acute Care Surg. 2018 Jan 12. doi: 10.1097/TA.0000000000001800. [Epub ahead of print]

Assessment of Prehospital Hemorrhage and Airway Care Using a Simulation Model.

Skube ME, Witthuhn S, Mulier K, Boucher B, Lusczek E, Beilman GJ.

BACKGROUND: The quality of prehospital care impacts patient outcomes. Military efforts have focused on training revision and the creation of high fidelity simulation models to address potentially survivable injuries. We sought to investigate the applicability of models emphasizing hemorrhage control and airway management to a civilian population.

METHODS: Prehospital healthcare providers (PHPs) undergoing their annual training were enrolled. A trauma scenario was simulated with two modules: hemorrhage control and airway management. Experienced raters used a validated tool to assess performance. Pearson correlation, logistic regression, and chi-square tests were used for analysis.

RESULTS: Ninety-five PHPs participated with a mean experience of 15.9 ± 8.3 years, and 7.4% reported past military training. The PHPs' overall execution rate of the six hemorrhage control measures varied from 38.9% to 88.4%. The median blood loss was 1700 mL (IQR, 1043-2000), and the mean global rater score (GRS) was 25.0 ± 7.4 (scale 5-40). There was a significant relationship between PHP profession and past military experience to their consideration of blood transfusion and tranexemic acid. An inverse relationship between blood loss and GRS was found ($r = -0.59$, $n = 88$, $p = 1.93 \times 10$). After simulated direct laryngoscope (DL) failure in the airway module, 58% of PHPs selected video laryngoscopy (VL) over placement of a supraglottic airway (SGA). Eighty-six percent of participants achieved bilateral chest rise in the manikin regardless of management method. Participants reported improved comfort with skills after simulation.

CONCLUSIONS: Our data reveal marginal performance in hemorrhage control regardless of the PHP's prior experience. The majority of PHPs were able to secure an advanced airway if DL was unavailable with a predisposition for VL over SGA. Our findings support the need for continued training for PHPs highlighting hemorrhage control maneuvers and increased familiarity with airway management options. Improved participant confidence post-training gives credence to simulation training.

LEVEL OF EVIDENCE: III, prognostic/epidemiological.

J Thorac Dis. 2017 Oct;9(10):3996-4005

Predictors of arterial desaturation during intubation: a nested case-control study of airway management-part I.

Smischney NJ, Seisa MO, Heise KJ, Wiegand RA, Busack KD, Loftsgard TO, Schroeder DR, Diedrich DA

Background: Arterial desaturations experienced during endotracheal intubation (ETI) may lead to poor outcomes. Thus, our primary aim was to identify predictors of arterial desaturation (pulse oximetry <90%) during the peri-intubation period and to assess outcomes of those who developed arterial hypoxemia.

Methods: Adult patients admitted to a medical and/or surgical intensive care unit (ICU) over the time period of January 1st 2013 through December 31st 2014 who required ETI were included. Only the first intubation was captured. Arterial desaturation was defined as pulse oximetry readings of <90% (hypoxemia) in the immediate peri-intubation period. Patients were then grouped in cases (those who developed desaturation) and controls (those who did not develop this complication).

Results: The final cohort included 420 patients. Arterial desaturations occurred in 74 (18%) patients. When adjusting for significant predictors on univariate analysis and known predictors of a difficult airway, only acute respiratory failure (OR 2.38; 95% CI: 1.15-4.93; P=0.02) and provider training level (OR 7.12; 95% CI: 1.65-30.67; P=0.016) remained significant. Higher pulse oximetry readings prior to intubation was found to be protective on multivariate analysis (OR 0.92; 95% CI: 0.89-0.96; P<0.01; per one percent increase).

Conclusions: Patients who were intubated for acute respiratory failure and those who were intubated by junior level trainees had increased odds of experiencing arterial desaturation in the peri-intubation period. Patients experiencing arterial desaturation had lower pulse oximetry readings prior to intubation suggesting a possible delay at intubation.

BMJ Open. 2017 Aug 7;7(7):e014697. doi: 10.1136/bmjopen-2016-014697.

Injury profile suffered by targets of antipersonnel improvised explosive devices: prospective cohort study.

Smith S, Devine M, Taddeo J, McAlister VC

OBJECTIVE: To describe pattern 1 injuries caused by the antipersonnel improvised explosive device (AP-IED) in comparison to those previously described for antipersonnel mines (APM).

DESIGN: Prospective cohort study of 100 consecutive pedestrian victims of an AP-IED, with traumatic amputation without regard for gender, nationality or military status.

SETTING: Multinational Medical Unit at Kandahar Air Field, Afghanistan.

PARTICIPANTS: One hundred consecutive patients, all male, 6-44 years old.

MAIN OUTCOME MEASURES: The details of injuries were recorded to describe the pattern and characterize the injuries suffered by the target of AP-IEDs. The level of amputation, the level of soft tissue injury, the fracture pattern (including pelvic fractures) as well as perineal, gluteal, genital and other injuries were recorded.

RESULTS: Victims of AP-IED were more likely, compared with APM victims, to have multiple amputations (70.0% vs 10.4%; p<0.001) or genital injury (26% vs 13%; p=0.007). Multiple amputations occurred in 70 patients: 5 quadruple amputations, 27 triple amputations and 38 double amputations. Pelvic fracture occurred in 21 victims, all but one of whom had multiple amputations. Severe perineal, gluteal or genital injuries were present in 46 patients. Severe soft tissue injury was universal, with injection of contaminated soil along tissue planes well above entry sites. There were 13 facial injuries, 9 skull fractures and 3 traumatic brain injuries. Eleven eye injuries were seen; none of the victims with eye injuries were wearing eye protection. The casualty fatality rate was at least 19%. The presence of more than one amputation was associated with a higher rate of pelvic fracture (28.6% vs 3.3%; p=0.005) and perineal-gluteal injury (32.6% vs 11.1%; p=0.009).

CONCLUSION: The injury pattern suffered by the target of the AP-IED is markedly worse than that of conventional APM. Pelvic binders and tourniquets should be applied at the point of injury to patients with multiple amputations or perineal injuries.

J Trauma Acute Care Surg. 2018 Jan 24. doi: 10.1097/TA.0000000000001804. [Epub ahead of print]

Abdominal Trauma Surgery During Recent U.S. Combat Operations from 2002-2016.

Stockinger ZT, Turner CA, Gurney JM

BACKGROUND: Abdominal surgery constitutes approximately 13% of surgical procedures performed for combat injuries. This study examines the frequencies and type of abdominal surgical procedures performed during recent U.S. Military operations.

METHODS: A retrospective analysis of the Department of Defense Trauma Registry (DoDTR) was performed for all Role 2 (R2) and Role 3 (R3) medical treatment facilities (MTFs), from January 2002 to May 2016. The 273 ICD-9-CM procedure codes that were identified as abdominal surgical procedures were stratified into 24 groups based on anatomic and functional classifications and then grouped by whether or not they were laparoscopic. Procedure grouping and categorization were determined, and adjudicated if necessary, by subject matter experts. Data analysis used Stata Version 14 (College Station, Texas).

RESULTS: A total of 26,548 abdominal surgical procedures were identified at R2 and R3 MTFs. The majority of abdominal surgical procedures were reported at R3 facilities. The largest procedure group at both R2 and R3 MTFs were procedures involving the bowel. There were 18 laparoscopic procedures reported (R2:4 R3:14). Laparotomy Not Otherwise Specified was the second largest procedure group at both R2 (1,060, 24.55%) and R3 (4,935, 22.2%) MTFs. Abdominal caseload was variable over the 15 year study period.

CONCLUSIONS: Surgical skills such as open laparotomy and procedures involving the bowel are crucial in war surgery. The abundance of laparotomy NOS may reflect inadequate documentation, or the plethora of 2nd and 3rd look operations and washouts performed for complex abdominal injuries. Traditional elective general surgical cases (gallbladder, hernia) were relatively infrequent. Laparoscopy was almost nonexistent. Open abdominal surgical skills therefore remain a necessity for the deployed U.S. Military General Surgeons; this is at odds with the shifting paradigm from open to laparoscopic skills in stateside civilian and military hospitals.

LEVEL OF EVIDENCE: Level III, Epidemiologic study.

Am J Emerg Med. 2017 Mar;35(3):499-501

Analysis of intraosseous blood samples using an EPOC point of care analyzer during resuscitation.

Tallman CI, Darracq M, Young M

BACKGROUND: In the early phases of resuscitation in a critically ill patient, especially those in cardiac arrest, intravenous (IV) access can be difficult to obtain. Intraosseous (IO) access is often used in these critical situations to allow medication administration. When no IV access is available, it is difficult to obtain blood for point of care analysis, yet this information can be crucial in directing the resuscitation. We hypothesized that IO samples may be used with a point of care device to obtain useful information when seconds really do matter.

METHODS: Patients presenting to the emergency department requiring resuscitation and IO placement were prospectively enrolled in a convenience sample. 17 patients were enrolled. IO and IV samples obtained within five minutes of one another were analyzed using separate EPOC® point of care analyzers. Analytes were compared using Bland Altman Plots and intraclass correlation coefficients.

RESULTS: In this analysis of convenience sampled critically ill patients, the EPOC® point of care analyzer provided results from IO samples. IO and IV samples were most comparable for pH, bicarbonate, sodium and base excess, and potentially for lactic acid; single outliers for bicarbonate, sodium and base excess were observed. Intraclass correlation coefficients were excellent for sodium and reasonable for pH, pO2, bicarbonate, and glucose. Correlations for other variables measured by the EPOC® analyzer were not as robust.

CONCLUSION: IO samples can be used with a bedside point of care analyzer to rapidly obtain certain laboratory information during resuscitations when IV access is difficult.

J Emerg Med. 2018 Jan 20. pii: S0736-4679(17)31184-8

An Impaled Potential Unexploded Device in the Civilian Trauma Setting: A Case Report and Review of the Literature.

Thaut LC, Murtha AS, Johnson AE, Roper JL

BACKGROUND: The management of patients with impaled unexploded devices is rare in the civilian setting. However, as the lines of the traditional battlefield are blurred by modern warfare and terrorist activity, emergency providers should be familiar with facility protocols, plans, and contact information of their local resources for unexploded devices.

CASE REPORT: A 44-year-old male sustained a close-proximity blast injury to his lower extremities while manipulating a mortar-type firework. He presented to the regional trauma center with an open, comminuted distal femur fracture and radiographic evidence of a potential explosive device in his thigh. His management was coordinated with the local Explosive Ordinance Disposal and the fire department.

WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?: Explosive devices pose a grave threat when encountered. Familiarization with protocols to manage these patients can mitigate disaster. Emergency providers should expect and be prepared to coordinate care for these patients.

J Trauma Acute Care Surg. 2018 Jan 24. doi: 10.1097/TA.0000000000001816. [Epub ahead of print]

Permissive Hypotension vs. 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 pre-operative 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 1158 patients were included. Blood pressure targets in the intervention arms varied from systolic BP 50 - 70 mmHg or MAP ≥ 50 mmHg as compared to systolic BP 65 - 100 mmHg or MAP ≥ 65 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% CI 0.53 to 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.

LEVEL OF EVIDENCE: Systematic Review, Level II PROSPERO REGISTRATION: CRD42017070526.

J Trauma Acute Care Surg. 2017 Dec 28. doi: 10.1097/TA.0000000000001764. [Epub ahead of print]

Prehospital Spine Immobilization/Spinal Motion Restriction in Penetrating Trauma: a Practice Management Guideline from the Eastern Association for the Surgery of Trauma (EAST).

Velopulos CG, Shihab HM, Lottenberg L, Feinman M, Raja A, Salomone J, Haut ER

BACKGROUND: Spine immobilization in trauma has remained an integral part of most emergency medical services (EMS) protocols despite a lack of evidence for efficacy and concern for associated complications, especially in penetrating trauma patients. We reviewed the published evidence on the topic of prehospital spine immobilization or spinal motion restriction in adult patients with penetrating trauma to structure a Practice Management Guideline.

METHODS: We conducted a Cochrane style systematic review and meta-analysis, and applied GRADE methodology to construct recommendations. Qualitative and quantitative analyses were used to evaluate the literature on the critical outcomes of mortality, neurologic deficit, and potentially reversible neurologic deficit.

RESULTS: A total of 24 studies met inclusion criteria, with qualitative review conducted for all studies. We used five studies for the quantitative review (meta-analysis). No study showed benefit to spine immobilization with regard to mortality and neurologic injury, even for patients with direct neck injury. Increased mortality was associated with spine immobilization, with RR 2.4 (CI 1.07, 5.41). The rate of neurologic injury or potentially reversible injury was very low, ranging from 0.002 to 0.076 and 0.00034 to 0.055, with no statistically significant difference for neurologic deficit or potentially reversible deficit, RR 4.16 (CI 0.56, 30.89), and RR 1.19 (CI 0.83, 1.70), although the point estimates favored no immobilization.

CONCLUSIONS: Spine immobilization in penetrating trauma is associated with increased mortality and has not been shown to have a beneficial effect on mitigating neurologic deficits, even potentially reversible neurologic deficits. We recommend that spine immobilization not be used routinely for adult patients with penetrating trauma.

LEVEL OF EVIDENCE: Level II STUDY TYPE: Systematic Review with Meta-analysis.

Injury. 2017 Nov 23. pii: S0020-1383(17)30821-5. doi: 10.1016/j.injury.2017.11.029. [Epub ahead of print]

Early transfusion on battlefield before admission to role 2: A preliminary observational study during "Barkhane" operation in Sahel.

Vitalis V, Carfantan C, Montcriol A, Peyrefitte S, Luft A, Pouget T, Sailliol A, Ausset S, Meaudre E, Bordes J

INTRODUCTION: Haemorrhage is the leading cause of death after combat related injuries and bleeding management is the cornerstone of management of these casualties. French armed forces are deployed in Barkhane operation in the Sahel-Saharan Strip who represents an immense area. Since this constraint implies evacuation times beyond doctrinal timelines, an institutional decision has been made to deploy blood products on the battlefield and transfuse casualties before role 2 admission if indicated. The purpose of this study was to evaluate the transfusion practices on battlefield during the first year following the implementation of this policy.

MATERIALS AND METHODS: Prospective collection of data about combat related casualties categorized alpha evacuated to a role 2. Battlefield transfusion was defined as any transfusion of blood product (red blood cells, plasma, whole blood) performed by role 1 or Medevac team before admission at a role 2. Patients' characteristics, battlefield transfusions' characteristics and complications were analysed.

RESULTS: During the one year study, a total of 29 alpha casualties were included during the period study. Twenty-eight could be analysed, 7/28 (25%) being transfused on battlefield, representing a total of 22 transfusion episodes. The most frequently blood product transfused was French lyophilized plasma (FLYP). Most of transfusion episodes occurred during medevac. Compared to non-battlefield transfused casualties, battlefield transfused casualties suffered more wounded anatomical regions (median number of 3 versus 2, p = 0.04), had a higher injury severity score (median ISS of 45 versus 25, p = 0,01) and were more often transfused at role 2, received more plasma units and whole blood units. There was no difference in evacuation time to role 2 between patients transfused on battlefield and non-transfused patients. There was no complication related to battlefield transfusions. Blood products transfusion onset on battlefield ranged from 75 min to 192 min after injury.

CONCLUSION: Battlefield transfusion for combat-related casualties is a logistical challenge. Our study showed that such a program is feasible even in an extended area as Sahel-Saharan Strip operation theatre and reduces time to first blood product transfusion for alpha casualties. FLYP is the first line blood product on the battlefield.

Mil Med. 2018 Jan 1;183(1-2):e95-e103

Influence of Personality Traits on the Effective Performance of Lifesaving Interventions: Example of the Tourniquet Application in Forward Combat Casualty Care.

Vuillemin Q, Schwartzbrod PE, Pasquier P, Sibille F, Trousselard M, Ferrer MH

Introduction: Health care delivery in military conflicts implies high-stress environments. Hemorrhage is the first cause of survivable death among combat casualties, and tourniquet application is one of the most critical lifesaving interventions on the battlefield. However, previous studies have shown high failure rates in tourniquet application. Our study aimed to assess the correlation between personality traits that may interfere with effective tourniquet application in a simulated extremity hemorrhage.

Materials: Seventy-two French soldiers, previously trained to forward combat casualty care, were evaluated by self-administered questionnaires and submitted to the simulation in group of six. We focused on measuring the empathic personality of the subjects, their peer-to-peer relationships (altruism), as well as their relationship to themselves (mindfulness and self-esteem). The effectiveness of the tourniquet was evidenced by the interruption of the popliteal artery flow Doppler signal. A composite variable called "efficiency" was defined by elimination of popliteal pulse Doppler signal in less than 60 s.

Results: Tourniquet application interrupted arterial flow in 37 participants (51.39%). Efficiency was obtained by 19 participants (26.39%). We observed that soldiers with high active altruism applied less-efficient tourniquet (odds ratio = 0.15; 95% confidence interval = 0.04-0.59). On the contrary, soldiers with high self-esteem scores applied more efficient tourniquet (odds ratio = 3.95; 95% confidence interval = 1.24-12.56). There was no significant difference concerning empathy and mindfulness scores.

Conclusion: Tourniquet application is technically simple but painful and may involve personal sensitivity. These initial findings highlight the necessity to further explore the psychological processes involved in lifesaving interventions. Self-esteem stands out as a real asset in terms of military competence and resilience, a major prerequisite in stressful situations. Changing altruistic motivations of soldiers is likely not desirable, but being aware of its potential effects may help to develop personal adaptive strategies and to optimize collective training.

J Spec Oper Med. Winter 2017;17(4):37-44.

Effects of Distance Between Paired Tourniquets.

Wall PL, Buising CM, Nelms D, Grulke L, Renner CH, Sahr SM.

BACKGROUND: In practice, the distance between paired tourniquets varies with unknown effects.

METHODS: Ratcheting Medical Tourniquets were applied to both thighs of 15 subjects distally (fixed location) and proximally (0, 2, 4, 8, 12cm gap widths, randomized block). Applications were pair, single distal, single appropriate proximal. Tightening ended one-ratchet tooth advance past Doppler-indicated occlusion. Pairs had alternating tightening starting distal.

RESULTS: Occlusion pressures were higher for: each single than respective individual pair tourniquet, each pair distal than respective pair proximal, and each single distal than respective single proximal (all $p < .0001$). Despite thigh circumference increasing proximally, occlusion pressures were lower with proximal tourniquet involvement (pair or single, $p < .0001$). Occlusion losses before 120 seconds occurred most frequently with pairs (0cm 4, 2cm 4, 4cm 6, 8cm 7, 12cm 5 for 26 of 150), in increasing frequency with increasingly proximal singles (0cm 0, 2cm 1, 4cm 1, 8cm 2, 12cm 6 for 10 of 150, $p < .0001$ for trend), and least with single distal (2 of 150, $p < .0001$). Paired tourniquets required fewer ratchet advances per tourniquet (pair distal 5 ± 1, pair proximal 4 ± 1, single distal 6 ± 1, single proximal 6 ± 1). Final ratchet tooth advancement pressure increases (mmHg) were greatest for singles (distal 61 ± 10, proximal 0cm 53 ± 7, 2cm 51 ± 9, 4cm 50 ± 7, 8cm 45 ± 7, 12cm 36 ± 7) and least in pairs (distal 41 ± 8, proximal 32 ± 7) with progressively less pair interaction as distance increased (pressure change for the pair tourniquet not directly advanced: 0cm 13 ± 4, 2cm 10 ± 4, 4cm 6 ± 3, 8cm 1 ± 2, 12cm -1 ± 2).

CONCLUSIONS: Occlusion pressures are lower for paired than single tourniquets despite variable intertourniquet distances. Very proximal placement has a pressure advantage; however, pairs and very proximal locations may be less likely to maintain occlusion. Increasingly proximal placements also increase tissue at risk; therefore, distal placements and minimal intertourniquet distances should still be recommended.

J Trauma Acute Care Surg. 2017 Dec;83(6):1023-1031

Contemporary management of subclavian and axillary artery injuries-A Western Trauma Association multicenter review.

Waller CJ, Cogbill TH, Kallies KJ, Ramirez LD, Cardenas JM, Todd SR, Chapman KJ, Beckman MA, Sperry JL, Anto VP, Eriksson EA, Leon SM, Anand RJ, Pearlstein M, Capano-Wehrle L, Cothren Burlew C, Fox CJ, Cullinane DC, Roberts JC, Harrison PB, Berg GM, Haan JM, Lightwine K.

BACKGROUND: Subclavian and axillary artery injuries are uncommon. In addition to many open vascular repairs, endovascular techniques are used for definitive repair or vascular control of these anatomically challenging injuries. The aim of this study was to determine the relative roles of endovascular and open techniques in the management of subclavian and axillary artery injuries comparing hospital outcomes, and long-term limb viability.

METHODS: A multicenter, retrospective review of patients with subclavian or axillary artery injuries from January 1, 2004, to December 31, 2014, was completed at 11 participating Western Trauma Association institutions. Statistical analysis included χ, t-tests, and Cochran-Armitage trend tests. A p value less than 0.05 was significant.

RESULTS: Two hundred twenty-three patients were included; mean age was 36 years, 84% were men. An increase in computed tomography angiography and decrease in conventional angiography was observed over time ($p = 0.018$). There were 120 subclavian and 119 axillary artery injuries. Procedure type was associated with injury grade ($p < 0.001$). Open operations were performed in 135 (61%) patients, including 93% of greater than 50% circumference lacerations and 83% of vessel transections. Endovascular repairs were performed in 38 (17%) patients; most frequently for pseudoaneurysms. Fourteen (6%) patients underwent a hybrid procedure. Use of endovascular versus open procedures did not increase over the duration of the study ($p = 0.248$). In-hospital mortality rate was 10%. Graft or stent thrombosis occurred in 7% and graft or stent infection occurred in 3% of patients. Mean follow-up was 1.6 ± 2.4 years ($n = 150$). Limb salvage was achieved in 216 (97%) patients.

CONCLUSION: The management of subclavian and axillary artery injuries still requires a wide variety of open exposures and procedures, especially for the control of active hemorrhage from more than 50% vessel lacerations and transections. Endovascular repairs were used most often for pseudoaneurysms. Low early complication rates and limb salvage rates of 97% were observed after open and endovascular repairs.

LEVEL OF EVIDENCE: Prognostic/epidemiologic, level IV.

Medicine (Baltimore). 2017 Dec;96(52):e9396

Tranexamic acid reduces blood loss in intertrochanteric fractures: A meta-analysis from randomized controlled trials.

Wang W, Yu J.

BACKGROUND: This meta-analysis aims to assess the efficacy and safety of tranexamic acid for reducing blood loss and transfusion requirements in patients with intertrochanteric fractures.

METHODS: We conduct electronic searches of Medline (1966-2017.09), PubMed (1966-2017.09), Embase (1980-2017.09), ScienceDirect (1985-2017.09), and the Cochrane Library. Only randomized controlled trials (RCTs) are included. The quality assessments are performed according to the Cochrane systematic review method. Fixed/random-effect model is used according to the heterogeneity tested by I statistic. Meta-analysis is performed using Stata 11.0 software.

RESULTS: A total of 4 RCTs are retrieved involving 514 participants. The present meta-analysis indicated that there were significant differences between groups in terms of total blood loss (weighted mean differences=-131.49, 95% confidence interval (CI): -163.63 to -99.35, P=.00), hemoglobin decline (weighted mean differences=-0.31, 95% CI, -0.44 to -0.19, P=.00), and transfusion rate (risk differences=-1.11, 95% CI, -0.19 to -0.04, P=.00). In addition, no increased risk of adverse effects was identified in both groups.

CONCLUSION: Local administration of tranexamic acid is associated with a reduced total blood loss, postoperative hemoglobin decline, and transfusion requirements in patients with intertrochanteric fractures. High-quality RCTs are still required for further investigation.

Ann Emerg Med. 2018 Jan;71(1):64-73

Cost-effectiveness of Magnetic Resonance Imaging in Cervical Spine Clearance of Neurologically Intact Patients With Blunt Trauma.

Wu X, Malhotra A, Geng B, Liu R, Abbed K, Forman HP, Sanelli P

STUDY OBJECTIVE: Use of magnetic resonance imaging (MRI) for cervical clearance after a negative cervical computed tomography (CT) scan result in alert patients with blunt trauma who are neurologically intact is not infrequent, despite poor evidence in regard to its utility. The objective of this study is to evaluate the utility and cost-effectiveness of using MRI versus no follow-up in this patient population.

METHODS: A modeling-based decision analysis was performed during the lifetime of a 40-year-old individual from a societal perspective. The 2 strategies compared were no follow-up and MRI. A Markov model with a 3% discount rate was used with parameters from the literature. Base cases and probabilistic and sensitivity analyses were performed to assess the cost-effectiveness of the strategies.

RESULTS: The cost of MRI follow-up was $11,477, with a health benefit of 24.03 quality-adjusted life-years; the cost of no follow-up was $6,432, with a health benefit of 24.08 quality-adjusted life-years. No follow-up was the dominant strategy, with a lower cost and a higher utility. Probabilistic sensitivity analysis showed no follow-up to be the better strategy in all 10,000 iterations. No follow-up was the better strategy irrespective of the negative predictive value of initial CT result, and it remained the better strategy when the incidence of missed unstable injury resulting in permanent neurologic deficits was less than 64.2% and the incidence of patients immobilized with a hard collar who still received cord injury was greater than 19.7%. Multiple 3-way sensitivity analyses were performed.

CONCLUSION: MRI is not cost-effective for further evaluation of unstable injury in neurologically intact patients with blunt trauma after a negative cervical spine CT result.

Br J Haematol. 2017 Dec;179(5):802-810. doi: 10.1111/bjh.14999. Epub 2017 Nov 22.

Platelets derived from fresh and cold-stored whole blood participate in clot formation in rats with acute traumatic coagulopathy.

Wu X, Darlington DN, Montgomery RK, Liu B, Keesee JD, Scherer MR, Benov A, Chen J, Cap AP

ABSTRACT:
The in vitro haemostatic functions of fresh whole blood (FWB) are well preserved after cold storage. This study aimed to determine whether platelets derived from FWB and stored whole blood (SWB) contribute to clot formation in tissue injury after transfusion into coagulopathic rats with polytrauma/haemorrhage (T/H). The rats were resuscitated 1 h after trauma with FWB or SWB collected from green fluorescence protein (GFP) transgenic rats. After transfusion, a liver incision was made and the tissue was collected 10 min after injury to identify GFP+ platelets by immunohistochemistry. In comparison to FWB, platelet aggregation to adenosine diphosphate and protease-activated receptor-4 was reduced by 35% and 20%, and clotting time was shortened by 25% in SWB. After transfusion, SWB led to a significant increase in platelet activation as measured by an elevation of CD62P and phosphatidylserine expression. The platelets from SWB were in a higher activation state, and showed higher clearance rate and formation of platelet-leucocyte aggregates than those from FWB after transfusion. Platelets from both FWB and SWB were equivalently incorporated into the clot at the incisional site, as determined by co-localization of CD61 and GFP. This study suggests that SWB contributes to haemostatic function and is an effective alternative resource to treat trauma patients.

Burns. 2017 Nov 20. pii: S0305-4179(17)30572-7. doi: 10.1016/j.burns.2017.10.012. [Epub ahead of print]

Efficacy and feasibility of opioids for burn analgesia: An evidence-based qualitative review of randomized controlled trials.

Yang C, Xu XM, He GZ

ABSTRACT:
Opioids are commonly used for burn analgesia, but no comprehensive reviews have been published on such use. We aimed to assess the literature regarding the effectiveness and side effects of opioids both in adult and pediatric burn patients. We conducted a systematic search of the PubMed, Embase, Cochrane, and Web of Science databases. Information on study characteristics, results, and interventions was extracted. The review identified nine studies that satisfied the inclusion criteria. Burn sizes of patients ranged from 1% to 62% of the body. The examined studies showed that dressing or cream containing morphine could potentially decrease pain, use of analgesics, and side effects associated with systemic opioid medications compared with control groups. Oral transmucosal fentanyl citrate (OTFC) was equivalent, or even preferable, to oral morphine, hydromorphone, and oxycodone in provision of analgesia for burn wound care in pediatric patients. Intranasal fentanyl (INF) was equivalent to oral morphine in burn wound care both in adult and pediatric patients. OTFC and INF could be considered as viable non-invasive analgesic alternatives to oral opioids for procedural burn pain. However, the level of evidence still seems quite uncertain because of the limited sample size.

Transfusion. 2017 Dec 21. doi: 10.1111/trf.14462. [Epub ahead of print]

Evaluation of the advantages of platelet concentrates stored at 4°C versus 22°C.

Yang J, Yin W, Zhang Y, Sun Y, Ma T, Gu S, Gao Y, Zhang X, Yuan J, Wang W

BACKGROUND: Platelet (PLT) storage at cold temperatures (4°C) can reduce bacterial contamination and lower the risk of transfusion-related complications. We compared the effects of 22 and 4°C storage conditions for PLTs to further explore the efficiency of hemostasis in acute bleeding and extended PLT shelf life.

STUDY DESIGN AND METHODS: Manually prepared PLTs (PLT concentrates in plasma, not PLT additive solution) were stored at 4 and 22°C. The PLT counts, scanning electronic microscope observations, blood gas indices, biochemical indices, PLT aggregative function, and surface CD62P expression were monitored and compared between the groups.

RESULTS: There was no obvious change in PLT counts between Day 21 at 4°C and Day 5 at 22°C. PLTs stored at 4°C for 10 to 14 days were dramatically activated, had rough surfaces, and showed a significant degree of long pseudopodia formation. The pH of the PLTs on Day 5 was lower at 22°C than at 4°C, while the lactate dehydrogenase and lactic acid levels in the former group were significantly higher ($p < 0.005$). The maximum aggregation rates induced by collagen and arachidonic acid in the PLTs stored at 4°C for 5 days remained higher than 80%, while the rates induced by four inducers in the PLTs stored at 22°C were less than 5%. PLTs stored at 4°C for 10 to 14 days showed higher surface expression of PAC-1 and CD62P**.**

CONCLUSION: PLT counts, cellular morphologies, PLT membranes, cytoplasmic structures, aggregation rates, and hemostatic PLT function stored at 4°C for 10 to 14 days were better than those stored at 22°C for 5 days.

J Trauma Acute Care Surg. 2017 Dec 28. doi: 10.1097/TA.0000000000001790. [Epub ahead of print]

Activities of the THOR-AABB working party.

Yazer MH, Spinella PC

ABSTRACT:
The AABB (formerly the American Association of Blood Banks) is an international authority on transfusion medicine and tissue banking. The Trauma, Hemostasis and Oxygenation Research (THOR) Network is an international multidisciplinary network of civilian and military providers ranging from first responders and medics to critical care physicians, and from basic scientists to clinical trialists. The THOR Network's vision is to improve outcomes from traumatic hemorrhagic shock by optimizing the acute phase of resuscitation. Its mission is to develop and implement best practices for prehospital care through to the completion of the acute phase of hemorrhagic shock resuscitation. Thus, there is significant overlap between the missions of these two groups. To this end, the joint THOR-AABB working party (WP) was created in the summer of 2016 with a view to improving patient outcomes by the establishment of a formal collaboration between these two groups. The WP has been engaged in many different endeavors, from successfully changing the AABB's standards for the administration of whole blood, to writing commentaries on the safety of uncrossmatched red blood cells and antibody titer methods and thresholds in potentially incompatible plasma products, to hosting a day-long symposium on blood product resuscitation of massively bleeding patients in conjunction with the AABB annual meeting. This review details the activities of the WP and indicates some future activities.

J Trauma Acute Care Surg. 2017 Dec 28. doi: 10.1097/TA.0000000000001778. [Epub ahead of print]

Raising the Standards on Whole Blood.

Yazer MH, Cap AP, Spinella PC

Quote:

“ Raising the standards on WB

The safety of transfusing incompatible plasma is well established and indeed this practice is permitted in the AABB standards for all plasma-containing products except WB. However, the transfusion of WB to a recipient of unknown ABO group is currently prohibited by the AABB standards thereby delaying the administration of this product to some massively bleeding patients until their ABO group becomes known. This prohibition is retarding the implementation of civilian pre- and early in-hospital WB transfusion programs. The AABB/THOR working party generated a petition that was signed by 217 experts in the fields of transfusion medicine and resuscitation medicine from 24 countries, demonstrating that there is significant domestic and international interest in using low titer group O WB in traumatically injured patients or in others with life-threatening hemorrhage (http://rdcr.org/thor-aabb-working-group/)

A version of this document, along with the aforementioned petition and evidence of the safety of transfusing incompatible plasma from the literature, was considered by the AABB’s standards committee; standard 5.15.1 in the 31st edition of the standards that come into effect on 1 April, 2018 will now feature wording that will permit the use of group O, low titer WB for recipients of known or unknown ABO group as follows: Recipients shall receive ABO group-compatible Red Blood Cell components, ABO group-specific Whole Blood, or low titer group O Whole Blood (for non-group O or for recipients whose ABO group is unknown). The 31st edition of the standards goes on to indicate that the definition of “low titer” shall be made locally by each transfusion service, and that the transfusion service must have a policy specifying which patients are eligible to receive WB, the maximum quantity of WB per patient, and how to monitor for potential adverse events post-transfusion (standard 5.27.1). With the regulatory impediments removed, the determination of the efficacy of cold stored, low titer WB in civilian patients with massive hemorrhage will now begin in earnest.(29)”

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Prothrombin Complex Concentrate Reversal of Coagulopathy in Emergency General Surgery Patients.

Younis M, Ray-Zack M, Haddad NN, Choudhry A, Hernandez MC, Wise K, Zielinski MD.

BACKGROUND: Coagulopathy can delay or complicate surgical diseases that require emergent surgical treatment. Prothrombin complex concentrates (PCC) provide concentrated coagulation factors which may reverse coagulopathy more quickly than plasma (FFP) alone. We aimed to determine the time to operative intervention in coagulopathic emergency general surgery patients receiving either PCC or FFP. We hypothesize that PCC administration more rapidly normalizes coagulopathy and that the time to operation is diminished compared to FFP alone.

METHODS: Single institution retrospective review was performed for coagulopathic EGS patients during 2/1/2008 to 8/1/2016. Patients were divided into three groups (1) PCC alone (2) FFP alone and (3) PCC and FFP. The primary outcome was the duration from clinical decision to operate to the time of incision. Summary and univariate analyses were performed.

RESULTS: Coagulopathic EGS patients (n = 183) received the following blood products: PCC (n = 20, 11%), FFP alone (n = 119, 65%) and PCC/FFP (n = 44, 24%). The mean (± SD) patient age was 71 ± 13 years; 60% were male. The median (IQR) Charlson comorbidity index was similar in all three groups (PCC = 5(4-6), FFP = 5(4-7), PCC/FFP = 5(4-6), p = 0.33). The mean (± SD) dose of PCC administered was similar in the PCC/FFP group and the PCC alone group (2539 ± 1454 units vs. 3232 ± 1684, p = .09). The mean (±SD) time to incision in the PCC alone group was significantly lower than the FFP alone group (6.0 ± 3.6 vs. 8.8 ± 5.0 h, p = 0.01). The mean time to incision in the PCC + FFP group was also significantly lower than the FFP alone group (7.1 ± 3.6 vs. 8.8 ± 5.0, p = 0.03). The incidence of thromboembolic complications was similar in all three groups.

CONCLUSIONS: PCC, alone or in combination with FFP, reduced INR and time to surgery effectively and safely in coagulopathic EGS patients without an apparent increased risk of thromboembolic events, when compared to FFP use alone.

LEVEL OF EVIDENCE: IV single institutional retrospective review.

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Topical Tranexamic Acid Compared With Anterior Nasal Packing for Treatment of Epistaxis in Patients Taking Antiplatelet Drugs: Randomized Controlled Trial.

Zahed R, Mousavi Jazayeri MH, Naderi A, Naderpour Z, Saeedi M

OBJECTIVE: We evaluated the efficacy of topical application of the injectable form of tranexamic acid (TXA) compared with anterior nasal packing (ANP) for the treatment of epistaxis in patients taking antiplatelet drugs (aspirin, clopidogrel, or both) who presented to the emergency department (ED).

METHODS: A randomized, parallel-group clinical trial was conducted at two EDs. A total of 124 participants were randomized to receive topical TXA (500 mg in 5 mL) or ANP, 62 patients per group. The primary outcome was the proportion of patients in each group whose bleeding had stopped at 10 minutes. Secondary outcomes were the rebleeding rate at 24 hours and 1 week, ED length of stay (LOS), and patient satisfaction.

RESULTS: Within 10 minutes of treatment, bleeding was stopped in 73% of the patients in the TXA group, compared with 29% in the ANP group (difference = 44%, 95% confidence interval, 26% to 57%; $p < 0.001$). Additionally, rebleeding was reported in 5 and 10% of patients during the first 24 hours in the TXA and the ANP groups, respectively. At 1 week, 5% of patients in the TXA group and 21% of patients in the ANP group had experienced recurrent bleeding ($p = 0.007$). Patients in the TXA group reported higher satisfaction scores (median [interquartile range {IQR}], 9 [8-9.25]) compared with the ANP group (median [IQR] = 4 [3-5]; $p < 0.001$). Discharge from the ED in <2 hours was achieved in 97% of patients in the TXA group versus 13% in the ANP group ($p < 0.001$). There were no adverse events reported in either group.

CONCLUSIONS: In our study population, epistaxis treatment with topical application of TXA resulted in faster bleeding cessation, less rebleeding at 1 week, shorter ED LOS, and higher patient satisfaction compared with ANP.

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Prehospital analgesic choice in injured patients does not impact on rates of vomiting: Experience from a New South Wales primary retrieval service.

Zhang M, Cowan T, Smiles JP, Morgan M, Armstrong J, Goswami C, Sewell C

OBJECTIVE: This study aimed to explore the analgesic regimes adopted in our contemporary retrieval practice and the incidence of vomiting in ED after prehospital analgesic use.

METHOD: A retrospective review was conducted on trauma patients retrieved by the Hunter Primary Retrieval Service in the Hunter New England Local Health District, New South Wales, Australia, during 2015.

RESULTS: Of the 379 patients attended by the service in 2015, 196 of them (mean age 38.6, SD 19.68, years) were selected for this review. Morphine was the most commonly used analgesic (mean 68.37%; 95% CI 61.36-74.81%), followed by fentanyl (mean 48.47%; 95% CI 41.29-55.70%) and ketamine (mean 34.18%; 95% CI 27.57-41.28%). Fourteen (7.14%, 95% CI 3.96-11.69%) patients vomited either prehospital or within the ED. Patients in both the emesis and the non-emesis group were comparable in demographics. None of the three studied analgesics were observed to be significantly associated with higher risk of vomiting than the others in this review, although a higher dose of fentanyl was given to the non-emesis group ($P = 0.04$).

CONCLUSIONS: The frequency of vomiting in the retrieved patients observed in our study was less than previously reported in the literature. Opioids still prevailed over ketamine as the preferred initial analgesic, with ketamine most commonly used as an adjunct. Multi-centre trials in this field would be preferable in future in view of the relatively low incidence of vomiting in retrieved trauma patients.