Tactical Combat Casualty Care

Journal Article Abstracts

Committee on Tactical Combat Casualty Care
November 2014

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Abstracts

Spine (Phila Pa 1976). 2014 Sep 1;39(19):E1174-80. doi: 10.1097/BRS.0000000000000466.

Does a kaolin-impregnated hemostatic dressing reduce intraoperative blood loss and blood transfusions in pediatric spinal deformity surgery?

Abbott EM, Nandyala SV, Schwend RM.

STUDY DESIGN: Retrospective case-control study.

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

SUMMARY OF BACKGROUND DATA: Minimizing blood loss and transfusions are clear benefits for patient safety. A technique common in both severe trauma and combat medicine that has not been reported in the spine literature is wound packing with a kaolin-impregnated hemostatic dressing.

METHODS: Estimated blood loss and transfusion amounts were analyzed in a total of 117 retrospectively identified cases. The control group included 65 patients (46 females, 19 males, 12.7±4.5 yr, 10.2±4.8 levels fused) who received standard operative care with gauze packing between June 2007 and March 2010. The treatment group included 52 patients (33 females, 19 males, 13.9±3.2 yr, 10.4±4.3 levels fused) who underwent intraoperative packing with QuikClot Trauma Pads (QCTP, Z-Medica Corporation) for all surgical procedures from July 2010 to August 2011. No other major changes in the use of antifibrinolytics or perioperative, surgical, or anesthesia technique were noted. Statistical differences were analyzed using analysis of covariance in R with P value of less than 0.05. The statistical model included sex, age, weight, scoliosis type, the number of vertebral levels fused, and surgery duration as covariates.

RESULTS: The treatment group had 40% less intraoperative estimated blood loss than the control group (974 mL vs. 1620 mL) ($P<0.001$). Patients who received the QCTP treatment also had 42% less total perioperative transfusion volume (499 mL vs. 862 mL) ($P<0.01$).

CONCLUSION: The use of a kaolin-impregnated intraoperative trauma pad seems to be an effective and inexpensive method to reduce intraoperative blood loss and transfusion volume in pediatric spinal deformity surgery.

LEVEL OF EVIDENCE: 3.

J Ocul Pharmacol Ther. 2014 Aug 28. [Epub ahead of print]

Intraocular Penetration of Systemic Antibiotics in Eyes with Penetrating Ocular Injury.

Ahmed S, Kuruvilla O, Chin Yee D, Aggarwal H, Li Y, Edwards P, Qiao X, Gao H.

PURPOSE: To determine whether penetrating scleral or corneal injury can enhance intraocular penetration of systemic moxifloxacin, vancomycin, and ceftazidime. Methods: Thirty rabbits were divided into 3 groups for each antibiotic and then further subdivided to receive either scleral or corneal injury to the right eye. The left eye served as a control. Intravenous antibiotics were given following injury, and eyes were subsequently enucleated. Vitreous antibiotic concentration was determined by high-performance liquid chromatography analysis. Plasma concentration was measured for comparison.

RESULTS: Intravitreal moxifloxacin concentration was unchanged by injury. Minimum inhibitory concentration (MIC90) was achieved in the vitreous against the most common gram-positive endophthalmitis-causing organisms. Intravitreal vancomycin levels were not enhanced by injury and did not reach the MIC90 for gram-positive organisms commonly causing intraocular infection. Intravitreal ceftazidime was increased in the injured eyes, 67% and 73% higher in scleral and corneal injury eyes. It reached MIC90 of many gram-negative bacteria.

CONCLUSIONS: Intravitreal antibiotic penetration of systemic antibiotics with or without penetrating ocular injury varies depending on the antibiotic. For prevention or treatment of gram-positive-bacteria-causing endophthalmitis, intravitreal vancomycin is necessary and provides the most reliable coverage. Systemic ceftazidime can be used for many gram-negative bacteria, but intravitreal injection is recommended for better coverage, especially for more-potent organisms. Systemic moxifloxacin can be considered for most gram-positive and -negative infections due to it excellent intraocular penetration and broad coverage, but the patient's previous history of its topical use and increasing resistance patterns must be considered.

J Trauma Acute Care Surg. 2014 Oct;77(4):592-8

Prehospital hypertension is predictive of traumatic brain injury and is associated with higher mortality.

Barmparas G, Liou DZ, Lamb AW, Gangi A, Chin M, Ley EJ, Salim A, Bukur M.

BACKGROUND: The purpose of the current study was to investigate the effect of early adrenergic hyperactivity as manifested by prehospital (emergency medical service [EMS]) hypertension on outcomes of traumatic brain injury (TBI) patients and to develop a prognostic model of the presence of TBI based on EMS and admission (emergency department [ED]) hypertension.

METHODS: This study is a retrospective review of the 2007 to 2008 National Trauma Data Bank including blunt trauma patients 15 years or older with available EMS and ED vital signs. Patients with head Abbreviated Injury Scale (AIS) score of 3 or greater were selected, and mortality was examined within EMS systolic blood pressure (SBP) groups: lower than 100 mm Hg, 110 mm Hg to 150 mm Hg, 160 mm Hg to 180 mm Hg, and 190 mm Hg to 230 mm Hg. A forward logistic regression model including the EMS heart rate, EMS SBP, EMS Glasgow Coma Scale (GCS) score, ED heart rate, and ED SBP was used to identify predictors of a TBI in patients with ED GCS score of less than or equal to 8, 9 to 13, and 14 to 15.

RESULTS: For the 5-year study period, 315,242 patients met inclusion criteria. Adjusted odds for mortality increased in a stepwise fashion with increasing EMS SBP compared with patients with normal EMS SBP (adjusted odds ratio [95% confidence interval], 1.33 [1.22-1.44], $p < .001$, for EMS SBP of 160-180 mm Hg and 1.97 [1.76-2.21], $p < 0.001$, for EMS SBP of 190-230 mm Hg). A 7-point scoring system was developed for each ED GCS score group to predict the presence of a TBI. EMS SBP of greater than 150 mm Hg and ED SBP of greater than 150 mm Hg were both predictive of the presence of a TBI in patients with ED GCS score of 8 or less and in patients with ED GCS score of 9 to 13 or 14 to 15, respectively.

CONCLUSION: Prehospital hypertension in TBI is associated with a higher mortality risk. Early hypertension in the prehospital setting and at admission can be used to predict the presence of such injuries. These findings may have important early triage and treatment implications.

LEVEL OF EVIDENCE: Prognostic study, level III

J Spec Oper Med. 2014 Fall;14(3):40-57.

Management of External Hemorrhage in Tactical Combat Casualty Care: Chitosan-Based Hemostatic Gauze Dressings - TCCC Guidelines-Change 13-05.

Bennett BL, Littlejohn LF, Kheirabadi BS, Butler FK, Kotwal RS, Dubick MA, Bailey JA.

ABSTRACT:

Hemorrhage remains the leading cause of combat death and a major cause of death from potentially survivable injuries. Great strides have been made in controlling extremity hemorrhage with tourniquets, but not all injuries are amenable to tourniquet application. Topical hemostatic agents and dressings have also contributed to success in controlling extremity and compressible junctional hemorrhage, and their efficacy continues to increase as enhanced products are developed. Since the addition of Combat Gauze™ (Z-Medica Corporation, Wallingford, CT, USA; http://www.z-medica.com/) in April 2008 to the Tactical Combat Casualty Care (TCCC) Guidelines, there are consistent data from animal studies of severe hemorrhage that chitosan-based hemostatic gauze dressings developed for battlefield application are, at least, equally efficacious as Combat Gauze. Successful outcomes are also reported using newer chitosan-based dressings in civilian hospital-based surgical case reports and prehospital (battlefield) case reports and series. Additionally, there have been no noted complications or safety concerns in these cases or across many years of chitosan-based hemostatic dressing use in both the military and civilian prehospital sectors. Consequently, after a decade of clinical use, there is added benefit and a good safety record for using chitosan-based gauze dressings. For these reasons, many specific US military Special Operations Forces, NATO militaries, and emergency medical services (EMS) and law enforcement agencies have already implemented the widespread use of these new recommended chitosan-based hemostatic dressings. Based on the past battlefield success, this report proposes to keep Combat Gauze as the hemostatic dressing of choice along with the new addition of Celox™ Gauze (Medtrade Products Ltd., Crewe, UK; http://www.celoxmedical.com/usa/products /celox-gauze/) and ChitoGauze® (HemCon Medical Technologies, Portland, OR, USA; http://www.hemcon.com/) to the TCCC Guidelines.

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S71-6

Role I trauma experience of the Israeli Defense Forces on the Syrian border.

Benov A(1), Glassberg E, Nadler R, Gendler S, Erlich T, Bader T, Rasmussen TE, Kreiss Y.

CONCLUSION: The experience of the IDF-MC Role I facilities in caring for civilian injuries along a hostile international border is unique. In this capacity and based on an effective data collection system, the IDF-MC has demonstrated effectiveness in triaging patients and providing lifesaving and resuscitative interventions including TXA and FDP. Ongoing data collection and analysis serve as the basis for constant improvement in combat casualty care. Lessons learned are implemented throughout all branches and echelons of care. Efforts to provide medical relief to victims of the Syrian civil war continue. While we hope for a better future, as long as these lessons continue to accumulate, it is our obligation to use them to support improvement of trauma care and hopefully save more lives.

JEMS 2014;Epub ahead of print

Tactical Emergency Casualty Care Pediatric Guidelines.

Bobko J, Callaway D

QUOTE:

Pediatric vs. Adult TECC Guidelines

Pediatric care guidelines for the TECC phases of care as a whole mirror the adult Tactical Emergency Casualty Care Pediatric Guidelines guidelines with several important distinctions. As with adults, rapid hemorrhage control and tourniquet application is emphasized. The TECC pediatric guidelines are the first to specifically recommend pediatric tourniquet application. Supported by the only study to date,15 this recommendation is carried through the direct care, indirect care and evacuation phase guidelines.

Further recommendations put forth in the guidelines are important both for the provider and the management level oversight of response personnel. Based on physiologic differences in pediatric patients, changes in management and equipment are delineated. Consistent with the adult guidelines, primary emphasis is again placed on achieving and maintaining hemostasis. Once achieved, controlling the pediatric airway is the next priority. Interventions, including positioning, manipulation and ventilation strategies, diverge from the adult guidelines.

Utilization of bag-valve mask ventilation is emphasized and shoulder elevation is recommended. Age criteria for invasive airway intervention is delineated and makes use of the “signs of puberty” method of age delineation familiar to most prehospital providers. Other topics addressed in the pediatric appendix include recommendations for intraosseous line placement as primary access, vigilance in avoidance of hypothermia and resuscitation guidelines.

Again, because of the dramatic variance in size of the pediatric population, thoracostomy needle sizes in pediatric casualties have yet to be proven in the literature. As such, the TECC committee chose to recommend a minimum catheter gauge size thereby allowing for local medical direction and provider discretion.

Recommendations regarding the use of tranexamic acid, hypotensive resuscitation and whole blood transfusion were deferred pending establishment of supporting evidence. These topics were passed to the TECC research subcommittee to drive future pediatric trauma resuscitation studies.

J Trauma Acute Care Surg. 2014 Sep;77(3):501-3

Boston marathon bombings: an after-action review.

Boston Trauma Center Chiefs' Collaborative.

Collaborators: Millham FH, Burke P, Gates J, Gupta A, Mooney D, Rabinovici R, Yaffe MB, Velmahos GC.

QUOTES:

Aid by First Responders

"Another unusual feature of the Boston Marathon bombing was the proximity of a generously staffed medical resuscitation tent in immediate proximity to the blast zones. Injured patients were able to receive immediate care from nurses, physicians, paramedics, emergency medical teams, Boston Police, and National Guardsmen, some of whom had experience in the management of blast victims in war. The early and liberal use of tourniquets on bleeding extremities, possibly reflecting knowledge gained in combat,7,8 may have contributed to patient outcomes. However, not all tourniquets were applied effectively. Several makeshift field tourniquets such as belts or other articles of clothing did not control bleeding sufficiently. Proper tourniquet technique, such as frequent tightening and occasional double tourniquet application on large extremities, were not used. Training for first responders should address this critical need."

Tourniquets

"(1) Effective use of tourniquets as first aid should be part of the national first aid curriculum. (2) Military tourniquets should be stocked in all emergency vehicles in sufficient quantity to deal with multiple trauma patients."

J Spec Oper Med. 2014 Fall;14(3):13-38.

Fluid Resuscitation for Hemorrhagic Shock in Tactical Combat Casualty Care: TCCC Guidelines Change 14-01 - 2 June 2014.

Butler FK, Holcomb JB, Schreiber MA, Kotwal RS, Jenkins DA, Champion HR, Bowling F, Cap AP, Dubose JJ, Dorlac WC, Dorlac GR, McSwain NE, Timby JW, Blackbourne LH, Stockinger ZT, Standenes G, Weiskopf RB, Gross KR, Bailey JA.

ABSTRACT:

This report reviews the recent literature on fluid resuscitation from hemorrhagic shock and considers the applicability of this evidence for use in resuscitation of combat casualties in the prehospital Tactical Combat Casualty Care (TCCC) environment. A number of changes to the TCCC Guidelines are incorporated: (1) dried plasma (DP) is added as an option when other blood components or whole blood are not available; (2) the wording is clarified to emphasize that Hextend is a less desirable option than whole blood, blood components, or DP and should be used only when these preferred options are not available; (3) the use of blood products in certain Tactical Field Care (TFC) settings where this option might be feasible (ships, mounted patrols) is discussed; (4) 1:1:1 damage control resuscitation (DCR) is preferred to 1:1 DCR when platelets are available as well as plasma and red cells; and (5) the 30-minute wait between increments of resuscitation fluid administered to achieve clinical improvement or target blood pressure (BP) has been eliminated.

Also included is an order of precedence for resuscitation fluid options. Maintained as recommendations are an emphasis on hypotensive resuscitation in order to minimize (1) interference with the body's hemostatic response and (2) the risk of complications of over-resuscitation. Hextend is retained as the preferred option over crystalloids when blood products are not available because of its smaller volume and the potential for long evacuations in the military setting.

Prehosp Emerg Care. 2014 Oct 28. [Epub ahead of print]

Law Enforcement-applied Tourniquets: A Case Series of Life-saving Interventions.

Callaway DW, Robertson J, Sztajnkrycer MD

ABSTRACT:

Although the epidemiology of civilian trauma is distinct from that encountered in combat, in both settings, extremity hemorrhage remains a major preventable cause of potential mortality. The current paper describes the largest case series in the literature in which police officers arriving prior to emergency medical services applied commercially available field tourniquets to civilian victims of violent trauma. Although all 3 patients with vascular injury arrived at the receiving emergency department in extremis, they were successfully resuscitated and survived to discharge without major morbidity. While this outcome is likely multifactorial and highlights the exceptional care delivered by the modern trauma system, tourniquet application appears to have kept critically injured patients alive long enough to reach definitive trauma care. No patient had a tourniquet-related complication. This case series suggests that law enforcement officers can effectively identify indications for tourniquets and rapidly apply such life-saving interventions.

JEMS 2014;Epub ahead of print

The evolution of civilian high threat medical guidelines.

Callaway D, Smith E

QUOTES:

"TCCC guidelines have been one of the major factors in reducing preventable death on the modern battlefield: the case fatality rate in current combat operations has decreased from approximately 15% in Vietnam to 7.6–9.4% during Operation Iraqi Freedom and Operation Enduring Freedom. In a memorandum dated Aug. 6, 2009, the Defense Health Board made note of several special operations where all members were trained in TCCC and had no reported incidents of preventable battlefield fatalities during the entirety of their combat deployments. American forces are now down from 9% to 2–3% killed in action due to exsanguination from an extremity wound; down from 5% to less than 1% killed from open/tension pneumothorax; and remain around 1% killed in action from airway obstruction (but these airway issues are more complex than those of the past).

More than 10 years of data have presented continuing evidence to support TCCC. The guidelines are well known, well supported and ingrained throughout the military. The proven success of TCCC on the battlefield has led the civilian medical community, both tactical and conventional, to closely examine the tenants and consider integration of TCCC into civilian trauma care."

"In 2005, several civilian first responder entities began discussing how TCCC could be transitioned into a civilian-appropriate format. In 2008, the George Washington University and Arlington County (Va.) Fire Department coined the term "Tactical Emergency Casualty Care (TECC)" for the translation of TCCC into a set of guidelines for use by civilian first responders in high threat scenarios. Emergency is a civilian term; combat is a military term. The concepts in each set of guidelines are the same, but the language and the focus are different. As part of the process, development and continued evidence-based and best-practice-based growth of the civilian TECC guidelines, the founders of the TECC concept established the Committee for Tactical Emergency Casualty Care (CTECC) - a nonprofit committee of civilian operational experts.

These experts first met in 2011 and established the first set of TECC guidelines by changing TCCC to civilian language and focus. CTECC works as a nonprofit and nonproprietary grassroots effort to create and maintain a set of high threat medical guidelines that are open to and shared with all first responders. TECC is a medical care framework for high threat operations based upon the military dogma of TCCC, but adapted to allow for civilian language, protocols, population, scope of practice and operational constraints. TECC isn't in competition with TCCC, it's the evolution of TCCC into the civilian realm. They're the same principles and practices translated and evolved for civilian use and operations."

Curr Opin Crit Care. 2014 Dec;20(6):638-45.

Acute traumatic coagulopathy.

Cap A, Hunt B

PURPOSE OF REVIEW: Mortality from trauma remains a global public health challenge, with most preventable deaths due to bleeding. The recognition of acute traumatic coagulopathy as a distinct clinical entity characterized by early coagulation dysfunction, arising prior to medical intervention, has revolutionized trauma management over the last decade. The aim of this article is to review our current understanding of acute traumatic coagulopathy.

RECENT FINDINGS: We focus on recent advances in the mechanistic understanding of acute traumatic coagulopathy, particularly the changes in coagulation factors, physiological anticoagulants, endothelial activation, fibrinolysis and platelet dysfunction. Evolving diagnostic and therapeutic approaches are discussed, including viscoelastic coagulation monitoring and the role of tranexamic acid and blood products.

SUMMARY: Emphasis is now placed on early prevention, diagnosis, and aggressive initial treatment of coagulopathy and fibrinolysis with haemostatic blood products and tranexamic acid in addition to red cell units in order to reduce bleeding and improve clinical outcomes.

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S228-36.

State of the science review: Advances in pain management in wounded service members over a decade at war.

Clifford JL(1), Fowler M, Hansen JJ, Cheppudira B, Nyland JE, Salas MM, McGhee LL, Petz LN, Loyd DR.

ABSTRACT:

The pain conditions and comorbidities experienced by injured service members and the challenge of pain management by the military medical system offer a unique opportunity to inform pain management and medical research. In this article, acute and chronic pain issues, current treatment options and limitations, as well as novel approaches to pain management are discussed within the context of combat casualty care, from the battlefield to hospitalization and rehabilitation. This review will also highlight the current pain management limitations that need to be addressed in future clinical and basic science research to improve care for our nation's injured service members.

Mil Med. 2014 Oct;179(10):1083-9.

A review of mild traumatic brain injury diagnostics: current perspectives, limitations, and emerging technology.

Cook GA, Hawley JS.

ABSTRACT:

Mild traumatic brain injury (mTBI) or concussion is a common battlefield and in-garrison injury caused by transmission of mechanical forces to the head. The energy transferred in such events can cause structural and/or functional changes in the brain that manifest as focal neurological, cognitive, or behavioral dysfunction. Current diagnostic criteria for mTBI are highly limited, variable, and based on subjective self-report. The subjective nature of the symptoms, both in quantity and quality, together with their large overlap in other physical and behavioral maladies, limit the clinician's ability to accurately diagnose, treat, and make prognostic decisions after such injuries. These diagnostic challenges are magnified in an operational environment as well. The Department of Defense has invested significant resources into improving the diagnostic tools and accuracy for mTBI. This focus has been to supplement the clinician's examination with technology that is better able to objectify brain dysfunction after mTBI. Through this review, we discuss the current state of three promising technologies--soluble protein biomarkers, advanced neuroimaging, and quantitative electroencephalography--that are of particular interest within military medicine.

J Vasc Surg. 2014 Jul 24. pii: S0741-5214(14)01275-0.

Quantification of residual limb skeletal muscle perfusion with contrast-enhanced ultrasound during application of a focal junctional tourniquet.

Davidson BP, Belcik JT, Mott BH, Landry G, Lindner JR.

OBJECTIVE: Focal junctional tourniquets (JTs) have been developed to control hemorrhage from proximal limb injuries. These devices may permit greater collateral perfusion than circumferential tourniquets. We hypothesized that JTs eliminate large-vessel pulse pressure yet allow a small amount of residual limb perfusion that could be useful for maintaining tissue viability.

METHODS: Ten healthy control subjects were studied. Transthoracic echocardiography, Doppler ultrasound of the femoral artery (FA) and posterior tibial artery, and contrast-enhanced ultrasound (CEU) perfusion imaging of the anterior thigh extensor and calf plantar flexor muscles were performed at baseline and during application of a JT over the common FA. Intramuscular arterial pulsatility index was also measured from CEU intensity variation during the cardiac cycle.

RESULTS: FA flow was eliminated by JTs in all subjects; posterior tibial flow was eliminated in all but one. Perfusion measured in the thigh and calf muscles was similar at baseline (0.33 ± 0.29 vs 0.29 ± 0.22 mL/min/g). Application of the JT resulted in a reduction of perfusion ($P < .05$) that was similar for the thigh and calf (0.08 ± 0.07 and 0.10 ± 0.03 mL/min/g). On CEU, microvascular flux rate was reduced by ≈55%, and functional microvascular blood volume was reduced by ≈35%. Arterial pulsatility index was reduced by ≈90% in the calf. JT inflation did not alter left ventricle dimensions, fractional shortening, cardiac output, or arterial elastance as a measure of total systolic load.

CONCLUSIONS: Application of a JT eliminates conduit arterial pulse and markedly reduces intramuscular pulse pressure, but thigh and calf skeletal muscle perfusion is maintained at 25% to 35% of basal levels. These data suggest that JTs that are used to control limb hemorrhage allow residual tissue perfusion even when pulse pressure is absent.

Syst Rev. 2014 Oct 24;3(1):123

Protocol for a systematic review of the clinical effectiveness of pre-hospital blood components compared to other resuscitative fluids in patients with major traumatic haemorrhage.

Dretzke J, Smith IM, James RH, Midwinter MJ.

BACKGROUND: There is growing interest in the use of blood components for pre-hospital resuscitation of patients with major traumatic haemorrhage. It has been speculated that early resuscitation with blood components may have benefits in terms of treating trauma-induced coagulopathy, which in turn may influence survival. The proposed systematic review will evaluate the evidence on the clinical effectiveness of pre-hospital blood components (red blood cells and/or plasma or whole blood), in both civilian and military settings, compared with other resuscitation strategies in patients with major traumatic haemorrhage.

METHODS/DESIGN: Standard systematic review methods aimed at minimising bias will be employed for study identification, selection and data extraction. General medical and specialist databases will be searched; the search strategy will combine terms for the population, intervention and setting. Studies will be selected for review if the population includes adult patients with major traumatic haemorrhage who receive blood components in a pre-hospital setting (civilian or military). Systematic reviews, randomised and non-randomised controlled trials and controlled observational studies will be included. Uncontrolled studies will be considered depending on the volume of controlled evidence. Quality assessment will be tailored to different study designs. Both patient related and surrogate outcomes will be considered. Synthesis is likely to be primarily narrative, but meta-analyses and subgroup analyses will be undertaken where clinical and methodological homogeneity exists.

DISCUSSION: Given the increasing use by emergency services of blood components for pre-hospital resuscitation, this is a timely systematic review, which will attempt to clarify the evidence base for this practice. As far as the authors are aware, the proposed systematic review will be the first to address this topic.

Am J Emerg Med. 2014 Oct;32(10):1174-8.

Tracheal intubation difficulties in the setting of face and neck burns: myth or reality?

Esnault P, Prunet B, Cotte J, Marsaa H, Prat N, Lacroix G, Goutorbe P, Montcriol A, Dantzer E, Meaudre E.

INTRODUCTION: Face and/or neck burn (FNB) exposes patients to the double respiratory risk of obstruction and hypoxia, and these risks may require a tracheal intubation. This study aims to describe the incidence and the characteristics of difficult intubation in FNB patients.

METHODS: We conducted a 5-year retrospective, single-center study including all patients meeting the following criteria: 18 years of age or older, an FNB at least 1% of burned surface area with a severity equal to or greater than the superficial second degree, and intubation and a burn center admission within the first 24 hours after the burn. Patients were compared according to the difficulty of their intubation.

RESULTS: Between January 2007 and December 2011, we included 134 patients. The incidence of difficult intubation was 11.2% but was greater in the burn center than in the pre-burn center: 16.9% vs 3.5% (P = .02). The most important difference between patients with or without difficult intubation was the time between the burn injury and the intubation: 210 (105-290) vs 120 (60-180) minutes (P = .047). After multivariate analysis, an intubation performed at a burn center was independently associated with difficult intubation: odds ratio = 3.2; 95% confidence interval, 1.1-528.

CONCLUSIONS: This study underlines the high incidence of difficult intubation in FNB patients, greater than 11.2%, and demonstrates that intubation is more difficult when realized at a burn center, probably because it is performed later, allowing for development of cervical and laryngeal edema.

JEMS 2014;Epub ahead of print

FBI's view to improving survival in active shooter events.

Fabbri W

QUOTE:

The Continuing Challenge

"A number of recurring concepts were noted by the group at the first and second meetings of the Hartford Consensus.

First, because the next active shooter event can occur anywhere in the U.S., local public safety in all communities must incorporate active shooter planning into their operations. The ability to respond immediately and effectively is critical if the number of victims and loss of life are to be minimized. This means all elements of a coordinated public safety response to an active shooter must be available at all times, on every shift, and integrated into the routine operations of fire/rescue and EMS services as well as the police. Regular training and review by leaders across public safety agencies are required to ensure a practiced, coordinated response by police, fire/rescue services and EMS without advance notice. We must remain capable of deploying special teams to critical incidents, as the possibility of complex attacks involving multiple assailants and unconventional threats certainly exists. However, experience over the past decade and a half demonstrates that the vast majority of incidents involve one assailant armed with conventional firearms. This is partly the basis of the change in police tactics advocating immediate engagement of the shooter by patrol officers. Like law enforcement, fire/rescue and EMS agencies must be capable of rapid action without the delay required to marshal special operations teams.

Second, hemorrhage control actions by the police must be taught and applied in a manner consistent with law enforcement tactics. These skills must augment rather than degrade the primary police mission of stopping the wounding of additional victims while managing the risk to responding officers, who are at statistically high risk for injury as they engage the shooter.

The same requirement applies to supporting actions by fire/rescue and EMS. Their actions must not degrade the police response or place themselves or the police at increased risk by complicating the tactical situation any more than necessary. Coordinated active shooter responses by police, fire/rescue and EMS are complex, and don't lend themselves to a cookie cutter approach. To be effective they must be tailored to the resources and level of risk tolerance of a given community.

Third, if community-based active shooter plans are to become a long-term capability, education and training in the skills and concepts underlying these plans must be provided consistently over the long term. Existing training programs such as the Prehospital Trauma Life Support (PHTLS) course and the military equivalent Tactical Combat Casualty Care (TCCC)

course are examples of medical analogs to the special training available to our law enforcement colleagues. The recent ACS guideline for prehospital hemorrhage control is an example of the evidence-based guidance needed to improve the uniform effectiveness of emergency care prior to arrival at the hospital. Development of similar training and guidance applicable to critical incidents is one means of maintaining an effective, agile medical response to active shooter

and other criminal MCIs.

Finally, it's important that access to surgical care is in place at the end of the continuum of public safety response to active shooter events. While appropriate emphasis is placed on field tourniquet control of extremity hemorrhage, victims of penetrating chest and abdominal wounds require priority triage and evacuation to a surgical suite. In parts of the country with limited hospital resources, surgeons and their emergency medicine colleagues will play an important role by ensuring that the hospital contingency plans required for accreditation include the capability to provide damage control surgery to multiple victims of an active shooter event."

Curr Opin Hematol. 2014 Nov;21(6):503-8

Adjunct agents for bleeding.

Franchini M, Mannucci PM.

PURPOSE OF REVIEW: This review provides a summary of the most recent clinical trials evaluating the hemostatic agents for the treatment of coagulopathy associated with critical bleeding. In particular, antifibrinolytic agents (i.e., aprotinin, tranexamic and ε-aminocaproic acids), desmopressin, recombinant activated factor VII, fibrinogen and prothrombin complex concentrates are evaluated.

RECENT FINDINGS: Among the various therapeutic options available, tranexamic acid is emerging as the most promising. Indeed, a recent randomized trial has shown a benefit survival of the early administration of tranexamic acid in patients with trauma-induced coagulopathy.

SUMMARY: Although preliminary data document a potential therapeutic role for prohemostatic pharmacologic approaches, further evidence arising from randomized controlled trials is needed to assess the safety and efficacy of such agents in the setting of critical bleeding.

J Emerg Med. 2014 Sep 27. pii: S0736-4679(14)00748-3.

Comparison of the Effects of Ketamine and Morphine on Performance of Representative Military Tasks.

Gaydos SJ, Kelley AM, Grandizio CM, Athy JR, Walters PL.

BACKGROUND: When providing care under combat or hostile conditions, it may be necessary for a casualty to remain engaged in military tasks after being wounded. Prehospital care under other remote, austere conditions may be similar, whereby an individual may be forced to continue purposeful actions despite traumatic injury. Given the adverse side-effect profile of intramuscular (i.m.) morphine, alternative analgesics and routes of administration are of interest. Ketamine may be of value in this capacity.

OBJECTIVES: To delineate performance decrements in basic soldier tasks comparing the effects of the standard battlefield analgesic (10 mg i.m. morphine) with 25 mg i.m. ketamine.

METHODS: Representative military skills and risk propensity were tested in 48 healthy volunteers without pain stimuli in a double-blind, placebo-controlled, crossover design.

RESULTS: Overall, participants reported more symptoms associated with ketamine vs. morphine and placebo, chiefly dizziness, poor concentration, and feelings of happiness. Performance decrements on ketamine, when present, manifested as slower performance times rather than procedural errors.

CONCLUSIONS: Participants were more symptomatic with ketamine, yet the soldier skills were largely resistant to performance decrements, suggesting that a trained task skill (autonomous phase) remains somewhat resilient to the drugged state at this dosage. The performance decrements with ketamine may represent the subjects' adoption of a cautious posture, as suggested by risk propensity testing whereby the subject is aware of impairment, trading speed for preservation of task accuracy. These results will help to inform the casualty care community regarding appropriate use of ketamine as an alternative or opioid-sparing battlefield analgesic.

Injury. 2014 Aug 11. Epub ahead of print

Prehospital fluid resuscitation in hypotensive trauma patients: Do we need a tailored approach?

Geeraedts LM Jr, Pothof LA, Caldwell E, de Lange-de Klerk ES, D'Amours SK

AIM: The ideal strategy for prehospital intravenous fluid resuscitation in trauma remains unclear. Fluid resuscitation may reverse shock but aggravate bleeding by raising blood pressure and haemodilution. We examined the effect of prehospital i.v. fluid on the physiologic status and need for blood transfusion in hypotensive trauma patients after their arrival in the emergency department (ED).

METHODS: Retrospective analysis of trauma patients (n=941) with field hypotension presenting to a level 1 trauma centre. Regression models were used to investigate associations between prehospital fluid volumes and shock index and blood transfusion respectively in the emergency department and mortality at 24h.

RESULTS: A 1L increase of prehospital i.v. fluid was associated with a 7% decrease of shock index in the emergency department ($p<0.001$). Volumes of 0.5-1L and 1-2L were associated with reduced likelihood of shock as compared to volumes of 0-0.5L: OR 0.61 ($p=0.03$) and OR 0.54 ($p=0.02$), respectively. Volumes of 1-2L were also associated with an increased likelihood of receiving blood transfusion in ED: OR 3.27 ($p<0.001$). Patients who had received volumes of >2L have a much greater likelihood of receiving blood transfusion in ED: OR 9.92 ($p<0.001$). Mortality at 24h was not associated with prehospital i.v. fluids.

CONCLUSION: In hypotensive trauma patients, prehospital i.v. fluids were associated with a reduction of likelihood of shock upon arrival in ED. However, volumes of >1L were associated with a markedly increased likelihood of receiving blood transfusion in ED. Therefore, decision making regarding prehospital i.v. fluid resuscitation is critical and may need to be tailored to the individual situation. Further research is needed to clarify whether a causal relationship exists between prehospital i.v. fluid volume and blood transfusion. Also, prospective trials on prehospital i.v. fluid resuscitation strategies in specific patient subgroups (e.g. traumatic brain injury and concomitant haemorrhage) are warranted.

J Trauma Acute Care Surg. 2014 Sep;77(3):479-85

Frozen blood and lessons learned from 9/11.

Gordon NT, Schreiber MA.

CONCLUSION: There are many benefits to fRBC use. Current data show that fRBCs are safe and at least an equivalent therapeutic option for the care of trauma patients compared with lRBCs. fRBCs have decreased inflammatory markers and increased oxygen-carrying capacity compared with lRBCs. The benefits of freezing and washing can mitigate the effects of the blood storage lesion. Clinical trials comparing lRBCs with fRBCs are warranted. Furthermore, the benefits of fRBC use to better control blood bank inventory are manifold. The ability to guide specialization of care for patients with challenging cross-matches is crucial for a diverse population. fRBCs can also be used to address many of the lessons learned and recommendations put forth by the AABB after the 9/11 attack. An fRBC bank would alleviate the need for emergent donations and address short-term liquid blood shortages during known cyclical and disaster-induced shortages. Finally, fRBC use would address the fundamental issue of waste. Blood donated during disasters does not benefit critical patients because it is not available until at least 48 hours after it is donated. It is the blood donated days prior that has been component separated, tested, and packaged that benefits these patients. Any surplus of donated blood collected during a time of need or generosity is potentially wasted if not used before expiration. fRBC technology enables better preparation and avoidance of donated blood wastage during a disaster by prolonging the period of storage.

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S109-13.

Optimal training for emergency needle thoracostomy placement by prehospital personnel: didactic teaching versus a cadaver-based training program.

Grabo D, Inaba K, Hammer P, Karamanos E, Skiada D, Martin M, Sullivan M, Demetriades D.

BACKGROUND: Tension pneumothorax can rapidly progress to cardiac arrest and death if not promptly recognized and appropriately treated. We sought to evaluate the effectiveness of traditional didactic slide-based lectures (SBLs) as compared with fresh tissue cadaver-based training (CBT) for placement of needle thoracostomy (NT).

METHODS: Forty randomly selected US Navy corpsmen were recruited to participate from incoming classes of the Navy Trauma Training Center at the LAC + USC Medical Center and were then randomized to one of two NT teaching methods. The following outcomes were compared between the two study arms: (1) time required to perform the procedure, (2) correct placement of the needle, and (3) magnitude of deviation from the correct position.

RESULTS: During the study period, a total of 40 corpsmen were enrolled, 20 randomized to SBL and 20 to CBT arms. When outcomes were analyzed, time required to NT placement was not different between the two arms. Examination of the location of needle placement revealed marked differences between the two study groups. Only a minority of the SBL group (35%) placed the NT correctly in the second intercostal space. In comparison, the majority of corpsmen assigned to the CBT group demonstrated accurate placement in the second intercostal space (75%).

CONCLUSION: In a CBT module, US Navy corpsmen were better trained to place NT accurately than their traditional didactic SBL counterparts. Further studies are indicated to identify the optimal components of effective simulation training for NT and other emergent interventions.

Br J Anaesth. 2014 Oct 8. [Epub ahead of print]

Rescuing the obese or burned airway: are conventional training manikins adequate? A simulation study.

Howes TE, Lobo CA, Kelly FE, Cook TM

BACKGROUND: Percutaneous tracheal access is required in more than 40% of major airway emergencies, and rates of failure are high among anaesthetists. Supraglottic airway management is more likely to fail in patients with obesity or neck pathology. Commercially available manikins may aid training. In this study, we modified a standard 'front of neck' manikin and evaluated anaesthetists' performance of percutaneous tracheal access.

METHODS: Two cricothyroidotomy training manikins were modified using sections of belly pork to simulate a morbidly obese patient and an obese patient with neck burns. An unmodified manikin was used to simulate a slim patient. Twenty consultant anaesthetists were asked to manage a 'can't intubate, can't ventilate' scenario involving each of the three manikins. Outcome measures were success using their chosen technique and time to first effective breath.

RESULTS: Success rates using first-choice equipment were: 'slim' manikin 100%, 'morbidly obese' manikin 60%, and 'burned obese' manikin 77%. All attempts on the 'slim' manikin succeeded within 240 s, the majority within 120 s. In attempts on the 'morbidly obese' manikin, 60% succeeded within 240 s and 20% required more than 720 s. All attempts on the 'burned obese' manikin succeeded within 180 s.

CONCLUSIONS: Significantly greater technical difficulty was experienced with our 'morbidly obese' manikin compared with the unmodified manikin. Failure rates and times to completion were considerably more consistent with real-life reports. Modifying a standard manikin to simulate an obese patient is likely to better prepare anaesthetists for this challenging situation. Development of a commercial manikin with such properties would be of value.

Best Pract Res Clin Anaesthesiol. 2014 Sep;28(3):285-96.

Volume therapy in trauma and neurotrauma.

James MF

ABSTRACT

Volume therapy in trauma should be directed at the restitution of disordered physiology including volume replacement to re-establishment of tissue perfusion, correction of coagulation deficits and avoidance of fluid overload. Recent literature has emphasized the importance of damage control resuscitation, focusing on the restoration of normal coagulation through increased use of blood products including fresh frozen plasma, platelets and cryoprecipitate. However, once these targets have been met, and in patients not in need of damage control resuscitation, clear fluid volume replacement remains essential. Such volume therapy should include a balance of crystalloids and colloids. Pre-hospital resuscitation should be limited to that required to sustain a palpable radial artery and adequate mentation. Neurotrauma patients require special consideration in both pre-hospital and in-hospital management.

Anesthesiology. 2014 Oct;121(4):730-9

Effect of hydroxyethyl starch on postoperative kidney function in patients having noncardiac surgery.

Kashy BK, Podolyak A, Makarova N, Dalton JE, Sessler DI, Kurz A.

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

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

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

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

JEMS 2014;Epub ahead of print

Boston EMS transitions to warm zone operations after the Boston Marathon Bombing.

Kearney B, Kue R

QUOTES:

“Military experiences over the past decade have demonstrated improved outcomes to victims of traumatic bleeding with early hemorrhage control techniques employed at the point of injury. This type of focused intervention, described in military-based medical training programs such as Tactical Combat Casualty Care (TCCC), has been integrated into an early and coordinated response with law enforcement.”

“Since the late 1970s, Boston EMS EMTs and paramedics have used surgical tubing tourniquets for extremity hemorrhage control successfully.12,13 In the last few years, all Boston EMS field response units have added hemostatic gauze dressings to their hemorrhage control kits. And since the 2013 bombings, commercial windlass-type tourniquets have been issued to all department members in addition to the surgical tubing tourniquets.”

“Boston EMS has also developed response kits that focus on hemorrhage control and basic airway measures based on TCCC & TECC guidelines.8 These compact kits include rapid deployment items such as tourniquets, hemostatic gauze and pressure bandages that focus care primarily on hemorrhage control.”

BMJ. 2014 Aug 13;349:g4934.

Tranexamic acid for surgical bleeding.

Ker K, Roberts I

QUOTE:

"Treatments that reduce bleeding often increase the risk of thrombosis. According to the summary of product characteristics,9 tranexamic acid is contraindicated in patients with a history of arterial or venous thrombosis. However, in the CRASH-2 trial there were fewer vascular occlusive deaths associated with tranexamic acid and a statistically significant reduction in fatal and non-fatal myocardial infarction. The pathogenesis of perioperative myocardial infarction includes an imbalance in myocardial oxygen supply and demand, rupture of coronary artery plaque, and platelet activation. By reducing surgical bleeding, tranexamic acid might reduce the perioperative tachycardia that increases myocardial oxygen demand and prevent the decrease in haemoglobin level responsible for reduced myocardial oxygen supply. Furthermore, plasmin is a potent mediator of inflammation and by inhibiting plasmin production, tranexamic acid might reduce the inflammatory response thought to contribute to rupture of coronary artery plaque."

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S101-8.

Long-term effects of Combat Ready Clamp application to control junctional hemorrhage in swine.

Kheirabadi BS, Terrazas IB, Miranda N, Estep JS, Corona BT, Kragh JF Jr, Dubick MA.

BACKGROUND: Groin application of Combat Ready Clamp (CRoC) in pigs elicits an acute inflammation in underlying ischemic tissues. This study examined functional recovery of pigs' hind leg(s) following 2 hours of CRoC application.

METHODS: Left femoral arteries were isolated and injured in anesthetized pigs. Following 25% hemorrhage, CRoC was applied on the inguen for 2 hours (n = 6), and wounds were covered with combat gauze (CG). Bleeding was treated in the control animals (n = 5) with CG only. Next, CRoC and CG were removed, arteries were repaired and reflowed, and animals were recovered. The legs' mobility was scored daily, and their neuromuscular functions were measured on Days 7 and 14. Computed tomographic angiography and blood analysis were performed on Days 0, 2, 7, and 14. Pigs were then euthanized, and tissues were collected for histology. Umbilicus application of CRoC was also tested in four pilot experiments.

RESULTS: Inguinal application of CRoC with 524 ± 12 mm Hg pressure occluded iliac arteries and collateral circulation. Following surgical repair, blood flow to the arteries was restored, and five of six CRoC-applied legs recovered full mobility within 9 days. Control-treated legs recovered full function in 3 days ($p = 0.001$). At 2 weeks, muscle strength of CRoC-applied legs was diminished ($p < 0.05$ vs. baselines or controls). Injury biomarkers in the CRoC group increased severalfold compared with the controls on Day 2 but returned to baseline afterward. Histologic changes were mostly mild and indicative of ischemia in the CRoC group. Umbilical application of CRoC required higher pressure (625 ± 8 mm Hg) and caused gross ischemic necrosis of lumbar muscles with significant disabilities.

CONCLUSION: Two-hour inguinal application of CRoC caused mild and reversible ischemic injuries, which delayed full recovery of the limb function by a few days. In contrast, 2-hour umbilicus application of CRoC resulted in extensive muscle necrosis with functional disabilities. While CRoC seems safe and effective for inguinal application, other tourniquets should be evaluated for treating bilateral junctional bleeding.

J Spec Oper Med. 2014 Fall;14(3):58-63.

Testing of junctional tourniquets by military medics to control simulated groin hemorrhage.

Kragh JF Jr, Parsons DL, Kotwal RS, Kheirabadi BS, Aden JK 3rd, Gerhardt RT, Baer DG, Dubick MA.

BACKGROUND: Junctional hemorrhage is a common cause of death on the battlefield, but there is no documented direct comparison for the use of junctional tourniquet models by US medics. The purpose of this testing is to assess military medic experience with the use of junctional tourniquets in simulated out-of-hospital trauma care.

METHODS: Nine medics (seven men and two women) used four different junctional tourniquets: Combat Ready Clamp™ (CRoC™; http://www.combatmedicalsystems .com), Abdominal Aortic and Junctional Tourniquet™ (AAJT™; http://www.compressionworks.net), Junctional Emergency Treatment Tool (JETT™; http://www.narescue .com), and SAM Junctional Tourniquet® (SJT®; http:// www.sammedical.com/products). These medics also acted as simulated casualties. Effectiveness percentages, as measured by stopped distal pulse by Doppler auscultation, and time to effectiveness were recorded in two tests per tourniquet (72 total tests). Tourniquet users ranked their preference of model by answering the question: "If you had to go to war today and you could only choose one, which tourniquet would you choose to bring?"

RESULTS: All tourniquets used were safe under the conditions of this study. Both the SJT and the CRoC had high effectiveness percentages; their rate difference was not statistically significant. The SJT and the CRoC had fast times to effectiveness; their time difference was not statistically significant. Users preferred the SJT and the CRoC; their ranked difference was not statistically significant.

CONCLUSION: The SJT and the CRoC were equally effective and fast and were preferred by the participants.

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S121-6.

Evaluation of standard versus nonstandard vital signs monitors in the prehospital and emergency departments: results and lessons learned from a trauma patient care protocol.

Liu NT, Holcomb JB, Wade CE, Darrah MI, Salinas J.

BACKGROUND: This study aimed to determine the effectiveness of using a wireless, portable vital signs monitor (WVSM) for predicting the need for lifesaving interventions (LSIs) in the emergency department (ED) and use a multivariate logistic regression model to determine whether the WVSM was an improved predictor of LSIs in the ED over the standard of care monitor currently being used.

METHODS: This study analyzed 305 consecutive patients transported from the scene via helicopter to a Level I trauma center. For 104 patients in the study, a WVSM was also attached to the patient's arm and used to record and display prehospital and hospital physiologic data in real time on a handheld computer and in the trauma bay. Multivariate logistic regression analyses were performed for accuracy in predicting needs for LSIs in control and WVSM subjects. In addition, receiver operating characteristic curves were obtained to examine the discriminating power of the models for the outcome of one or more LSIs in the ED.

RESULTS: Of the 305 patients, 73 underwent 109 LSIs in the ED. Of these, 21 patients wore the WVSM during transport in addition to the standard monitor. Logistic regression analysis revealed that heart rate, respiratory rate, and systolic blood pressure were significantly associated with an increased risk for LSIs in the ED ($p < 0.05$). Receiver operating characteristic curve analysis also demonstrated better prediction for LSIs performed in the ED in WVSM subjects than in control subjects (area under the curve, 0.86 vs. 0.81, respectively).

CONCLUSION: The WVSM system leads to improved LSI accuracy in the ED. In addition, many important lessons have been learned in preparation for this study. Adoption of nonstandard vital signs monitors into critical care/trauma medicine may require a new paradigm of personnel education, training, and practice.

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

Asian J Surg. 2014 Oct;37(4):205-7.

Hemostatic resuscitation for massive hemorrhage with warm fresh whole blood in a patient with severe blunt trauma.

Liu YH, Chao CS, Chang YP, Chin HK

ABSTRACT:

A 24-year-old male Navy soldier was struck on the left thigh by a ruptured cable and was subsequently thrown into the sea. Initial evaluation showed an Injury Severity Score of 34. Core body temperature was 34.1°C. Laboratory data included a hemoglobin level of 4.5 g/dL and a hematocrit of 13.3%. Prothrombin time was prolonged (>100 seconds), international normalized ratio was elevated (9.99), and partial thromboplastin time was elevated (>180 seconds). The patient was treated for hypothermia, coagulopathy, and metabolic acidosis during resuscitation. The patient was transfused with 16,320 mL of blood during the first 24 hours following the accident, including 4500 mL (18 units) of warm fresh whole blood (WFWB) donated by the patient's military colleagues. The patient was successfully resuscitated, and the injured leg was salvaged. Component therapy can afford replacement of specific deficiencies or requirements, decrease the risk of transfusion-transmitted infectious diseases, and improve resource utilization. However, a protocol of early transfusion with WFWB should be considered during resuscitation following massive hemorrhage in specific conditions such as battlefields or urgent situations.

Ann Emerg Med. 2014 Sep 15 [Epub ahead of print]

When Used for Sedation, Does Ketamine Increase Intracranial Pressure More Than Fentanyl or Sufentanil?

Loflin R, Koyfman A

QUOTE:

"The authors identified 120 potential studies, of which 5 met inclusion criteria; the total number of subjects across all studies was 198. The authors noted clinical heterogeneity among the included studies, which spanned 17 years, with 4 of the studies performed in head-injured, mechanically ventilated adult patients in European ICUs and 1 study performed in spontaneously breathing pediatric patients without head injury who were undergoing lumbar puncture in the United States. Intracranial pressure was measured by various methods among the studies, including frontal ventriculostomy and opening pressure on lumbar puncture, or the specific method was not provided. The study quality was also variable, with 3 of the studies having unclear allocation concealment and 1 study that was not blinded.

Given these limitations, the results suggest no difference in mean intracranial pressure or cerebral perfusion pressure in patients receiving ketamine compared with opioids. The results were robust to sensitivity and subgroup analyses with regard to mechanical versus spontaneous ventilation, concomitant medications, and secular trends in ICU care."

Plast Reconstr Surg. 2014 Oct;134(4 Suppl 1):22.

Implementation of tranexamic acid to reduce blood loss during cranial vault remodeling for craniosynostosis at a single institution.

Martin DT, Gries H, Diggs BS, Koh JL, Selden NR, Schreiber MA, Kuang AA.

CONCLUSIONS: : The introduction of TXA for non-syndromic single-suture synostosis repair at our institution resulted in significant reductions in blood loss and need for blood product transfusion for cranial vault remodeling. Postoperative hematocrits remained the same even with less blood transfusion. In addition, TXA use nearly eliminated the need for plasma transfusion, and is associated with shorter hospital stay. No difference in postoperative complications was observed. Our data provides further support for the continued use of TXA in our program and its wider acceptance for pediatric cranial vault remodeling.

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S156-62

The use of rigid eye shields (Fox shields) at the point of injury for ocular trauma in Afghanistan.

Mazzoli RA, Gross KR, Butler FK

BACKGROUND: Unlike hemorrhagic injuries in which direct pressure is indicated, any pressure placed on the eye after penetrating trauma can significantly worsen the injury by expulsing intraocular contents. The accepted first response measure for obvious or suspected penetrating ocular injury is placement of a rigid shield that vaults the eye so as to prevent accidental iatrogenic aggravation during transport to the ophthalmologist. Patching and placing intervening gauze between the shield and the eye are both contraindicated. Anecdotally, compliance with these recommendations is poor in the military and civilian communities alike; however, published studies documenting compliance are uniformly lacking. This study was undertaken to provide such an evaluation.

METHODS: In this retrospective observational study, the Department of Defense Trauma Registry was reviewed to identify eye injuries in Afghanistan from 2010 to 2012 and to examine compliance with eye shield recommendations. One hundred fifty-seven records of eye casualties were identified and categorized according to diagnostic codes, noting use of a shield. A subset of 30 records was further analyzed for compliance with other core treatment measures specified by the operant Clinical Practice Guideline. Because comparative studies do not exist, simple statistical analysis was performed.

RESULTS: Overall, 39% of eye injuries received a shield at the point of injury (61% failure), ranging from 0% to 50% between diagnostic subgroups. Subset analysis revealed that only 4.2% of injuries were successfully mitigated at the point of injury (95.8% failure).

CONCLUSION: In one of the few studies documenting the use of eye shields after ocular trauma, anecdotal reports of poor, inadequate, or incorrect compliance with basic recommendations were substantiated. Several factors may account for these findings. Corrective efforts should include enhanced educational emphasis and increased shield availability.

LEVEL OF EVIDENCE: Epidemiologic study, level IV. Therapeutic study, level IV.

International J Pharmaceutical Compounding 2014;18:432

Stability of tranexamic acid in 0.9% sodium chloride, stored in Type 1 class vials and ethylene/propylene copolymer plastic containers.

McCluskey SV, Sztajnkrycer MD, Jenkins DA, Berns KS, Park MS

Abstract

Tranexamic acid has recently been demonstrated to decrease all-cause mortality and deaths due to hemorrhage in trauma patients. The optimal administration of tranexamic acid is within one hour of injury, but not more than three hours from the time of injury. To aid with timely administration, a premixed solution of 1 gram tranexamic acid and 0.9% sodium chloride was proposed to be stocked as a medication in both the aeromedical transport helicopters and Emergency Department at Mayo Clinic Hospital - Rochester Saint Marys campus. Since no published stability data exists for tranexamic acid diluted with 0.9% sodium chloride, this study was undertaken to determine the stability of tranexamic acid diluted with 0.9% sodium chloride while being stored in two types of containers. Stability was determined through the use of a stability-indicating high-performance liquid reverse phase chromatography assay, pH, and visual tests. Tranexamic acid solutions of 1 g and 0.9% sodium chloride 65 mL were studied at predetermined intervals for 90 days in ethylene/propylene copolymer plastic containers, protected from light, and at both controlled room and refrigerated temperatures. Tranexamic acid solutions of 1 gram in 0.9% sodium chloride 50 mL were studied at predetermined intervals for 180 days in clear Type 1 borosilicate glass vials sealed with intact elastomeric, Flourotec-coated stoppers, stored protected from light at controlled room temperature. Solutions stored in the ethylene/propylene copolymer plastic containers at both storage temperatures maintained at least 98% of initial potency throughout the 90 day study.. Solutions stored in glass vials at controlled room temperature maintained at least 92% of initial potency throughout the 180-day study period. Visual and pH tests revealed stable, clear, colorless, and particulate-free solutions throughout the respective study periods.

Mil Med. 2014 Oct;179(10):1133-40

Stellate ganglion block used to treat symptoms associated with combat-related post-traumatic stress disorder: a case series of 166 patients.

Mulvaney SW, Lynch JH, Hickey MJ, Rahman-Rawlins T, Schroeder M, Kane S, Lipov E

OBJECTIVE: Report the successful use of stellate ganglion blocks (SGBs) in 166 active duty service members with multiple combat deployments experiencing anxiety symptoms associated with post-traumatic stress disorder (PTSD).

BACKGROUND: Successful treatment of PTSD symptoms with SGB has been reported previously. This is the largest published case series evaluating SGB with a minimum of 3 months follow-up.

METHODS: Following clinical interview including administration of the PTSD Checklist (PCL), 166 service members with symptoms of PTSD elected to receive a SGB. All patients received a SGB on the right side at the level of the sixth cervical vertebrae (C6). The PCL was administered the day before treatment to establish a baseline, repeated 1 week later, and then monthly out to 3 months. A positive response was considered to be an improvement in the PCL score by 10 or greater points. Follow-up PCL scores from 3 to 6 months were obtained and analyzed for 166 patients.

RESULTS: In a military population with multiple combat deployments, over 70% of the patients treated had a clinically significant improvement in their PCL score which persisted beyond 3 to 6 months postprocedure.

CONCLUSION: Selective blockade of the right cervical sympathetic chain at the C6 level is a safe and minimally invasive procedure that may provide durable relief from anxiety symptoms associated with PTSD.

Cochrane Database Syst Rev. 2013 Jul 23

Hydroxyethyl starch (HES) versus other fluid therapies: effects on kidney function.

Mutter TC, Ruth CA, Dart AB

BACKGROUND: Hydroxyethyl starches (HES) are synthetic colloids commonly used for fluid resuscitation to replace intravascular volume, yet they have been increasingly associated with adverse effects on kidney function. This is an update of a Cochrane review first published in 2010.

OBJECTIVES: To examine the effects of HES on kidney function compared to other fluid resuscitation therapies in different patient populations.

DATA COLLECTION AND ANALYSIS: Screening, selection, data extraction and quality assessments for each retrieved article were carried out by two authors using standardized forms. All outcomes were analyzed using relative risk (RR) and 95% confidence intervals (95% CI). Authors were contacted when published data were incomplete. Preplanned sensitivity and subgroup analyses were performed after data were analyzed with a random-effects model.

MAIN RESULTS: This review included 42 studies (11,399 patients) including 19 studies from the original review (2010), as well as 23 new studies. Fifteen studies were excluded from the original review (nine retracted from publication due to concerns about integrity of data and six lacking individual patient creatinine data for the calculation of RIFLE criteria). Overall, there was a significant increase in the need for RRT in the HES treated individuals compared to individuals treated with other fluid therapies (RR 1.31, 95% CI 1.16 to 1.49; 19 studies, 9857 patients) and the number with author-defined kidney failure (RR 1.59, 95% CI 1.26 to 2.00; 15 studies, 1361 patients). The RR of AKI based on RIFLE-F (failure) criteria also showed an increased risk of AKI in individuals treated with HES products (RR 1.14, 95% CI 1.01 to 1.30; 15 studies, 8402 participants). The risk of meeting urine output and creatinine based RIFLE-R (risk) criteria for AKI was in contrast in favour of HES therapies (RR 0.95, 95% CI 0.91 to 0.99; 20 studies, 8769 patients). However, when RIFLE-R urine output based outcomes were excluded as per study protocol, the direction of AKI risk again favoured the other fluid type, with a non-significant RR of AKI in HES treated patients (RR 1.05, 95% CI 0.97 to 1.14; 8445 patients). A more robust effect was seen for the RIFLE-I (injury) outcome, with a RR of AKI of 1.22 (95% CI 1.08 to 1.37; 8338 patients). No differences between subgroups for the RRT and RIFLE-F based outcomes were seen between sepsis versus non-sepsis patients, high molecular weight (MW) and degree of substitution (DS) versus low MW and DS (≥ 200 kDa and > 0.4 DS versus 130 kDa and 0.4 DS) HES solutions, or high versus low dose treatments (i.e. ≥ 2 L versus < 2 L). There were differences identified between sepsis versus non-sepsis subgroups for the RIFLE-R and RIFLE-I based outcomes only, which may reflect the differing renal response to fluid resuscitation in pre-renal versus sepsis-associated AKI. Overall, methodological quality of the studies was good.

AUTHORS' CONCLUSIONS: The current evidence suggests that all HES products increase the risk in AKI and RRT in all patient populations and a safe volume of any HES solution has yet to be determined. In most clinical situations it is likely that these risks outweigh any benefits, and alternate volume replacement therapies should be used in place of HES products.

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S146-50

Tranexamic acid at the point of injury: the Israeli combined civilian and military experience.

Nadler R, Gendler S, Benov A, Strugo R, Abramovich A, Glassberg E.

BACKGROUND: Accumulating evidence established the benefit of tranexamic acid (TXA) for traumatic bleeding in the hospital setting. TXA use in the field (at or near the point of injury [POI]) was described in the military setting but not in the civilian one. The current study describes the Israeli combined experience (civilian and military) of administering TXA in the field.

METHODS: The Israel Defense Forces (IDF) and Magen David Adom (MDA) (the national Israeli civilian emergency medical service) protocols for giving TXA at the POI are presented. We then review all trauma patients who received TXA in the field in accord with either protocol. Data were abstracted from the IDF Trauma Registryand from the MDA database.

RESULTS: Data regarding casualties treated with TXA by the IDF Medical Corps and MDA between December 2011 and August 2013 are presented. One hundred three casualties who received TXA in the field were identified. The median age was 26.5 years, and 83 (88%) were male. The mechanism of injury was penetrating in 48 cases (51%). POI data indicate slightly higher injury severity for the group of patients treated by MDA compared with patients treated by the IDF (systolic blood pressure, 90 mm Hg vs. 110 mm Hg; Glasgow Coma Scale [GCS] score, 11 vs. 15; hemoglobin, 11.9 vs. 13.3; $p < 0.05$).

CONCLUSION: On the basis of our combined data, it appears that administering TXA in the field is feasible in the civilian and the military setting. Lessons learned in military settings are applicable to civilian medical systems. Action investigations and comparison of the different protocols may further improve treatment at or near the POI.

LEVEL OF EVIDENCE: Therapeutic study, level V.

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S114-20

Prehospital blood transfusion in the en route management of severe combat trauma: a matched cohort study.

O'Reilly DJ, Morrison JJ, Jansen JO, Apodaca AN, Rasmussen TE, Midwinter MJ.

BACKGROUND: The value of prehospital blood transfusion (PHBTx) in the management of severe trauma has not been established. This study aimed to evaluate the effect of PHBTx on mortality in combat casualties.

METHODS: This is a retrospective cohort study of casualties admitted to the field hospital at Camp Bastion, Afghanistan, by the Medical Emergency Response Team from May 2006 to March 2011. Participants were divided into two consecutive cohorts by the introduction of PHBTx. Paired groups of patients were chosen by combining propensity score methodology with detailed matching of injury profile. Thus recipients of PHBTx were matched with nonrecipients who would have received it had it been available.

RESULTS: A total of 1,592 patients were identified. Of the 1,153 patients to whom PHBTx was potentially available, 310 received it (26.9%). The rate of severe injury (Injury Severity Score [ISS] > 15) rose from 28% before PHBTx was available to 43% thereafter ($p < 0.001$). Mortality in the latter group was higher (14% vs. 10%, $p = 0.013$) but not in the severely injured patients (32% vs. 28%, $p = 0.343$). Ninety-seven patients were paired. The mortality of matched patients who received PHBTx, compared with those with similar injury patterns who did not, was less than half (8.2% vs. 19.6%, $p < 0.001$). However, matched recipients had more prehospital interventions, reached hospital more quickly, and had lower heart rate at admission (all $p < 0.05$). Matched recipients received more red blood cells within 24 hours (median, 4 U; interquartile range [IQR], 2-10 U) than nonrecipients (median 0 U; IQR, 0-3.5 U) and more fresh frozen plasma (median, 2 U; IQR, 2-9 U vs. median, 0 U; IQR, 0-1 U) (both $p < 0.001$).

CONCLUSION: An aggressive approach to damage control resuscitation including the use of PHBTx was associated with a large improvement in mortality. However, because of confounders resulting from changes in practice, the isolated contribution of PHBTx cannot be determined from this study.

LEVEL OF EVIDENCE: Therapeutic study, level IV.

Aviat Space Environ Med. 2014 Nov;85(11):1130-5.

Risk management analysis of air ambulance blood product administration in combat operations.

Powell-Dunford N, Quesada JF, Malsby RF, Chou V, Gerhardt RT, Gross KR, Shackelford SA.

BACKGROUND: Between June-October 2012, 61 flight-medic-directed transfusions took place aboard U.S. Army Medical Evacuation (medevac) helicopters in Afghanistan. This represents the initial experience for pre-hospital blood product transfusion by U.S. Army flight medics.

METHODS: We performed a retrospective review of clinical records, operating guidelines, after-action reviews, decision and information briefs, bimonthly medical conferences, and medevac-related medical records.

RESULTS: A successful program was administered at 10 locations across Afghanistan. Adherence to protocol transfusion indications was 97%. There were 61 casualties who were transfused without any known instance of adverse reaction or local blood product wastage. Shock index (heart rate/systolic blood pressure) improved significantly en route, with a median shock index of 1.6 (IQR 1.2-2.0) pre-transfusion and 1.1 (IQR 1.0-1.5) post-transfusion ($P < 0.0001$). Blood resupply, training, and clinical procedures were standardized across each of the 10 areas of medevac operations.

DISCUSSION: Potential risks of medical complications, reverse propaganda, adherence to protocol, and diversion and/or wastage of limited resources were important considerations in the development of the pilot program. Aviation-specific risk mitigation strategies were important to ensure mission success in terms of wastage prevention, standardized operations at multiple locations, and prevention of adverse clinical outcomes. Consideration of aviation risk mitigation strategies may help enable other helicopter emergency medical systems to develop remote pre-hospital transfusion capability. This pilot program provides preliminary evidence that blood product administration by medevac is safe.

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S57-65.

Vietnam (1972) to Afghanistan (2014): the state of military trauma care and research, past to present.

Pruitt BA Jr, Rasmussen TE.

QUOTE:
MILITARY TRAUMA SYSTEMS

"The greatest difference in combat casualty care between the RVN conflict and the wars in Afghanistan and Iraq has been the development and implementation of what is now referred to as the Defense Center of Excellence (DCoE) Joint Trauma System or JTS. The DCoE JTS is a global trauma system which, through its performance improvement processes, coordinates and standardizes the trauma related activities of all three armed services (Army, Navy and Air Force).12 Except for the coordinated transfer of burned patients from any of the military medical services to the Army Burn Center in San Antonio, which was developed during the RVN conflict, the U.S. did not go to war with a unified trauma system in Vietnam, nor was one developed. During the Vietnam War, the Army, Navy, Air Force and Marines generally worked disparately in their own operational lanes and process improvement of trauma care was limited to nonexistent. In contrast, military medical care in Afghanistan and Iraq has been performed under the coordination of the DCoE JTS, whose very mission since its initiation in 2004 has been continuous real-time performance improvement. The JTS has deployed trauma systems specialists to collect performance improvement information for the extensive Department of Defense Trauma Registry (DoDTR - formerly the Joint Theater Trauma Registry) and has disseminated a vetted, evidence supported set of clinical practice guidelines designed to standardize all aspects of care (point of injury to definitive stateside) among the three services."

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S127-33

Self-expanding foam for prehospital treatment of intra-abdominal hemorrhage: 28-day survival and safety.

Rago AP, Duggan MJ, Beagle J, Peev MP, Marini J, Hwabejire JO, Hannett P, Zugates G, Busold R, Helmick M, Velmahos G, Demoya MA, Yeh DD, Fagenholz PJ, Sharma U, King DR.

BACKGROUND: Intracavitary noncompressible hemorrhage remains a significant cause of preventable death on the battlefield and in the homeland. We previously demonstrated the hemostatic efficacy of an in situ self-expanding poly(urea)urethane foam in a severe, closed-cavity, hepatoportal exsanguination model in swine. We hypothesized that treatment with, and subsequent explantation of, foam would not adversely impact 28-day survival in swine.

METHODS: Following a closed-cavity splenic transection, animals received either fluid resuscitation alone (control group, n = 6) or resuscitation plus foam treatment at doses of 100 mL (n = 6), 120 mL (n = 6), and 150 mL (n = 2). Foam was allowed to polymerize in situ and was explanted after 3 hours. The animals were recovered and monitored for 28 days.

RESULTS: All 18 animals in the 100-mL, 120-mL, and control groups survived to the 28-day endpoint without complications. The 150-mL group was terminated after the acute phase (n = 2). En bloc explantation of the foam took less than 2 minutes and was associated with millimeter-sized remnant particles. All foam animal required some level of enteric repair (imbrication or resection). Excluding the aborted 150-mL group, all animals survived, with no differences in renal or hepatic function, serum chemistries, or semiquantitative abdominal adhesion scores. Histologic analysis demonstrated that remnant particles were associated with a fibrotic capsule and mild inflammation, similar to that of standard suture reaction. In addition, safety testing (including genotoxicity, pyrogenicity, and cytotoxicity) was performed consistent with the ISO-10993 standard, and the materials passed all tests.

CONCLUSION: For a distinct dose range, 28-day recovery after foam treatment and explantation for noncompressible, intra-abdominal hemorrhage is not associated with significant physiologic or biochemical evidence of end-organ dysfunction. A foam volume exceeding the maximum tolerable dose was identified. Bowel repair is required to ensure survival.

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S237-9.

A perspective on the 2014 Institute of Medicine report on the long-term effects of blast exposures.

Rasmussen TE, Elster EA, Rauch TM, Brix KA

CONCLUSION:

The findings and recommendations of the 2014 IOM report are useful, but they must be considered in appropriate context. The report's less-than-precise terminology, restrictive methodology, and uneven treatment of topics limit its utility as a clinical review or policy analysis. Although the document provides a pertinent summary of the chronic neurologic and psychological effects of primary blast, its conclusions and recommendations for acute secondary blast injury are needlessly narrow. They do not reflect the gritty experiences and clinical observations of a modern generation of military medics and surgeons.

Oddly, the document made only two recommendations for military medical research: (1) development of blast sensors and (2) a screening test to be conducted on young men and women at the time of their enlistment. It would have been better had the report made no recommendations for DoD research. While these topics are fascinating, war-tested military providers and scientists agree that the DoD's research agenda must be much broader or more inclusive. In addition, the IOM document made several research recommendations to the VA that would be more appropriately addressed by the DoD including the conduct of epidemiologic, biochemical, and neuroimaging studies to identify markers of blast injury. In reality, the DoD has a much larger research role in this than the VA.

Military blast research must also focus on relevant, realistic, and rapidly translatable science including that pertaining to the effects of secondary blast on bone and soft tissues, circulation, and organ function as well as optimizing the tactical and en route care of blast-injured personnel. As our nation binds its wounds from more than a decade of explosive injuries, it is important that a clear, contemporary, and inclusive understanding of blast injury be conveyed to the public and to policy makers. This understanding should respect the sacrifices of our most recent generation of war fighters and properly address the full spectrum of necessary research. If done correctly, an analysis of this sort will not only do justice to US service personnel and veterans but also improve the care of civilian victims of terrorist acts using explosive devices. Looking to the future, constructive collaboration among the DoD, the VA, and independent organizations such as the IOM will be essential to garner the lessons learned from the longest war in US history. These efforts will be necessary to guide relevant, forward-looking but accomplishable research endeavors. Although the IOM's 2014 blast injury report is valuable as far as it goes, it does not go far enough. Those who read it should do so with appropriate context and not generalize its findings or recommendations, as they are not representative of the entire range of modern blast injury

JEMS 2014;Epub ahead of print

Interoperable core skills for training to respond to violent incidents.

Rathburn D, Meoli M

QUOTE:

Tactical Combat Casualty Care

"TCCC is currently the only evidence-based standard of prehospital care rendered to a casualty in a tactical, combat environment from the point of injury until they arrive at the medical treatment facility. A comprehensive study of preventable deaths in Vietnam and Somalia concluded the three most common causes of preventable battlefield death are exsanguination from extremity wounds (60%), tension pneumothorax (33%) and airway obstruction (6%). Although battle-proven, TCCC principles on potential causes of death that can kill within 20 minutes from the point of injury clearly apply to civilian tactical trauma care, the terminology is military, which can sometimes be controversial.

Tactical emergency medical support (TEMS) or tactical emergency casualty care (TECC) are civilian terminology for TCCC. The Committee for Tactical Emergency Casualty Care (C-TECC) used the military battlefield guidelines of TCCC as the evidence-based starting point in the development of TECC terminology.

TCCC/TECC doctrine states three distinct threat levels or "phases" which indicate the kind of care that should or shouldn't be rendered. Recognizing that nothing is absolute, these are guidelines where "tactics drive medicine."

1. Hot zone (care under fire/direct threat): The casualty is exposed to effective or potentially effective enemy fire. Either there is a clear and present active shooter, or the casualty is still in the line of fire where a perpetrator can pop up and start shooting again. All efforts are directed at eliminating the threat and/or getting the casualty and the team out of the line of fire. Assuming the team has established fire superiority, the only appropriate treatment would normally be to stop uncontrolled extremity hemorrhage with a tourniquet in less than 20 seconds. If fire superiority can't be reasonably assured, the casualty should be immediately extracted using standardized techniques without medical aid.

2. Warm zone (tactical field care/indirect threat): The casualty is still on the inner perimeter of a live mission, but is in a position of cover and concealment, not directly exposed to enemy fire. Appropriate actions at this stage include tourniquet application, wound packing, hemostatic agents, compression bandaging, chest sealing and/or decompression and advanced airway control.

3. Cold zone (tactical evacuation/evacuation): The casualty and the medic are now out of the inner perimeter."

Ann Emerg Med. 2014 Sep 17 [Epub ahead of print]

Does Tranexamic Acid Improve Outcomes in Patients Undergoing Urgent or Emergency Surgery?

Robertson J, Koyfman A

QUOTE:

"In conclusion, this meta-analysis reported a 30% reduction in the need for transfusions with the administration of tranexamic acid at the time of emergency hip and femur fracture surgery. However, given the multiple limitations of this systematic review, the benefits and potential harms of administration in the ED remain unknown."

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S77-82

A laparoscopic swine model of noncompressible torso hemorrhage.

Ross JD, Burns CJ, Sagini EM, Zarzabal LA, Morrison JJ.

BACKGROUND: Hemorrhage persists as the leading cause of potentially preventable civilian and military death. Noncompressible torso hemorrhage (NCTH) is a particularly lethal injury complex, with few contemporary prehospital interventions available. Various porcine models of hemorrhage have been developed for civilian and military trauma research. However, the predominant contemporary models lack key physiologic characteristics including the natural tamponade provided by an intact abdominal wall.To improve physiologic and clinical relevance, we developed a laparoscopic model of NCTH. This approach maintains both the integrity of the peritoneum and the natural tamponade effect of an intact abdominal wall while preserving the intrinsic physiologic responses to hemorrhage. Furthermore, we present data quantifying the contribution of the swine contractile spleen in the context of uncontrolled hemorrhage.

METHODS: Anesthetized adult male Yorkshire swine underwent a laparoscopic Grade V liver injury, with or without open preinjury splenectomy. Animals were observed without intervention for a total of 120 minutes after injury to simulate point of injury, transport time, and arrival at hospital.

RESULTS: Shed blood-to-body weight ratio did not differ among groups; however, mortality was higher in splenectomized animals (67% vs. 33%). Cox regression modeling demonstrated a critical time point of 45 minutes and blood pressure as significant predictors of mortality.

CONCLUSION: This study describes a model of NCTH that reflects clinically relevant physiology in trauma and uncontrolled hemorrhage. In addition, it quantitatively assesses the role of the swine contractile spleen in the described model.

Arch Orthop Trauma Surg. 2014 Nov;134(11):1609-14

Intravenous use of tranexamic acid reduces postoperative blood loss in total knee arthroplasty.

Sabatini L, Atzori F, Revello S, Scotti L, Debiasi F, Massè A.

INTRODUCTION: Blood transfusion is often required in total knee replacement (TKR); several methods of blood preservation are commonly used but the ideal solution is to reduce the blood loss during and after surgery. Aim of the study was to evaluate the hemostatic efficacy and safety of intravenous use of tranexamic acid in patients receiving TKR (cemented).

MATERIALS AND METHODS: Forty-five patients after TKR receive treatment with tranexamic acid (TXA, treatment group), and 45 were managed with fibrin tissue adhesive (control group). Hemoglobin values decrease and transfusions in both groups were recorded. Statistical analysis was performed with Student t test and χ (2) test. A statistical model was elaborated to evaluate together all variables and to underline what data can increase transfusions need.

RESULTS: A significant reduction was detected in hemoglobin values in the first 3 days after surgery in the treatment group. The difference in all cases was significant. When tranexamic acid was administered, the need for transfusions was lower (difference statistically significant). No major adverse events were recorded in our series. The use of autologous blood preparation before surgery led to a higher transfusion rate.

CONCLUSION: Tranexamic acid reduced blood loss in TKR and significantly reduced the blood transfusion need also when compared to fibrin tissue adhesive. The use of tranexamic acid is safe and in future may avoid preparation of autologous blood unit before surgery with a decrease of cost and medical figures involved.

J Emerg Med. 2014 Oct;47(4):427-9

Positive FAST without hemoperitoneum due to fluid resuscitation in blunt trauma.

Slutzman JE, Arvold LA, Rempell JS, Stone MB, Kimberly HH.

BACKGROUND: The focused assessment with sonography in trauma (FAST) examination is an important screening tool in the evaluation of blunt trauma patients.

OBJECTIVES: To describe a case of a hemodynamically unstable polytrauma patient with positive FAST due to fluid resuscitation after blunt trauma.

CASE REPORT: We describe a case of a hemodynamically unstable polytrauma patient who underwent massive volume resuscitation prior to transfer from a community hospital to a trauma center. On arrival at the receiving institution, the FAST examination was positive for free intraperitoneal fluid, but no hemoperitoneum or significant intra-abdominal injuries were found during laparotomy. In this case, it is postulated that transudative intraperitoneal fluid secondary to massive volume resuscitation resulted in a positive FAST examination.

CONCLUSION: This case highlights potential issues specific to resuscitated trauma patients with prolonged transport times. Further study is likely needed to assess what changes, if any, should be made in algorithms to address the effect of prior resuscitative efforts on the test characteristics of the FAST examination.

Shock. 2014 May;41 Suppl 1:70-5

Low titer group O whole blood in emergency situations.

Strandenes G, Berséus O, Cap AP, Hervig T, Reade M, Prat N, Sailliol A, Gonzales R, Simon CD, Ness P, Doughty HA, Spinella PC, Kristoffersen EK.

ABSTRACT:

In past and ongoing military conflicts, the use of whole blood (WB) as a resuscitative product to treat trauma-induced shock and coagulopathy has been widely accepted as an alternative when availability of a balanced component-based transfusion strategy is restricted or lacking. In previous military conflicts, ABO group O blood from donors with low titers of anti-A/B blood group antibodies was favored. Now, several policies demand the exclusive use of ABO group-specific WB. In this short review, we argue that the overall risks, dangers, and consequences of "the ABO group-specific approach," in emergencies, make the use of universal group O WB from donors with low titers of anti-A/B safer. Generally, risks with ABO group-specific transfusions are associated with in vivo destruction of the red blood cells transfused. The risk with group O WB is from the plasma transfused to ABO-incompatible patients. In the civilian setting, the risk of clinical hemolytic transfusion reactions (HTRs) due to ABO group-specific red blood cell transfusions is relatively low (approximately 1:80,000), but the consequences are frequently severe. Civilian risk of HTRs due to plasma incompatible transfusions, using titered donors, is approximately 1:120,000 but usually of mild to moderate severity. Emergency settings are often chaotic and resource limited, factors well known to increase the potential for human errors. Using ABO group-specific WB in emergencies may delay treatment because of needed ABO typing, increase the risk of clinical HTRs, and increase the severity of these reactions as well as increase the danger of under-resuscitation due to lack of some ABO groups. When the clinical decision has been made to transfuse WB in patients with life-threatening hemorrhagic shock, we recommend the use of group O WB from donors with low anti-A/B titers when logistical constraints preclude the rapid availability of ABO group-specific WB and reliable group matching between donor and recipient is not feasible.

Ann Emerg Med. 2014 Oct;64(4):385-388.

Ketamine and intraocular pressure in children.

Wadia S, Bhola R, Lorenz D, Padmanabhan P, Gross J, Stevenson M

STUDY OBJECTIVE: We determine the increase in intraocular pressure during pediatric procedural sedation with ketamine, and the proportion of children whose increase might be clinically important (at least 5 mm Hg).

METHODS: We prospectively enrolled children aged 8 to 18 years, chosen to receive ketamine sedation in a pediatric emergency department. We measured intraocular pressure before sedation, immediately after ketamine administration, 2 minutes post-drug administration, and every 5 minutes thereafter until recovery or 30 minutes after the final dose. We descriptively report our observations.

RESULTS: For the 60 children enrolled, the median intraocular pressure increase was 3 mm Hg (range 0 to 8 mm Hg). Fifteen children had a brief greater than or equal to 5 mm Hg increase in intraocular pressure from baseline.

CONCLUSION: In this study of ketamine sedation in children with healthy eyes, we observed mild increases in intraocular pressure that at times transiently exceeded our bounds for potential clinical importance (5 mm Hg).

Injury. 2014 Oct;45(10):1585-9

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

Walker NM, Eardley W, Clasper JC

ABSTRACT:

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

J Trauma Acute Care Surg 2014;77:734-742

What do the people who transport trauma patients know about tourniquets?

Wall P, Welander J, Smith HL, Buisina CM, Sahr SM

BACKGROUND: The primary study objectives were to gather information concerning the tourniquet knowledge, experience, training, protocols, preferences, and equipment of civilian prehospital providers.

METHODS: This is a survey of 151 prehospital care providers.

RESULTS: Survey respondents included 27 basic, 1 intermediate, and 75 paramedic emergency medical technicians; 1 registered nurse; 4 firefighters without medical certifications; 2 respondents not yet certified; and 1 respondent not listing certifications. Respondents had 2 months to 40 years of experience and came from emergency medical services in communities of 101 to 206,688 residents located 10 minutes to 103 minutes from a Level 1 or 2 trauma center. Twenty-five had used tourniquets: 5 in military and 22 in civilian settings. Civilian tourniquets were most frequently used for motor vehicle - then farm - and manufacturing-related injuries with severe bleeding. Tourniquet knowledge was poor for all groupings (with or without tourniquet experience, military experience, all certifications, all years of experience): 91% did not understand that wider tourniquets require less pressure for arterial occlusion, 69% did not know that stopping venous flow without arterial is harmful, and 37% did not know the correct tourniquet locations for distal limb injuries. Of the 81 on a service and without military experience, 44 had received any tourniquet training; 14 of the 44 had commercial emergency tourniquet access, and 27 indicated their service had a tourniquet protocol. Of the 37 on a service with no tourniquet training, 5 had access to a commercial emergency tourniquet, and 5 indicated their service had a tourniquet protocol.

CONCLUSION: Civilian prehospital providers encounter situations for tourniquet use, but many do not know information important for optimal tourniquet use. Therefore, if surgeons want civilian prehospital care to include the use of effective, arterial flow occluding tourniquets at appropriate limb locations, they need to communicate with their emergency medical service providers concerning tourniquet knowledge, training, protocols, and appropriate equipment

J Trauma Acute Care Surg. 2014 Sep;77(3 Suppl 2):S140-5

Use of an impedance threshold device in spontaneously breathing patients with hypotension secondary to trauma: an observational cohort feasibility study.

Wampler D, Convertino VA, Weeks S, Hernandez M, Larrumbide J, Manifold C.

BACKGROUND: An impedance threshold device (ITD) intended for use in the spontaneously breathing patient has been shown to raise blood pressure in hypotensive patients. This device has not been evaluated in patients with hypotension secondary to trauma. This study focused on changes in key vital signs when the ITD was added to the paramedic treatment protocol for hypotensive patients with prehospital traumatic injury.

METHODS: A 6-month prospective nonrandomized observational cohort study was conducted of 200 spontaneously breathing symptomatic adult patients with prehospital hypotension due to multiple causes; the patients of primary interest experienced a traumatic injury. Upon determination of hypotension (systolic blood pressure of approximately ≤90 mm Hg), standard therapy was initiated by application of the mask-style ITD. Vital signs were documented every 2 minutes to 5 minutes after intervention. A change in mean arterial pressure (MAP) with ITD use was the primary study endpoint.

RESULTS: Of the 200 hypotensive subjects treated, 29 (3 were excluded because of incomplete data sets and 3 patients treated with the ITD were excluded because their blood pressure did not meet inclusion criterion) were hypotensive secondary to trauma. Their MAP increased from 60 mm Hg (SD, 11 mm Hg; 95% confidence interval [CI], 8.17-15.432) to 78 mm Hg (16 mm Hg; 95% CI, 12.43-23.46) ($p = 0.001$), without significant change in mean heart rate. Approximately 75% of the patients reported moderate to easy tolerance. Similar increases in MAP were observed in the non-traumatic patients, from 60 mm Hg (10 mm Hg; 95% CI, 9.4-11.5) to 70 (15; 95% CI, 13.4-16.7) ($p = 0.0001$).

CONCLUSION: In this observational cohort study of patients with hypotension secondary to trauma, the ITD was well tolerated, and MAP as well as systolic and diastolic blood pressure were improved. The patients were not over-resuscitated with this intervention. On the basis of these findings, additional studies in patients with hypotension secondary to traumatic injury should be performed to better define the need and benefit of additional fluid resuscitation when the ITD is used.

LEVEL OF EVIDENCE: Therapeutic study, level IV.