Committee on Surgical Combat Casualty Care (CoSCCC)

Journal Watch

1st Quarter

FY 2023

Journal Watch Key Terminology Searched:

Microcirculation
Shock
Human subject research
Haemorrhagic shock
Traumatic brain injury
Plasma
Transfusion
RBCs
Stability
Blast
Amputation
Traumatic Clinical outcomes
Injury
Coagulopathy
Fibrinogen concentrate
Viscoelastic haemostatic assays
Guidelines
Fractures
REBOA
Orthopaedic trauma
Wound ballistics
Cause of injury
Damage Control Resuscitation
Tension pneumothorax
Blast Injury
Combat casualty care
Surgical skills
Novel Coronavirus
Predictions
Limb Salvage
Trauma Management
Sublingual
IDF
Multiple trauma
Coagulopathy
Pre-hospital
Trauma
Resuscitation
Ultrasound
Facial trauma
Multiple
Clinical parameters
Pelvic fracture
Cryoprecipitate
Massive transfusion
Angiography
Internal fixation
X-ray
Antibiotic prophylaxis
Perioperative antibiotics
Faecal diversion
Head injuries
Battlefield Injury
Thoracotomy
Died of Wounds
medical treatment facility
Emergency surgery
COVID-19
Vital Signs
Temporary Shunts
Haemorrhage
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Institutional review board
Shock index
Diagnostic accuracy
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Imaging
Severe trauma
Afghanistan
War
Transfusion
Damage control Surgery
Battlefield Trauma
Fibrinogen
ABO
External fixation
Pelvic ring
Pre-peritoneal pelvic packing
Long bone fractures
Surgical site infection
Primary repair
Poly-trauma
Prolonged field care
Military Medicine
Killed in Action
Mortality
Infection prevention
Hypocalcemia
Global Surgery

Isr Med Assoc J. 2022 Sep;24(9):570-573.

Emergent exploratory thoracotomy with military casualties: contemporary prehospital management and outcome (see editorial page 619)

Ronny Ben-Avi[1], Alex Sorkin[2 3], Roy Nadler[2], Avishai M Tsur[2], Shaul Gelikas[2 4], Jacob Chen[1 5 6], Avi Benov[2 7]

Abstract

Background: Chest trauma is among the most common types of trauma, corresponding to 10% of trauma patients admitted to hospitals. In the military setting, thoracic trauma was reported as a significant cause of death. With well-timed treatment, chest trauma is regarded as survivable. Emergency thoracotomy (ET) is considered when the patient with trauma to the chest needs immediate resuscitation. Survival rate is reported as low as 1% in some reports and 20% in others. The survival rate depends on injury mechanism, protocols for intervention, and other decompressive procedures.

Objectives: To determine parameters that may impact survival of ET.

Methods: We conducted a retrospective cohort study to compare prehospital and in-hospital data regarding ET in the emergency department (ED) versus the operating room (OR).

Results: Between 2009 and 2017, 6532 casualties presented to the ED; 1125 with trauma to the chest. Fifty-four of those with chest trauma underwent ET in the hospital (4.8%), 22 (41%) in the ED, and 32 (59%) in the OR. The overall mortality of the ET subgroup was 48%. With regard to thoracotomies, 19/22 of patients (86%) who underwent ET in the ED died compared to 2/28 in the OR (13%).

Conclusions: Utilizing ET after chest trauma with appropriate clinical indications, well-trained personnel, and prompt transportation poses a significant challenge, but may be associated with better survival than that reported previously with military casualties. Adoption of indications and timed allocation to the OR may improve outcomes with chest trauma casualties.

Isr Med Assoc J. 2022 Sep;24(9):584-590.

Trends in prehospital pain management: two decades of point-of-injury care

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Abstract

Background: Pain control in trauma is an integral part of treatment in combat casualty care. More soldiers injured on the battlefield need analgesics for pain than life-saving interventions (LSIs). Early treatment of pain improves outcomes after injury, while inadequate treatment leads to higher rates of post-traumatic stress disorder (PTSD).

Objectives: To describe the experience of the Israel Defense Forces (IDF) Medical Corps with prehospital use of analgesia.

Methods: All cases documented in the IDF-Trauma Registry between January 1997 and December 2019 were examined. Data collection included analgesia administered, mechanism of injury, wound distribution, and life-saving interventions performed.

Results: Of 16,117 patients, 1807 (11.2%) had at least one documented analgesia. Demographics included 91.2% male; median age 21 years. Leading mechanism of injury was penetrating (52.9%). Of injured body regions reported, 46.2% were lower extremity wounds. Most common types of analgesics were morphine (57.2%) and fentanyl (27%). Over the two decades of the study period, types of analgesics given by providers at point of injury (POI) had changed. Fentanyl was introduced in 2013, and by 2019 was given to 39% of patients. Another change was an increase of casualties receiving analgesia from 5-10% until 2010 to 34% by 2019. A total of 824 LSIs were performed on 556 patients (30.8%) receiving analgesia and no adverse events were found in any of the casualties.

Conclusions: Most casualties at POI did not receive any analgesics. The most common analgesics administered were opioids. Over time analgesic administration has gained acceptance and become more commonplace on the battlefield.

EClinicalMedicine. 2022 Sep 29;54:101676.doi: 10.1016/j.eclinm.2022.101676. eCollection 2022 Dec.

Analysis of 983 civilian blast and ballistic casualties and the generation of a template of injury burden: An observational study

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Abstract

Background: Terrorism and armed conflict cause blast and ballistic casualties that are unusual in civilian practice. The immediate surgical response to mass casualty events, with civilians injured by these mechanisms, has not been systematically characterized. Standardizing an approach to reacting to these events is challenging but is essential to optimize preparation for them. We aimed to quantify and assesses the surgical response to blast and ballistic injuries managed in a world-class trauma unit paradigm.

Methods: This was an observational study conducted at the UK-led military Medical Treatment Facility, Camp Bastion, Afghanistan from original theatre log-book entries between Nov 5, 2009, and Sept 21, 2014; a total of 10,891 consecutive surgical cases prospectively gathered by surgical teams were catalogued. Patients with combatant status/wearing body-armour to various degrees including interpreters were excluded from the study. Civilian casualties that underwent primary trauma surgery for blast and ballistic injuries were included (n=983). Surgical activity was analyzed as a rate per 100 casualties, and patients were grouped according to adult vs. pediatric and ballistic vs. blast injury mechanisms to aid comparison.

Findings: The three most common surgical procedures for civilian blast injuries were debridement, amputation, and laparotomy. For civilian ballistic injuries, these were debridement, laparotomy and vascular procedures. Blast injuries generated more amputations in both adults and children compared to ballistic injuries. Blast injuries generated more removal of fragmentation material compared to ballistics injuries amongst adult casualties. Ballistic injuries lead to more chest drain insertions in adults. As a rate per 100 casualties, adults injured by blast underwent significantly more debridement (63·5); temporary skeletal stabilization (13·2) and vascular procedures (12·8) compared to children (43·4, z=4·026, p=0·00007; 5·7, z=2·230, p=0·022; 4·9, z=2·468, p=0·014). Adults injured by ballistics underwent significantly more debridement (63·4); chest drain (12·3) and temporary skeletal fixation procedures (11·4) compared to children (50·0, z=2·058, p=0.040, p<0·05; 2·9, z=2·283, p=0.0230; 2·9, z=2·131, p=0.034 respectively). By comparison, children injured by ballistics underwent significantly more removal of fragmentation and ballistic materials (20·6) when compared to adults (7·7, z=-3·234; p=0.001).

Interpretation: This is the first evidence-based, template of the immediate response required to manage civilians injured by blast and ballistic mechanisms. The template presented can be applied to similar conflict zones and to prepare for terror attacks on urban populations.

Funding: The work was supported in part by a grant to LM from School of Medicine, University of St Andrews.

Keywords: Ballistic; Blast; Civilian; Explosion; Injury; Surgery; Template; Terror attacks; Trauma; Treatment; War

Eur J Trauma Emerg Surg. 2022 Oct;48(5):3969-3979.doi: 10.1007/s00068-022-01916-z. Epub 2022 Feb 26.

Physiology dictated treatment after severe trauma: timing is everything

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Abstract

Introduction: Damage control strategies in resuscitation and (fracture) surgery have become standard of care in the treatment of severely injured patients. It is suggested that damage control improves survival and decreases the incidence of organ failure. However, these strategies can possibly increase the risk of complications such as infections. Indication for damage control procedures is guided by physiological parameters, type of injury, and the surgeon's experience. We analyzed outcomes of severely injured patients who underwent emergency surgery.

Methods: Severely injured patients, admitted to a level-1 trauma center ICU from 2016 to 2020 who were in need of ventilator support and required immediate surgical intervention (≤24 h) were included. Demographics, treatment, and outcome parameters were analyzed.

Results: Hundred ninety-five patients were identified with a median ISS of 33 (IQR 25-38). Ninety-seven patients underwent immediate definitive surgery (ETC group), while 98 patients were first treated according to damage control principles with abbreviated surgery (DCS group). Although ISS was similar in both groups, DCS patients were younger, suffered from more severe truncal injuries, were more frequently in shock with more severe acidosis and coagulopathy, and received more blood products. ETC patients with traumatic brain injury needed more often a craniotomy. Seventy-four percent of DCS patients received definitive surgery in the second surgical procedure. There was no difference in mortality, nor any other outcome including organ failure and infections.

Conclusions: When in severely injured patients treatment is dictated by physiology into either early definitive surgery or damage control with multiple shorter procedures stretched over several days combined with aggressive resuscitation with blood products, outcome is comparable in terms of complications.

Keywords: Damage control surgery; Early total care; Outcome.

Acute Med Surg. 2022 Sep 30;9(1):e792. doi: 10.1002/ams2.792. eCollection 2022 Jan-Dec.

Combined, converted, and prophylactic use of resuscitative endovascular balloon occlusion of the aorta for severe torso trauma: a retrospective study

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Abstract

Introduction: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is used as an intra-aortic balloon occlusion in Japan; however, protocols for its effective use in different conditions have not been established. This study aimed to summarize the strategies of REBOA use in severe torso trauma.

Methods: Twenty-nine cases of REBOA for torso trauma treated at our hospital over 5 years were divided into hemodynamically unstable (HU) (n = 12), cardiac arrest (CA) (n = 13), and hemodynamically stable (HS) (n = 4) groups. We retrospectively examined patient characteristics, trauma mechanism, injury site, severity score, intervention type, and survival rates at 24 h in each group.

Results: In the HU group, 9 and 3 patients survived and died within 24 h, respectively; time to intervention (56.6 versus 130.7 min, P = 0.346) tended to be shorter and total occlusion time (40.2 versus 337.7 min, P = 0.009) was significantly shorter in survivors than in nonsurvivors. In the CA group, 10 patients were converted from resuscitative thoracotomy with aortic cross-clamp (RTACC); one patient survived. All four patients in the HS group survived, having received prophylactic REBOA.

Conclusion: The efficacy of REBOA for severe torso trauma depends on the patient's condition. If the patients are hemodynamically unstable, time to intervention and total occlusion time could correlate with survival. The combined use of REBOA with definitive hemostasis could improve outcomes. Conversion from RTACC in the cardiac arrest patients and prophylactic use in the hemodynamically stable patients can be one of the potentially effective options, although further studies are needed.

Keywords: Hemorrhagic shock; multiple trauma; resuscitation; resuscitative endovascular balloon occlusion of the aorta; resuscitative thoracotomy with aortic cross-clamp

Cureus. 2022 Oct 28;14(10):e30817.doi: 10.7759/cureus.30817. eCollection 2022 Oct.

Limb Salvage vs. Amputation: Factors Influencing the Decision-Making Process and Outcomes for Mangled Extremity Injuries

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Abstract

In the setting of acute severe limb injury, the clinical decision to either attempt limb salvage or to perform a primary amputation presents a significant challenge to the trauma team. The initial step in the management of a mangled limb is invariably resuscitation and stabilisation of the patient and an evaluation of the limb. However, the decision-making process on whether to amputate vs attempt limb salvage is dependent on a range of complex factors. This includes assessing the degree of injury to the components of the limb architecture, essential skeletal stability, soft tissues, vasculature, and neurological structures. Whether or not the patient would survive an attempt to limb salvage is of course not the only variable to be taken into account. The likely and expected outcomes of attempted salvage in each individual case must be considered and furthermore, what the acceptable side-effect profile including the risk of failure would be for each individual patient should be assessed against the importance, real or perceived, that limb function is maintained. Finally, the patient's choice should also be taken into account alongside their occupation and pre-morbid functional status. How the surgeon makes this life-changing, or life-threatening decision, is of great clinical significance, and there are myriad scoring systems published that purport to assist in this matter. However, the changing structures of the trauma system, expansion and advancement of skillsets and technology means an updated review is required to help weigh up the challenging decision of limb amputation vs salvage, which usually takes place in a time-pressured and highly emotional emergency setting. An evidence-based, standardized structure to assist in these calculations could support surgeons and improve outcomes for these patients.

Keywords: amputation; complex limb injuries; limb-salvage; mangled limb; poly trauma.

Arch Pathol Lab Med. 2022 Sep 9. doi: 10.5858/arpa.2021-0624-OA. Online ahead of print.

Outcomes of Cold-Stored, Low-Titer Group O Whole Blood Transfusions in Nontrauma Massive Transfusion Protocol Activations

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Abstract

Context.—: The use of low-titer group O whole blood (LTOWB) in military and civilian trauma centers shows no significant difference in outcomes compared with component therapy.

Objective.—: To compare the use of LTOWB with standard component therapy in nontrauma patients requiring massive transfusion at a major academic medical center.

Design.—: This is a retrospective cohort study comparing nontrauma patients who received at least 1 unit of cold-stored LTOWB during a massive transfusion with those who received only blood component therapy during a massive transfusion. Primary outcomes are mortality at 24 hours and 30 days. Secondary outcomes are degree of hemolysis, length of inpatient hospital stay, and time to delivery of blood products.

Results.—: One hundred twenty massive transfusion activations using 1570 blood products from 103 admissions were identified during the study period. Fifty-five admissions were included in the component cohort and 48 in the LTOWB cohort. There were no significant differences in primary outcomes: 24-hour mortality odds ratio, 2.12 (P = .14); 30-day mortality odds ratio, 1.10 (P = .83). Length of stay was found to be statistically significantly different and was 1.58 days shorter in the LTOWB cohort compared with the component cohort (95% CI, 1.44-1.73; P < .001). There were no significant differences in the remaining secondary outcomes.

Conclusions.—: LTOWB therapy appears no worse than using standard component therapy in nontrauma patients requiring a massive transfusion activation, suggesting that LTOWB is a reasonable alternative to component therapy in nontrauma, civilian hospital patients, even when blood type is known.

Crit Care. 2022 Sep 26;26(1):290. doi: 10.1186/s13054-022-04167-x.

Cryoprecipitate transfusion in trauma patients attenuates hyperfibrinolysis and restores normal clot structure and stability: Results from a laboratory sub-study of the FEISTY trial

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Abstract

Background: Fibrinogen is the first coagulation protein to reach critical levels during traumatic haemorrhage. This laboratory study compares paired plasma samples pre- and post-fibrinogen replacement from the Fibrinogen Early In Severe Trauma studY (FEISTY; NCT02745041). FEISTY is the first randomised controlled trial to compare the time to administration of cryoprecipitate (cryo) and fibrinogen concentrate (Fg-C; Riastap) in trauma patients. This study will determine differences in clot strength and fibrinolytic stability within individuals and between treatment arms.

Methods: Clot lysis, plasmin generation, atomic force microscopy and confocal microscopy were utilised to investigate clot strength and structure in FEISTY patient plasma.

Results: Fibrinogen concentration was significantly increased post-transfusion in both groups. The rate of plasmin generation was reduced 1.5-fold post-transfusion of cryo but remained unchanged with Fg-C transfusion. Plasminogen activator inhibitor 1 activity and antigen levels and Factor XIII antigen were increased post-treatment with cryo, but not Fg-C. Confocal microscopy analysis of fibrin clots revealed that cryo transfusion restored fibrin structure similar to those observed in control clots. In contrast, clots remained porous with stunted fibres after infusion with Fg-C. Cryo but not Fg-C treatment increased individual fibre toughness and stiffness.

Conclusions: In summary, our data indicate that cryo transfusion restores key fibrinolytic regulators and limits plasmin generation to form stronger clots in an ex vivo laboratory study. This is the first study to investigate differences in clot stability and structure between cryo and Fg-C and demonstrates that the additional factors in cryo allow formation of a stronger and more stable clot.

Keywords: Clot structure; Cryoprecipitate; Fibrinogen; Fibrinolysis; Trauma coagulopathy.

JAMA Netw Open. 2022 Oct 3;5(10):e2234258. doi: 10.1001/jamanetworkopen.2022.34258.

Association of Early Norepinephrine Administration With 24-Hour Mortality Among Patients With Blunt Trauma and Hemorrhagic Shock

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Abstract

Importance: Hemorrhagic shock is a common cause of preventable death after injury. Vasopressor administration for patients with blunt trauma and hemorrhagic shock is often discouraged.

Objective: To evaluate the association of early norepinephrine administration with 24-hour mortality among patients with blunt trauma and hemorrhagic shock.

Design, setting, and participants: This retrospective, multicenter, observational cohort study used data from 3 registries in the US and France on all consecutive patients with blunt trauma from January 1, 2013, to December 31, 2018. Patients were alive on admission with hemorrhagic shock, defined by prehospital or admission systolic blood pressure less than 100 mm Hg and evidence of hemorrhage (ie, prehospital or resuscitation room transfusion of packed red blood cells, receipt of emergency treatment for hemorrhage control, transfusion of >10 units of packed red blood cells in the first 24 hours, or death from hemorrhage). Blunt trauma was defined as any exposure to nonpenetrating kinetic energy, collision, or deceleration. Statistical analysis was performed from January 15, 2021, to February 22, 2022.

Exposure: Continuous administration of norepinephrine in the prehospital environment or resuscitation room prior to hemorrhage control, according to European guidelines.

Main outcomes and measures: The primary outcome was 24-hour mortality, and the secondary outcome was in-hospital mortality. The average treatment effect (ATE) of early norepinephrine administration on 24-hour mortality was estimated according to the Rubin causal model. Inverse propensity score weighting and the doubly robust approach with 5 distinct analytical strategies were used to determine the ATE.

Results: A total of 52 568 patients were screened for inclusion, and 2164 patients (1508 men [70%]; mean [SD] age, 46 [19] years; median Injury Severity Score, 29 [IQR, 17-36]) presented with acute hemorrhage and were included. A total of 1497 patients (69.1%) required emergency hemorrhage control, 128 (5.9%) received a prehospital transfusion of packed red blood cells, and 543 (25.0%) received a massive transfusion. Norepinephrine was administered to 1498 patients (69.2%). The 24-hour mortality rate was 17.8% (385 of 2164), and the in-hospital mortality rate was 35.6% (770 of 2164). None of the 5 analytical strategies suggested any statistically significant association between norepinephrine administration and 24-hour mortality, with ATEs ranging from -4.6 (95% CI, -11.9 to 2.7) to 2.1 (95% CI, -2.1 to 6.3), or between norepinephrine administration and in-hospital mortality, with ATEs ranging from -1.3 (95% CI, -9.5 to 6.9) to 5.3 (95% CI, -2.1 to 12.8).

Conclusions and relevance: The findings of this study suggest that early norepinephrine infusion was not associated with 24-hour or in-hospital mortality among patients with blunt trauma and hemorrhagic shock. Randomized clinical trials that study the effect of early norepinephrine administration among patients with trauma and hypotension are warranted to further assess whether norepinephrine is safe for patients with hemorrhagic shock.