Tactical Combat Casualty Care

Journal Article Abstracts

Committee on Tactical Combat Casualty Care

November 2018

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Abstracts

J Spec Oper Med. Fall 2018;18(3):71-74.

Does Pain Have a Role When It Comes to Tourniquet Training?

Alterie J, Dennis AJ, Baig A, Impens A, Ivkovic K, Joseph KT, Messer TA, Poulakidas S, Starr FL, Wiley DE, Bokhari F, Nagy KK.

BACKGROUND: One of the greatest conundrums with tourniquet (TQ) education is the use of an appropriate surrogate of hemorrhage in the training setting to determine whether a TQ has been successfully used. At our facility, we currently use loss of audible Doppler signal or loss of palpable pulse to represent adequate occlusion of vasculature and thus successful TQ application. We set out to determine whether pain can be used to indicate successful TQ application in the training setting.

METHODS: Three tourniquet systems (a pneumatic tourniquet, Combat Application Tourniquet® [C-A-T], and Stretch Wrap and Tuck Tourniquet™ [SWAT-T]) were used to occlude the arterial vasculature of the left upper arm (LUA), right upper arm (RUA), left forearm (LFA), right forearm (RFA), right thigh (RTH), and right calf (RCA) of 41 volunteers. A 4MHz, handheld Doppler ultrasound was used to confirm loss of Doppler signal (LOS) at the radial or posterior tibial artery to denote successful TQ application. Once successful placement of the TQ was noted, subjects rated their pain from 0 to 10 on the visual analog scale. In addition, the circumference of each limb, the pressure with the pneumatic TQ, number of twists with the C-A-T, and length of TQ used for the SWAT-T to obtain LOS was recorded.

RESULTS: All 41 subjects had measurements at all anatomic sites with the pneumatic TQ, except one participant who was unable to complete the LUA. In total, pain was rated as 1 or less by 61% of subjects for LUA, 50% for LFA, 57.5% for RUA, 52.5% RFA, 15% for RTH, and 25% for RCA. Pain was rated 3 or 4 by 45% of subjects for RTH. For the C-A-T, data were collected from 40 participants. In total, pain was rated as 1 or less by 57.5% for the LUA, 70% for the LFA, 62.5% for the RUA, 75% for the RFA, 15% for the RTH, and 40% for the RCA. Pain was rated 3 or 4 by 42.5%. The SWAT-T group consisted of 37 participants for all anatomic locations. In total, pain was rated as 1 or less by 27% for LUA, 40.5% for the LFA, 27.0% for the RUA, 43.2 for the RFA, 18.9% for the RTH, and 16.2% for the RCA. Pain was rated 5 by 21.6% for RTH application, and 3 or 4 by 35%.

CONCLUSION: The unexpected low pain values recorded when loss of signal was reached make the use of pain too sensitive as an indicator to confirm adequate occlusion of vasculature and, thus, successful TQ application.

J Trauma Acute Care Surg. 2018 Oct 23 Epub ahead of print

The Impact of Pre Hospital Administration of Freeze Dried Plasma on Casualty Outcome.

Amir S, Maya ST, Irina R, Kobi P, Yoram K, Elon G, Avraham Y; ITG.

BACKGROUND: Hemorrhage is the most common preventable cause of death in both civilian and military trauma. There is no consensus regarding the appropriate fluid resuscitation protocol. Plasma, as a resuscitative fluid, has substantial benefits as a volume expander, owing to its relatively high oncotic pressure and its positive effect on trauma induced coagulopathy by replenishing the lost coagulation factors, rather than diluting the casualty's remaining factors. The Israel Defense Force Medical Corps decided to use Freeze dried plasma (FDP) as the fluid of choice for casualties in hemorrhagic shock in the prehospital setting. The aim of our study is to compare the differences of coagulation, perfusion measurements, resource utilization, and outcome between casualties receiving FDP to casualties who didn't receive FDP in the prehospital setting.

METHODS: This is a retrospective matched cohort study based on two groups of casualties (those treated with FDP vs. those without FDP treatment). The control group was compiled in three steps of precision for age, gender, mechanism of injury and maximum level of severity for each nine injured body regions. Data were collected from the IDF Trauma Registry and The National Israel Trauma Registry.

RESULTS: The study group comprised 48 casualties receiving FDP and 48 controls with no differences in demographic, evacuation time and injury characteristics. The FDP group demonstrated a lower level of hemoglobin (12.7 gr/dzl) (OR 3.11 95%CI 1.10-8.80), lower level of INR (1.1) (OR 3.09 95%CI 1.04-9.14) and lower level of platelets (230x10/L) (OR 3.06 95%CI 1.16-8.06). No other differences were found between the two groups.

CONCLUSION: The use of FDP in the prehospital setting has logistic benefits and a positive effect on coagulation profile, with no other significant effects. Future studies need to be done on larger groups in order to verify trends or nullify our hypotheses.

LEVEL OF EVIDENCE: IV STUDY TYPE: retrospective matched cohort study.

J Trauma Acute Care Surg. 2018 Oct;85(4):782-787

Vitamin C in burns, sepsis, and trauma.

Anand T, Skinner R.

Quote:
“How can we make volume resuscitation more effective, with less volume? What adjuncts can be utilized to accomplish this, without causing further harm? After presenting to the trauma bay, the severely injured patient is actively resuscitated with fluids and pressors and undergoes operative intervention to manage the injury, but the battle between the proinflammatory and anti-inflammatory state has yet to be addressed; this is where the role of vitamin C arises. In the first 24 to 48 hours after a moderate to severe trauma,when intracellular levels of vitamin C are low, with disturbed endothelial and EGL integrity, with overwhelming ROS concentration, augmenting our natural defenses against ROS and the concomitant endotheliopathy is a potential option with vitamin C.

Much of the research performed thus far has been in animal models. Few prospective trials have been performed. Although more research is still needed to completely elucidate ascorbate's effects upon the endothelial system in human trials, the mounting evidence, however, shows an overall beneficial effect in the microenvironment, leading to improved end-organ perfusion. Concerns of ascorbate's renal adverse effects are valid but have not been consistently observed in literature.We suggest a prospective study randomizing trauma patients to receive high-dose parenteral infusion of vitamin C in the first 24 hours of hospitalization. Trauma patients meeting Level 1 activation criteria and admitted to the ICU should be considered, regardless of the delay in presentation, as ascorbate has been found to be beneficial even when infused in patients with delayed presentation to the emergency department. Intravenous infusion of ascorbate is key, as peak blood levels via oral dosing are limited by the mucosal gut absorption.”

Crit Care Med. 2018 Dec;46(12):e1145-e1151

Use of Vasopressor Increases the Risk of Mortality in Traumatic Hemorrhagic Shock: A Nationwide Cohort Study in Japan.

Aoki M, Abe T, Saitoh D, Hagiwara S, Oshima K

OBJECTIVES: To evaluate the possible association of vasopressor use with mortality in traumatic hemorrhagic shock patients.

DESIGN: Retrospective cohort study.

SETTING: Traumatic hemorrhagic shock patients at 260 emergency hospitals in Japan between 2004 and 2015.

PATIENTS: Three-thousand five-hundred fifty-one traumatic hemorrhagic shock patients who had systolic hypotension (< 90 mm Hg) on arrival at the emergency department and a blood transfusion received within the first 24 hours.

INTERVENTIONS: The use of vasopressor for traumatic hemorrhagic shock within the first 24 hours.

MEASUREMENTS AND MAIN RESULTS: Among 236,698 trauma patients, 3,551 were included in the study. Overall, 198 of 459 patients (43%) in the vasopressor+ group expired compared with 481 of 3,092 patients (16%) in the vasopressor- group. Use of vasopressor had an odds ratio of 2.172 (95% CI, 1.666-2.833) for in-hospital mortality adjusted for age, gender, year of onset, cause of injury, mechanism of injury, vital signs at the emergency department, Injury Severity Score, use of prehospital IV fluid, and volume of blood transfusion within the first 24 hours. In the propensity score-matched cohort and two subgroup analyses (massive transfusion and survivable injury models), use of vasopressor was associated with higher mortality (odds ratio, 2.168; 95% C, 1.442-3.320), (odds ratio, 2.029; 95% CI, 1.414-2.911; massive transfusion model), and (odds ratio, 1.959; 95% CI, 1.364-2.814; survivable injury model).

CONCLUSIONS: Use of vasopressor for traumatic hemorrhagic shock was associated with mortality after controlling for biases (trauma severity; volume of fluid resuscitation).

Eur J Trauma Emerg Surg. 2018 Sep 27. Epub ahead of print

Hemodynamic consequences of extremity injuries following a terrorist bombing attack: retrospective cohort study.

Ashkenazi I, Sevi R, Turégano-Fuentes F, Walsh M, Olsha O, Schecter W, Alfici R

BACKGROUND: Extremities are commonly injured following bomb explosions. The main objective of this study was to evaluate the prevalence of hemorrhagic shock (HS) in victims of explosion suffering from extremity injuries.

METHODS: Retrospective study based on a cohort of patient records maintained in one hospital's mass casualty registry.

RESULTS: Sixty-six victims of explosion who were hospitalized with extremity injuries were identified and evaluated. Sixteen (24.2%) of these were hemodynamically unstable during the first 24 h of treatment. HS could be attributed to associated injuries in seven of the patients. In the other nine patients, extremity injury was the only injury that could explain HS in seven patients and the extremity injury was a major contributor to HS together with another associated injury in two patients. In those 9 patients, in whom the extremity injury was the sole or major contributor to HS, a median of 10 (range 2-22) pRBC was transfused during the first 24 h of treatment. Six of the nine patients were in need of massive transfusion. Fractures in both upper and lower extremities, Gustilo IIIb-c open fractures and AIS 3-4 were found to be risk factors for HS.

CONCLUSIONS: Ample consideration should be given to patients with extremity injuries due to explosions, as these may be immediately life threatening. Tourniquet use should be encouraged in the pre-hospital setting. Before undertaking surgery, emergent HS should be considered in these patients and prevented by appropriate resuscitation.

J Spec Oper Med. Fall 2018;18(3):50-56.

A Pilot Study of Four Intraosseous Blood Transfusion Strategies.

Auten JD, Mclean JB, Kemp JD, Roszko PJ, Fortner GA, Krepela AL, Walchak AC, Walker CM, Deaton TG, Fishback JE.

BACKGROUND: Intraosseous (IO) access is used by military first responders administering fluids, blood, and medications. Current IO transfusion strategies include gravity, pressure bags, rapid transfusion devices, and manual push-pull through a three-way stopcock. In a swine model of hemorrhagic shock, we compared flow rates among four different IO blood transfusion strategies.

METHODS: Nine Yorkshire swine were placed under general anesthesia. We removed 20 to 25mL/kg of each animal's estimated blood volume using flow of gravity. IO access was obtained in the proximal humerus. We then autologously infused 10 to 15mL/kg of the animal's estimated blood volume through one of four randomly assigned treatment arms.

RESULTS: The average weight of the swine was 77.3kg (interquartile range, 72.7kg-88.8kg). Infusion rates were as follows: gravity, 5mL/min; Belmont rapid infuser, 31mL/min; single-site pressure bag, 78mL/min; double-site pressure bag, 103mL/min; and push-pull technique, 109mL/min. No pulmonary arterial fat emboli were noted.

CONCLUSION: The optimal IO transfusion strategy for injured Service members appears to be single-site transfusion with a 10mL to 20mL flush of normal saline, followed immediately by transfusion under a pressure bag. Further study, powered to detect differences in flow rate and clinical complications is required.

Mil Med. 2018 Jul 11 Epub ahead of print

Evaluation of a Novel Fibrin Sealant Patch in Hemorrhage Control After Vascular or Hepatic Injury.

Baker J, Goodman M, Makley A, Stevens-Topie S, Veile R, Mahoney E, Heyl J, Cox D, Pritts T, Athota K

Introduction: Acute hemorrhage remains the leading cause of death in potentially survivable injuries. The use of topical hemostatic agents has increased over the last two decades with the evolution of damage control surgery. By 2008, the military widely adopted Combat Gauze as the hemostatic dressing of choice for compressible hemorrhage. The goal of this study was to compare the performance of a novel fibrin sealant patch to Combat Gauze in two clinically relevant models of hemorrhage.

Materials and Methods: Yorkshire swine underwent unilateral femoral artery puncture or a grade V liver laceration with timed free bleeding then received either the fibrin patch or Combat Gauze packing with 3 minutes of standardized pressure. Animals were then resuscitated to maintain a mean arterial pressure of 60 mmHg for 4 hours. Hemostasis, blood loss, resuscitation volume, survival, vessel patency, and hematologic parameters were evaluated.

Results: Hemostasis was equivalent in both groups after hepatic and vascular injury. Survival was 80% in the fibrin patch vascular injury group and 100% in all other groups. Hematologic parameters were not significantly different between treatment groups. Femoral artery patency was 80% in both groups after vascular injury. With simulated ambulation after vessel injury, 60% of the Combat Gauze group and 80% of the fibrin patch group remained hemostatic ($p > 0.05$). In simulated re-exploration with packing removal, all animals rebled after hemostatic product removal.

Conclusion: There was no significant difference in hemostasis between a novel fibrin patch and Combat Gauze after extremity arterial or hepatic injury. This novel fibrin patch may have a clinical advantage over the Combat Gauze, as it can be left in the body, thereby limiting the potential need for reoperation.

Neurosurg Clin N Am. 2018 Oct;29(4):557-565

Management of Intraoperative Coagulopathy.

Bar-Natan M, Hymes K.

ABSTRACT:
Intraoperative bleeding can be minimized with optimal preoperative preparation but cannot be completely prevented. There are circumstances when patients need emergent operative intervention, and thorough hemostatic evaluation and preparation is not possible. In this review, the authors summarize the recommendations for rapid reversal of vitamin K antagonists and direct oral anticoagulants before procedures. The authors review the potential causes for intraoperative bleeding and the methods for rapid and accurate diagnosis. The authors summarize the current evidence for treatment options, including transfusion of platelets and coagulation factors and the use of topical agents, antidotes to direct-acting anticoagulants, antifibrinolytics, and desmopressin.

J Spec Oper Med. Fall 2018;18(3):75-78.

The Combat Application Tourniquet Versus the Tactical Mechanical Tourniquet.

Beaven A, Ballard M, Sellon E, Briard R, Parker P.

BACKGROUND: Exsanguination from limb injury is an important battlefield consideration that is mitigated with the use of emergency tourniquets. The Combat Application Tourniquet (C-A-T®) is the current British military standard tourniquet.

METHODS: We tested the self-application of a newer tourniquet system, the Tactical Mechanical Tourniquet (TMT), against self-application of the C-A-T. A total of 24 healthy British military volunteers self-applied the C-A-T and the TMT to their mid thigh in a randomized, sequential manner. Popliteal artery flow was monitored with a portable ultrasound machine, and time until arterial occlusion was measured. Pain scores were also recorded.

Results: The volunteers allowed testing on their lower limbs (n = 48 legs). The C-A-T was applied successfully to 22 volunteers (92%), and the TMT was successfully applied to 17 (71%). Median time to reach complete arterial occlusion was 37.5 (interquartile range [IQR], 27-52) seconds with the C-A-T, and 35 (IQR, 29-42) seconds with the TMT. The 2.5-second difference in median times was not significant (ρ = .589). The 1-in-10 difference in median pain score was also not significant (ρ = .656). The success or failure of self-application between the two tourniquet models as assessed by contingency table was not significant (p= .137).

CONCLUSION: The TMT is effective when self-applied at the mid-thigh. It does not offer an efficacy advantage over the C-A-T.

JAMA. 2018 Aug 28;320(8):779-791.

Effect of a Strategy of a Supraglottic Airway Device vs Tracheal Intubation During Out-of-Hospital Cardiac Arrest on Functional Outcome: The AIRWAYS-2 Randomized Clinical Trial.

Benger J, Kirby K, Black S, Brett S, Clout M, Lazaroo M, Nolan J, Reeves B, Robinson M, Scott L, Smartt H, South A, Stokes E, Taylor J, Thomas M, Voss S, Wordsworth S, Rogers C

Importance: The optimal approach to airway management during out-of-hospital cardiac arrest is unknown.

Objective: To determine whether a supraglottic airway device (SGA) is superior to tracheal intubation (TI) as the initial advanced airway management strategy in adults with non-traumatic out-of-hospital cardiac arrest.

Design, Setting, and Participants: Multicenter, cluster randomized clinical trial of paramedics from 4 ambulance services in England responding to emergencies for approximately 21 million people. Patients aged 18 years or older who had a non-traumatic out-of-hospital cardiac arrest and were treated by a participating paramedic were enrolled automatically under a waiver of consent between June 2015 and August 2017; follow-up ended in February 2018.

Interventions: Paramedics were randomized 1:1 to use TI (764 paramedics) or SGA (759 paramedics) as their initial advanced airway management strategy.

Main Outcomes and Measures: The primary outcome was modified Rankin Scale score at hospital discharge or 30 days after out-of-hospital cardiac arrest, whichever occurred sooner. Modified Rankin Scale score was divided into 2 ranges: 0-3 (good outcome) or 4-6 (poor outcome; 6 = death). Secondary outcomes included ventilation success, regurgitation, and aspiration.

Results: A total of 9296 patients (4886 in the SGA group and 4410 in the TI group) were enrolled (median age, 73 years; 3373 were women [36.3%]), and the modified Rankin Scale score was known for 9289 patients. In the SGA group, 311 of 4882 patients (6.4%) had a good outcome (modified Rankin Scale score range, 0-3) vs 300 of 4407 patients (6.8%) in the TI group (adjusted risk difference [RD], -0.6% [95% CI, -1.6% to 0.4%]). Initial ventilation was successful in 4255 of 4868 patients (87.4%) in the SGA group compared with 3473 of 4397 patients (79.0%) in the TI group (adjusted RD, 8.3% [95% CI, 6.3% to 10.2%]). However, patients randomized to receive TI were less likely to receive advanced airway management (3419 of 4404 patients [77.6%] vs 4161 of 4883 patients [85.2%] in the SGA group). Two of the secondary outcomes (regurgitation and aspiration) were not significantly different between groups (regurgitation: 1268 of 4865 patients [26.1%] in the SGA group vs 1072 of 4372 patients [24.5%] in the TI group; adjusted RD, 1.4% [95% CI, -0.6% to 3.4%]; aspiration: 729 of 4824 patients [15.1%] vs 647 of 4337 patients [14.9%], respectively; adjusted RD, 0.1% [95% CI, -1.5% to 1.8%]).

Conclusions and Relevance: Among patients with out-of-hospital cardiac arrest, randomization to a strategy of advanced airway management with a supraglottic airway device compared with tracheal intubation did not result in a favorable functional outcome at 30 days.
Trial Registration: ISRCTN Identifier: 08256118.

Medicine (Baltimore). 2018 Oct;97(40):e12593.

Comparison of blind intubation via supraglottic airway devices versus standard intubation during different airway emergency scenarios in inexperienced hand: Randomized, crossover manikin trial.

Bielski A, Rivas E, Ruetzler K, Smereka J, Puslecki M, Dabrowski M, Ladny J, Frass M, Robak O, Evrin T, Szarpak L

BACKGROUND: Securing the airway and enabling adequate oxygenation and ventilation is essential during cardiopulmonary resuscitation (CPR). The aim of the study was to evaluate the success rate of blind intubation via the I-Gel and the Air-Q compared with direct laryngoscopy guided endotracheal intubation by inexperienced physician and to measure time to successful intubation.

METHODS: The study was designed as a randomized, cross-over simulation study. A total of 134 physicians, from specialties other than Anesthesia or Emergency Medicine, who considered themselves skilled in endotracheal intubation but who have never used any kind of supraglottic airway device performed blind intubation via the I-Gel and Air-Q and direct laryngoscopy guided endotracheal intubation in 3 randomized scenarios: normal airway without chest compression during intubation attempt; normal airway with continuous chest compression during intubation attempt; difficult airway with continuous chest compression.

RESULTS: Scenario A: Success rate with initial intubation attempt was 72% for endotracheal intubation, 75% in Air-Q, and 81% in I-Gel. Time to endotracheal intubation and ease of intubation was comparable with all 3 airway devices used. Scenario B: Success rate with the initial intubation attempt was 42% for endotracheal intubation, compared with 75% in Air-Q and 80% in I-Gel. Time for endotracheal intubation was significantly prolonged in endotracheal intubation (42 seconds, 35-49), compared with Air-Q (21 seconds, 18-32) and I-Gel (19 seconds, 17-27). Scenario C: The success rate with the initial intubation attempt was 23% in endotracheal intubation, compared with 65% in Air-Q and 74% in I-Gel. Time to intubation was comparable with both supraglottic airway devices (20 vs 22 seconds) but was significantly shorter compared with endotracheal intubation (50 seconds, $P < .001$).

CONCLUSIONS: Less to moderately experienced providers are able to perform endotracheal intubation in easy airways but fail during ongoing chest compressions and simulated difficult airway. Consequently, less to moderately experienced providers should refrain from endotracheal intubation during ongoing chest compressions during CPR and in expected difficult airways. Supraglottic airway devices are reliable alternatives and blind intubation through these devices is a valuable airway management strategy.

Prehosp Emerg Care. 2018 Oct 25:1-6

Intraosseous Administration of Tissue Plasminogen Activator on a Mobile Stroke Unit.

Bowry R, Nour M, Kus T, Parker S, Stephenson J, Saver J, Grotta JC, Ostermayer D.

OBJECTIVE: Mobile stroke units offer improved time to administration of thrombolytics for ischemic stroke patients. Acquisition of intravenous (IV) access, however, can be challenging in the prehospital environment leading to treatment delays. Intraosseous (IO) access is commonly used in the prehospital setting for a variety of conditions and may serve as a viable means for tPA (tissue plasminogen activator) administration.

METHODS/RESULTS: We describe 3 cases in which tPA was administered via IO access on a mobile stroke unit as part of the Benefits of Stroke Treatment Delivered Using a Mobile Stroke Unit Compared to Standard Management by Emergency Medical Services (BEST-MSU) trial.

CONCLUSION: No adverse events were observed in the process of obtaining IO access or administering tPA.

J Trauma Acute Care Surg. 2018 Oct;85(4):717-724

Abdominal Aortic and Junctional Tourniquet release after 240 minutes is survivable and associated with small intestine and liver ischemia after porcine class II hemorrhage.

Brännström A, Rocksén D, Hartman J, Nyman N, Gustavsson J, Arborelius UP, Günther M.

BACKGROUND: Uncontrolled hemorrhage is a leading cause of tactical trauma-related deaths. Hemorrhage from the pelvis and junctional regions are particularly difficult to control due to the inability of focal compression. The Abdominal Aortic and Junctional Tourniquet (AAJT) occludes aortic blood flow by compression of the abdomen. The survivability of tourniquet release beyond 120 minutes is unknown and fluid requirements to maintain sufficient blood pressure during prolonged application are undetermined. We therefore compared 60-minute and 240-minute applications and release of the AAJT for 30 minutes, with crystalloid fluid therapy, after a Class II hemorrhage.

METHODS: Sixty-kilogram anesthetized pigs were subjected to 900-mL hemorrhage and AAJT application for 60 minutes (n = 5), 240 minutes (n = 5), and fluid therapy only for 240 minutes (n = 5) and reperfusion for 30 minutes.

RESULTS: The AAJT application was hemodynamically and respiratory tolerable for 60 minutes and 240 minutes. Cumulative fluid requirements decreased by 64%, comparable to 3000 mL of crystalloids. Mechanical ventilation was impaired. AAJT increased the core temperature by 0.9°C compared with fluid therapy. Reperfusion consequences were reversible after 60 minutes but not after 240 minutes. A 240-minute application resulted in small intestine and liver ischemia, persisting hyperkalemia, metabolic acidosis, and myoglobinemia, suggesting rhabdomyolysis.

CONCLUSION: The AAJT application for 240 minutes with reperfusion was survivable in an intensive care setting and associated with abdominal organ damage. Long time consequences and spinal cord effects was not assessed. We propose an application time limit within 60 minutes to 240 minutes, though further studies are needed to increase the temporal resolution. The AAJT application may be considered as a rescue option to maintain central blood pressure and core temperature in cases of hemorrhagic shock from extremity bleedings, if fluid therapy is unavailable or if the supply is limited.

LEVEL OF EVIDENCE: Therapeutic study, level II.

J Trauma Acute Care Surg. 2018 Oct;85(4):668-673. doi: 10.1097/TA.0000000000001841.

Characterizing injury severity in nonaccidental trauma: Does Injury Severity Score miss the mark?

Brown JB(1), Gestring ML, Leeper CM, Sperry JL, Peitzman AB, Billiar TR, Gaines BA.

BACKGROUND: Children suffering nonaccidental trauma (NAT) are at high risk of death. It is unclear whether markers of injury severity for trauma center/system benchmarking such as Injury Severity Score (ISS) adequately characterize this. Our objective was to evaluate mortality prediction of ISS in children with NAT compared with accidental trauma (AT).

METHODS: Pediatric patients younger than 16 years from the Pennsylvania state trauma registry 2000 to 2013 were included. Logistic regression predicted mortality from ISS for NAT and AT patients. Multilevel logistic regression determined the association between mortality and ISS while adjusting for age, vital signs, and injury pattern in NAT and AT patients. Similar models were performed for head Abbreviated Injury Scale (AIS). Sensitivity analysis examined impaired functional independence at discharge as an alternate outcome.

RESULTS: Fifty thousand five hundred seventy-nine patients were included with 1,866 (3.7%) NAT patients. Non-accidental trauma patients had a similar rate of mortality at an ISS of 13 as an ISS of 25 for AT patients. Non-accidental trauma patients also have higher mortality for a given head AIS level (range, 1.2-fold to 5.9-fold higher). Injury Severity Score was a significantly greater predictor of mortality in AT patients (adjusted odds rations [AOR], 1.14; 95% confidence interval [CI], 1.13-1.15; $p < 0.01$) than NAT patients (AOR, 1.09; 95% CI, 1.07-1.12; $p < 0.01$) per 1-point ISS increase, while head injury was a significantly greater predictor of mortality in NAT patients (AOR, 3.48; 95% CI, 1.54-8.32; $p < 0.01$) than AT patients (AOR, 1.21; 95% CI, 0.95-1.45; $p = 0.12$). Non-accidental trauma patients had a higher rate of impaired functional independence at any given ISS or head AIS level than AT patients.

CONCLUSION: Non-accidental trauma patients have higher mortality and impaired function at a given ISS/head AIS than AT patients. Conventional ISS thresholds may underestimate risk and head injury is a more important predictor of mortality in the NAT population. These findings should be considered in system performance improvement and benchmarking efforts that rely on ISS for injury characterization.

LEVEL OF EVIDENCE: Epidemiologic study, level III.

HSS J. 2018 Oct;14(3):338-340

Has Tranexamic Acid in Total Knee Arthroplasty Made Tourniquet Use Obsolete?

Brusalis C, Bostrom M, Richardson S.

ABSTRACT:
The application of tranexamic acid (TXA) in total joint arthroplasty has dramatically improved peri-operative blood management. In light of these benefits, a study by Huang et al., "Intravenous and Topical Tranexamic Acid Alone Are Superior to Tourniquet Use for Primary Total Knee Arthroplasty," evaluates the need for continued use of the intra-operative tourniquet, which remains a routine practice with documented benefits and adverse effects. This review evaluates the study's design and critically interprets its findings for clinical practice. Through a prospective, randomized trial, Huang et al. demonstrated that among selected patients undergoing primary total knee arthroplasty, the use of a tourniquet results in no reduction in blood loss beyond that provided by TXA alone. Moreover, the use of TXA without a tourniquet led to improved early clinical outcomes such as reduced post-operative swelling, improved knee range of motion at discharge, and enhanced patient satisfaction. As medicine is practiced in an increasingly value-driven environment, this study provides a useful method for evaluating the utility of commonly used interventions. Its findings highlight the need for future investigations into the optimal administration of TXA in total knee arthroplasty.

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Tactical Combat Casualty Care for Medical Personnel (TCCC-MP) Recommended Post-Course Metrics: 24 July 2018

Butler FK

The recent DoD Instruction 1322.24 has now made TCCC the standard for battlefield trauma care in the US Military.

As the DoD seeks to ensure that all TCCC training is conducted though high-quality courses, it becomes imperative to have assessment metrics that document that TCCC-MP students have successfully captured the course concepts.

The metrics listed here are available now and should be used to ensure that the requisite information has been effectively transferred in TCCC-MP courses and that military medical individuals taking the course are, indeed, ready to save lives on the battlefield.

1. **Fund of TCCC Knowledge (Written Post-Course Test)**
   - JTS-developed test question bank—updated each year
   - 60 questions per test
   - Randomized order of questions
   - 75% is minimum passing score (45 or more correct)

   a. **NAEMT-conducted courses**
   - The CoTCCC staff provides an updated test question bank to NAEMT headquarters annually.
   - A TCCC Microsoft (MS) Access–based random test generating program is made available to TCCC-MP course coordinators.
   - NAEMT TCCC-MP course coordinators will generate unique tests with randomized selection of questions from the current test bank for each TCCC course.
   - The TCCC-MP questions and test generator program are also held at NAEMT headquarters.
   - If the TCCC training site does not have MS Access, NAEMT headquarters will provide a test to the cognizant TCCC-MP course coordinator upon request.
   - Course coordinators will maintain completed tests for each TCCC-MP student at each training site for 5 years. These records must be made available to NAEMT upon request.
   - NAEMT compiles all test scores in their database. This is a requirement for Commission on Accreditation for Prehospital Continuing Education (CAPCE) continuing education credit.
   - Additional quality assurance steps include regular, independent course evaluations by students. These evaluations are reviewed and analyzed, and appropriate follow-up action taken as needed.
   - Test question challenges will be brought to the attention of the instructor for adjudication. He or she can forward the challenge to NAEMT headquarters for assistance as needed.

   b. **For non-NAEMT TCCC courses**
   - The CoTCCC staff, upon request, will provide an updated test question bank to DoD Schoolhouses and Training Sites that teach TCCC-MP courses with each annual updated curriculum release. These sites can create tests with randomized question orders as per NAEMT training centers above.
   - Alternatively, if the Schoolhouses or Training Sites that teach TCCC-MP courses do not wish to use MS Access, they can create their own test question randomization plan/software and use that to select questions from the updated 2018 TCCC-MP Test Question bank.
   - The number of questions and the minimum passing score should be as noted above.
   - All of the functions listed above for NAEMT courses to generate and maintain completed TCCC-MP post-course tests and test scores should be performed at local TCCC-MP training sites (until the emerging DHA Joint Trauma Education and Training Directorate or the services assume oversight of these functions).

2. **TCCC-MP Critical Decision Case Studies (CDCS) Written Test**
   - All of the TCCC-MP CDCS will be presented as part of the curriculum.
   - The case studies will also be included as a separate TCCC-MP question bank.
   - The TCCC CDCS written test will be generated by the random test question–generating program.
   - The 2018 TCCC-MP CDCS test will have a total of 28 questions.
   - 75% or higher is the minimum passing score (21 or more correct)

   a. **NAEMT-conducted courses**
   - CDCS testing will be conducted as per section 1(a) above

   b. **Non-NAEMT TCCC courses**
   - CDCS testing will be conducted as per section 1(a) above

3. **Hands-On Skills (TCCC Skill Sheets)**
   - There are currently nine TCCC Skills Sheets for the TCCC-MP course.
   - A Skill Sheet will be completed for each student for each specified TCCC practical skill.
   - The Skill Sheet will be completed throughout the course after practice on that skill with instructor supervision and grading.

   a. **Both NAEMT-conducted TCCC-MP courses and non-NAEMT courses**
   - Course coordinators will maintain completed skill sheets at the local training site for 5 years.

Curr Opin Crit Care. 2018 Dec;24(6):525-530

Updates in emergency airway management.

Carlson J, Wang H

PURPOSE OF REVIEW: Historically, most evidence supporting emergency airway management strategies have been limited to small series, retrospective analyses and extrapolation from other settings (i.e. the operating room). Over the past year, several large, randomized clinical trials have offered new findings to inform emergency airway management techniques.

RECENT FINDINGS: One large, randomized clinical trial, found improved first attempt success rates with bougie facilitated intubation compared with traditional intubation. Two randomized clinical trials suggested better outcomes in adult out-of-hospital cardiac arrest (OHCA) with supraglottic airways (SGA) than intubation. A randomized clinical trial in OHCA patients could not identify outcome differences between endotracheal intubation (ETI) and bag-valve mask (BVM) ventilation but suggested higher rates of aspiration with BVM.

SUMMARY: These studies offer new findings to inform the practice of emergency airway management. Bougie use should be considered as a first-line approach in emergency intubation. SGA-based strategies should be considered as a first-line approach in the management of OHCA.

BMC Surg. 2018 Aug 29;18(1):68. doi: 10.1186/s12893-018-0398-z.

A systematic review on the use of topical hemostats in trauma and emergency surgery.

Chiara O, Cimbanassi S, Bellanova G, Chiarugi M, Mingoli A, Olivero G, Ribaldi S, Tugnoli G, Basilicò S, Bindi F, Briani L, Renzi F, Chirletti P, Di Grezia G, Martino A, Marzaioli R, Noschese G, Portolani N, Ruscelli P, Zago M, Sgardello S, Stagnitti F, Miniello S

BACKGROUND: A wide variety of hemostats are available as adjunctive measures to improve hemostasis during surgical procedures if residual bleeding persists despite correct application of conventional methods for hemorrhage control. Some are considered active agents, since they contain fibrinogen and thrombin and actively participate at the end of the coagulation cascade to form a fibrin clot, whereas others to be effective require an intact coagulation system. The aim of this study is to provide an evidence-based approach to correctly select the available agents to help physicians to use the most appropriate hemostat according to the clinical setting, surgical problem and patient's coagulation status.

METHODS: The literature from 2000 to 2016 was systematically screened according to PRISMA [Preferred Reporting Items for Systematic Reviews and Meta-Analyses] protocol. Sixty-six articles were reviewed by a panel of experts to assign grade of recommendation (GoR) and level of evidence (LoE) using the GRADE [Grading of Recommendations Assessment, Development and Evaluation] system, and a national meeting was held.

RESULTS: Fibrin adhesives, in liquid form (fibrin glues) or with stiff collagen fleece (fibrin patch) are effective in the presence of spontaneous or drug-induced coagulation disorders. Mechanical hemostats should be preferred in patients who have an intact coagulation system. Sealants are effective, irrespective of patient's coagulation status, to improve control of residual oozing. Hemostatic dressings represent a valuable option in case of external hemorrhage at junctional sites or when tourniquets are impractical or ineffective.

CONCLUSIONS: Local hemostatic agents are dissimilar products with different indications. A knowledge of the properties of each single agent should be in the armamentarium of acute care surgeons in order to select the appropriate product in different clinical conditions.

J Neurotrauma. 2018 Jul 24. doi: 10.1089/neu.2018.5712.

Prehospital Trauma Care among 68 European Neurotrauma Centers: Results of the CENTER-TBI Provider Profiling Questionnaires.

Cnossen M, van der Brande R, Lingsma H, Polinder S, Lecky F, Maas A

ABSTRACT:
The first hour following traumatic brain injury (TBI) is considered crucial to prevent death and disability. It is, however, not established yet how the prehospital care should be organized to optimize recovery during the first hour. The objective of the current study was to examine variation in prehospital trauma care across Europe aiming to inform comparative effectiveness analyses on care for neurotrauma patients. A survey on prehospital trauma care was sent to 68 neurotrauma centers from 20 European countries participating in the Collaborative European NeuroTrauma Effectiveness Research in TBI (CENTER-TBI) study. The survey was developed using literature review and expert opinion and was pilot tested in 16 centers. All participants completed the questionnaire. Advanced life support was used in half of the centers (n = 35; 52%), whereas the other centers used mainly basic life support (n = 26; 38%). A mobile medical team (MMT) could be dispatched 24/7 in most centers (n = 66; 97%). Helicopters were used in approximately half of the centers to transport the MMT to the scene (n = 39; 57%) and the patient to the hospital (n = 31, 46%). Half of the centers used a stay-and-play approach at the scene (n = 37; 55%), while the others used a scoop-and-run approach or another policy. We found wide variation in prehospital trauma care across Europe. This may reflect differences in socio-economic situations, geographic differences, and a general lack of strong evidence for some aspects of prehospital care. The current variation provides the opportunity to study the effectiveness of prehospital interventions and systems of care in comparative effectiveness research.

J Trauma Acute Care Surg. 2018 Sep;85(3):485-490

In vitro effects of a kaolin-coated hemostatic dressing on anticoagulated blood.

Cripps M, Cornelius C, Nakonezny P, Vazquez N, Wey J, Gales P

BACKGROUND: The use of kaolin-coated dressings has become common and have efficacy in normal patients, but their increased use will inevitably include use on bleeding patients taking anticoagulants. We hypothesize that kaolin coating material (KCM) will improve clotting regardless of anticoagulation medication.

METHODS: A prospective study was performed on blood from patients who were on a vitamin K antagonist (VKA), unfractionated heparin (UH), an antiplatelet (AP) agent, a Xa inhibitor (Xa), or a direct thrombin inhibitor (DTI). None were on more than one type of anticoagulation medication. Viscoelastic testing was performed with and without KCM. All p values were adjusted for multiple comparisons.

RESULTS: The addition of KCM significantly decreased the time for initial clot formation (CT) in all groups. The mean CT for controls was decreased from 692 to 190.8 s ($p < 0.0001$). KCM decreased the initial clot formation time by about 1.5 times in those on DTI ($p = 0.043$) and 2.5 times in those taking AP medication ($p < 0.001$). The most profound effect was seen in those on UH (no KCM 1,602 s vs. KCM 440 s; $p < 0.001$), VKA (no KCM 1,152 s vs. 232 s; $p < 0.01$), and Xa (no KCM 1,342 s vs. 287 s; $p < 0.001$). Analysis of other clot formation parameters revealed that KCM significantly improved the clot formation kinetics (CFT) only in patients taking Xa ($p = 0.03$). KCM improved maximum clot strength in patients on Xa inhibitors ($p = 0.05$). Patients on UH had a larger effect size with an increase in clot strength from 24.35 mm to 43.35 mm whereas those on Xa had an increase of 38.7 mm to 49.85 mm.

CONCLUSION: In this in vitro analysis, the addition of KCM to the blood of patients taking any of these anticoagulation medications significantly improved the time to initial clot formation, indicating that kaolin-based hemostatic dressings will be effective in initiating clot formation in patients on anticoagulants.

LEVEL OF EVIDENCE: Therapeutic, level IV.

J Trauma Acute Care Surg. 2018 Oct;85(4):665-667

Tourniquet usage in prehospital care and resuscitation of pediatric trauma patients-Pediatric Trauma Society position statement.

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

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

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

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

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

LEVEL OF EVIDENCE: Guidelines/algorithm study, level IIIa.

J Surg Res. 2018 Nov;231:15-23

Pleural electrical impedance is a sensitive, real-time indicator of pneumothorax.

DeArmond D, Das N, Restrepo C, Johnson S, Michalek J, Hernandez B

BACKGROUND: Chest tube management protocols, particularly in patients with alveolar-pleural air leak due to recent surgery or trauma, are limited by concerns over safety, especially concerns about rapid and occult development of pneumothorax. A continuous, real-time monitor of pneumothorax could improve the quality and safety of chest tube management. We developed a rat model of pneumothorax to test a novel approach of measuring electrical impedance within the pleural space as a monitor of lung expansion.

MATERIALS AND METHODS: Anesthetized Sprague-Dawley rats underwent right thoracotomy. A novel impedance sensor and a thoracostomy tube were introduced into the right pleural space. Pneumothorax of varying volumes ranging from 0.2 to 20 mL was created by syringe injection of air via the thoracostomy tube. Electrical resistance measurements from the pleural sensor and fluoroscopic images were obtained at baseline and after the creation of pneumothorax and results compared.

RESULTS: A statistically significant, dose-dependent increase in electrical resistance was observed with increasing volume of pneumothorax. Resistance measurement allowed for continuous, real-time monitoring of pneumothorax development and the ability to track pneumothorax resolution by aspiration of air via the thoracostomy tube. Pleural resistance measurement demonstrated 100% sensitivity and specificity for all volumes of pneumothorax tested and was significantly more sensitive for pneumothorax detection than fluoroscopy.

CONCLUSIONS: The electrical impedance-based pleural space sensor described in this study provided sensitive and specific pneumothorax detection, which was superior to radiographic analysis. Real-time, continuous monitoring for pneumothorax has the potential to improve the safety, quality, and efficiency of postoperative chest tube management.

Transfusion. 2018 Oct;58(10):2326-2334

Blood utilization and mortality in victims of gun violence.

DeMario V, Sikorski R, Efron D, Serbanescu M, Buchanan R, Wang E, Visagie M, Gehrie E, Manukyan MC, Noll K, Ken Lee KH, Ness PM, Frank SM.

BACKGROUND: Blood transfusion can be lifesaving for patients with hemorrhage; however, transfusion requirements for victims of gun violence are poorly understood.

STUDY DESIGN AND METHODS: In an urban, Level 1 trauma center, 23,422 trauma patients were analyzed in a retrospective cohort study. Patients with gunshot wounds (GSWs) (n = 2,672; 11.4% of trauma patients) were compared to those with non-GSW traumatic injuries from 2005 to 2017, to assess blood utilization.

RESULTS: The GSW cohort was approximately five times more likely to require transfusion (538 of 2672 [20.1%] vs. 798 of 20,750 [3.9%]; $p < 0.0001$), and the number of blood component units transfused per patient was approximately 10 times greater (3.3 ± 13.5 vs. 0.31 ± 3.8 units/patient; $p < 0.0001$), compared to the non-GSW cohort. The risk-adjusted likelihood of requiring high-dose transfusion was greater in the GSW cohort (odds ratio, 2.38; 95% confidence interval, 1.14-5.80), and requirements were increased for all four blood components (red blood cells, platelets, plasma, and cryoprecipitate). Patients with GSWs had approximately 14 times greater overall mortality (653 of 2672 [24.4%] vs. 352 of 20,750 [1.7%]; $p < 0.0001$]. Compared to non-GSW penetrating injuries (e.g., stab wounds), those with GSWs had approximately four times higher transfusion requirements (3.3 ± 13.5 vs. 0.80 ± 3.8 units/patient; $p < 0.0001$), and approximately eight times greater overall mortality (653 of 2672 [24.4%] vs. 28 of 956 [2.9%]; $p < 0.0001$).

CONCLUSIONS: Compared to other traumatic injuries, GSW injuries are associated with substantially greater blood utilization and mortality. Trauma centers treating GSW injuries should have ready access to all blood components and ability to implement massive transfusions.

Anesth Analg. 2018 Oct 9. Epub ahead of print

Airway Management and Clinical Outcomes in External Laryngeal Trauma: A Case Series.

DePorre AR, Schechtman SA, Hogikyan ND, Thompson A, Westman AJ, Sargent RA, Rosko AJ, Bauer A, Shanks AM, Kupfer RA, Healy DW.

ABSTRACT:
External laryngeal trauma is a rare but potentially fatal event that presents several management challenges. This retrospective observational case series conducted at a level-1 trauma center over a 12-year period consists of 62 cases of acute external laryngeal trauma. Patient demographics, mode and mechanisms of injury, presenting signs and symptoms, initial imaging results, airway management, time to surgical management, and 6-month outcomes including airway status, deglutition status, and voice quality were investigated. No difference was found in mortality or 6-month outcomes between patients requiring surgical repair and/or tracheostomy versus patients with less severe injuries managed conservatively.

J Surg Educ. 2018 Sep 12. pii: S1931-7204(18)30489-6. doi:10.1016/j.jsurg.2018.08.014. [Epub ahead of print]

What Happens After a Stop the Bleed Class? The Contrast Between Theory and Practice.

Dhillon N, Dodd B, Hotz H, Patel K, Linaval N, Margulies D, Ley E, Barmparas G

OBJECTIVE: The Department of Homeland Security launched the Stop the Bleed initiative, a campaign intended to teach bystanders hemorrhage control strategies. Despite the program's popularity, little is known about actions taken by participants afterwards. We sought to determine how often participants acquired the equipment that is necessary in applying the skills taught.

DESIGN: A standardized survey instrument was distributed to all American College of Surgeons Bleeding Control Basic (B-Con) class participants from 05/2017 to 01/2018. The instrument queried about the likelihood of applying skills and obtaining materials. A web-based survey was administered one month later inquiring whether materials were obtained and barriers that would prohibit acquisition.

SETTING: Academic, urban, Level I trauma center.

PARTICIPANTS: Healthcare and nonhealthcare personnel.

RESULTS: There were 336 and 183 participants who completed the initial and subsequent web-based survey, respectively. Participants indicated a high likelihood of applying a tourniquet (95.5%), applying pressure (97.9%), and packing a wound (96.4%), if required. Additionally, 74.7% and 76.2% reported a high likelihood of obtaining a tourniquet and packing material, respectively. However, only 21.3% and 50.8% obtained a tourniquet and packing material, respectively, 1 month later. Cost, time, and accessibility of items during a time of need were cited to be common reasons for not obtaining these materials.

CONCLUSIONS: Despite reporting a high likelihood of utilizing hemorrhage control skills upon completion of the B-Con class, few went on to acquire the materials needed to apply these skills among those who responded. These results may be impacted by loss of follow up and response bias. Developing strategies that allow for easy access to materials is imperative and may lead to both better implementation of the purposes of the program and improved dissemination of its principles within the community.

Injury. 2018 Sep 14. pii: S0020-1383(18)30534-5. doi: 10.1016/j.injury.2018.09.027. [Epub ahead of print]

The impact of enoxaparin administration in relationship to hemorrhage in mild traumatic brain injury.

Dhir T, Weiss E, Wolanin K, Randhawa S, Samuel S, Minimo C, Becker G, McGreen B, Kriza C, Patel N, Kaplan M, Leung P

BACKGROUND: Venous thromboembolism prophylaxis in the general trauma population is well established. However, risk of increased intracranial hemorrhage in traumatic brain injury (TBI) population is of concern. The aim for this study is to identify a reproducible model of mild traumatic brain injury (mTBI), evaluated by clinical and histological markers and test the hypothesis that enoxaparin increases the risk of spontaneous brain hemorrhage.

METHODS: 40 male Sprague Dawley rats were randomly assigned to 5 groups: group 1 (sham) with no TBI along with 4 groups comparing mTBI with and without pharmacological intervention using enoxaparin at 24 h and 72 h respectively. Mild traumatic brain injury was induced using a weight drop apparatus, with a clinical endpoint of time to right (TTR), along with histological and spectrophotometer analysis for qualitative hemorrhage.

RESULTS: There is a statistically significant difference between group 1 (sham) and all other groups with a mean longer time to right of 64 s ($p = 0.005$) in the mTBI groups. There was a statistically significant difference between group 1 (sham) and all other groups with an increase of 6 g/dL hemoglobin ($p < 0.001$) in the mTBI groups with no difference in hemorrhage between groups that were treated with enoxaparin.

CONCLUSION: The weight drop apparatus is a reproducible model for mTBI that has correlations with clinical and qualitative data. This model was able to produce clinical signs of concussion, as reflected by longer TTR and increased hemoglobin in the mTBI groups. Upon further analysis, there was no increase in hemorrhage in the pharmacological intervention groups with enoxaparin.

J Emerg Med. 2018 Sep;55(3):366-371

Emergency Medical Services Simple Thoracostomy for Traumatic Cardiac Arrest: Postimplementation Experience in a Ground-based Suburban/Rural Emergency Medical Services Agency.

Dickson R, Gleisberg G, Aiken M, Crocker K, Patrick C, Nichols T, Mason C, Fioretti J

BACKGROUND: Tube thoracostomy has long been the standard of care for treatment of tension pneumothorax in the hospital setting yet is uncommon in prehospital care apart from helicopter emergency medical services.

OBJECTIVE: We aimed to evaluate the performance of simple thoracostomy (ST) for patients with traumatic cardiac arrest and suspected tension pneumothorax.

METHODS: We conducted a retrospective case series of consecutive patients with traumatic cardiac arrest where simple thoracostomy was used during the resuscitation effort. Data were abstracted from our Zoll emergency medical record (Zoll Medical Corp., Chelmsford, MA) for patients who received the procedure between June 1, 2013 and July 1, 2017. We collected general descriptive characteristics, procedural success, presence of air or blood, and outcomes for each patient.

RESULTS: During the study period we performed ST on 57 patients. The mean age was 41 years old (range 15-81 years old) and 83% were male. Indications included 40 of 57 (70%) blunt trauma and 17 of 57 (30%) penetrating trauma. The presenting rhythm was pulseless electrical activity 65%, asystole 26%, ventricular tachycardia/fibrillation 4%, and nonrecorded 5%. Eighteen of 57 (32%) had air return, 14 of 57 (25%) return of spontaneous circulation, with 6 of 57 (11%) surviving to 24 h and 4 of 57 (7%) discharged from the hospital neurologically intact. Of the survivors, all were blunt trauma mechanism with initial rhythms of pulseless electrical activity. There were no reported medic injuries.

CONCLUSIONS: Our data show that properly trained paramedics in ground-based emergency medical services were able to safely and effectively perform ST in patients with traumatic cardiac arrest. We found a significant (32%) presence of pneumothorax in our sample, which supports previously reported high rates in this patient population.

Anaesthesia. 2019 Jan;74(1):29-32

Impact of change in head and neck position on ultrasound localisation of the cricothyroid membrane: an observational study.

Dixit A, Ramaswamy K, Perera S, Sukumar V, Frerk C

ABSTRACT:
The ideal position for performing surgical cricothyroidotomy is with full neck extension. Some authors have recommended marking the cricothyroid membrane before general anaesthesia, typically with the patient's head and neck in a neutral position. The primary aim of this observational study was to determine whether skin marks made over the centre of the cricothyroid membrane with the head and neck in the neutral position moved outside the boundaries of the membrane when the neck was subsequently extended. The secondary aim was to assess changes in the height of the cricothyroid membrane between the neutral and extended positions. Twenty-two volunteers completed the study. With the head and neck in the neutral position, the distance between the upper and lower borders ('height') of the cricothyroid membrane was measured by a radiologist using ultrasound. The skin was marked over the mid-point of the membrane. The subject then maximally extended the neck, and the measurements and marking were repeated. The skin marking over the centre point of the cricothyroid membrane moved by median (IQR [range]) 5 (4-6 [0-10]) mm when the head and neck were moved from a neutral to a fully extended position. The initial skin mark moved to lie outside the boundary of the cricothyroid membrane in 12 of 22 subjects after extending the neck. The height of the cricothyroid membrane increased by 30% with the neck extended. We recommend that marking the skin in preparation for cricothyroidotomy should be performed with the neck extended, not with the head and neck in the neutral position as previously suggested.

Br J Anaesth. 2018 Nov;121(5):1173-1178

Laryngeal handshake technique in locating the cricothyroid membrane: a non-randomised comparative study.

Drew T, McCaul C.

BACKGROUND: Evaluation of the anterior neck anatomy is used to identify the cricothyroid membrane (CTM) before front of neck airway access. This has been traditionally performed using palpation which results in misidentification of the CTM in a high proportion of subjects. The 'laryngeal handshake' is currently advocated by the Difficult Airway Society as the method to identify the CTM. We sought to investigate the accuracy of this technique in females.

METHODS: Five clinicians were asked to identify the CTM using the 'laryngeal handshake' technique in a total of 45 anaesthetised females (Group L) and by conventional palpation in 45 controls (Group P). We measured and analysed the distance to actual CTM using ultrasound, the time to identification, and perceived difficulty using a visual analogue scale.

RESULTS: Successful identification of the CTM occurred in 28/45 (62%) patients in Group L vs 15/45 (33%) in Group P [P=0.006; mean difference, 29%; 95% confidence interval (CI), 21-39%]. Distance to the CTM (P=0.012) and visual analogue scale (P=0.012) were significantly reduced in Group L. Mean time to CTM identification was greater in Group L at 31 (5.6) s, compared with Group P, which took 18 (5.5) s (P<0.001). The midline was accurately identified more frequently in Group L than in Group P (39/45 vs 28/45, P=0.008).

CONCLUSIONS: The 'laryngeal handshake' method of palpation is more accurate but takes longer than conventional palpation technique in locating the CTM and the midline. This is of particular relevance if a vertical incision is required to perform front of neck access when anatomy is indistinct.

Prehosp Emerg Care. 2018 Nov 2:1-5. Epub ahead of print

Proximal External Aortic Compression for Life-Threatening Abdominal-Pelvic and Junctional Hemorrhage: An Ultrasonographic Study in Adult Volunteers.

Douma M, Picard C, O'Dochartaigh D, Brindley P

INTRODUCTION: Following life-threatening junctional trauma, the goal is to limit blood loss while expediting transfer to operative rescue. Unfortunately, life-threatening abdominal-pelvic or junctional hemorrhage is often not amenable to direct compression and few temporizing strategies are available beyond hemostatic dressings, hypotensive resuscitation, and balanced transfusion.

OBJECTIVES: In this study, we evaluated proximal external aortic compression to arrest blood flow in healthy adult men.

METHODS: This was a simulation trial of proximal external aortic compression, for life-threatening abdominal-pelvic and junctional hemorrhage, in a convenience sample of healthy adult male volunteers. The primary end points were cessation of femoral blood flow as assessed by pulse wave Doppler ultrasound at the right femoral artery, caudal to the inguinal ligament. Secondary end points were discomfort and negative sequelae.

RESULTS: Aortic blood flow was arrested in 12 volunteers. Median time to blood flow cessation was 12.5 seconds. Median reported discomfort was 5 out of 10. No complications or negative sequelae were reported.

CONCLUSION: This trial suggests that it may be reasonable to attempt temporization of major abdominal-pelvic and junctional hemorrhage using bimanual proximal external aortic compression. In the absence of immediate alternatives for this dangerous and vexing injury pattern, there appear to be few downsides to prehospital proximal external aortic compression while concomitantly expediting definite care.

Mil Med. 2018 Sep 1;183(suppl_2):161-167

Burn Casualty Care in the Deployed Setting.

Driscoll I, Mann-Salinas E, Boyer N, Pamplin J, Serio-Melvin M, Salinas J, Borgman M, Sheridan R, Melvin J, Peterson W, Graybill J, Rizzo J, King B, Chung K, Cancio L, Renz E, Stockinger Z

ABSTRACT:
Management of wartime burn casualties can be very challenging. Burns frequently occur in the setting of other blunt and penetrating injuries. This clinical practice guideline provides a manual for burn injury assessment, resuscitation, wound care, and specific scenarios including chemical and electrical injuries in the deployed or austere setting. The clinical practice guideline also reviews considerations for the definitive care of local national patients, including pediatric patients, who are unable to be evacuated from theater. Medical providers are encouraged to contact the US Army Institute of Surgical Research (USAISR) Burn Center when caring for a burn casualty in the deployed setting.

J Spec Oper Med. Fall 2018;18(3):62-66.

Facial Trauma Care in the Austere Environment.

Farber S, Kantar R, Rodriguez E

ABSTRACT:
As the United States continues to increase its use of Special Operations Forces worldwide, treatment of craniomaxillofacial (CMF) trauma must be adapted to meet the needs of the warfighter. The remoteness of Special Operations can result in potentially longer times until definitive treatment may be reached. A significant portion of Service members incur injury to the CMF region (42%). Severe CMF trauma can result in substantial hemorrhage and airway compromise. These can be immediately life threatening and must be addressed expeditiously. Numerous devices and techniques for airway management have been made available to the forward provider. A thorough review of nonsurgical and surgical airway management of the patient with facial injury for the forward provider and providers at receiving facilities is provided in this article. Techniques to address flail segments of the facial skeleton are critical in minimizing airway compromise in these patients. There are many methods to control hemorrhage from the head and neck region. Hemorrhage control is critical to ensure survival in the austere environment and allow for transport to a definitive care facility. Associated injuries to the cervical spine, globe, skull base, carotid artery, and brain must be carefully evaluated and addressed in these patients. Management of vision- threatening orbital compartment syndrome is critical in patients with CMF injuries. Because the head and neck region remains relatively vulnerable in the warfighter, combat CMF trauma will continue to occur. Forward providers will benefit from a review of the acute treatment of CMF traumatic injury. Properly triaging and treating facial injuries is necessary to afford the best chance of survival for patients with a devastating combat CMF injury.

Prehosp Emerg Care. 2018 Nov-Dec;22(6):659-661

Spinal Motion Restriction in the Trauma Patient - A Joint Position Statement.

Fischer P, Perina D, Delbridge T, Fallat M, Salomone J, Dodd J, Bulger E, Gestring M

ABSTRACT:
The American College of Surgeons Committee on Trauma (ACS-COT), American College of Emergency Physicians (ACEP), and the National Association of EMS Physicians (NAEMSP) have previously offered varied guidance on the role of backboards and spinal immobilization in out-of-hospital situations. This updated consensus statement on spinal motion restriction in the trauma patient represents the collective positions of the ACS-COT, ACEP and NAEMSP. It has further been formally endorsed by a number of national stakeholder organizations. This updated uniform guidance is intended for use by emergency medical services (EMS) personnel, EMS medical directors, emergency physicians, trauma surgeons, and nurses as they strive to improve the care of trauma victims within their respective domains.

Mil Med Res. 2018 Sep 13;5(1):31

Combat lifesaver-trained, first-responder application of junctional tourniquets: a prospective, randomized, crossover trial.

Flecha I, Naylor J, Schauer S, Curtis R, Cunningham C

BACKGROUND: Junctional hemorrhage surpassed extremity hemorrhage as the leading cause of preventable death after the resurgence of limb tourniquets during the recent conflicts in Afghanistan and Iraq. Junctional tourniquets (JTQs) were developed in response to this injury pattern. Published data for JTQ efficacy are limited and do not incorporate nonmedical, military first responders. We compared the time for effective placement and scores for device satisfaction between two different JTQs, stratified by combat lifesaver (CLS) and combat medics.

METHODS: We performed a prospective, randomized, crossover trial utilizing the SAM® Medical Junctional Tourniquet (SJT) and Junctional Emergency Treatment Tool (JETT™). Investigators simple randomized CLS and combat medics to SJT or JETT for their first JTQ application on mannequins with penetrating inguinal injuries. Then, participants immediately placed the other JTQ on another casualty with the same injury. The primary outcome measured was time of successful application. Success was defined as proper JTQ placement and a pressure reading of at least 180 mmHg. We compared outcomes between CLS and combat medics. Unsuccessful JTQ applications were excluded from the comparative analysis.

RESULTS: From June 2015 to August 2015, a total of 227 personnel (133 CLS and 94 combat medics) at Fort Hood, Texas, USA volunteered to participate in the study. Twenty-eight percent (38 of 133) of CLS and 40% (38 of 94) of combat medics placed both JTQs successfully, for a total of 152 applications (76 SJTs and 76 JETTs). We found a significant difference between applications of the JETT between the CLS and combat medics (92.0 ± 37.7 s versus 70.5 ± 20.5 s, P = 0.004). No other subgroup analyses, whether by device or user, demonstrated a significant difference in application time. Both groups preferred the SJT over the JETT. CLS disagreed with combat medics that the JETT could be easily applied by one person (median 3.0 [2.0, 4.0] versus median 4.0 [3.0, 5.0]; P = 0.006).

CONCLUSION: Overall, success rates for both the SJT and JETT were low. Improved training is needed to increase successful application of junctional tourniquets before widespread implementation. Combat lifesavers and combat medics prefer the SJT over the JETT.

Emerg Med J. 2018 Nov;35(11):652-656

Managing accidental hypothermia: a UK-wide survey of prehospital and search and rescue providers.

Freeman S, Deakin C, Nelson MJ, Bootland D.

AIM: The management of hypothermic casualties is a challenge faced by all prehospital and search and rescue (SAR) teams. It is not known how the practice of these diverse teams compare. The aim of this study was to review prehospital hypothermia management across a wide range of SAR providers in the UK.

METHODS: A survey of ground ambulances (GAs), air ambulances (AAs), mountain rescue teams (MRTs, including Ministry of Defence), lowland rescue teams (LRTs), cave rescue teams (CRTs), and lifeboats and lifeguard organisations (LLOs) across the UK was conducted between May and November 2017. In total, 189 teams were contacted. Questions investigated packaging methods, temperature measurement and protocols for managing hypothermic casualties.

RESULTS: Response rate was 59%, comprising 112 teams from a wide range of organisations. Heavyweight (>3 kg) casualty bags were used by all CRTs, 81% of MRTs, 29% of LRTs, 18% of AAs and 8% of LLOs. Specially designed lightweight (<0.5 kg) blankets or wraps were used by 93% of LRTs, 85% of LLOs, 82% of GAs, 71% of AAs and 50% of MRTs. Bubble wrap was used mainly by AAs, with 35% of AAs reporting its use. Overall, 94% of packaging methods incorporated both insulating and vapour-tight layers. Active warming by heated pads or blankets was used by 65% of AAs, 60% of CRTs, 54% of MRTs, 29% of LRTs and 9% of GAs, with no LLO use. Temperature measurement was reported by all AAs and GAs, 93% of LRTs, 80% of CRTs, 75% of MRTs and 31% of LLOs. The favoured anatomical site for temperature measurement was tympanic. Protocols for packaging hypothermic casualties were reported by 73% of services.

CONCLUSIONS: This survey describes current practice in prehospital hypothermia management, comparing the various methods used by different teams, and provides a basis to direct further education and research.

Crit Care Med. 2018 Oct;46(10):1692-1693

Fluid, Fluid Everywhere, and All the Organs Did Not Shrink; Fluid, Fluid Everywhere, Administered Without a Think.

Fuller B

Quote:
"When put into context with the significant data regarding fluid overload and outcome, several thoughts come to mind. First, a patient should be given fluids: 1) if they are hypotensive and/or hypoperfused (they actually need an intervention); 2) if preload responsiveness exists (they will actually respond to the intervention in a positive way); and 3) with a therapeutic endpoint in mind (guidance regarding cessation of the intervention). Second, fluids should be administered as a rapid bolus, not slowly over time, and the routine prescription of "maintenance" fluids should be strongly discouraged for the great majority of critically ill patients. This practice pattern typically involves a fluid composition and rate that are completely arbitrary and often prescribed by the most inexperienced team member, with no therapeutic target in mind. Furthermore, the vast majority of fluids do not remain intravascular, especially when trickled in at a slow rate, and the effects of fluids are quite transient (8). Maintenance fluids create fluid creep and unnecessary positive fluid balance, a predictor of worse outcome. This work by Silversides et al (7) suggests that early fluid administration in the ICU not only contributes to worse outcome but has significant room for practice improvement with respect to dose, duration, and de-escalation of therapy (6). Finally, in the setting of positive fluid balance, late conservative fluid management can improve outcome (9–11). The current study by Silversides et al (7) goes a step further and suggests that active deresuscitation to remove fluid should be strongly considered. This investigation is important because the authors have targeted a ubiquitous intervention in the ICU and have provided ample rationale for the conduct of a prospective, interventional study. Until we await further data on this topic, the current work (7) combined with the existing body of literature demonstrates benefit to avoiding iatrogenic volume overload, and promoting euvolemia seems like a low-risk intervention that can be employed readily at the bedside."

Transfus Clin Biol. 2018 Nov;25(4):281-286

Plasma for direct therapeutic use, for today and tomorrow: A short critical overview.

Garraud O, Aubron C, Ozier Y, Coppo P, Tissot J

ABSTRACT:
Plasma for direct therapeutic use is a fast-evolving blood component in terms of its production and presentation. More than a dozen forms are available worldwide, which is often overlooked since most countries apply policies making only one or very few forms available for treating patients in need. It is most often reserved for the same three clinical indications, i.e. overall clotting-factor deficiency, reversal of vitamin K antagonists in the context of active bleeding or prior to urgent surgery, and therapeutic plasma exchange. The level of evidence is often less robust than generally acknowledged for such major indications while novel indications are tending to emerge in medical and trauma settings. This short review explores classical views and new prospects opened up by novel presentations and statuses for therapeutic plasma.

Int J Pediatr Otorhinolaryngol. 2018 Nov;114:124-128

A multidisciplinary international collaborative implementing low cost, high fidelity 3D printed airway models to enhance Ethiopian anesthesia resident emergency cricothyroidotomy skills.

Gauger V, Rooney D, Kovatch K, Richey L, Powell A, Berhe H, Zopf D

BACKGROUND: Similar to other sub-Saharan countries, Ethiopia suffers from a severe shortage of adequately trained health professionals. Academic partnerships can support sustainable training programs and build capacity for low-resource settings. 3D modeling and simulation-based training provide necessary tools, especially for rarely-encountered clinical situations, such as needle cricothyroidotomy.

METHODS: Departments of Anesthesiology, Otolaryngology, and Learning Health Sciences collaborated to develop a low-cost, high-fidelity simulator and Cricothryoidotomy Skills Maintenance Program (CSMP). Twelve anesthesia residents at St. Paul's Hospital Medical Millennium College in Addis Ababa, Ethiopia participated in CSMP. The program consisted of a didactic session with presentation and demonstration and an immersive CICO scenario. Program evaluation was performed using pre/post-training knowledge and 2 procedural performance assessments-the CSMP Global Rating Scale and the Checklist. With consent, performances were videotaped and rated independently by 3 University of Michigan faculty.

RESULTS: Improvements were identified in all areas, including residents' knowledge, measured by mean summed test scores (Mpre = 3.31, Mpost = 4.46,p = 0.003), time to perform cricothyroidotomy (Mpre = 96.64,Mpost = 72.82,p = 0.12), residents' performance quality, measured by overall mean Global ratings, (Mpre = 0.20; Mpost = 0.70) with improvements identified at the item-level, p = 0.001 with moderate-large effect sizes, and residents' ability to complete tasks, measured by mean Checklist ratings (Mpre = 0.51,Mpost = 0.90, with item-level improvements observed, $p \leq 0.01$, with small-large effect sizes. Residents' self-reported confidence also improved (Mpre = 1.69, Mpost = 3.08, p = 0.001).

CONCLUSION: Our work shows that cricothyroidotomy skills taught to anesthesia residents at SPHMMC with a 3D printed laryngotracheal model improves knowledge, skills, and confidence. The creation of a low-cost, high-fidelity simulator and a CSMP has the potential to impact patient care and safety world-wide.

Wilderness Environ Med. 2018 Dec;29(4):499-503

"Cold Card" to Guide Responders in the Assessment and Care of Cold-Exposed Patients.

Giesbrecht G

INTRODUCTION: A concise, easy-to-use decision aid "Cold Card" that can be carried in the field by wilderness search and rescue teams or medical responders to advise on assessment and care of cold-exposed patients was created.

METHODS: A 2-sided card was designed to summarize the important principles established by the Wilderness Medical Society practice guidelines for hypothermia. The card was continually updated through feedback from several content experts. The card was then distributed for further feedback from members of the Search and Rescue Volunteer Association of Canada and enrollees of the Baby It's Cold Outside web-based educational program. This additional feedback was used to create the final iteration of the card.

RESULTS: On the front "ASSESS COLD PATIENT" side, the level of cold exposure or hypothermia is accomplished by evaluating (as either normal or impaired function) consciousness, movement, shivering, and alertness on a series of concentric rings. The important treatment actions are provided for each cold-exposure level. The back "CARE FOR COLD PATIENT" side provides the required elements and principles of use for a hypothermia wrap. The Cold Card is available for free download and unlimited use for education or in-field instruction by any individual or group. The card should be printed on heavy, waterproof stock (13×18 cm) for use in all weather conditions.

CONCLUSIONS: Key elements of hypothermia evaluation and field care have been summarized on a small portable card for laypersons, trained rescuers, and first responders.

Curr Opin Hematol. 2018 Nov;25(6):482-485

'Massive transfusion protocols and the use of tranexamic acid'.

Godbey E, Schwartz J

PURPOSE OF REVIEW: We review recent articles pertaining to the use of tranexamic acid (TXA) in populations at risk for massive transfusion. Although there are no recent studies that specifically examine the use of TXA in massive transfusion protocols (MTPs), there are a few studies with subgroups of massive transfusion patients.

RECENT FINDINGS: In recent years, many publications have discussed outcomes and safety associated with the addition of TXA to treatment plans for bleeding pediatric, trauma, and postpartum hemorrhage patients. In general, TXA appears to decrease mortality and transfusion requirements.

SUMMARY: TXA was shown to decrease mortality in several bleeding populations. It is now a common addition to MTPs. There is conflicting evidence regarding the potential of TXA as a risk factor for thrombotic events. Ongoing studies should provide additional evidence regarding the thrombotic risk of TXA in massive transfusion.

J Am Coll Surg. 2018 Nov;227(5):502-506

Post-Mortem Evaluation of Potentially Survivable Hemorrhagic Death in a Civilian Population.

Goolsby C, Rouse E, Rojas L, Goralnick E, Levy M, Kirsch T, Eastman A, Kellermann A, Strauss-Riggs K, Hurst N

BACKGROUND: Although the survivability of military extremity hemorrhage is well documented, equivalent civilian data are limited. We analyzed statewide autopsy records in Maryland to determine the number of hemorrhagic deaths that might have been potentially survivable with prompt hemorrhage control. Similar analyses of battlefield deaths led to life-saving changes in military medical practice.

STUDY DESIGN: This is a retrospective study of decedent records. The objective is to estimate the number of hemorrhagic deaths that might have been prevented by prompt placement of an extremity tourniquet. Maryland autopsy records from 2002 to 2016 were selected using the following search terms: amputation, arm/arms, avulsion, exsanguination, extremity/extremities, leg/legs. The records were analyzed by applying a checklist of previously developed military criteria to characterize deaths as potentially survivable or nonsurvivable with prompt use of a tourniquet. Suicides and decedents less than 18 years old were excluded. The study did not use information about living participants. Two expert reviewers independently evaluated and scored the death records. Deaths were classified as either potentially survivable or nonsurvivable. A third reviewer broke any ties.

RESULTS: There were 288 full autopsy records included in the final analysis. Of the eligible decedents reviewed during the 14-year period, 124 of 288 had potentially survivable wounds; 164 had nonsurvivable wounds.

CONCLUSIONS: Over the 14-year study interval, 124 Maryland decedents-an average of 9 per year-might have been saved with prompt placement of a tourniquet. If extrapolated, approximately 480 people in the US might be saved per year. These results provide evidence to support educating and equipping the public to provide bleeding control.

JAMA Surg. 2018 Sep 1;153(9):791-799

Effectiveness of Instructional Interventions for Hemorrhage Control Readiness for Laypersons in the Public Access and Tourniquet Training Study (PATTS): A Randomized Clinical Trial.

Goralnick E, Chaudhary M, McCarty J, Caterson E, Goldberg S, Herrera-Escobar J, McDonald M, Lipsitz S, Haider A

Importance: Several national initiatives have emerged to empower laypersons to act as immediate responders to reduce preventable deaths from uncontrolled bleeding. Point-of-care instructional interventions have been developed in response to the scalability challenges associated with in-person training. However, to our knowledge, their effectiveness for hemorrhage control has not been established.

Objective: To evaluate the effectiveness of different instructional point-of-care interventions and in-person training for hemorrhage control compared with no intervention and assess skill retention 3 to 9 months after hemorrhage control training.

Design, Setting, and Participants: This randomized clinical trial of 465 laypersons was conducted at a professional sports stadium in Massachusetts with capacity for 66 000 people and assessed correct tourniquet application by using different point-of-care interventions (audio kits and flashcards) and a Bleeding Control Basic (B-Con) course. Non-B-Con arms received B-Con training after initial testing (conducted from April 2017 to August 2017). Retesting for 303 participants (65%) was performed 3 to 9 months after training (October 2017 to January 2018) to evaluate B-Con retention. A logistic regression for demographic associations was performed for retention testing.

Interventions: Participants were randomized into 4 arms: instructional flashcards, audio kits with embedded flashcards, B-Con, and control. All participants received B-Con training to later assess retention. Main Outcomes and Measures: Correct tourniquet application in a simulated scenario.

Results: Of the 465 participants, 189 (40.7%) were women and the mean (SD) age was 46.3 (16.1) years. For correct tourniquet application, B-Con (88% correct application [n = 122]; P < .001) was superior to control (n = 104 [16%]) while instructional flashcards (n = 117 [19.6%]) and audio kit (n = 122 [23%]) groups were not. More than half of participants in point-of-care arms did not use the educational prompts as intended. Of 303 participants (65%) who were assessed 3 to 9 months after undergoing B-Con training, 165 (54.5%) could correctly apply a tourniquet. Over this period, there was no further skill decay in the adjusted model that treated time as either linear (odds ratio [OR], 0.98; 95% CI, 0.95-1.03) or quadratic (OR, 1.00; 95% CI, 1.00-1.00). The only demographic that was associated with correct application at retention was age; adults aged 18 to 35 years (n = 58; OR, 2.39; 95% CI, 1.21-4.72) and aged 35 to 55 years (n = 107; OR, 1.77; 95% CI, 1.04-3.02) were more likely to be efficacious than those older than 55 years (n = 138).

Conclusions and Relevance: In-person hemorrhage control training for laypersons is currently the most efficacious means of enabling bystanders to act to control hemorrhage. Laypersons can successfully perform tourniquet application after undergoing a 1-hour course. However, only 54.5% retain this skill after 3 to 9 months, suggesting that investigating refresher training or improved point-of-care instructions is critical.

Mil Med. 2018 Sep 1;183(suppl_2):115-117

Pelvic Fracture Care.

Gordon W, Fleming M, Johnson A, Gurney J, Shackelford S, Stockinger Z

ABSTRACT:
While combat-related pelvis fractures are more commonly open, higher energy, and complex in pattern than those seen in the civilian setting, the principles of management are similar. The primary differences are related to the austere setting in which the initial management takes place, and the lack of resources typically available. Initial management consists of cessation of hemorrhage, along with the multi-disciplinary prioritized management of associated injuries, and skeletal stabilization. This is most commonly achieved with a compressive sheet or pelvic binder, with pelvic external fixation when resources allow, and debridement of open wounds as necessary. Definitive, internal fixation is delayed until the patient arrives at a higher echelon of care.

Eur Rev Med Pharmacol Sci. 2018 May;22(10):2973-2977

An algorithm to avoid missed open-book pelvic fractures.

Habib N, Filardo G, Delcogliano M, Arigoni M, Candrian C.

OBJECTIVE: In polytrauma patients, to limit the pelvic space favoring internal bleeding, the use of pelvic binders is now a standard practice. In case of external pelvic binder placement with anatomic reduction of the symphyseal and sacroiliac joints, delayed diagnosis and missed injuries could occur. The aim of this study is to document the risk of missed diagnosis, as well as to identify a possible algorithm for optimal management of traumatized patients with pelvic binders, in order to reach an early diagnosis of pelvic fractures without additional risks.

CASE REPORT: We report three cases of open-book pelvic fractures that were initially missed. The external pelvic binders applied had adequately reduced the fractures. The computed tomography on arrival excluded a diastasis of the symphysis pubis. On removal of the pelvic binder and repetition of the radiological imaging, the fractures were evidenced.

CONCLUSIONS: We have accordingly created an algorithm for polytrauma patients to determine when the pelvic binder should be released before radiological imaging and when repeated radiological imaging should be done. The use of this algorithm in trauma centers will help to reduce the number of missed injuries, and the number of late diagnoses as well as will increase the patient survival rates.

Medicine (Baltimore). 2018 Sep;97(36):e11573

Is the combined application of both drain-clamping and tranexamic acid superior to the single use of either application in patients with total-knee arthroplasty?: A meta-analysis of randomized controlled trials.

Han Y, Huang H, Pan J, Zeng L, Liang G, Liang H, Yang W, Guo D, Liu J

BACKGROUND: To compare the efficacy and safety of the combined application of both drain-clamping and tranexamic acid (TXA) versus the single use of either application in patients with total-knee arthroplasty (TKA).

METHODS: Databases (EMBASE, PubMed, Cochrane Library, Web of Sciences, the Google database, and the Ovid database) were searched from their inception through April 2018 for randomized controlled trials (RCTs) comparing the combined application of both drain-clamping and TXA versus single use of either application in patients with TKA. The Cochrane risk of bias (ROB) tool was used to assess the methodologic quality. The primary outcomes were blood loss in drainage, total blood loss, transfusion rate, and hemoglobin decline. The secondary outcomes were postoperative complications, the Knee Society Score (KSS), and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score. The statistical analysis was performed with RevMan 5.3.5 software.

RESULTS: A total of five RCTs (479 participants) were included in our meta-analysis. The present meta-analysis indicated that significant differences existed in the total blood loss (mean difference [MD]=-145.86, 95% confidence interval [CI]: -228.64 to -63.08, P=.0006), blood loss in drainage (MD=-169.06, 95% CI: -248.56 to -89.57, P<.0001), hemoglobin decline (MD=-0.66, 95% CI: -1.00 to -0.33, P=.0001), and transfusion rate (MD=0.44, 95% CI: 0.26-0.75, P=.002) between the groups. However, regarding postoperative complications, no significant differences were found between the 2 groups in the KSS and the WOMAC score (P>.05).

CONCLUSION: Combined application of both drain-clamping and TXA was associated with significant reductions in blood loss in drainage, total blood loss, hemoglobin decline, and the need for transfusion. However, high-quality, well-designed RCTs with long-term follow-up are still required.

Acta Anaesthesiol Scand. 2018 Sep 10. Epub ahead of print

Iatrogenic cerebral gas embolism - A systematic review of case reports.

Hatling D, Høgset A, Guttormsen A, Müller B

BACKGROUND: Cerebral gas embolism is a complication of several medical procedures and occurs when gas enters the cerebral circulation. Knowledge about etiology and outcome in affected patients is limited, and prospective trials on management and treatment are hardly feasible. Case reports are therefore an important source of information.

METHODS: A systematic literature search was conducted in June 2016 and May 2018, supplemented by a manual search. Titles and abstracts were systematically assessed for eligibility, followed by full-text screening for included papers. Screening and data extraction were performed independently by two researchers. Cases of cerebral gas embolism due to any iatrogenic cause were included. Criteria for exclusion were: animal studies, non-cerebral localization, extravascular gas only, and non-iatrogenic causes. 264 cases reported in 189 papers were included.

RESULTS: A broad range of procedures leading to iatrogenic cerebral gas embolism (ICGE) were identified and a comprehensive list is presented in this article. Procedures were mostly reported as conducted correctly, but procedure related error, patient activity, or defective equipment were also reported as causes. Neurological, neuropsychological, and cardiopulmonary symptoms were common. The diagnosis was frequently based on or confirmed by radiology, usually CT. Hyperbaric oxygen therapy was applied in a large number of cases.

CONCLUSION: The reported causes, symptoms and signs, and outcomes of ICGE vary significantly, and awareness of the condition in the medical community is essential. A standardized method of reporting could facilitate higher quality research in the field.

Eur J Trauma Emerg Surg. 2018 Sep 17. Epub ahead of print

Resource use and clinical outcomes in blunt thoracic injury: a 10-year trauma registry comparison between southern Finland and Germany.

Heinänen M, Brinck T, Lefering R, Handolin L, Söderlund T

PURPOSE: Serious thoracic injuries are associated with high mortality, morbidity, and costs. We compared patient populations, treatment, and survival of serious thoracic injuries in southern Finland and Germany.

METHODS: Mortality, patient characteristics and treatment modalities were compared over time (2006-2015) in all patients with Abbreviated Injury Scale (AIS) thorax ≥ 3, Injury Severity Score (ISS) > 15, age > 15 years, blunt trauma mechanism, and treatment in Intensive Care Unit (ICU) in Level 1 hospitals included in the Helsinki Trauma Registry (HTR) and the Trauma Register DGU® (TR-DGU).

RESULTS: We included 934 patients from HTR and 25 448 patients from TR-DGU. Pre-hospital differences were seen between HTR and TR-DGU; transportation in the presence of a physician in 61% vs. 97%, helicopter use in 2% vs. 42%, intubation in 31% vs. 55%, and thoracostomy in 6% vs. 10% of cases, respectively. The mean hospital length of stay (LOS) and ICU LOS was shorter in HTR vs. TR-DGU (13 vs. 25 days and 9 vs. 12 days, respectively). Our main outcome measure, standardised mortality ratio, was not statistically significantly different [1.01, 95% confidence interval (CI) 0.84-1.18; HTR and 0.97, 95% CI 0.94-1.00; TR-DGU].

CONCLUSIONS: Major differences were seen in pre-hospital resources and use of pre-hospital intubation and thoracostomy. In Germany, pre-hospital intubation, tube thoracostomy, and on-scene physicians were more prevalent, while patients stayed longer in ICU and in hospital compared to Finland. Despite these differences in resources and treatment modalities, the standardised mortality of these patients was not statistically different.

Sci Rep. 2018 Aug 1;8(1):11567. doi: 10.1038/s41598-018-30053-0.

Synthetic colloid resuscitation in severely injured patients: analysis of a nationwide trauma registry (TraumaRegister DGU).

Hilbert-Carius P, Schwarzkopf D, Reinhart K, Hartog C, Lefering R, Bernhard M, Struck M

ABSTRACT:
The purpose of this study was to investigate the efficacy and safety of synthetic colloid resuscitation among severely injured patients. Fluid resuscitation of trauma patients of a nationwide trauma registry was analysed between 2002 and 2015. Effects of synthetic colloid resuscitation in the pre-hospital setting and emergency department on renal failure, renal replacement therapy and multiple organ failure were analysed among patients with ≥2 days intensive care unit stay, and in-hospital mortality was analysed among all patients. 48,484 patients with mean age of 49 years and mean injury severity score of 23 points were included; 72.3% were male and 95.5% had blunt trauma. Risk-adjusted analyses revealed that patients receiving >1,000 ml synthetic colloids experienced an increase of renal failure and renal replacement therapy rates (OR 1.42 and 1.32, respectively, both $p \leq 0.006$). Any synthetic colloid use was associated with an increased risk of multiple organ failure ($p < 0.001$), but there was no effect on hospital mortality ($p = 0.594$). Between 2002 and 2015 usage of synthetic colloids dropped, likewise did total fluid intake and usage of blood products. The data from this analysis suggests that synthetic colloid resuscitation provides no beneficial effects and might be harmful in patients with severe trauma.

Ann Emerg Med. 2018 Sep;72(3):259-269

A Two-Center Validation of "Patient Does Not Follow Commands" and Three Other Simplified Measures to Replace the Glasgow Coma Scale for Field Trauma Triage.

Hopkins E, Green S, Kiemeney M, Haukoos J

STUDY OBJECTIVE: Out-of-hospital personnel worldwide calculate the 13-point Glasgow Coma Scale (GCS) score as a routine part of field trauma triage. We wish to independently validate a simpler binary assessment to replace the GCS for this task.

METHODS: We analyzed trauma center registries from Loma Linda University Health (2003 to 2015) and Denver Health Medical Center (2009 to 2015) to compare the binary assessment "patient does not follow commands" (ie, GCS motor score <6) with GCS score less than or equal to 13 for the prediction of 5 trauma outcomes: emergency intubation, clinically significant brain injury, need for neurosurgical intervention, Injury Severity Score greater than 15, and mortality. As a secondary analysis, we similarly evaluated 3 other measures simpler than the GCS: GCS motor score less than 5, Simplified Motor Score, and the "alert, voice, pain, unresponsive" scale.

RESULTS: In this analysis of 47,973 trauma patients, we found that the binary assessment "patient does not follow commands" was essentially identical to GCS score less than or equal to 13 for the prediction of all 5 trauma outcomes, with slightly superior positive likelihood ratios (eg, those for mortality 2.37 versus 2.13) offsetting slightly inferior negative ones (eg, those for mortality 0.25 versus 0.24) and its graphic depiction of sensitivity versus specificity superimposing the GCS prediction curve. We found similar results for the 3 other simplified measures.

CONCLUSION: In this 2-center external validation, we confirmed that a simple binary assessment-"patient does not follow commands"-could effectively replace the more complicated GCS for field trauma triage.

J Med Case Rep. 2018 Sep 21;12(1):271

False negative computed tomography scan due to pelvic binder in a patient with pelvic disruption: a case report and review of the literature.

Jamme S, Poletti A, Gamulin A, Rutschmann O, Andereggen E, Grosgurin O, Marti C

BACKGROUND: Pelvic binders are routinely used in the prehospital setting for stabilization of pelvic injuries in patients with trauma. Emergency department trauma management relies on primary and secondary survey assessment and imaging, most often computed tomography, in hemodynamically stable patients. Maintaining the pelvic binder in situ allows stabilization of pelvic injuries during imaging but may hinder the visualization of some pelvic lesions. We report a very rare case of severe pelvic disruption with an absolutely normal computed tomography scan due to the effective placement of a pelvic binder.

CASE PRESENTATION: We report the case of a 49-year-old Caucasian man referred to our Emergency Department after a high velocity motorcycle accident. Primary assessment revealed a left wrist deformation and pelvic pain, and a pelvic binder was applied by paramedics. A total body computed tomography scan was performed after arrival in our Emergency Department and did not reveal any pelvic injury. The pelvic binder was removed and because of persisting symphyseal pain, pelvic plain radiography was performed revealing a pelvic disruption with an opening of the pubic symphysis and of the left sacroiliac joint ("open book" type pelvic injury) requiring surgical stabilization.

CONCLUSIONS: Pelvic binders may mask pelvic disruption in patients with trauma. Pelvic plain radiography should be repeated after pelvic binder removal in patients with high velocity trauma and pelvic symptoms or neurological alterations limiting the reliability of clinical examination.

Ann Emerg Med. 2018 Sep;72(3):272-279.e1

Implementation of a Clinical Bundle to Reduce Out-of-Hospital Peri-intubation Hypoxia.

Jarvis J, Gonzales J, Johns D, Sager L

STUDY OBJECTIVE: Peri-intubation hypoxia is an important adverse event of out-of-hospital rapid sequence intubation. The aim of this project is to determine whether a clinical bundle encompassing positioning, apneic oxygenation, delayed sequence intubation, and goal-directed preoxygenation is associated with decreased peri-intubation hypoxia compared with standard out-of-hospital rapid sequence intubation.

METHODS: We conducted a retrospective, before-after study using data from a suburban emergency medical services (EMS) system in central Texas. The study population included all adults undergoing out-of-hospital intubation efforts, excluding those in cardiac arrest. The before-period intervention was standard rapid sequence intubation using apneic oxygenation at flush flow, ketamine, and a paralytic. The after-period intervention was a care bundle including patient positioning (elevated head, sniffing position), apneic oxygenation, delayed sequence intubation (administration of ketamine to facilitate patient relaxation and pre-oxygenation with a delayed administration of paralytics), and goal-directed pre-oxygenation. The primary outcome was the rate of peri-intubation hypoxia, defined as the percentage of patients with a saturation less than 90% during the intubation attempt.

RESULTS: The before group (October 2, 2013, to December 13, 2015) included 104 patients and the after group (August 8, 2015, to July 14, 2017) included 87 patients. The 2 groups were similar in regard to sex, age, weight, ethnicity, rate of trauma, initial oxygen saturation, rates of initial hypoxia, peri-intubation peak SpO2, preintubation pulse rate and systolic blood pressure, peri-intubation cardiac arrest, and first-pass and overall success rates. Compared with the before group, the after group experienced less peri-intubation hypoxia (44.2% versus 3.5%; difference -40.7% [95% confidence interval -49.5% to -32.1%]) and higher peri-intubation nadir SpO2 values (100% versus 93%; difference 5% [95% confidence interval 2% to 10%]).

CONCLUSION: In this single EMS system, a care bundle encompassing patient positioning, apneic oxygenation, delayed sequence intubation, and goal-directed pre-oxygenation was associated with lower rates of peri-intubation hypoxia than standard out-of-hospital rapid sequence intubation.

Scand J Trauma Resusc Emerg Med. 2018 Aug 22;26(1):68

Prehospital treatment of patients with acute intracranial pathology: adherence to guidelines and blood pressure recommendations by the Danish Air Ambulance.

Juelsgaard J, Rognås L, Knudsen L, Hansen T, Rasmussen M

BACKGROUND: Hypoxia and hypotension may be associated with secondary brain injury and negative outcomes in patients with traumatic and non-traumatic intracranial pathology. Guidelines exist only for the prehospital management of patients with severe traumatic brain injury (TBI). In patients with non-traumatic intracranial pathology, TBI guideline recommendations may be applied to assess whether hypoxia and hypotension should be avoided during prehospital treatment. The main study objective was to assess the extent to which Danish Helicopter Emergency Medical Service (HEMS) critical care teams adhere to the prehospital TBI guideline recommendations for the management of patients with a clinical diagnosis of non-traumatic intracranial pathology or isolated TBI. Furthermore, in the same two groups of patients, we evaluated the adherence of the Danish HEMS critical care teams to recommendations aiming to maintain systolic blood pressure (SBP) > 110 mmHg and > 120 mmHg.

METHODS: In total, 211 prehospital patient records were studied. All patients were treated for non-traumatic intracranial pathology or isolated TBI by the Danish HEMS critical care teams from October 1, 2014, to January 1, 2017. Adherence to the prehospital TBI guideline recommendations and the SBP recommendations above was assessed in non-TBI and TBI populations.

RESULTS: The adherence rates to TBI guideline recommendations among Danish HEMS critical care teams were 69% (n = 106 [95% CI: 61-77%]) in the non-TBI population and 74% (n = 43 [95% CI: 61-85%]) in the TBI population. SBP > 110 mmHg was observed in 74% (n = 113 [95% CI: 66-81%]) and 69% (n = 40 [95% CI: 56-81%]) of cases in the non-TBI and TBI population, respectively. SBP > 120 mmHg was observed in 55% (n = 84, [95% CI: 47-63%]) of patients in the non-TBI population and 55% (n = 32 [95% CI: 42-68%]) of the patients in the TBI population.

CONCLUSIONS: Due to a lack of comparative data, it is difficult to determine the performance quality of the Danish HEMS critical care teams. Our findings may suggest that adherence to TBI guidelines and SBP recommendations needs to be a continuous focal point for the Danish HEMS to avoid secondary brain damage.

Brain Inj. 2018 Aug 23:1-9. doi: 10.1080/02699052.2018.1510542

Variable saline resuscitation in a murine model of combined traumatic brain injury and haemorrhage.

Jung A, Johnson M, Veile R, Friend L, Stevens-Topie S, Elterman J, Pritts T, Makley A, Goodman M

BACKGROUND: Resuscitation strategies for combined traumatic brain injury (TBI) with haemorrhage in austere environments are not fully established. Our aim was to establish the effects of various saline concentrations in a murine model of combined TBI and haemorrhage, and identify an effective resuscitative strategy for the far-forward environment.

METHODS: Male C57BL/6 mice underwent closed head injury and subjected to controlled haemorrhage to a systolic blood pressure of 25 mmHg via femoral artery cannulation for 60 min. Mice were resuscitated with a fixed volume bolus or variable volumes of fluid to achieve a systolic blood pressure goal of 80 mmHg with 0.9% saline, 3% saline, 0.1-mL bolus of 23.4% saline, or a 0.1-mL bolus of 23.4% saline followed by 0.9% saline (23.4+).

RESULTS: 23.4% saline and 23.4+ resulted in higher mortality at 6 h compared to 0.9% saline. Use of 3% saline required less volume to achieve targeted resuscitation, did not affect survival, and did not exacerbate post-traumatic inflammation. While 23.4+ resuscitation utilized lower volume, it resulted in hypernatremia, azotemia, and elevated systemic pro-inflammatory cytokines. All groups except 3% saline demonstrated progression of neuron damage, with cerebral oedema highest with 0.9% saline.

CONCLUSIONS: 3% saline demonstrated favourable balance of survival, blood pressure restoration, minimization of inflammation, and prevention of ongoing neurologic injury without contributing to significant physiologic derangements. 23.4% saline administration may not be appropriate in the setting of concomitant hypotension.

Int J Surg Case Rep. 2018;51:368-371

Massive systemic arterial air embolism caused by an air shunt after blunt chest trauma: A case report.

Kandori K, Ishii W, Iiduka R

INTRODUCTION: Systemic arterial air embolism (SAAE) is a rare but fatal condition, with only a few cases reported, and the detailed etiology underlying SAAE remains unknown. We report a first case of massive SAAE after blunt chest injury, wherein the presence of traumatic air shunt was confirmed by direct observation during surgery. We also summarize our experience with six other SAAE cases.

PRESENTATION OF CASE: A 68-year-old woman was admitted in a state of cardiac arrest after a fall. Emergency room thoracotomy determined complete transection of left main bronchus and left superior pulmonary vein. Postmortem computed tomography (CT) revealed full of air in the aortic arch, the descending aorta, and the great vessels. Therefore, one of the cause of death might be SAAE.

DISCUSSION: An air shunt after blunt chest trauma can cause SAAE, and clinical signs and operative findings can provide clues for possible SAAE. The bronchopulmonary vein fistula, the aortic injury and full-thickness myocardial injury have the potential to become traumatic air shunts. In cases with a coexisting air shunt, pneumothorax, lung contusions and positive-pressure ventilation can be risk factors for SAAE, as sources of air continually entering the systemic arterial circulation.

CONCLUSION: SAAE is caused by an air shunt following trauma. Clinical signs and operative findings summarized in this case should aid in the recognition of possible SAAE.

J Maxillofac Oral Surg. 2018 Jun;17(2):264-265

A Simple and Effective Scalp Tourniquet for Controlling Scalp Hemorrhage.

Khan M, Rai A, Jain A

Quote:
"We suggest use of sterile surgical glove as a scalp tourniquet which is a simple, less time-consuming technique and provides adequate control of hemorrhage intraoperatively.
A sterile glove is cut from its wrist portion (Fig. 1) and is stretched and tied over scalp just above eyebrows, external auricle and just below the external occipital protuberance. The glove is placed over cottonpadded gauge to prevent any injury to underlying tissue. Locking artery forceps is used to hold the stretched glove to maintain adequate pressure (Fig. 2).

We have used this technique in 35 patients, and it successfully provided with hemorrhage control (Fig. 3). The mean time for application of this tourniquet in all cases was 5.68 min, and it can be safely kept for a period of 60–90 min over the scalp during surgery. The advantages of this technique are being inexpensive, simple, less timeconsuming, and no additional material or preparation is required. The two main disadvantages of this technique are (a) the pressure applied by the glove cannot be monitored and (b) it cannot be used for surgical procedures performed at the peripheral aspects of scalp."

J Surg Res. 2018 Nov;231:99-108

Long-term consequences of abdominal aortic and junctional tourniquet for hemorrhage control.

Kheirabadi B, Terrazas I, Miranda N, Voelker A, Klemcke H, Brown A, Dubick M

BACKGROUND: Specialized tourniquets have been deployed to the battlefield for the control of junctional/pelvic hemorrhage despite limited knowledge concerning their safety and duration of use. This study investigated long-term effects of abdominal application of the abdominal aortic and junctional tourniquet (AAJT) in a swine survival model.

METHODS: Anesthetized spontaneously air-breathing swine were subjected to bilateral femoral artery injuries and subsequent 40% hemorrhage. Further hemorrhage was controlled by applying the AAJT on the lower abdomen for 0 h (n = 2, controls), 1 h (n = 6), 1.5 h (n = 6), or 2 h (n = 3). Before tourniquet release, arterial injuries were repaired, and mechanical ventilation and rapid crystalloid fluid were provided for at least 5 min. Additional fluid and 500 mL autologous blood were transfused after restoring blood flow. Animals were recovered and their mobility and health monitored up to 2 wk.

RESULTS: AAJT application occluded the infrarenal abdominal aorta and stopped bilateral groin hemorrhage with rapid reversal of hemorrhagic shock and improved cranial blood pressure. All animals including controls recovered overnight but regaining hind leg function varied among AAJT-treated groups. In contrast to 1 h AAJT-treated swine that recovered full mobility in 1 wk, 2 h animals developed persistent hind leg paraplegia concurrent with urinary retention and ischemic necrosis of lumber muscles and had to be euthanized 3 d after surgery. Half of the 1.5-h group also had to be euthanized early due to paraplegia, whereas the other half recovered motor function within 2 wk.

CONCLUSIONS: The results of this animal study indicated that ischemic reperfusion injuries associated with abdominal application of the AAJT were time-dependent. To avoid permanent injuries, AAJT application on the abdomen to control a groin hemorrhage could not be longer than 1 h. This was consistent with recent instructions for application of this tourniquet on the abdomen in patients.

Orthop Traumatol Surg Res. 2018 Nov;104(7):1003-1007

Tranexamic acid is effective for blood management in open-wedge high tibial osteotomy.

Kim K, Kim H, Kim G, Bae S

INTRODUCTION: There has been paucity in literature regarding the blood-sparing effect of TXA after high tibial osteotomy (HTO). The purpose of this study is to determine the efficacy of tranexamic acid (TXA) with regard to its blood-sparing effects in open-wedge HTO, and to assess thromboembolic complications in patients undergoing open-wedge HTO with or without the use of TXA.

HYPOTHESIS: The intravenous TXA would reduce postoperative blood loss and transfusion requirements without increasing thromboembolic complications in open-wedge HTO.

MATERIALS AND METHODS: From March 2011 to December 2016, medial open-wedge HTO was performed in 150 consecutive knees with varus gonarthrosis. The mean age at the time of surgery was 55.3±5.0 years. TXA was intravenously used in the latter 75 knees (TXA group), and the group was retrospectively compared with the former 75 knees without use of TXA (control group). Outcome measures were postoperative hemoglobin drop, drain amount, total estimated blood loss, transfusion requirements, and incidence of thromboembolic complications.

RESULTS: The use of TXA led to a significant decrease in hemoglobin drop ($p<0.001$) and drain amount ($p=0.025$). Total estimated blood loss was lower in the TXA group than in the control group ($p<0.001$). Two knees in the control group had postoperative blood transfusion, compared to none in the TXA group ($p>0.05$). There were no thromboembolic complications such as symptomatic deep vein thrombosis and pulmonary embolism in both groups.

CONCLUSION: The use of TXA reduced perioperative hemoglobin drop, drain amount, and total estimated blood loss without thromboembolic complications in patients undergoing open-wedge HTO. Therefore, the use of TXA is a safe and viable option for perioperative blood management in open-wedge HTO.

LEVEL OF EVIDENCE: III, Case control study.

World Neurosurg. 2018 Oct;118:e513-e525

Early (≤48 Hours) versus Late (>48 Hours) Surgery in Spinal Cord Injury: Treatment Outcomes and Risk Factors for Spinal Cord Injury.

Kim M, Hong S, Jeon S, Roh S, Lee S

OBJECTIVES: Surgical management of spinal cord injury (SCI) is challenging. There is no standard guideline regarding the timing of surgery, although physicians have prioritized early surgery over the past decades. Although better outcomes have been observed from these studies, the definition of early surgery has been controversial, although mostly limited to 24-hours after injury. For some hospitals, this early surgery could be difficult to implement in practice. Hence, we re-evaluated the timing of early surgery as surgery within 48 hours and investigated the surgical outcomes of SCI depending on whether surgery was performed early (≤48 hours) or late (>48 hours). The primary outcomes were improvement in the American Spinal Injury Association Impairment Scale (AIS) grade in early and late surgery groups.

METHODS: This study was a retrospective cohort study in individuals aged 15-85 years, who underwent surgery for SCI between 2005 and 2016. The rate of AIS grade improvements was measured at 6 months after injury. Of the 86 enrolled patients, 31 (mean, 40.9 ± 12.64 hours) and 55 (mean, 168.25 ± 93.01 hours) patients were assigned to the early and late surgery groups, respectively.

RESULTS: AIS grade improvement was significantly greater in the early than in the late group (P = 0.039). In the early group, there was no significant difference in neurologic improvements among the AIS B, C, and D groups, but the AIS A group showed a significant improvement (P = 0.015). This finding was not observed in the late group (P = 0.060). AIS grade improvement was also significantly greater in the incomplete SCI group than in the complete SCI group, for all measurements (early, P = 0.007, late, P = 0.009). Other factors that significantly affected clinical outcomes were AIS grade on admission and the level of the injury.

J Spec Oper Med. Fall 2018;18(3):15-21.

Study of Tourniquet Use in Simulated First Aid: User Judgment.

Kragh JF Jr, Tan AR, Newton NJ, Aden JK 3rd, Dubick MA.

BACKGROUND: The purpose of this study was to survey the judgments of tourniquet users in simulation to discern opportunities for further study.

METHODS: The study design constituted two parts: questions posed to four tourniquet users and then their tourniquet use was surveyed in simulated first aid, where the users had to decide how to perform among five different cases. The questions addressed judged confidence, blood volumes, a reason bleeding resumes, regret of preventable death, hemorrhage assessment, need for side-by-side use of tourniquets, shock severity, predicting reliability, and difference in blood losses. The mechanical performance was tested on a manikin. Case 1 had no bleeding. Case 2 had limb-wound bleeding that indicated tourniquet use in first aid. Case 3 was like case 2, except the patient was a child. Case 4 was like case 2, except caregiving was under gunfire. Case 5 was like case 4, but two tourniquets were to be used side by side. Each user made tests of the five cases to constitute a block. Each user had three blocks. Case order was randomized within blocks. The study had 60 tests.

RESULTS: In answering questions relevant to first-aid use of limb tourniquets, judgments were in line with previous studies of judgment science, and thus were plausibly applicable. Mechanical performance results on the manikin were as follows: 38 satisfactory, 10 unsatisfactory (a loose tourniquet and nine incorrect tourniquet placements), and 12 not applicable (case 1 needed no mechanical intervention). For cases 1 to 5, satisfactory results were: 100%, 83%, 100%, 75%, and 58%, respectively. For blocks 1 to 3, satisfactory results were 50%, 83%, and 83%, respectively.

CONCLUSION: For tourniquet use in simulated first aid, the results are plausibly applicable because user judgments were coherent with those in previous studies of judgment science. However, the opportunities for further studies were noted.

Ann Emerg Med. 2018 Sep;72(3):299-301

Beyond ATLS: Demystifying the Expert Resuscitationist.

Lai S, Jain A, Mason J, Grock A

Quotes:

"WITH THIS IN MIND, HOW CAN ONE START TO BECOME AN EXPERT RESUSCITATIONIST?"

"FORESIGHT AND PLANNING
Expert resuscitation team leaders begin a successful resuscitation even before the patient arrives through mental rehearsal. In their minds, they anticipate the clinical course, critical actions, and potential complications as they await their patient's arrival. Mental rehearsal as a group (ie, a huddle) can also boost team performance.13-16 **"**

"FILTERING DATA AND SYNTHESIZING THE SITUATION
The physical position of the team leader in the room is also key to managing the rapid influx of stimuli.2 In the ideal location, the expert is central to all incoming data, but
can also see the entirety of the situation, coordinate logistics, and ensure that critical actions are accomplished."

"ANTICIPATE AND ACT
Despite vast experience and mental rehearsal, the expert resuscitationist has to manage uncertainty and anticipate the unexpected.9-11,13,15,16 One helpful trick is a "defensive pessimism" mind-set when approaching resuscitations. Despite the best planning, resuscitations can take unexpected twists. Discussing these possibilities ahead of time can decrease the stress and uncertainty."

"AFTER-EVENT ANALYSIS"

Anesth Analg. 2018 Oct 12. doi: 10.1213/ANE.0000000000003849. Epub ahead of print

Prospective, Randomized Comparison of the i-gel and the Self-Pressurized air-Q Intubating Laryngeal Airway in Elderly Anesthetized Patients.

Lee J, Kim D, Choi S, Ha S, Kim S, Kim M.

BACKGROUND: Age-related changes in upper airway anatomy may affect the overall performance of supraglottic airways significantly. The clinical performance of the i-gel and the self-pressurized air-Q intubating laryngeal airways with non-inflatable cuffs for elderly populations remains unknown, unlike in children. Thus, we performed a prospective, randomized comparison of these 2 supraglottic airways in elderly patients undergoing general anesthesia.

METHODS: We recruited 100 patients, 65-90 years of age, who were scheduled for elective surgery under general anesthesia with muscle relaxation. The enrolled patients were allocated to the i-gel or self-pressurized air-Q group. We assessed oropharyngeal leak pressure as the primary outcome and fiberoptic view after placement and fixation of the airway and at 10 minutes after the initial assessment. The fiberoptic view was scored using a 5-point scale as follows: vocal cords not visible; vocal cords and anterior epiglottis visible, >50% visual obstruction of epiglottis to vocal cords; vocal cords and anterior epiglottis visible, <50% visual obstruction of epiglottis to vocal cords; vocal cords and posterior epiglottis visible; and vocal cords visible. We also investigated success rate and ease of insertion, insertion time, and manipulations during insertion as insertion variables, complications during maintenance and emergence periods, and postoperative pharyngolaryngeal complications including sore throat, dysphagia, and dysphonia.

RESULTS: After assessing for eligibility, 48 patients were allocated to each group. Oropharyngeal leak pressures were significantly higher in the i-gel group than in the self-pressurized air-Q group ($P < .001$) at the 2 measurement points. The raw mean difference at initial assessment and the median difference after 10 minutes were 5.5 cm H_2O (95% confidence interval, 3.3-7.6 cm H_2O) and 5.0 (95% confidence interval, 2.0-7.0 cm H_2O), respectively. The initial scores of fiberoptic view were similar in the 2 groups. However, the self-pressurized air-Q supraglottic airway provided a significantly improved fiberoptic view at 10 minutes after initial assessment ($P = .030$). We found no statistically significant differences in insertion variables and complications between the 2 groups.

CONCLUSIONS: The i-gel provided better sealing function than the self-pressurized air-Q supraglottic airway according to the high oropharyngeal leak pressures in elderly patients during general anesthesia. The self-pressurized air-Q supraglottic airway had improved fiberoptic views in elderly patients during general anesthesia.

Am J Surg. 2018 Sep 26. pii: S0002-9610(18)30525-7. doi: 10.1016/j.amjsurg.2018.09.025. Epub ahead of print

Stop the Bleed Training empowers learners to act to prevent unnecessary hemorrhagic death.

Lei R, Swartz M, Harvin J, Cotton B, Holcomb J, Wade C, Adams S

BACKGROUND: Uncontrolled bleeding is a leading cause of preventable death from trauma. With the rise in mass casualty events, training of laypersons can be life-saving. "Stop the Bleed" is a campaign to teach the public techniques of bleeding control. We believe that training in these techniques will increase participants' willingness and preparedness to intervene and increase knowledge of trauma/hemorrhage control.

METHODS: We created a "Stop the Bleed" training program. School nurses, medical students, researchers, and community members participated in the program. Pre- and post-training questionnaires assessed participants' willingness/preparedness to intervene in a casualty event and knowledge of trauma/hemorrhage control.

RESULTS: There was a significant change in attitudes after receiving training ($p < 0.05$). There was also an improvement in knowledge regarding bleeding control techniques.

CONCLUSIONS: "Stop the Bleed" training empowers participants with the confidence and knowledge to aid others in preventable hemorrhagic death.

Cochrane Database Syst Rev. 2018 Aug 3;8:CD000567. doi: 10.1002/14651858.CD000567.pub7.

Colloids versus crystalloids for fluid resuscitation in critically ill people.

Lewis S, Pritchard M, Evans D, Butler A, Alderson P, Smith A, Roberts I.

BACKGROUND: Critically ill people may lose fluid because of serious conditions, infections (e.g. sepsis), trauma, or burns, and need additional fluids urgently to prevent dehydration or kidney failure. Colloid or crystalloid solutions may be used for this purpose. Crystalloids have small molecules, are cheap, easy to use, and provide immediate fluid resuscitation, but may increase oedema. Colloids have larger molecules, cost more, and may provide swifter volume expansion in the intravascular space, but may induce allergic reactions, blood clotting disorders, and kidney failure. This is an update of a Cochrane Review last published in 2013.

OBJECTIVES: To assess the effect of using colloids versus crystalloids in critically ill people requiring fluid volume replacement on mortality, need for blood transfusion or renal replacement therapy (RRT), and adverse events (specifically: allergic reactions, itching, rashes).

SEARCH METHODS: We searched CENTRAL, MEDLINE, Embase and two other databases on 23 February 2018. We also searched clinical trials registers.

SELECTION CRITERIA: We included randomised controlled trials (RCTs) and quasi-RCTs of critically ill people who required fluid volume replacement in hospital or emergency out-of-hospital settings. Participants had trauma, burns, or medical conditions such as sepsis. We excluded neonates, elective surgery and caesarean section. We compared a colloid (suspended in any crystalloid solution) versus a crystalloid (isotonic or hypertonic).

DATA COLLECTION AND ANALYSIS: Independently, two review authors assessed studies for inclusion, extracted data, assessed risk of bias, and synthesised findings. We assessed the certainty of evidence with GRADE.

MAIN RESULTS: We included 69 studies (65 RCTs, 4 quasi-RCTs) with 30,020 participants. Twenty-eight studied starch solutions, 20 dextrans, seven gelatins, and 22 albumin or fresh frozen plasma (FFP); each type of colloid was compared to crystalloids. Participants had a range of conditions typical of critical illness. Ten studies were in out-of-hospital settings. We noted risk of selection bias in some studies, and, as most studies were not prospectively registered, risk of selective outcome reporting. Fourteen studies included participants in the crystalloid group who received or may have received colloids, which might have influenced results. We compared four types of colloid (i.e. starches; dextrans; gelatins; and albumin or FFP) versus crystalloids. **Starches versus crystalloids:** we found moderate-certainty evidence that there is probably little or no difference between using starches or crystalloids in mortality at: end of follow-up (risk ratio (RR) 0.97, 95% confidence interval (CI) 0.86 to 1.09; 11,177 participants; 24 studies); within 90 days (RR 1.01, 95% CI 0.90 to 1.14; 10,415 participants; 15 studies); or within 30 days (RR 0.99, 95% CI 0.90 to 1.09; 10,135 participants; 11 studies).We found moderate-certainty evidence that starches probably slightly increase the need for blood transfusion (RR 1.19, 95% CI 1.02 to 1.39; 1917 participants; 8 studies), and RRT (RR 1.30, 95% CI 1.14 to 1.48; 8527 participants; 9 studies). Very low-certainty evidence means we are uncertain whether either fluid affected adverse events: we found little or no difference in allergic

reactions (RR 2.59, 95% CI 0.27 to 24.91; 7757 participants; 3 studies), fewer incidences of itching with crystalloids (RR 1.38, 95% CI 1.05 to 1.82; 6946 participants; 2 studies), and fewer incidences of rashes with crystalloids (RR 1.61, 95% CI 0.90 to 2.89; 7007 participants; 2 studies). **Dextrans versus crystalloids**: We found moderate-certainty evidence that there is probably little or no difference between using dextrans or crystalloids in mortality at: end of follow-up (RR 0.99, 95% CI 0.88 to 1.11; 4736 participants; 19 studies); or within 90 days or 30 days (RR 0.99, 95% CI 0.87 to 1.12; 3353 participants; 10 studies). We are uncertain whether dextrans or crystalloids reduce the need for blood transfusion, as we found little or no difference in blood transfusions (RR 0.92, 95% CI 0.77 to 1.10; 1272 participants, 3 studies; very low-certainty evidence). We found little or no difference in allergic reactions (RR 6.00, 95% CI 0.25 to 144.93; 739 participants; 4 studies; very low-certainty evidence). No studies measured RRT. **Gelatins versus crystalloids:** We found low-certainty evidence that there may be little or no difference between gelatins or crystalloids in mortality: at end of follow-up (RR 0.89, 95% CI 0.74 to 1.08; 1698 participants; 6 studies); within 90 days (RR 0.89, 95% CI 0.73 to 1.09; 1388 participants; 1 study); or within 30 days (RR 0.92, 95% CI 0.74 to 1.16; 1388 participants; 1 study). Evidence for blood transfusion was very low certainty (3 studies), with low event rate or data not reported by intervention. Data for RRT were not reported separately for gelatins (1 study). We found little or no difference between groups in allergic reactions (very low-certainty evidence). **Albumin or FFP versus crystalloids:** We found moderate-certainty evidence that there is probably little or no difference between using albumin or FFP or using crystalloids in mortality at: end of follow-up (RR 0.98, 95% CI 0.92 to 1.06; 13,047 participants; 20 studies); within 90 days (RR 0.98, 95% CI 0.92 to 1.04; 12,492 participants; 10 studies); or within 30 days (RR 0.99, 95% CI 0.93 to 1.06; 12,506 participants; 10 studies). We are uncertain whether either fluid type reduces need for blood transfusion (RR 1.31, 95% CI 0.95 to 1.80; 290 participants; 3 studies; very low-certainty evidence). Using albumin or FFP versus crystalloids may make little or no difference to the need for RRT (RR 1.11, 95% CI 0.96 to 1.27; 3028 participants; 2 studies; very low-certainty evidence), or in allergic reactions (RR 0.75, 95% CI 0.17 to 3.33; 2097 participants, 1 study; very low-certainty evidence).

AUTHORS' CONCLUSIONS: Using starches, dextrans, albumin or FFP (moderate-certainty evidence), or gelatins (low-certainty evidence), versus crystalloids probably makes little or no difference to mortality. Starches probably slightly increase the need for blood transfusion and RRT (moderate-certainty evidence), and albumin or FFP may make little or no difference to the need for renal replacement therapy (low-certainty evidence). Evidence for blood transfusions for dextrans, and albumin or FFP, is uncertain. Similarly, evidence for adverse events is uncertain. Certainty of evidence may improve with inclusion of three ongoing studies and seven studies awaiting classification, in future updates.

Ther Clin Risk Manag. 2018 Sep 12;14:1701-1709

Fluid resuscitation in critically ill patients: a systematic review and network meta-analysis.

Liu C, Mao Z, Hu P, Hu X, Kang H, Hu J, Yang Z, Ma P, Zhou F

Objective: The aim of this study was to compare the effectiveness of different fluids on critically ill patients who need fluid resuscitation through a systematic review and network meta-analysis (NMA).

Data sources: Electronic databases were searched up to March 2018 for randomized controlled trials comparing the effectiveness of different fluids in critically ill patients. The primary outcome was mortality, and the secondary outcomes were the incident of acute kidney injury (AKI) and risk of receiving renal replacement therapy (RRT). A Bayesian NMA was conducted, and the quality of evidence contributing to each network estimate was assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group criteria.

Results: We deemed 49 trials eligible, including 40,910 participants. The quality of evidence was rated as moderate in most comparisons. There was no significant difference among resuscitation fluids in mortality. NMA at the 9-node level showed the most effective fluid was balanced crystalloid (BC) (80.79%, the ranking of resuscitation fluid based on cumulative probability plots and surface under the cumulative ranking curves [SUCRAs]). NMA at the 10-node level showed that the most effective fluid was Plasma-Lyte (77.52%). Results of sensitivity analyses in mortality did not reveal any significant changes in the findings for primary outcomes. High-molecular-weight hetastarch (H-HES) was associated with an increased incidence of AKI when compared with gelatin (odds ratio [OR], 0.43; 95% credibility interval [CrI], 0.19-0.94), low-molecular-weight hetastarch (L-HES; OR, 0.50; 95% CrI, 0.30-0.87), BC (OR, 0.55; 95% CrI, 0.34-0.88), and normal saline (OR, 0.56; 95% CrI, 0.34-0.93). Meanwhile, H-HES was also associated with an increased risk of receiving RRT when compared with BC (OR, 0.51; 95% CrI, 0.27-0.93) and normal saline (OR, 0.52; 95% CrI, 0.24-0.96).

Conclusion: BCs, especially the Plasma-Lyte, are presumably the best choice for most critically ill patients who need fluid resuscitation. Meanwhile, the use of H-HES was associated with an increased incidence of AKI and risk of receiving RRT.

J Trauma Acute Care Surg. 2018 Nov 2.Epub ahead of print

The Las Vegas Mass Shooting: An analysis of blood component administration and blood bank donations.

Lozada M, Cai S, Li M, Davidson S, Nix J, Ramsey G

BACKGROUND: The deadliest mass shooting in modern United States history occurred October 1, 2017 in Las Vegas, killing 58 and overwhelming hospitals with over 600 injured. The scope of the tragedy offers insight into medical demands, which may help guide preparedness for future mass shooting incidents.

METHODS: Retrospective, de-identified, healthcare institution-provided data from all hospitals and blood banks providing care to Las Vegas shooting victims was gathered. Study authors independently reviewed all data and cross-referenced it for verification. Main outcomes and measures include the number of victims requiring hospital and intensive care admission, the amount and types of blood components transfused during the first 24 hours, and the amount of blood donated to local blood banks following the Las Vegas mass shooting.

RESULTS: 220 patients required hospital admission, 68 of them to critical care. Nearly 500 blood components were transfused during the first 24 hours in a red blood cell:plasma:platelet ratio of 1:0.54:0.81. Public citizens donated almost 800 units of blood immediately after the shooting; over 17% of this donated blood was wasted.

CONCLUSIONS: The amount of blood components transfused per patient admitted was similar in magnitude to other mass casualty events, and available blood supply met patient demand. The public call for blood donors was not necessary to meet immediate demand and led to resource waste. Preparation for future mass shooting incidents should include training the community in hemorrhage control, encouraging routine blood donation, and avoiding public calls for blood donation unless approved by local blood suppliers.

LEVEL OF EVIDENCE: III.

Pediatr Crit Care Med. 2018 Dec;19(12):e637-e642

Safety of Tranexamic Acid During Pediatric Trauma: A Nationwide Database Study.

Maeda T, Michihata N, Sasabuchi Y, Matsui H, Ohnishi Y, Miyata S, Yasunaga H

OBJECTIVES: The present study aimed to examine the association between tranexamic acid use and adverse effects (seizures, thromboembolism, and renal dysfunction) in a pediatric trauma population using a national inpatient database in Japan. We also assessed the association between tranexamic acid use and in-hospital mortality.

DESIGN: A nationwide, retrospective cohort study using propensity score analyses.

SETTING: Japanese Diagnosis Procedure Combination inpatient database.

PATIENTS: Pediatric patients less than or equal to 12 years old admitted in hospital with the diagnosis of trauma between July 2010 and March 2014 (n = 61,779).

INTERVENTIONS: None.

MEASUREMENTS AND MAIN RESULTS: Propensity score matching created 1,914 pairs of patients with and without tranexamic acid administration. Propensity-matched analysis showed that the proportion of seizures was significantly higher in the tranexamic acid group than in the non-tranexamic acid group (7/1,914, 0.37% vs 0/1,914, 0%; difference, 0.37%; 95% CI, 0.10-0.64; p = 0.008). However, none of the other outcomes were significantly different between the groups.

CONCLUSIONS: Tranexamic acid use is associated with a significantly increased risk of seizures. However, no difference exists among any other outcomes between the tranexamic acid and non-tranexamic acid groups.

J Trauma Acute Care Surg. 2018 Nov;85(5):1007-1015

Evaluation and management of abdominal stab wounds: A Western Trauma Association critical decisions algorithm.

Martin M, Brown C Shatz D, Alam H, Brasel K, Hauser C, de Moya M, Moore E, Rowell S, Vercruysse G, Baron B, Inaba K.

ABSTRACT:
This is a recommended management algorithm from the Western Trauma Association addressing the management of adult patients with abdominal stab wounds. Because there is a paucity of published prospective randomized clinical trials that have generated Class I data, these recommendations are based primarily on published observational studies and expert opinion of Western Trauma Association members. The algorithm and accompanying comments represent a safe and sensible approach that can be followed at most trauma centers. We recognize that there will be patient, personnel, institutional, and situational factors that may warrant or require deviation from the recommended algorithm. We encourage institutions to use this as a guideline to develop their own local protocols.

PLoS One. 2018 Nov 1;13(11):e0204746

Risk of acute myocardial infarction during use of individual NSAIDs: A nested case-control study from the SOS project.

Masclee G, Straatman H, Arfè A, Castellsague J, Garbe E, Herings R, Kollhorst B, Lucchi S, Perez-Gutthann S, Romio S, Schade R, Schink T, Schuemie M, Scotti L, Varas-Lorenzo C, Valkhoff V, Villa M, Sturkenboom

BACKGROUND: Use of selective COX-2 non-steroidal anti-inflammatory drugs (NSAIDs) (coxibs) has been associated with an increased risk of acute myocardial infarction (AMI). However, the risk of AMI has only been studied for very few NSAIDs that are frequently used.

OBJECTIVES: To estimate the risk of AMI for individual NSAIDs.

METHODS: A nested case-control study was performed from a cohort of new NSAID users ≥18 years (1999-2011) matching cases to a maximum of 100 controls on database, sex, age, and calendar time. Data were retrieved from six healthcare databases. Adjusted odds ratios (ORs) of current use of individual NSAIDs compared to past use were estimated per database. Pooling was done by two-stage pooling using a random effects model (ORmeta) and by one-stage pooling (ORpool).

RESULTS: Among 8.5 million new NSAID users, 79,553 AMI cases were identified. The risk was elevated for current use of ketorolac (ORmeta 2.06;95%CI 1.83-2.32, ORpool 1.80; 1.49-2.18) followed, in descending order of point estimate, by indometacin, etoricoxib, rofecoxib, diclofenac, fixed combination of diclofenac with misoprostol, piroxicam, ibuprofen, naproxen, celecoxib, meloxicam, nimesulide and ketoprofen (ORmeta 1.12; 1.03-1.22, ORpool 1.00;0.86-1.16). Higher doses showed higher risk estimates than lower doses.

CONCLUSIONS: The relative risk estimates of AMI differed slightly between 28 individual NSAIDs. The relative risk was highest for ketorolac and was correlated with COX-2 potency, but not restricted to coxibs.

Pediatr Emerg Care. 2018 Aug;34(8):594-598. doi: 10.1097/PEC.0000000000001570.

Pediatric Massive Transfusion: A Systematic Review.

Maw G, Furyk C

INTRODUCTION: Balanced resuscitation of plasma, platelets, and red blood cells is now recognized as improving outcomes in traumatic bleeding in adults. The correct approach in children has yet to be determined.

METHODS: We performed a systematic review of the literature into transfusion protocols in traumatic hemorrhage in children by conducting an article search of significant databases to identify relevant articles. Studies of interest included interventional trials with comparisons relating to the transfusion of blood including blood component therapy. The search identified 422 articles of interest, the abstracts of which were independently reviewed by 2 authors for inclusion in the trial. This revealed 35 articles, the full texts of which were reviewed. There were no randomized controlled trials and 4 nonrandomized trials with a further 21 articles that were deemed relevant. The data were insufficient for meta-analysis, and so a descriptive analysis was performed.

RESULTS: There were 4 main trials. Two trials were small (approximately 100 patients) nonrandomized trials into pediatric hemorrhage managed as per a massive transfusion protocol or at physician discretion. One was a retrospective analysis of pediatric trauma patients who received red blood cell transfusion with differing platelet ratios, and one was a trauma database review of component ratios in hemorrhaging children. All 4 trials found increased ratios had no effect on mortality.

DISCUSSION: As well as blood component therapy, adjunctive therapies used in the management of bleeding children are discussed. These include tranexamic acid, viscoelastic hemostatic assays, factor VIIa, and fibrinogen use.

CONCLUSIONS: There is little evidence for improved outcomes using component-based transfusion in a rigid 1:1:1 strategy in children. A goal-directed approach using viscoelastic hemostatic assay-guided treatment with early institution of tranexamic acid and fibrinogen replacement is considered the way forward.

Mil Med. 2018 Sep 1;183(suppl_2):67-72

Neurosurgery and Medical Management of Severe Head Injury.

McCafferty R, Neal C, Marshall S, Pamplin J, Rivet D, Hood B, Cooper P, Stockinger Z

ABSTRACT:
Management of the patient with moderate to severe brain injury in any environment can be time consuming and resource intensive. In the austere or hostile environment, the challenges to deliver care to this patient population are magnified. These guidelines have been developed by acknowledging commonly recognized recommendations for neurosurgical and neuro-critical care patients and augmenting those evaluations and interventions based on the experience of neurosurgeons, trauma surgeons, and intensivists who have delivered care during recent coalition conflicts.

Injury. 2018 Sep 24 Epub ahead of print

Can they stop the bleed? Evaluation of tourniquet application by individuals with varying levels of prior self-reported training.

McCarty J, Caterson E, Chaudhary M, Herrera-Escobar J, Hashmi Z, Goldberg S, Goolsby C, Lipsitz S, Haider A, Goralnick E

BACKGROUND: Application of extremity tourniquets is a central tenet of multiple national initiatives to empower laypersons to provide hemorrhage control (HC). However, the efficacy of the general population who self-report prior first-aid (FA) or HC training on individual's ability to control bleeding with a tourniquet remains unknown. Therefore, the objective of this study was to assess the effectiveness of laypeople with self-reported prior FA or HC training to control bleeding with a tourniquet.

STUDY DESIGN: Employees of a stadium were assessed via simulation in their ability to apply a Combat Application Tourniquet. As a subgroup analysis of a larger study, participants who self-reported: 1) No prior training, 2) FA training only or 2) FA + HC training were compared. Logistic regression adjusting for age, gender, education, willingness-to-assist, and comfort level in HC was performed.

RESULTS: 317 participants were included. Compared to participants with no prior training (14.4%,n = 16/111), those with FA training only (25.2%,n = 35/139) had a 2.12-higher odds (95%CI:1.07-4.18) of correct tourniquet application while those with FA + HC (35.8%,n = 24/67) had a 3.50-higher odds (95%CI:1.59-7.72) of correct application. Participants with prior FA + HC were more willing-to-assist and comfortable performing HC than those without prior training ($p < 0.05$). However, reporting being very willing-to-assist [OR0.83, 95%CI: 0.43-1.60] or very comfortable [OR1.11,95%CI:0.55-2.25] was not associated with correct tourniquet application.

CONCLUSION: Self-reported prior FA + HC training, while associated with increased likelihood to correctly apply a tourniquet, results in only 1/3 of individuals correctly performing the skill. As work continues in empowering and training laypeople to act as immediate responders, these findings highlight the importance of effective layperson education techniques.

J Spec Oper Med. Fall 2018;18(3):39-44.

Worldwide Case Reports Using the iTClamp for External Hemorrhage Control.

McKee J, Kirkpatrick A, Bennett B, Jenkins D, Logsetty S, Holcomb J

BACKGROUND: Historically, hemorrhage control strategies consisted of manual pressure, pressure dressings, gauze with or without hemostatic ingredients for wound packing, or the use of tourniquets. The iTClamp is a relatively new alternative to stop external bleeding.

METHODS: An anonymous survey was used to evaluate the outcomes of the iTClamp in worldwide cases of external bleeding.

RESULTS: A total of 245 evaluable applications were reported. The iTClamp stopped the bleeding in 81% (n = 198) of the cases. Inadequate bleeding control was documented in 8% (n = 20) and in the remaining 11% (n = 27), bleeding control was not reported. The top three anatomic body regions for iTClamp application were the scalp, 37% (n = 91); arm, 20% (n = 49); and leg, 19% (n = 46). In 26% of the reported cases (direct pressure [23% (n = 63)] and tourniquets [3% (n = 8]), other techniques were abandoned in favor of the iTClamp. Conversely, the iTClamp was abandoned in favor of direct pressure 11 times (4.4%) and abandoned in favor of a tourniquet three times (1%).

CONCLUSION: The iTClamp appears to be a fast and reliable device to stop external bleeding. Because of its function and possible applications, it has potential to lessen the gap between and add to the present selection of devices for treatment of external bleeding.

Asian J Neurosurg. 2018 Jul-Sep;13(3):636-639

Prehospital Care in Traumatic Brain Injury: Factors Affecting Patient's Outcome.

Meena U, Gupta A, Sinha V

Background: Traumatic brain injury (TBI) is the leading cause of deaths worldwide. The morbidity and mortality due to TBI are related to both primary as well as secondary insults. The patients who survive from the primary insults, some may still have long-term disabilities. Most of these outcomes are related to the high incidence of prehospital secondary brain insults. Knowledge of these variables and timely management of the disease at the prehospital level can significantly improve the outcome and decrease the mortality.

Aims: The present study is aimed to evaluate the current status of prehospital care, prehospital factors, epidemiological characteristics, and outcome of TBI patients at a Level 1 trauma center. Material and Methods: It is a prospective observational study of 830 cases of TBI, done from November 15, 2015, to March 15, 2016, in the Department of Neurosurgery, Institute of Traumatology, SMS Medical College, Jaipur, Rajasthan, India.

Results: Analysis of data revealed that the incidence of TBI in males is four times higher than females. Most patients are in the age group of 21-30 years (30.24%) followed by 31-40 years (18.55%). Road traffic injury (69.52%) is the most common mode of injury in the age group of 21-30 years followed by injury due to fall (22.77%) which mostly affects the age group of 0-10 years (72.64%) and 61-70 years (38.6%). Analysis of different factors revealed that age is significantly correlated with the outcome having $P = 0.016$. Glasgow Coma Scale, saturation of peripheral oxygen, systolic blood pressure at admission are also significantly correlated with the outcome having $P < 0.001$, $P < 0.001$, and $P < 0.001$, respectively.

Conclusion: It is evident from the study that the factors which affect the outcome of a TBI are influenced by prehospital care, and thus prehospital management of the TBIs can definitely improve the outcomes.

J Trauma Acute Care Surg. 2018 Oct;85(4):691-696

A comparison of resuscitation intensity and critical administration threshold in predicting early mortality among bleeding patients: A multicenter validation in 680 major transfusion patients.

Meyer D, Cotton B, Fox E, Stein D, Holcomb J, Cohen M, Inaba K, Rahbar E; PROPPR Study Group.

BACKGROUND: To address deficiencies associated with the classic definition of massive transfusion (MT), critical administration threshold (CAT) and resuscitation intensity (RI) were developed to better quantify the overall severity of illness and predict the need for transfusions and early mortality. We sought to evaluate these as more appropriate replacements for MT in defining mortality risk in patients undergoing major transfusions.

METHODS: Patients predicted to receive MT at 12 Level I trauma centers were randomized in the Pragmatic, Randomized Optimal Platelet and Plasma Ratios (PROPPR) trial. MT of 10 U or greater red blood cell (RBC) in 24 hours; CAT+, 3 U or greater RBC in the first hour; and RI, total products in the first 30 minutes (1 U RBC, 1 U plasma, 1000 mL crystalloid, 500 mL colloid each valued at 1 U). Resuscitation intensity was evaluated as a continuous variable and dichotomized as RI4+, where RI is 4 U or greater. Each metric was evaluated for its ability to predict mortality at 3 hours, 6 hours, and 24 hours, and at 30 days.

RESULTS: Of the 680 patients, 301 patients met MT definition, 521 were CAT+, and 445 were RI4+. Of those that died, 23% never reached MT threshold, but all were captured by CAT+ and RI4+. The 3-hour (9% vs. 9%), 6-hour (14% vs. 14%), 24-hour (17% vs. 18%), and 30-day mortality rates (28% vs. 29%) were similar between CAT+ and RI4+ patients. When RI was evaluated as a continuous variable, each unit increase was associated with a 20% increase in hemorrhage-related mortality (odds ratio, 1.20; 95% confidence interval, 1.15-1.29; $p < 0.05$).

CONCLUSION: Both RI and CAT are valid surrogates for early mortality in patients undergoing major transfusion, capturing patients omitted by the MT definition. The CAT+ showed the best sensitivity; RI4+ demonstrated better specificity and good positive predictive values and negative predictive values. While CAT+ may be suited for patients receiving an RBC-dominant resuscitation, RI4+ is more comprehensive. RI can also be used as a continuous variable to provide quantitative as well as qualitative risk of death.

LEVEL OF EVIDENCE: Prognostic, level III.

Acta Anaesthesiol Scand. 2018 Sep 19 Epub ahead of print

Oropharyngeal leak pressure of the LMA Protector™ vs the LMA Supreme™; a prospective, randomized, controlled clinical trial.

Moser B, Keller C, Audigé L, Bruppacher H

BACKGROUND: Clinical characteristics such as oropharyngeal leak pressure (OLP) and ventilation peak pressure are important factors for successful use of supraglottic airway devices in general anaesthesia. We hypothesized that the LMA Protector™ compared to the LMA Supreme™ may develop a higher OLP, which could be of clinical significance.

METHODS: Ninety-six patients were randomized to the LMA Protector™ or LMA Supreme™ groups. We measured oropharyngeal leak pressure within 5 minutes after insertion of the supraglottic airway device with a standardized cuff pressure at 60 cm H2 O. Secondary parameters, such as insertion time of the supraglottic airway device, the number of attempts inserting the supraglottic airway device and the gastric tube, volume of gastric contents, and maximum airway pressure, as well as pulse oximetry throughout the operation were measured. Further, blood staining after removal of the supraglottic airway device and postoperative airway morbidity 3 hours after surgery were determined.

RESULTS: The mean difference of oropharyngeal leak pressure was 5.2 (95% CI 2.8-7.6), ie, 30.9 (7.4) cmH2 O for the LMA Protector™ vs 25.6 (4.4) cmH2 O for the LMA Supreme™ ($P < 0.001$; mean(SD)). Similarly, there was a mean difference between OLP and maximal ventilation peak pressure 5.6 (95% CI 3.1-8.2) ie 19.6 (7.7) cmH2 O for the LMA Protector™ vs 14.0 (4.4) cmH2 O for the LMA Supreme™ ($P < 0.001$). No difference was found between the groups for other secondary parameters, as well as postoperative airway morbidity.

CONCLUSION: The LMA Protector™ enabled a higher OLP compared to the LMA Supreme™. This finding may be important for patients requiring a higher peak pressure for sufficient supraglottic airway device ventilation.

J Trauma Acute Care Surg. 2018 Aug;85(2):298-302

The use of ABC score in activation of massive transfusion: The yin and the yang.

Motameni A, Hodge R, McKinley W, Georgel J, Strollo B, Benns M, Miller K, Harbrecht B

BACKGROUND: Hemorrhage is the most common cause of early death in trauma patients. Massive transfusion protocols (MTPs) have been designed to accelerate the release of blood products but can result in waste if activated inappropriately. The Assessment of Blood Consumption (ABC) score has become a widely accepted score for MTP activation. In this study, we compared the use of ABC criteria to physician judgment in MTP activation.

METHODS: Adult trauma patients treated at University of Louisville Trauma Center from January 2016 to December 2016 were studied. Activation via ABC score was assessed retrospectively from emergency department (ED) data. Location, timing of activation, percent of patients using more than 5 units of packed red blood cells, amount of product waste, factors associated with early activation by physicians, and mortality were analyzed.

RESULTS: Three thousand four hundred twenty-one patients were included in this study. Only 33% of the patients who would have had MTP activation based on the ABC criteria used more than 5 units of blood products within 24 hours of admission compared with 65% of the patients in whom clinical judgment was used. Seventy-six percent of all MTP activations from clinical judgment would have been activated by the ABC criteria in the ED. Fifty-five percent of all MTP activations via clinical judgment were activated in the operating room and 41% in the ED. Eighty-one percent of activations that occurred in the operating room by physician judgment could have been activated earlier in the ED if the ABC criteria had been used. However, ABC score can lead to higher potential fresh frozen plasma waste (588 vs. 84 units) compared with physician judgment.

CONCLUSIONS: The ABC criteria overestimate need for massive transfusion and can lead to increased product waste compared with physician judgment, but its use leads to earlier MTP activation. Criteria to trigger MT activation should rely on both clinical acumen and validated prediction tools.

LEVEL OF EVIDENCE: Prognostic, level III.

J Trauma Acute Care Surg. 2018 Sep 19 Epub ahead of print

Tranexamic Acid Administration is Associated With an Increased Risk of Post-Traumatic Venous Thromboembolism.

Myers S, Kutcher M, Rosengart M, Sperry J, Peitzman A, Brown J, Neal M

BACKGROUND: Tranexamic acid (TXA) is used as a hemostatic adjunct for hemorrhage control in the injured patient and reduces early preventable death. But the risk of venous thromboembolism (VTE) has been incompletely explored. Previous studies investigating the effect of TXA on VTE vary in their findings. We performed a propensity matched analysis to investigate the association between TXA and VTE following trauma, hypothesizing that TXA is an independent risk factor for VTE.

METHODS: This retrospective study queried trauma patients presenting to a single level I trauma center from 2012 to 2016. Our primary outcome was composite pulmonary embolism or deep vein thrombosis. Mortality, transfusion, ICU and hospital lengths of stay (LOS) were secondary outcomes. Propensity matched mixed effects multivariate logistic regression was used to determine adjusted odds ratio (aOR) and 95% confidence intervals of TXA on outcomes of interest, adjusting for prespecified confounders. Competing risks regression assessed subdistribution hazard ratio (SHR) of VTE after accounting for mortality.

RESULTS: Out of 21,931 patients, 189 pairs were well matched across propensity score variables (standardized differences <0.2). Median ISS was 19 (IQR 12, 27) and 14 (IQR 8, 22) in TXA and non-TXA groups, respectively (p=0.19). TXA was associated with more than 3-fold increase in the odds of VTE (aOR 3.3; 95%CI 1.3-9.1, p=0.02). TXA was not significantly associated with survival (aOR 0.86; 95%CI 0.23-3.25, p=0.83). Risk of VTE remained elevated in the TXA cohort despite accounting for mortality (SHR 2.42; 95% CI 1.11-5.29, p=0.03).

CONCLUSION: TXA may be an independent risk factor for VTE. Future investigation is needed to identify which patients benefit most from TXA, especially given risks of this intervention, to allow a more individualized treatment approach that maximizes benefits and mitigates potential harms.

LEVEL OF EVIDENCE: Level III; Therapeutic.

J Trauma Acute Care Surg. 2018 Oct 2 Epub ahead of print

Future strategies for remote damage control resuscitation after traumatic hemorrhage.

Naumann D, Khan M, Smith J, Rickard R, Woolley T

ABSTRACTS:
One of the key elements of remote damage control resuscitation (RDCR) is a hemostatic resuscitation strategy to prevent the triad of coagulopathy, acidosis and hypothermia. Transfusion of whole blood has been an effective solution for both military and civilian patients, and appears to be superior to individual component therapy. At first, whole blood seems to be the ideal solution for RDCR, but it has some clinical and logistic drawbacks that may limit its use in the prehospital, battlefield, austere, and remote settings, or during multiple casualty or massive transfusion scenarios. The ideal resuscitation product for RDCR after traumatic hemorrhagic shock would be light-weight, long lasting, easily stored in large quantities, free from refrigeration, carry no risk of blood-borne infection or ABO-incompatibility, and carry out the same physiological functions as blood. Lyophilized plasma appears to fulfil many of these criteria, and is in current clinical use. There have been promising preclinical investigations of haemoglobin-based oxygen carriers (HBOC) and lyophilized platelet preparations, and one HBOC is in clinical use. It seems feasible that in the near future there may be a total blood substitution strategy for RDCR that is priority based, aimed at repaying the oxygen debt, restoration of the endothelium, and mitigation of coagulopathy and inflammatory dysregulation. Further preclinical and clinical research activity may facilitate such a resuscitation strategy that is equivalent-or perhaps even superior-to whole blood, but without any of its drawbacks.

TYPE OF ARTICLE: Current opinion

LEVEL OF EVIDENCE: Not applicable.

World J Surg. 2018 Oct 24 Epub ahead of print

Epidemiology of Trauma Patients from the Mosul Offensive, 2016-2017: Results from a Dedicated Trauma Center in Erbil, Iraqi Kurdistan.

Nerlander M, Haweizy R, Wahab M, Älgå A, von Schreeb J

INTRODUCTION: Most epidemiological studies from conflicts are restricted to either combatants or civilians. It is largely unknown how the epidemiology differs between the two groups. In 2016, an Iraqi-led coalition began retaking Mosul from the terrorist group Islamic State of Iraq and Syria. One key institution that received trauma patients from Mosul was Emergency Management Center (EMC) in Erbil, 90 km away. The aim of this study was to describe the epidemiology, morbidity, and mortality of civilians and combatants admitted during the ongoing conflict.

METHOD: This retrospective cohort study utilized routinely collected data on patients with conflict-related injuries who were admitted to EMC between October 16, 2016, and July 10, 2017. Data processing and analysis was carried out using JMP 13. Categorical variables were compared using Fisher's exact test.

RESULTS: The analysis included 1725 patients, out of which 46% were civilian. Ordnance accounted for most injuries (68%), followed by firearms (18%) and improvised explosive devices (IEDs) (14%). The proportion of IED-related injuries among combatants were almost three times that of civilians. The proportions of abdominal injuries, need for surgery, laparotomies, and amputations were significantly higher among civilians than among combatants. The mortality rate was 0.5%.

DISCUSSION: The fact that civilians had greater surgical needs than combatants may be explained by several factors including a lack of ballistic protection. The extremely low mortality rate indicates significant gaps in prehospital care and transport. Our results may provide useful information to guide medical preparedness and response during future conflicts.

Emerg Med Int. 2018 Jun 10;2018:5649476. doi: 10.1155/2018/5649476. eCollection 2018.

Expert-Performed Endotracheal Intubation-Related Complications in Trauma Patients: Incidence, Possible Risk Factors, and Outcomes in the Prehospital Setting and Emergency Department.

Ono Y, Kakamu T, Kikuchi H, Mori Y, Watanabe Y, Shinohara K

ABSTRACT:
The aim of this study was to determine complication rates and possible risk factors of expert-performed endotracheal intubation (ETI) in patients with trauma, in both the prehospital setting and the emergency department. We also investigated how the occurrence of ETI-related complications affected the survival of trauma patients. This single-center retrospective observational study included all injured patients who underwent anesthesiologist-performed ETI from 2007 to 2017. ETI-related complications were defined as hypoxemia, unrecognized esophageal intubation, regurgitation, cardiac arrest, ETI failure rescued by emergency surgical airway, dental trauma, cuff leak, and mainstem bronchus intubation. Of the 537 patients included, 23.5% experienced at least one complication. Multivariable logistic regression analysis revealed that low Glasgow Coma Scale Score (adjusted odds ratio [AOR], 0.93; 95% confidence interval [CI], 0.88-0.98), elevated heart rate (AOR, 1.01; 95% CI, 1.00-1.02), and three or more ETI attempts (AOR, 15.71; 95% CI, 3.37-73.2) were independent predictors of ETI-related complications. We also found that ETI-related complications decreased the likelihood of survival of trauma patients (AOR, 0.60; 95% CI, 0.38-0.95), independently of age, male sex, Injury Severity Score, Glasgow Coma Scale Score, and off-hours presentation. Our results suggest that airway management in trauma patients carries a very high risk; this finding has implications for the practice of airway management in injured patients.

J Med Case Rep. 2018 Oct 7;12(1):291

Massive hemothorax due to two bleeding sources with minor injury mechanism: a case report.

Ota K, Fumimoto S, Iida R, Kataoka T, Ota K, Taniguchi K, Hanaoka N, Takasu A

BACKGROUND: Massive hemothorax resulting from a minor injury mechanism is considered to be rare particularly when the diaphragm is injured. We report a case of massive hemothorax with bleeding from the intercostal artery and diaphragmatic damage caused by minor blunt trauma.

CASE PRESENTATION: An 83-year-old Japanese man was transported to our hospital 3 hours after falling out of bed. Computed tomography revealed hemothorax and multiple rib fractures. He underwent fluid resuscitation and a tube thoracostomy, but he became hemodynamically unstable. Contrast-enhanced computed tomography revealed worsening hemothorax with contrast extravasation 4 hours after arrival at the hospital. Emergency angiography indicated hemorrhage in the area supplied by the tenth intercostal artery. Trans-catheter arterial embolization stabilized his vital signs for a short period. However, further hemodynamic stabilization required a thoracotomy, which revealed diaphragmatic trauma, which was removed and sutured before fixing his fractured ribs. His postoperative course was uneventful, and he was transferred to another hospital for rehabilitation without complications on hospital day 29.

CONCLUSIONS: Minor mechanisms of blunt trauma can cause rib fractures and massive hemothorax. Traumatic diaphragm injury should be considered a differential diagnosis if hemodynamic instability persists after trans-catheter arterial embolization in patients with lower level rib fractures.

Blood Transfus. 2018 Nov;16(6):490-497

Efficacy of topical tranexamic acid within a blood-saving programme for primary total hip arthroplasty: a pragmatic, open-label randomised study.

Pérez-Jimeno N, Muñoz M, Mateo J, Mayoral A, Herrera A.

BACKGROUND: Total hip arthroplasty entails considerable peri-operative blood loss, which may lead to acute post-operative anaemia and red blood cell transfusion. This study was aimed at assessing whether the addition of topical tranexamic acid to our ongoing blood-saving protocol for total hip arthroplasty was effective and safe.

MATERIALS AND METHODS: A pragmatic, prospective, open-label randomised study of patients scheduled for total hip arthroplasty at a single centre was conducted. Consecutive patients were randomly assigned to receive topical tranexamic acid (2 g) at the end of surgery (tranexamic group, n=125) or not (control group, n=129). A restrictive transfusion protocol was applied. Outcome measures were red blood cell loss at 24 hours after surgery, in-hospital transfusion rate, and incidence of thromboembolic complications.

RESULTS: Topical tranexamic acid was effective in reducing both red cell loss (mean difference: 138 mL [95% CI 87-189 mL]; p<0.001) in the 24h after surgery and in-hospital transfusion rates (12 vs 32.6%, for the tranexamic acid and control groups, respectively; p<0.001; relative risk=0.37 [95% CI 0.22-0.63]). However, relative red cell loss and transfusion rates were higher in females than in males, irrespectively of tranexamic acid use. The beneficial effect of tranexamic acid on transfusion was restricted to patients with pre-operative haemoglobin ≥13 g/dL (5.1 vs 24.8%; p<0.001). Topical tranexamic acid was well tolerated and no clinically apparent thromboembolic complications were witnessed.

DISCUSSION: The use of topical tranexamic acid after hip arthroplasty reduced red cell loss and transfusion rates; the efficacy of this strategy may be improved by reinforcing both pre-operative haemoglobin optimization and adherence to the practice of transfusing single units of red cells.

J Crit Care. 2018 Dec;48:243-250

Factors associated with the progression of conservatively managed acute traumatic subdural hemorrhage.

Powers A, Pinto M, Aldridge A, Tang O, Chen J, Berube R, Doberstein C, Fox J, Carnevale J, Asaad W

PURPOSE: Traumatic subdural hemorrhage (SDH) is associated with high mortality, yet many patients are not managed surgically. We sought to understand what factors might be associated with SDH enlargement to contribute to the triage of these conservatively managed patients.

MATERIALS AND METHODS: A consecutive series of 117 patients admitted to our institution's level 1 trauma center for SDH between January 1, 2010 and December 31, 2010 were evaluated. Volumetric measurement of SDHs was performed on initial and follow-up head computed tomography (CT) scans with recording of initial midline shift and classification by location. Multimodel analysis quantified associations with change in SDH volume.

RESULTS: Systolic blood pressure, presence of subarachnoid hemorrhage, and initial SDH volume demonstrated positive associations with change in SDH volume, while initial midline shift and transfusion of platelets demonstrated negative associations. Initial convexity SDH volume demonstrated positive association with change in convexity SDH volume, while initial midline shift and transfusion of platelets demonstrated negative associations. Anticoagulant/antiplatelet use demonstrated positive association with change in tentorial SDH volume, while time between CT scans demonstrated negative association.

CONCLUSIONS: Platelet transfusion, anticoagulation, and hypertension have significant associations with expansion in non-surgical cases of SDH. Monitoring these factors may assist triaging these patients.

In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2018-. 2018 Oct 27.

EMS, Tactical Combat Casualty Care.

Puryear B, Knight C.

ABSTRACT:
Tactical combat casualty care (TCCC or TC3) is the accepted battlefield prehospital standard of care. TCCC was reviewed and approved by the Committee on Tactical Combat Casualty Care (CoTCCC) which was established by the US Special Operations Command in 2002. Now, the CoTCCC operates under the Department of Defense (DoD) Joint Trauma System (JTS). The committee is formed by physicians, providers, and medical technicians across branches of the United States Army, Navy, Air Force, Marines, and Coast Guard and has 42 voting members. TCCC originated as a Naval Special Warfare biomedical research project in the early 1990s and was first published as a Military Medicine supplement in 1996. This research was stimulated by evidence showing that tactical medicine environment and care differed substantially from typical prehospital medicine, that 90% of all combat deaths occur prior to reaching a treatment facility, and that extremity hemorrhage was a major cause of combat death. This places the wounded combatant, unit medic, or fellow soldier in the primary role of life-sustaining care. Early and effective use of the tourniquet substantially improved outcomes through evaluation from 1993 to 1996; because of this, TCCC was formed and implemented, initially in small unit group tactics and eventually becoming the basis for trauma care in the battlefield setting. Currently, TCC is a DoD course that is offered by National Association of Emergency Medical Technicians (NAEMT) in either a 2-day course for medical personnel or a 1-day course for all combatants. NAEMT also offers Tactical Emergency Casualty Care (TECC) for civilian emergency medical services (EMS).[1]

Indian J Nephrol. 2018 Sep-Oct;28(5):351-357

Efficacy and Cost Comparison of Ertapenem as Outpatient Parenteral Antimicrobial Therapy in Acute Pyelonephritis due to Extended-spectrum Beta-lactamase-producing Enterobacteriaceae.

Ramasubramanian V, Murlidharan P, Nambi S, Pavithra S, Puthran S, Petigara T

ABSTRACT:
Outpatient parenteral antimicrobial therapy (OPAT) programs are becoming an increasingly popular trend in clinical practice as they offer several benefits to both patients and health-care setups. While OPAT is an established clinical practice in the Western world, the concept itself is alien to patients in India as they prefer the security of hospitals to receive antibiotics over OPAT. We evaluated the clinical response and cost comparison of ertapenem under OPAT versus inpatient settings in patients with extended-spectrum beta-lactamase (ESBL)-positive acute pyelonephritis (APN) given the increasing importance of optimizing both hospital beds and overall cost of patient care in India. APN was chosen as the indication to be studied as it is one of the common complicated urinary tract infections treated in our OPAT unit requiring 10-14 days of parenteral therapy with an agent active against various Gram-negative bacilli and multidrug-resistant organisms. One hundred patients were retrospectively studied based on whether antibiotics were administered during hospital stay alone (hospital only), during both hospital stay, and also as OPAT post discharge (hospital/OPAT) or as OPAT alone (OPAT only). Response to ertapenem and cost of treatment in inpatient versus OPAT settings were compared using Pearson's Chi-square or Fisher's exact test for categorical variables. ANOVA (or Kruskal-Wallis) was used for continuous variables. Baseline urine cultures were ESBL positive with 98% prevalence of Gram-negative bacilli (GNB). Colony counts were ≥100,000 in 74% patients. Only ertapenem, imipenem, and meropenem showed 100% sensitivity to ESBL-positive GNB in baseline urine culture and sensitivity reports. Ertapenem showed 100% sensitivity and complete clinical resolution for 96% patients with APN due to ESBL Enterobacteriaceae. It was administered as OPAT in 90% patients and significantly reduced overall treatment costs.

Mil Med. 2018 Sep 1;183(suppl_2):101-104

Wartime Vascular Injury.

Rasmussen T, Stockinger Z, Antevil J, White C, Fernandez N, White J, White P

ABSTRACT:
Wartime vascular injury can be particularly challenging due to the complexity of the case, concomitant injuries, resource limitations, and often lack of expertise of the operating surgeon. The proliferation of vascular shunting has been of particular importance as a damage control surgery technique to restore perfusion and temporize the immediate need for definitive repair necessary for limb salvage, particularly in austere locations. Diagnosis of vascular injury can be made using a variety of techniques, from physical examination to ankle-brachial indices to the use of CT angiography or invasive angiographic techniques. Operative planning and judgment are therefore critical in deciding both how and whether to operate. Surgeons likely to deploy should take every opportunity to practice vascular exposures and techniques through clinical practice and laboratory courses.

J Trauma Acute Care Surg. 2018 Nov;85(5):899-906

Hidden burden of venous thromboembolism after trauma: A national analysis.

Rattan R, Parreco J, Eidelson S, Gold J, Dharmaraja A, Zakrison T, Dante Yeh D, Ginzburg E, Namias N

BACKGROUND: Trauma patients are at increased risk for venous thromboembolism (VTE). One in four trauma readmissions occur at a different hospital. There are no national studies measuring readmissions to different hospitals with VTE after trauma. Thus, the true national burden in trauma patients readmitted with VTE is unknown and can provide a benchmark to improve quality of care.

METHODS: The Nationwide Readmission Database (2010-2014) was queried for patients ≥18 years non-electively admitted for trauma. Patients with VTE or inferior vena cava filter placement on index admission were excluded. Outcomes included 30-day and 1-year readmission to both index and different hospitals with a new diagnosis of VTE. Multivariable logistic regression identified risk factors. Results were weighted for national estimates.

RESULTS: Of the 5,151,617 patients admitted for trauma, 1.2% (n = 61,800) were readmitted within 1 year with VTE. Of those, 29.6% (n = 18,296) were readmitted to a different hospital. Risk factors for readmission to a different hospital included index admission to a for-profit hospital (OR 1.33 [1.27-1.40], $p < 0.001$), skull fracture (OR 1.20 [1.08-1.35], $p < 0.001$), Medicaid (OR 1.16 [1.06-1.26], $p < 0.001$), hospitalization >7 days (OR 1.12 [1.07-1.18], $p < 0.001$), and the lowest quartile of median household income for patient ZIP code (OR 1.13 [1.07-1.19], $p < 0.01$). The yearly cost of 1-year readmission for VTE was $256.9 million, with $90.4 million (35.2%) as a result of different hospital readmission.

CONCLUSIONS: Previously unreported, over one in three patients readmitted with VTE a year after hospitalization for trauma, accounting for over a third of the cost, present to another hospital and are not captured by current metrics. Risk factors are unique. This has significant implications for benchmarking, outcomes, prevention, and policy.

LEVEL OF EVIDENCE: Epidemiological study, level II.

J Spec Oper Med. Fall 2018;18(3):57-61.

Implementation and Evaluation of a First-Responder Bleeding-Control Training Program in a Rural Police Department.

Reed J, Carman M, Titch F, Kotwal R

BACKGROUND: In the prehospital environment, nonmedical first responders are often the first to arrive on the scene of a traumatic event and must be prepared to provide initial care at the point of injury. In civilian communities, these nonmedical first responders often include law enforcement officers. Hemorrhage is a major cause of death in trauma, and many of these deaths occur in the prehospital environment; therefore, prehospital training efforts should be directed accordingly toward bleeding control.

METHODS: A bleeding control training program was implemented and evaluated in a rural police department in Pinehurst, North Carolina, from February to April 2017. A repeated measures observational study was conducted to evaluate the training program. Measured were self-efficacy (pre- and post-test), knowledge (pretest, post-test 1 [immediate], post-test 2 [at 4 weeks]), and limb-tourniquet application time (classroom, simulation exercise).

RESULTS: The study population was composed of 28 police officers (92.9% male) whose median age was 37 (interquartile range, 22-55) years. Mean self-efficacy scores, equating to user confidence and the decision to intervene, increased from pre- to post-training (34.54 [standard deviation (SD) 4.16] versus 35.62 [SD 4.17]; p = .042). In addition, mean knowledge test scores increased from pre- to immediately post-training (75.00 [SD 16.94] versus 85.83 [SD 11.00]; p = .006), as well as from preto 4 weeks post-training (75.00 [SD 16.94] versus 84.17 [SD 11.77]; p = .018). Lower limb-tourniquet application times were more rapid in the classroom than during the simulation exercise (23.06 seconds [SD 7.68] versus 31.91 seconds [SD 9.81]; p = .005).

CONCLUSION: First-responder bleeding-control programs should be initiated and integrated at the local level throughout the Nation. Implementation and sustainment of such programs in police departments can save lives and enhance existing law enforcement efforts to protect and serve communities.

Clin Exp Emerg Med. 2018 Sep;5(3):208-209

Deformation of a humeral intraosseous catheter due to positioning for thoracostomy.

Reid C, Fogg T, Healy G

Quote:
"An adult victim of a motor vehicle collision was treated by a helicopter emergency medical service
team. Major head and thoracic injuries were managed by on scene rapid sequence intubation and open thoracostomy. A 45-mm 15-gauge humeral intraosseous needle (EZ-IO; Vidacare Corporation, Shavano Park, TX, USA) was used for vascular access prior to other procedural interventions.

The intraosseous catheter was removed in the emergency department using the standard manufacturer recommended technique by trauma team staff following establishment of further definitive venous access. There were no difficulties in removing it and it appeared to have been functioning effectively.

Following removal the intraosseous catheter was noted to be deformed (Fig. 1)."

"What is already known
Proximal humeral intraosseous access can be used in trauma prior to establishment of venous access. Dislodgement of these lines has been previously described secondary to shoulder abduction.

What is new in the current study
Deformation of a humeral intraosseous needle occurred in a trauma patient who had undergone ipsilateral thoracostomy. This is likely due to shoulder abduction and external rotation. Clinicians should be careful when positioning trauma patients with humeral intraosseous needles due to the risk of both dislodgement and deformation."

J Spec Oper Med. Summer 2018;18(2):58-62.

Old Tricks for New Dogs? John Caddy and the Victorian Origins of TCCC.

Reynolds P

ABSTRACT:
The success of Tactical Combat Casualty Care (TCCC) in reducing potentially preventable combat deaths may rely on both specific interventions (such as tourniquets) and the systematized application of immediate care. Essential elements of a combat care system include clear specification of immediate care priorities, standardized methodology, and inclusion and training of all nonmedical personnel in early response. Although TCCC is fairly recent, the construct is similar to that first suggested during the mid-nineteenth century by John Turner Caddy (1822-1902), a British Royal Navy staff surgeon. Although naval warfare engagements at the time were relatively infrequent, casualties could be numerous and severe and often overwhelmed the small medical staff on board. Caddy recognized that nonmedical personnel properly trained in the fundamentals of combat injury management would result in lives saved and greatly improved morale. The novelty was in his attempt to make procedures simple enough to be performed by nonmedical personnel under stress. However, Caddy's guidelines were completely overlooked for nearly two centuries. The principles of best practice for managing combat trauma injuries learned in previous wars have often been lost between conflicts. Understanding the historical roots of combat first responder care may enable us to better understand and overcome barriers to recognition and retention of essential knowledge.

J Trauma Acute Care Surg. 2018 Nov;85(5):894-898

No wire? No problem: Resuscitative endovascular balloon occlusion of the aorta can be performed effectively and more rapidly with a wire-free device.

Romagnoli A, Teeter W, Wasicek P, Gamble WB, Hu P, Stein D, Scalea T, Brenner M

BACKGROUND: A wire-free device is available for resuscitative endovascular balloon occlusion of the aorta (REBOA) providing aortic occlusion (AO) without lengthy platform guide-wires and large sheaths.

METHODS: This was a retrospective, single-institution review of patients who received REBOA from May 2014 to September 2017. Timing of procedural steps was measured in seconds using time-stamped videography.

RESULTS: Seventy-four patients received REBOA: 29 with a platform guidewire, 12-Fr sheath, and balloon catheter (W group), and 45 with a 7-Fr sheath and wire-free device (WF group). Mean age ($p = 0.22$) and ISS ($p = 0.80$) were similar between groups. Fifty-nine patients received REBOA at Zone 1, 15 patients at Zone 3. There was no difference in median [interquartile range] time to common femoral artery (CFA) access between the WF (194 [98-313] seconds) and W (193 [126-280] seconds) groups ($p = 0.96$). Both median time to AO after CFA access (WF, 158 [109-264] seconds vs. W, 307 [222-390] seconds, $p < 0.001$) and median total procedural time (WF, 366 [263-596] seconds vs. W, 511 [441-597] seconds; $p = 0.012$) were significantly shorter with the wire-free system. The rates of percutaneous versus open CFA access was not different between groups ($p = 0.48$). Both groups had a similar physiologic response to AO as measured by pre- and post-AO SBP ($p = 0.86$). Overall mortality rate was 74%, 90% in the W group, and 64% in the WF group ($p = 0.027$). The procedure-related complication rate was not significantly different between groups with regard to compartment syndrome (W, 3% vs. WF, 4%, $p = 1.0$), access-related complications (W, 0 vs. WF, 6%, $p = 0.28$), or systemic complication (W, 0 vs. WF, 9%, $p = 0.15$).

CONCLUSION: Once CFA access is obtained, AO with a smaller wire-free device reduces procedural time by approximately 50%. When perfusion to proximal organs is essential, the seconds saved to achieve AO may contribute to improved mortality. Time to obtain CFA access is not dependent on introducer sheath size.

LEVEL OF EVIDENCE: Therapeutic, level V.

Front Neurol. 2018 Apr 10;9:194

Prehospital Intubation and Outcome in Traumatic Brain Injury-Assessing Intervention Efficacy in a Modern Trauma Cohort.

Rubenson Wahlin R, Nelson D, Bellander B, Svensson M, Helmy A, Thelin E

Background: Prehospital intubation in traumatic brain injury (TBI) focuses on limiting the effects of secondary insults such as hypoxia, but no indisputable evidence has been presented that it is beneficial for outcome. The aim of this study was to explore the characteristics of patients who undergo prehospital intubation and, in turn, if these parameters affect outcome.

Material and methods: Patients ≥15 years admitted to the Department of Neurosurgery, Stockholm, Sweden with TBI from 2008 through 2014 were included. Data were extracted from prehospital and hospital charts, including prospectively collected Glasgow Outcome Score (GOS) after 12 months. Univariate and multivariable logistic regression models were employed to examine parameters independently correlated to prehospital intubation and outcome.

Results: A total of 458 patients were included (n = 178 unconscious, among them, n = 61 intubated). Multivariable analyses indicated that high energy trauma, prehospital hypotension, pupil unresponsiveness, mode of transportation, and distance to the hospital were independently correlated with intubation, and among them, only pupil responsiveness was independently associated with outcome. Prehospital intubation did not add independent information in a step-up model versus GOS ($p = 0.154$). Prehospital reports revealed that hypoxia was not the primary cause of prehospital intubation, and that the procedure did not improve oxygen saturation during transport, while an increasing distance from the hospital increased the intubation frequency.

Conclusion: In this modern trauma cohort, prehospital intubation was not independently associated with outcome; however, hypoxia was not a common reason for prehospital intubation. Prospective trials to assess efficacy of prehospital airway intubation will be difficult due to logistical and ethical considerations.

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 the operators 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.

Anaesthesiol Intensive Ther. 2018;50(4):259-262

Analysing the efficacy of the I-gel supraglottic airway device in the supine and lateral decubitus positions.

Saracoglu K, Demir A, Pehlivan G, Saracoglu A, Eti Z

BACKGROUND: The advantages of the I-gel supraglottic airway device include ease and speed of insertion, reduced trauma incidence, an integral bite block, gastric access, a non-inflatable cuff and superior seal pressure. The primary goal of this study was to compare airway leak pressures and the fibreoptic view in the supine and lateral positions. Our secondary aim was to analyse the effects of I-gel insertion on haemodynamic parameters.

METHODS: One hundred patients undergoing saturation biopsy due to prostatic hyperplasia were recruited to this prospective randomised study. An I-gel device was inserted in the supine position. Taking of measurements, patients were placed in the lateral decubitus position. Mean arterial pressure, heart rate, peripheral O_2 saturation and end-tidal CO_2 were recorded before and after insertion. Also recorded were the number of attempts and insertion time for the I-gel device. Oropharyngeal leak pressures and I-gel device positioning were scored in the lateral decubitus and supine positions.

RESULTS: It was possible to insert the I-gel device in 88 patients on the first attempt. The median time for insertion was 7.97 ± 2.18 sec. The mean arterial pressure and heart rate decreased 1 and 2 min after insertion. Oropharyngeal leak pressure was similar in the supine (27.45 ± 5.37 mm Hg) and lateral decubitus positions (26.04 ± 4.92 mm Hg) ($P > 0.05$). On fibreoptic examination through the I-gel device, the scores of patients were comparable in different positions ($P = 0.542$).

CONCLUSION: As there was no significant difference in oropharyngeal leak pressure and fibreoptic view, we concluded that the I-gel device may be used safely in both the supine and lateral positions.

Mil Med. 2018 Oct 6 Epub ahead of print

Prehospital Resuscitation Performed on Hypotensive Trauma Patients in Afghanistan: The Prehospital Trauma Registry Experience.

Schauer S, Naylor J, April M, Fisher A, Cunningham C, Fernandez J, Shreve B, Bebarta V

Introduction: Hemorrhage is the leading cause of potentially preventable death on the battlefield. Hypotension in the setting of trauma portends a higher rate of mortality. We describe the interventions for trauma-related hypotension performed in the prehospital combat setting in accordance with Tactical Combat Casualty Care (TCCC) guidelines.

Materials and Methods: We searched the Prehospital Trauma Registry for casualties from January 2013 to September 2014. Within that group, we searched for all casualties with documented hypotension by either measured systolic blood pressure ≤90 mmHg or a weak or absent radial pulse documented by the prehospital provider. We used descriptive statistics to analyze the interventions performed in our study sample.

Results: Of the 705 casualties available for query, 134 (19.0%) casualties with documented hypotension met inclusion criteria. Most casualties with hypotension had an alert mental status (70.1%), had a medical officer in their chain of care (59.0%), were Afghan (64.2%), and evacuated on an urgent status (78.4%). Explosives were the most frequent mechanism of injury (50.7%). There were 42 fluid administrations documented on 33 (24.6%) casualties. The most common fluid administered was normal saline (52.4%) followed by hetastarch solution (33.3%). There was one documented use of a fluid warmer in this cohort. One subject received four units of packed red blood cells. No other casualties had documented blood product administration. There were no documented administrations of PlasmaLyte. There were four casualties that received lactated Ringer's.

Conclusion: Most casualties with documented hypotension after trauma in the Prehospital Trauma Registry did not receive prehospital blood or fluid intervention. Of the interventions performed, most did not match with contemporary TCCC guidelines.

J Trauma Acute Care Surg. 2018 Sep;85(3):476-484

Can acute care surgeons perform while fatigued? An EAST multicenter study.

Schuster K, Hazelton J, Rattigan D, Nguyen L, Kim D, Spence L, Turay D, Luo-Owen X, Perez J, Dayal S, Blatt M, Hill C, Bhattacharya B

BACKGROUND: Fatigued surgeon performance has only been assessed in simulated sessions or retrospectively after a night on call. We hypothesized that objectively assessed fatigue of acute care surgeons affects patient outcome.

METHODS: Five acute care surgery services prospectively identified emergency cases over 27 months. Emergency cases were defined by the surgeon identifying the patient as requiring immediate operation upon consultation or admission. Within 48 hours, surgeons reported sleep time accumulated before operation, if nonclinical delays to operation occurred, and patient volume during the shift. To maximize differences, fatigued surgeons were defined as performing a case after midnight without having slept in the prior 18 hours. Rested surgeons performed cases at or before 8 PM or after at least 3 hours of sleep before operation. A four-level ordinal scale was used to assign case complexity. Hierarchical logistic regression models were constructed to assess the impact of fatigue on mortality and major morbidity while controlling for center and patient level factors.

RESULTS: Of 882 cases collected, 611 met criteria for fatigue or rested. Of these cases, 370 were performed at night and 182 by a fatigued surgeon. Rested surgeons were more likely to be operating on an older or female patient; other characteristics were similar. Mortality and major morbidity were similar between fatigued and rested surgeons (12.1% vs 12.1% and 46.9% vs 48.9%), respectively. After controlling for center and patient factors, surgeon fatigue did not affect mortality or major morbidity. Mortality variance was 6.30% and morbidity variance was 7.02% among centers.

CONCLUSION: Acute care surgeons have similar outcomes in a fatigued or rested state. Work schedules for acute care surgeons should not be adjusted to shifts less than 24 hours for the sole purpose of improving patient outcomes.

LEVEL OF EVIDENCE: Prognostic study, level IV.

Transfusion. 2018 Aug;58(8):1838-1845

Clinical outcomes among low-titer group O whole blood recipients compared to recipients of conventional components in civilian trauma resuscitation.

Seheult J, Anto V, Alarcon L, Sperry J, Triulzi D, Yazer M

BACKGROUND: The serological safety of transfusing ≤4 units of low titer group O whole blood (LTOWB) in civilian trauma patients has been demonstrated. This study investigated clinical outcomes of LTOWB recipients compared to patients who received only conventional blood components during their resuscitation.

STUDY DESIGN AND METHODS: A retrospective analysis of trauma patients' medical records who received LTOWB during the first 24 hours of their admission was performed. Using a 12-parameter propensity matching strategy, LTOWB recipients were matched to other patients who received at least one red blood cell (RBC) unit during their first 24 hours of admission but not LTOWB. The primary outcomes were mortality and blood use.

RESULTS: A total of 135 patients who received LTOWB (median 2 units) were matched to 135 patients who received conventional components. There were no significant differences in the matching parameters between the groups. There were no significant differences in outcomes between the conventional component and LTOWB groups: median (interquartile range) in-hospital mortality, 24.4% vs. 18.5% (respectively, p = 0.24); 24-hour mortality, 12.6% vs. 8.9% (respectively, p = 0.33). The hospital and intensive care unit lengths of stay were not significantly different between groups. The median number of RBC units transfused, including the contribution from the LTOWB, was not significantly different between the groups. The time to normalization of elevated plasma lactate levels tended to be shorter among the LTOWB recipients compared to the conventional component recipients (median 8.1 [3.7-15.4] hr vs. 13.2 [4.4-26.8] hr, respectively, p = 0.05).

CONCLUSION: The LTOWB recipients had similar clinical outcomes compared to recipients of conventional component therapy.

J Trauma Acute Care Surg. 2018 Dec;85(6):1055-1062

Whole blood mitigates the acute coagulopathy of trauma and avoids the coagulopathy of crystalloid resuscitation.

Sheppard F, Schaub L, Cap A, Macko A, Moore H, Moore E, Glaser C

INTRODUCTION: The contributions of type and timing of fluid resuscitation to coagulopathy in trauma remain controversial. As part of a multifunctional resuscitation fluid research effort, we sought to further characterize the coagulation responses to resuscitation, specifically as compared to whole blood. We hypothesized that early whole blood administration mitigates the acute coagulopathy of trauma by avoiding the coagulopathy of CR resuscitation.

METHODS: Anesthetized rhesus macaques underwent polytraumatic, hemorrhagic shock, then a crossover study design resuscitation (n = 6 each) with either whole blood first (WB-1st) followed by crystalloid (CR); or CR-1st followed by WB. Resuscitation strategies were the following: WB-1st received 50% shed blood in 30minutes, followed by twice the shed blood volume (SBV) of CR over 30minutes and one times the SBV CR over 60minutes, where CR-1st received twice the SBV of CR over 30minutes, followed by 50% of shed blood in 30minutes, and one times the SBV CR over 60minutes. Blood samples were collected at baseline, end-of-shock, end-of-first and end-of-second resuscitation stages, and end-of-resuscitation for assessment (thromboelastometry, platelet aggregation, and plasmatic coagulation factors). Statistical analyses were conducted using two-way analysis of variance ANOVA with Bonferroni correction and t-tests; significance was at $p < 0.05$.

RESULTS: Survival**,** blood loss, hemodynamics, and shock duration were equivalent between the groups. Compared to baseline, parameters measured at first and second resuscitation stage time points directly following CR infusion revealed abnormalities in thromboelastometry (clot formation time, α angle, and maximum clot firmness), platelet aggregation response (to collagen, arachidonic acid, and adenosine diphosphate), and plasmatic coagulation (prothrombin time, anti-thrombin 3, and fibrinogen), while whole blood infusion resulted in stabilization or correction of these parameters following its administration.

CONCLUSIONS: These data suggest that in the setting of trauma and hemorrhagic shock, the coagulation alterations begin before intervention/resuscitation; however, these are significantly aggravated by CR resuscitation and could perhaps be best termed acute coagulopathy of resuscitation.

STUDY TYPE: Translational animal model.

J Am Acad Dermatol. 2018 Jun 16 Epub ahead of print

The Use of QuikClot Combat Gauze During Mohs Stages for Intra-Operative Hemostasis.

Shiu V, Keller R

Quote:
"The Use of QuikClot Combat Gauze During Mohs Stages for Intra-Operative Hemostasis designed to be left in the wound, should not be included in the final dressing, and should be removed with forceps prior to closure. The cost, on average, is about $0.22 per Mohs surgery case. We have seen no side effects or adverse events while using this product. We have found QuikClot to be a cost-effective and useful adjunct to control bleeding intra-operatively during Mohs stages."

J Trauma Acute Care Surg. 2018 Sep;85(3):512-518

Lower extremity cooling reduces ischemia-reperfusion injury following Zone 3 REBOA in a porcine hemorrhage model.

Simon M, Tibbits E, Hoareau G, Davidson A, DeSoucy E, Faulconer E, Grayson J, Neff L, Johnson M, Williams T

BACKGROUND: New strategies to mitigate ischemia during REBOA and to prolong its maximal duration are needed. We hypothesized that simple external cooling of the hind limbs would decrease ischemia-reperfusion injury following prolonged Zone 3 REBOA.

METHODS: Twelve swine were anesthetized, instrumented, splenectomized, and then underwent 15% total blood volume hemorrhage. Animals were randomized to hypothermia or control followed by 4 hours of Zone 3 REBOA, resuscitation with shed blood, and 3 hours of critical care. Physiologic parameters were continuously recorded, and laboratory specimens were obtained at regular intervals. Baseline and end-of-study muscle biopsies were obtained for histologic analysis.

RESULTS: There were no significant differences between groups at baseline or after hemorrhage. Maximum creatine kinase was significantly lower in the hypothermia group compared with the normothermia group (median [interquartile range] = 3,445 U/mL [3,380-4,402 U/mL] vs. 22,544 U/mL [17,030-24,981 U/mL]; $p < 0.01$). Maximum serum myoglobin was also significantly lower in the hypothermia group (1,792 ng/mL [1,250-3,668 ng/mL] vs. 21,186 ng/mL [14,181-24,779 ng/mL]; $p < 0.01$). Fascial compartment pressures were significantly lower during critical care in the hypothermia group ($p = 0.03$). No histologic differences were observed in hind limb skeletal muscle.

CONCLUSIONS: External cooling during prolonged Zone 3 REBOA decreased ischemic muscle injury and resulted in lower compartment pressures following reperfusion. Hypothermia may be a viable option to extend the tolerable duration of Zone 3 occlusion, beyond what is currently achievable. Future survival studies are required to assess functional outcomes.

Plast Reconstr Surg Glob Open. 2018 Jun 19;6(6):e1846

Efficacy and Safety of Intravenous Meloxicam in Subjects with Moderate-to-severe Pain Following Abdominoplasty.

Singla N, Bindewald M Singla S, Leiman D, Minkowitz H, McCallum S, Mack R, Keller R, Freyer A, Du W

Background: A nanocrystal intravenous (IV) formulation of meloxicam is being studied with the aim of providing postoperative analgesia.

Methods: This randomized, multicenter, double-blind, placebo-controlled trial evaluated meloxicam IV 30 mg or placebo (≤ 3 doses) in 219 subjects undergoing abdominoplasty. The primary endpoint was the summed pain intensity difference over 24 hours postdose (SPID24).

Results: Meloxicam IV-treated subjects had a statistically significant reduction in the least squares mean of SPID24 compared with placebo-treated subjects (-4,262.1 versus -3,535.7; P = 0.0145). Meloxicam IV was associated with statistically significant differences over placebo on several other secondary endpoints, including other SPID intervals (ie, SPID12, SPID48, and SPID24-48), achievement of perceptible pain relief, the proportion of subjects with a ≥ 30% improvement in the first 24 hours, and Patient Global Assessment of pain at hour 48. Meloxicam IV was also associated with a reduction in the number of subjects receiving opioid rescue medication during hours 24-48 and the total number of doses of opioid rescue analgesia. Meloxicam IV was generally well tolerated, with the numbers and frequencies of adverse events similar to that of the placebo group. There was no evidence of an increased risk of adverse events commonly associated with nonsteroidal anti-inflammatory drugs including bleeding, thrombotic, cardiovascular, renal, hepatic, cardiovascular, injection site, and wound healing events.

Conclusion: Meloxicam IV provided sustained pain relief and generally was well tolerated in subjects with moderate-to-severe pain following abdominoplasty.

J Trauma Acute Care Surg. 2018 Oct 23. Epub ahead of print

Pre-hospital tourniquet use in penetrating extremity trauma: decreased blood transfusions and limb complications.

Smith A, Ochoa J, Wong S, Beatty S, Elder J, Guidry C, McGrew P, McGinness C, Duchesne J, Schroll R

BACKGROUND: Despite increasing popularity of pre-hospital tourniquet use in civilians, few studies have evaluated the efficacy and safety of tourniquet use. Furthermore, previous studies in civilian populations have focused on blunt trauma patients. The objective of this study was to determine if pre-hospital tourniquet use in patients with major penetrating trauma is associated with differences in outcomes compared to a matched control group.

METHODS: An eight-year retrospective analysis of adult patients with penetrating major extremity trauma amenable to tourniquet use (major vascular trauma, traumatic amputation and near-amputation) was performed at a level I trauma center. Patients with pre-hospital tourniquet placement (TQ) were identified and compared to a matched group of patients without tourniquets (N-TQ). Univariate analysis was used to compare outcomes in the groups.

RESULTS: A total of 204 patients were matched with 127 (62.3%) in the pre-hospital TQ group. No differences in patient demographics or injury severity existed between the two groups. Average time from tourniquet application to arrival in the ED was 22.5+1.3 minutes. Patients in the TQ group had higher average SBP on arrival in the ED (120+2 vs. 112+2, p=0.003). TQ group required less total PRBCs (2.0+0.1 vs. 9.3+0.6, p<0.001) and FFP (1.4+0.08 vs. 6.2+0.4, p<0.001). Tourniquets were not associated with nerve palsy (p=0.330) or secondary infection (p=0.43). Fasciotomy was significantly higher in the N-TQ group (12.6% vs. 31.4%, p<0.0001) as was limb amputation (0.8% vs. 9.1%, p=0.005).

CONCLUSIONS: This study demonstrated that pre-hospital tourniquets could be safely used to control bleeding in major extremity penetrating trauma with no increased risk of major complications. Pre-hospital tourniquet use was also associated with increased SBP on arrival to the ED, decreased blood product utilization and decreased incidence of limb related complications, which may lead to improved long-term outcomes and increased survival in trauma patients. IV, study type: therapeutic.

Mil Med. 2018 Sep 1;183(suppl_2):147-152

Hyperkalemia and Dialysis in the Deployed Setting.

Stewart I, Bolanos J, Little D, Chung K, Sosnov J, Miller N, Poirier M, Saenz K, McAlister V, Moghadam S, Kao R, Stockinger Z.

ABSTRACT:
Acute kidney injury is a recognized complication of combat trauma. The complications associated with acute kidney injury, such as life-threatening hyperkalemia, are usually delayed in onset. In the recent conflicts, rapid evacuation of U.S. and coalition personnel generally resulted in these complications occurring at higher echelons of care where renal replacement therapies were available. In the future however, deployed providers may not have this luxury and should be prepared to temporize patients while they await transport. In this clinical practice guideline, recommendations are made for the management of patients with, or at risk for, acute kidney injury and hyperkalemia in the austere, deployed environment.

Ann Emerg Med. 2018 Oct;72(4):333-341

A Multicenter Program to Implement the Canadian C-Spine Rule by Emergency Department Triage Nurses.

Stiell I, Clement C, Lowe M, Sheehan C, Miller J, Armstrong S, Bailey B, Posselwhite K, Langlais J, Ruddy K, Thorne S, Armstrong A, Dain C, Perry J, Vaillancourt C

STUDY OBJECTIVE: The Canadian C-Spine Rule has been widely applied by emergency physicians to safely reduce use of cervical spine imaging. Our objective is to evaluate the clinical effect and safety of real-time Canadian C-Spine Rule implementation by emergency department (ED) triage nurses to remove cervical spine immobilization.

METHODS: We conducted this multicenter, 2-phase, prospective cohort program at 9 hospital EDs and included alert trauma patients presenting with neck pain or with cervical spine immobilization. During phase 1, ED nurses were trained and then had to demonstrate competence before being certified. During phase 2, certified nurses were empowered by a medical directive to "clear" the cervical spine of patients, allowing them to remove cervical spine immobilization and to triage to a less acute area. The primary outcomes were clinical effect (cervical spine clearance by nurses) and safety (missed clinically important cervical spine injuries).

RESULTS: In phase 1, 312 nurses evaluated 3,098 patients. In phase 2, 180 certified nurses enrolled 1,408 patients (mean age 43.1 years, women 52.3%, collision 56.5%, and cervical spine injury 1.1%). In phase 2 and for the 806 immobilized ambulance patients, the primary outcome of immobilization removal by nurses was 41.1% compared with 0% before the program. The primary safety outcome of cervical spine injuries missed by nurses was 0. Time to discharge was reduced by 26.0% (3.4 versus 4.6 hours) for patients who had immobilization removed. In only 1.3% of cases did nurses indicate their discomfort with applying the Canadian C-Spine Rule.

CONCLUSION: We clearly demonstrated that ED triage nurses can successfully implement the Canadian C-Spine Rule, leading to more rapid and comfortable management of patients without any threat to patient safety. Widespread adoption of this approach should improve care and comfort for trauma patients, and could decrease length of stay in our very crowded EDs.

Asian Spine J. 2018 Oct 24 Epub ahead of print

A Randomized Controlled Trial of Topical Application of Tranexamic Acid in Patients with Thoracolumbar Spine Trauma Undergoing Long-Segment Instrumented Posterior Spinal Fusion.

Sudprasert W, Tanaviriyachai T, Choovongkomol K, Jongkittanakul S, Piyapromdee U

Study Design: Prospective, randomized controlled trial.

Purpose: To evaluate the effect of topically applied tranexamic acid (TXA) on postoperative blood loss of neurologically intact patients with thoracolumbar spine trauma.

Overview of Literature: Few articles exist regarding the use of topical TXA for postoperative bleeding and blood transfusion in spinal surgery.

Methods: A total of 57 patients were operated on with long-segment instrumented fusion without decompression. In 29 patients, a solution containing 1 g of TXA (20 mL) was applied to the site of surgery via a drain tube after the spinal fascia was closed, and then the drain was clamped for 2 hours. The 28 patients in the control group received the same volume of normal saline, and clamping was performed using the same technique. The groups were compared for postoperative packed red cells (PRC) transfusion rate and drainage volume.

Results: The rate of postoperative PRC transfusion was significantly lower in the topical TXA group than in the control group (13.8% vs. 39.3%; relative risk, 0.35; 95% confidence interval, 0.13 to 0.97; p=0.03). The mean total drainage volume was significantly lower in the topical TXA group than in the control group (246.7±125 mL vs. 445.7±211.1 mL, p<0.01). No adverse events or complications were recorded in any patient during treatment over a mean follow-up period of 27.5 months.

Conclusions: The use of topically administered 1 g TXA in thoracic and lumbar spinal trauma cases effectively decreased postoperative transfusion requirements and minimized postoperative blood loss, as determined by the total drainage volume.

Ann Emerg Med. 2018 Oct;72(4):354-360

Resuscitative Endovascular Balloon Occlusion of the Aorta Improves Cardiac Compression Fraction Versus Resuscitative Thoracotomy in Patients in Traumatic Arrest.

Teeter W, Romagnoli A, Wasicek P, Hu P, Yang S, Stein D, Scalea T, Brenner M

STUDY OBJECTIVE: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is emerging as an alternative to resuscitative thoracotomy for proximal aortic control in select patients with exsanguinating hemorrhage below the diaphragm. The purpose of this study is to compare interruptions in closed chest compression or open chest cardiac massage during REBOA versus resuscitative thoracotomy.

METHODS: From May 2014 to December 2016, patients in arrest who received aortic occlusion with REBOA or resuscitative thoracotomy were included. Total cardiac compression time was defined as the total time that closed chest compression was performed for REBOA patients and the total time that closed chest compression (before resuscitative thoracotomy) and open chest cardiac massage (after thoracotomy) were performed for resuscitative thoracotomy patients. Cardiac compression fraction was defined as the time compressions occurred during the entire resuscitation phase. All resuscitations were captured by multiview, time-stamped videography.

RESULTS: Fifty patients with aortic occlusion after arrest were enrolled: 22 REBOA and 28 resuscitative thoracotomy. Most were men (86%) (median age 30.2 years, interquartile range [IQR] 24.9 to 42.3; median Injury Severity Score 27, IQR 16 to 42; neither differed between groups). The median duration of total cardiac compression time was 945 seconds (IQR 697 to 1,357) for REBOA versus 496 seconds (IQR 375 to 933) for resuscitative thoracotomy. During initial resuscitation, compressions occurred 86.5% of the time (SD 9.7%) during resuscitation with REBOA versus 35.7% of the time (SD 16.4%) in patients receiving resuscitative thoracotomy. Cardiac compression fraction improved after open cross clamp in resuscitative thoracotomy patients to 73.2% of the time (SD 18.0%) but remained significantly less than the same period for REBOA (86.7%; SD 9.4%). Mean cardiac compression fraction for REBOA was significantly improved over that for resuscitative thoracotomy (86.2% [SD 9.1%] versus 55.3 [SD 17.1%]; mean difference 31.0%; 95% confidence interval for difference 22.7% to 39.23%; P<.001). Median pause in resuscitation related to procedural tasks was 0 seconds (IQR 0 to 13) for REBOA and 148 seconds (IQR 118 to 223) in resuscitative thoracotomy.

CONCLUSION: Total duration of interruptions of cardiac compressions is shorter for patients receiving REBOA versus resuscitative thoracotomy before and during resuscitation with aortic occlusion. Markers for perfusion during resuscitation must be examined to understand the effects of cardiac compressions and aortic occlusion on patients in arrest because of hemorrhagic shock.

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

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

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

Collaborators: Vu M, Todd S, Rainey E, Allen L, Agrawal V, Walker K, Gandhi R, Podbielski J

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

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

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

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

Eur Spine J. 2018 Dec;27(12):2999-3006

Prehospital care of spinal injuries: a historical quest for reasoning and evidence.

Ten Brinke J, Groen S, Dehnad M, Saltzherr T, Hogervorst M, Goslings J

PURPOSE: The practice of prehospital immobilization is coming under increasing scrutiny. Unravelling the historical sequence of prehospital immobilization might shed more light on this matter and help resolve the situation. Main purpose of this review is to provide an overview of the development and reasoning behind the implementation of prehospital spine immobilization.

METHODS: An extensive search throughout historical literature and recent evidence based studies was conducted.

RESULTS: The history of treating spinal injuries dates back to prehistoric times. Descriptions of prehospital spinal immobilization are more recent and span two distinct periods. First documentation of its use comes from the early 19th century, when prehospital trauma care was introduced on the battlefields of the Napoleonic wars. The advent of radiology gradually helped to clarify the underlying pathology. In recent decades, adoption of advanced trauma life support has elevated in-hospital trauma-care to an high standard. Practice of in-hospital spine immobilization in case of suspected injury has also been implemented as standard-care in prehospital setting. Evidence for and against prehospital immobilization is equally divided in recent evidence-based studies. In addition, recent studies have shown negative side-effects of immobilisation in penetrating injuries.

CONCLUSION: Although widely implementation of spinal immobilization to prevent spinal cord injury in both penetrating and blunt injury, it cannot be explained historically. Furthermore, there is no high-level scientific evidence to support or reject immobilisation in blunt injury. Since evidence in favour and against prehospital immobilization is equally divided, the present situation appears to have reached something of a deadlock. These slides can be retrieved under Electronic Supplementary Material.

Anaesthesia. 2018 Oct 4 Epub ahead of print

Supraglottic airway devices in difficult airway management: a retrospective cohort study of 658,104 general anaesthetics registered in the Danish Anaesthesia Database.

Thomsen J, Nørskov A, Rosenstock C

ABSTRACT:
Indications for using supraglottic airway devices have widened over time and they now hold a prominent role in guidelines for difficult airway management. We aimed to describe the use of supraglottic airway devices in difficult airway management. We included adult patients undergoing general anaesthesia registered in the Danish Anaesthesia Database from 2008 to 2012 whose airway management had been recorded as difficult, defined as: ≥ 3 tracheal intubation attempts; failed tracheal intubation; or difficult facemask ventilation. In the Danish Anaesthesia Database, a separate difficult airway management module requires the technique used in each successive airway management attempt to be recorded. The primary aim of the study was to describe the use of supraglottic airway devices in cases of difficult airway management. Secondary aims were to examine success rates of supraglottic airway devices in difficult airway management cases, and specifically in the cases of 'cannot intubate, cannot facemask ventilate'. Difficult airway management occurred in 4898 (0.74% (95%CI 0.72-0.76%)) of 658,104 records of general anaesthesia. Supraglottic airway devices were used or use was attempted in 607 cases of difficult airway management (12.4% (95%CI 11.5-13.3%)), and were successful in 395 (65.1% (95%CI 61.2-68.8%)) cases. In 'cannot intubate, cannot facemask ventilate' situations, supraglottic airway devices were used in 86 (18.9% (95%CI 15.6-22.8%)) of 455 records and were successful in 54 (62.8% (95%CI 52.2-72.3%)) cases. We found that supraglottic airway devices are not widely used in the management of the difficult airway despite their prominent role in difficult airway management guidelines.

J Trauma Acute Care Surg. 2018 Jul;85(1):101-107

Location is everything: The hemodynamic effects of REBOA in Zone 1 versus Zone 3 of the aorta.

Tibbits E, Hoareau G, Simon M, Davidson A, DeSoucy E, Faulconer E, DuBose J, Neff L, Grayson J, Williams T, Johnson M

OBJECTIVES: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an emerging technology to augment proximal blood pressure during the resuscitation of patients with non-compressible torso hemorrhage. Currently, placement choice, supraceliac (Zone 1) versus infrarenal (Zone 3) aorta, depends on injury patterns, but remains a highly debated topic. We sought to compare the proximal hemodynamic support provided by Zone 1 versus Zone 3 REBOA placement and the degree of hemodynamic instability upon reperfusion following intervention.

METHODS: Eighteen anesthetized swine underwent controlled hemorrhage of 25% total blood volume, followed by 45 minutes of Zone 1 REBOA, Zone 3 REBOA, or no intervention (control). They were then resuscitated with shed blood, aortic balloons were deflated, and 5 hours of critical care ensued prior to euthanasia. Physiologic parameters were recorded continuously, and blood was drawn for analysis at specified intervals. Significance was defined as $p < 0.05$.

RESULTS: There were no significant differences between groups at baseline or during the initial 30 minutes of hemorrhage. During the intervention period, average proximal MAP was significantly greater in Zone 1 animals when compared with Zone 3 animals (127.9 ± 1.3 vs. 53.4 ± 1.1 mm Hg) and greater in Zone 3 animals when compared with control animals (42.9 ± 0.9 mm Hg). Lactate concentrations were significantly higher in Zone 1 animals (9.6 ± 0.4 mmol/L) when compared with Zone 3 animals (5.1 ± 0.3 mmol/L) and control animals (4.2 ± 0.8 mmol/L).

CONCLUSIONS: In our swine model of hemorrhagic shock, Zone 3 REBOA provided minimal proximal hemodynamic support when compared with Zone 1 REBOA, albeit with less ischemic burden and instability upon reperfusion. In cases of impending hemodynamic collapse, Zone 1 REBOA placement may be more efficacious regardless of injury pattern, whereas Zone 3 should be reserved only for relatively stable patients with ongoing distal hemorrhage.

Am J Surg. 2018 Sep 22. Epub ahead of print

The emergency surgical airway: Bridging the gap from quality outcome to performance improvement through a novel simulation based curriculum.

Veenstra B, Wojtowicz A, Walsh N, Velasco J

BACKGROUND: Emergency surgical airway is a low frequency, high risk clinical scenario. Implementing a simulation-based curriculum may bridge the gap in surgical training and address quality assurance/performance improvement (QAPI) needs.

METHODS: We designed and implemented an Advanced Surgical Airway Curriculum (ASAC) modeled after proficiency-based training. General Surgery residents and student nurse anesthetists were enrolled. Evaluation consisted of cognitive tests, procedure checklists and questionnaire.

RESULTS: In total, 78 participants successfully completed the ASAC. Trainees agreed that the curriculum provided the cognitive and psychomotor skills necessary to perform both an open and needle cricothyroidotomy.

CONCLUSIONS: In the age of increased patient safety concerns, QAPI initiatives can serve as a driver for simulation-based training curricula, with particular focus on individualized, active learning. This may be particularly useful in high risk, low frequency scenarios in which the traditional method of "See one, Do one, Teach one," is not feasible.

J Trauma Acute Care Surg. 2018 May;84(5):736-744

Prehospital spine immobilization/spinal motion restriction in penetrating trauma: A practice management guideline from the Eastern Association for the Surgery of Trauma (EAST).

Velopulos C, Shihab H, Lottenberg L, Feinman M, Raja A, Salomone J, Haut E

BACKGROUND: Spine immobilization in trauma has remained an integral part of most emergency medical services 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 Grading of Recommendations, Assessment, Development, and Evaluation 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 risk ratio [RR], 2.4 (confidence interval [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.

CONCLUSION: 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: Systematic review with meta-analysis study, level III.

JAMA. 2018 Aug 28;320(8):769-778

Effect of a Strategy of Initial Laryngeal Tube Insertion vs Endotracheal Intubation on 72-Hour Survival in Adults With Out-of-Hospital Cardiac Arrest: A Randomized Clinical Trial.

Wang H, Schmicker R, Daya M, Stephens S), Idris A, Carlson J, Colella M, Herren H, Hansen M, Richmond N, Puyana J, Aufderheide T, Gray R, Gray P, Verkest M, Owens P, Brienza A, Sternig K, May S, Sopko G, Weisfeldt M, Nichol G

Importance: Emergency medical services (EMS) commonly perform endotracheal intubation (ETI) or insertion of supraglottic airways, such as the laryngeal tube (LT), on patients with out-of-hospital cardiac arrest (OHCA). The optimal method for OHCA advanced airway management is unknown.

Objective: To compare the effectiveness of a strategy of initial LT insertion vs initial ETI in adults with OHCA.

Design, Setting, and Participants: Multicenter pragmatic cluster-crossover clinical trial involving EMS agencies from the Resuscitation Outcomes Consortium. The trial included 3004 adults with OHCA and anticipated need for advanced airway management who were enrolled from December 1, 2015, to November 4, 2017. The final date of follow-up was November 10, 2017.

Interventions: Twenty-seven EMS agencies were randomized in 13 clusters to initial airway management strategy with LT (n = 1505 patients) or ETI (n = 1499 patients), with crossover to the alternate strategy at 3- to 5-month intervals.

Main Outcomes and Measures: The primary outcome was 72-hour survival. Secondary outcomes included return of spontaneous circulation, survival to hospital discharge, favorable neurological status at hospital discharge (Modified Rankin Scale score ≤3), and key adverse events.

Results: Among 3004 enrolled patients (median [interquartile range] age, 64 [53-76] years, 1829 [60.9%] men), 3000 were included in the primary analysis. Rates of initial airway success were 90.3% with LT and 51.6% with ETI. Seventy-two hour survival was 18.3% in the LT group vs 15.4% in the ETI group (adjusted difference, 2.9% [95% CI, 0.2%-5.6%]; P = .04). Secondary outcomes in the LT group vs ETI group were return of spontaneous circulation (27.9% vs 24.3%; adjusted difference, 3.6% [95% CI, 0.3%-6.8%]; P = .03); hospital survival (10.8% vs 8.1%; adjusted difference, 2.7% [95% CI, 0.6%-4.8%]; P = .01); and favorable neurological status at discharge (7.1% vs 5.0%; adjusted difference, 2.1% [95% CI, 0.3%-3.8%]; P = .02). There were no significant differences in oropharyngeal or hypopharyngeal injury (0.2% vs 0.3%), airway swelling (1.1% vs 1.0%), or pneumonia or pneumonitis (26.1% vs 22.3%).

Conclusions and Relevance: Among adults with OHCA, a strategy of initial LT insertion was associated with significantly greater 72-hour survival compared with a strategy of initial ETI. These findings suggest that LT insertion may be considered as an initial airway management strategy in patients with OHCA, but limitations of the pragmatic design, practice setting, and ETI performance characteristics suggest that further research is warranted.

Am J Emerg Med. 2018 Dec;36(12):2298-2306

Advanced airway management in out of hospital cardiac arrest: A systematic review and meta-analysis.

White L, Melhuish T, Holyoak R, Ryan T, Kempton H, Vlok R

OBJECTIVES: To assess the difference in survival and neurological outcomes between endotracheal tube (ETT) intubation and supraglottic airway (SGA) devices used during out-of-hospital cardiac arrest (OHCA).

METHODS: A systematic search of five databases was performed by two independent reviewers until September 2018. Included studies reported on (1) OHCA or cardiopulmonary resuscitation, and (2) endotracheal intubation versus supraglottic airway device intubation. Exclusion criteria (1) stimulation studies, (2) selectively included/excluded patients, (3) in-hospital cardiac arrest. Odds Ratios (OR) with random effect modelling was used. Primary outcomes: (1) return of spontaneous circulation (ROSC), (2) survival to hospital admission, (3) survival to hospital discharge, (4) discharge with a neurologically intact state.

RESULTS: Twenty-nine studies (n = 539,146) showed that overall, ETT use resulted in a heterogeneous, but significant increase in ROSC (OR = 1.44; 95%CI = 1.27 to 1.63; I2 = 91%; p < 0.00001) and survival to admission (OR = 1.36; 95%CI = 1.12 to 1.66; I2 = 91%; p = 0.002). There was no significant difference in survival to discharge or neurological outcome (p > 0.0125). On sensitivity analysis of RCTs, there was no significant difference in ROSC, survival to admission, survival to discharge or neurological outcome (p > 0.0125). On analysis of automated chest compression, without heterogeneity, ETT provided a significant increase in ROSC (OR = 1.55; 95%CI = 1.20 to 2.00; I2 = 0%; p = 0.0009) and survival to admission (OR = 2.16; 95%CI = 1.54 to 3.02; I2 = 0%; p < 0.00001).

CONCLUSIONS: The overall heterogeneous benefit in survival with ETT was not replicated in the low risk RCTs, with no significant difference in survival or neurological outcome. In the presence of automated chest compressions, ETT intubation may result in survival benefits.

J Trauma Acute Care Surg. 2018 Sep;85(3):519-526

Endovascular variable aortic control (EVAC) versus resuscitative endovascular balloon occlusion of the aorta (REBOA) in a swine model of hemorrhage and ischemia reperfusion injury.

Williams T, Tibbits E, Hoareau G, Simon M, Davidson A, DeSoucy E, Faulconer E, Grayson J, Neff L, Johnson M

BACKGROUND: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is effective at limiting hemorrhage from non-compressible sources and restoring but causes progressive distal ischemia, supraphysiologic pressures, and increased cardiac afterload. Endovascular variable aortic control (EVAC) addresses these limitations, while still controlling hemorrhage. Previous work demonstrated improved outcomes following a 90-minute intervention period in an uncontrolled hemorrhage model. The present study compares automated EVAC to REBOA over an occlusion period reflective of contemporary REBOA usage.

METHODS: Following instrumentation, 12 Yorkshire-cross swine underwent controlled 25% hemorrhage, a 45-minute intervention period of EVAC or REBOA, and subsequent resuscitation with whole blood and critical care for the remainder of a 6-hour experiment. Hemodynamics were acquired continuously, and laboratory parameters were assessed at routine intervals. Tissue was collected for histopathologic analysis.

RESULTS: No differences were seen in baseline parameters. During intervention, EVAC resulted in more physiologic proximal pressure augmentation compared with REBOA (101 vs. 129 mm Hg; 95% confidence interval [CI], 105-151 mm Hg; $p = 0.04$). During critical care, EVAC animals required less than half the amount of crystalloid (3,450 mL; 95% CI, 1,215-5,684 mL] vs. 7,400 mL [95% CI, 6,148-8,642 mL]; $p < 0.01$) and vasopressors (21.5 ng/kg [95% CI, 7.5-35.5 ng/kg] vs. 50.5 ng/kg [95% CI, 40.5-60.5 ng/kg]; $p = 0.05$) when compared with REBOA animals. Endovascular variable aortic control resulted in lower peak and final lactate levels. Endovascular variable aortic control animals had less aortic hyperemia from reperfusion with aortic flow rates closer to baseline (36 mL/kg per minute [95% CI, 30-44 mL/kg per minute] vs. 51 mL/kg per minute [95% CI, 41-61 mL/kg per minute]; $p = 0.01$).

CONCLUSIONS: For short durations of therapy, EVAC produces superior hemodynamics and less ischemic insult than REBOA in this porcine-controlled hemorrhage model, with improved outcomes during critical care. This study suggests EVAC is a viable strategy for in-hospital management of patients with hemorrhagic shock from non-compressible sources. Survival studies are needed to determine if these early differences persist over time.

J Trauma Acute Care Surg. 2018 Sep;85(3):637-641

Developing a national trauma system: Proposed governance and essential elements.

Winchell R, Eastridge B, Moore M, Ashley D, Gaines B, Gainor D, Jahangir A, Krieg J, Mays C, Michaels H, Namias N, Perina D, Bulger E, Stewart R

Quote:
"The 2016 NASEM report, ***A National Trauma Care System: Integrating Military and Civilian Trauma Systems to Achieve Zero Preventable Deaths After Injury***, is a call to action that outlines the critical need to create an integrated system for the care of the injured with strong federal leadership and sets a clear goal to eliminate preventable death and disability. This ambitious project will require a monumental and sustained effort from the very broad community of people involved in the care of the injured, in both the military and civilian sectors. This paper outlines the consensus of a large multidisciplinary group of leaders regarding the governance structure of the proposed system and presents an initial set of essential elements that were developed as a model for policy that will define that trauma system. On a practical and concrete basis, the aim is to disseminate information about the governance model and the essential elements to gain broad acceptance of these principles across the community of trauma stakeholders and to actively engage these stakeholders in action to promote development of the national system for injury care envisioned in the NASEM report."

J R Army Med Corps. 2018 Oct 3. Epub ahead of print

Catastrophic haemorrhage in military major trauma patients: a retrospective database analysis of haemostatic agents used on the battlefield.

Winstanley M, Smith J, Wright C

OBJECTIVES: Catastrophic haemorrhage is a leading cause of morbidity and mortality in trauma, in both military and civilian settings. There are numerous studies looking at the effectiveness of different haemostatic agents in the laboratory but few in a clinical setting. This study analyses the use of haemostatic dressings used in patients injured on the battlefield and their association with survival.

METHOD: A retrospective database review was undertaken using the UK Joint Theatre Trauma Registry from 2003 to 2014, during combat operations in Iraq and Afghanistan. Data included patient demographics, the use of haemostatic dressings, New Injury Severity Score (NISS) and patient outcome.

RESULTS: Of 3792 cases, a haemostatic dressing was applied in 317 (either Celox, Hemcon or Quickclot). When comparing patients who had a haemostatic dressing applied versus no haemostatic agent, there was a 7% improvement in survival. Celox was the only individual haemostatic dressing that was associated with a statistically significant improvement in survival, which was most apparent in the more severely injured (NISS 36-75).

CONCLUSION: We have shown an association between use of haemostatic agents and improved survival, mostly in those with more severe injuries, which is particularly evident in those administered Celox. This supports the continued use of haemostatic agents as part of initial haemorrhage control for patients injured in conflict and suggests that civilian organisations that may need to deal with patients with similar injury patterns should consider their use and implementation.

Mo Med. 2018 Sep-Oct;115(5):434-437

New Advances in the Care of the Hemorrhaging Patient.

Woods T, Scott K, Quick J

ABSTRACT:
Thirty-three percent of early traumatic deaths are secondary to hemorrhage. In addition to timing to source control, the literature has seen a surge of research on adjuncts in hemorrhage control. This review focuses on three of the latest interventions in the management of the bleeding patient; an endovascular aortic occlusive balloon, tranexamic acid (TXA), and updates to the massive transfusion protocol.

J Trauma Acute Care Surg. 2018 Jun;84(6S Suppl 1):S3-S13

Trauma Hemostasis and Oxygenation Research Network position paper on the role of hypotensive resuscitation as part of remote damage control resuscitation.

Woolley T, Thompson P, Kirkman E, Reed R, Ausset S, Beckett A, Bjerkvig C, Cap A, Coats T, Cohen M, Despasquale M, Dorlac W, Doughty H, Dutton R, Eastridge B, Glassberg E, Hudson A, Jenkins D, Keenan S, Martinaud C, Miles E, Moore E, Nordmann G, Prat N, Rappold J, Reade MC, Rees P, Rickard R, Schreiber M, Shackelford S, Skogran Eliassen H, Smith J, Smith M, Spinella P, Strandenes G, Ward K, Watts S, White N, Williams S.

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

Transfusion. 2018 Nov;58(11):2744-2746

The use of low-titer group O whole blood for the resuscitation of civilian trauma patients in 2018.

Yazer M, Spinella P

Quotes:

"There is increasing military and civilian evidence that the early intervention with blood products in patients with traumatic bleeding saves lives.1,2 There are many advantages of using whole blood (WB) in trauma resuscitation. WB contains less physiologically inert fluid, that is, fluid that does not carry oxygen or contribute to hemostasis, compared to reconstituting WB using additive solution containing red blood cells (RBCs) and a unit of plasma and WB platelets (PLTs), it provides balanced resuscitation while simplifying the logistics of the resuscitation as one bag can be administered instead of three, and the cold-stored PLTs in WB may provide improved hemostasis compared to roomtemperature PLTs.3"

"Thus, the time was propitious for the THOR (Trauma, Hemostasis & Oxygenation Research network)/AABB working party to conduct a survey of the 15 American sites, and a hospital in Norway, that are either currently using LTOWB or are in the advanced planning stages of implementing an LTOWB program as a guide for other hospitals that are considering commencing such a program (Table 1)."

"Among the 16 respondents (Table 2), there were five hospitals that did not have a limit on the number of LTOWB units that could be administered to traumatically injured patients, although at two of these hospitals there was a requirement for the blood bank physician to communicate with the trauma team about the patient's ongoing blood needs."

"Roughly half of the sites (9/16, 56%) use leukoreduced LTOWB. The most common definitions of low-titer anti-A and -B was less than 200 followed by less than 256."

"Most of the respondents stored the LTOWB as such for either 21 days (7/16, 44%) or 14 days (5/16, 31%); half (8/16, 50%) of the hospitals discard an unused LTOWB unit, while some (6/16, 38%) produce an RBC unit once the LTOWB unit reaches its maximum storage length as mandatedin the local policy."

Vox Sang. 2018 Oct;113(7):701-706

Vox Sanguinis International Forum on the use of prehospital blood products and pharmaceuticals in the treatment of patients with traumatic haemorrhage.

Yazer M, Spinella P, Allard S, Roxby D, So-Osman C, Lozano M, Gunn K, Shih A, Stensballe J, Johansson PI, Bagge Hansen M, Maegele M, Doughty H, Crombie N, Jenkins D, McGinity A, Schaefer R, Martinaud C, Shinar E, Strugo R, Chen J, Russcher H.

ABSTRACT:
While specific practices and transported blood products vary around the world, most of the respondents in this International Forum transported at least one blood product for the transfusion to bleeding patients en route to the hospital. The most commonly carried product was RBCs, while the use of whole blood will likely increase given the recent reports of its successful use in the civilian setting, and because of the change in the AABB's Standards regulating its use. It will be interesting to see if plasma use in the prehospital setting becomes more widely used given today's enhanced appreciated of the coagulopathy of trauma and plasma's beneficial effect in reversing it, and if blood products are transported to the scene of injury by more vehicles, that is, not just predominantly in helicopters. It was not surprising that TXA is being widely administered as close to the time of injury as possible given its potential benefit in these patients. This International Forum highlights the importance of focusing attention on prehospital transfusion management with a need to further high-quality research in this area to guide optimal resuscitation strategies.

J Spec Oper Med. Fall 2018;18(3):22-27.

Your Metric Matters! Choose Wisely to Assess User Performance With Tourniquets in Simulated First Aid.

Zhao N, Kragh JF Jr, Aden JK 3rd, Jordan B, Parsons D, Dubick M

BACKGROUND: Readiness to perform lifesaving interventions during emergencies is based on a person's preparation to proficiently execute the skills required. Graphically plotting the performance of a tourniquet user in simulation has previously aided us in developing our understanding of how the user actually behaves. The purpose of this study was to explore performance assessment and learning curves to better understand how to develop best teaching practices.

METHODS: These were retrospective analyses of a convenience sample of data from a prior manikin study of 200 tourniquet uses among 10 users. We sought to generate hypotheses about performance assessments relevant to developing best teaching practices. The focus was on different metrics of user performance.

RESULTS: When one metric was chosen over another, failure counts summed cumulatively over 200 uses differed as much as 12-fold. That difference also indicated that the degree of challenge posed to user performance differed by the metric chosen. When we ranked user performance with one metric and then with another, most (90%; nine of 10) users changed rank: five rose and four fell. Substantial differences in performance outcomes resulted from the difference in metric chosen, which, in turn, changed how the outcome was portrayed and thus interpreted. Hypotheses generated included the following: The usefulness of a specific metric may vary by the user's level of skill from novice to expert; demonstration of the step order in skill performance may suffice for initial training of novices; a mechanical metric of effectiveness, like pulse stoppage, may aid in later training of novices; and training users how to practice on their own and self-assess performance may aid their self-development.

CONCLUSION: The outcome of the performance assessments varied depending on the choice of metric in this study of simulated use of tourniquets.

Mil Med Res. 2018 Oct 4;5(1):34. doi: 10.1186/s40779-018-0181-6.

Chinese expert consensus on echelons treatment of thoracic injury in modern warfare.

Zong Z, Wang Z, Chen S, Qin H, Zhang L, Shen Y, Yang L, Du W, Chen C, Zhong X, Zhang L, Huo J, Kuai L, Shu L, Du G, Zhao Y; Representing the Traumatology Branch of the China Medical Rescue Association, the Youth Committee on Traumatology Branch of the Chinese Medical Association, the PLA Professional Committee and the Youth Committee on Disaster Medicine, and the Disaster Medicine Branch of the Chongqing Association f Integrative Medicine.

Collaborators: Bao Q, Chen D, Chen S, Cheng W, Dai R, Deng J, Ding Z, Gong T, Guo W, Hao S, Hu P, Huang F, Huang G, Jia W, Jiang S, Jin H, Kong D, Li X, Li X, Peng L, Qin H, Qu B, Ren G, Shen Y, Tang H, Wang C, Wang C, Wang ZN, Wu W, Wu X, Wu Z, X W, Xiao J, Yibulayin X, Xiang H, Xu F, Yan P, Yang L, Yang J, Yang Q, Yi Y, Yin C, Yu Y, Zhang R, Zhang S, Zhang W, Zhang Y, Zhang Y, Zhao X, Zhou Y, Zong Z, Zhu C

ABSTRACT:
The emergency treatment of thoracic injuries varies of general conditions and modern warfare. However, there are no unified battlefield treatment guidelines for thoracic injuries in the Chinese People's Liberation Army (PLA). An expert consensus has been reached based on the epidemiology of thoracic injuries and the concept of battlefield treatment combined with the existing levels of military medical care in modern warfare. Since there are no differences in the specialized treatment for thoracic injuries between general conditions and modern warfare, first aid, emergency treatment, and early treatment of thoracic injuries are introduced separately in three levels in this consensus. At Level I facilities, tension pneumothorax and open pneumothorax are recommended for initial assessment during the first aid stage. Re-evaluation and further treatment for hemothorax, flail chest, and pericardial tamponade are recommended at Level II facilities. At Level III facilities, simple surgical operations such as emergency thoracotomy and debridement surgery for open pneumothorax are recommended. The grading standard for evidence evaluation and recommendation was used to reach this expert consensus.