Committee on Surgical Combat Casualty Care

(CoSCCC)

Journal Watch

3rd Quarter

FY 2025

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
Whole Blood
Simulation
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
Walking Blood Bank
Coagulopathy
Haemorrhage
Ethics committees
Institutional review board
Shock index
Diagnostic accuracy
Thrombelastography (TEG)
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
Ukraine
Performance Improvement
Machine Learning

J Trauma Acute Care Surg. 2025 Jun 30.doi: 10.1097/TA.0000000000004698. Online ahead of print.

Military-civilian partnerships on the west coast: Differing models producing combat-ready trauma teams

Reynold Henry [1], Demetrios Demetriades, Rachel Hight, Daniel Lammers, John McClellan, John Fletcher, Brian Gavitt, Martin Schreiber

Abstract

Abstract: Military-civilian partnerships have emerged as essential platforms for preparing military trauma surgeons and health care teams for deployment. These programs, many of which were developed following congressional initiatives to enhance military trauma readiness, address the critical issue of sustaining trauma skills during peacetime avoiding a phenomenon known as the "Walker Dip," when skills and proficiency in treating battlefield injuries decline during peacetime after periods of intense conflict. They also provide military surgeons and other providers with training in research methodology and trauma systems management, skills that are difficult to obtain solely within the military structure. This article examines three distinct military-civilian partnership models based on West Coast trauma centers: Oregon Health & Science University (affiliated with the US Army), Los Angeles General Medical Center (affiliated with the US Navy), and UC Davis Medical Center (affiliated with the US Air Force). These programs provide critical trauma exposure while fostering advanced academic and leadership skills. The Joint Trauma System, with its focus on data-driven improvements in trauma care, has further shaped these programs. By comparing these models, we identify their strengths, deficits, and strategies for enhancing training effectiveness. The conclusion highlights the uniqueness of each site and affirms that there are multiple successful approaches to fostering military readiness.

Level of evidence: Expert Opinion; Level V.

Keywords: Joint Trauma System; Military-civilian partnerships; Walker Dip.

Eur J Vasc Endovasc Surg. 2025 May 19:S1078-5884(25)00453-8.doi: 10.1016/j.ejvs.2025.05.031. Online ahead of print.

Preliminary Assessment of Contemporary Wartime Vascular Injuries

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Abstract

Objective: Vascular trauma during military conflicts, often from blasts and high velocity gunshots, is a major challenge in vascular surgery. Advances in vascular surgery have improved wartime injury management. This study evaluated vascular injury patterns and key risk factors for death and amputation in a recent conflict.

Methods: This retrospective study analysed vascular injuries in hospitalised soldiers from a recent conflict using National Trauma Registry data. Primary outcomes were major amputation and death. Descriptive statistics and logistic regression were used for data analysis, following the STrengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.

Results: From 7 October 2023 to 31 May 2024, a total of 2 040 Israeli soldiers (1 990 male, 97.5%; mean age 25 ± 6.9 years, median age [interquartile range, IQR] 23 [20, 28] years) were treated for injuries sustained in a recent military conflict. Among them, 179 cases (9.0%; 176 male, 98.3%; mean age 25 ± 7.19 years) were identified as vascular casualties. A total of 218 vascular injuries (in these 179 patients) were reported, with lower extremities being the most affected region (112 of 218 vessels, 51.4%). The median time from injury to trauma centre arrival was 66 minutes and from the emergency department to surgery was 76 minutes (IQR 37, 330 minutes). In 136 patients, 161 vascular procedures were performed, mainly primary repair ± patch angioplasty (31.7%) and bypass (26.7%). Secondary amputation occurred in 10 of 179 (5.6%) cases, with an overall mortality rate of 8.9% (n = 16 of 179). Multivariate analysis found high Injury Severity Scores (odds ratio [OR] 1.08; 95% confidence interval [CI] 1.02 - 1.17; p = .016), systolic blood pressure < 90 mmHg at admission (OR 24.39; 95% CI 3.38 - 254.49; p =.003), and thoracic vessel injury (OR 15.23; 95% CI 1.68 - 177.04; p = .017) as risk factors for death. Lower extremity fractures (OR 6.51; 95% CI 1.35 - 49.01; p = .032) predicted lower extremity secondary amputation.

Conclusion: This study highlights the characteristics of vascular injuries in modern warfare, identifying higher mortality rates with thoracic vessel injuries, shock at admission, and high Injury Severity Scores, while secondary amputation correlates with lower extremity fractures.

Keywords: Arterial injury; Military trauma; Polytrauma; Pre-hospital care; Vascular trauma.

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Injuries Associated With Mandated Wear of Body Armor in Iraq

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Abstract

Introduction: Protective ballistic body armor (BA) may be needed during certain threat postures while deployed. This requirement often adds between 35 and 45lbs of extra weight carried by the service member (SM) for multiple hours during the day. The physical toll of that extra weight and the effect it may have on deployed medical resources has not been clearly characterized in the literature. We sought to evaluate the association of a protective BA wear requirement with musculoskeletal (MSK) complaints and to better characterize how these effects are manifested within the deployed military health care system.

Material and methods: All encounters at a Role III Field Hospital were evaluated and queried for MSK injury. Data collected included the SM type, age, gender, MSK anatomy of concern, type of evaluating provider, disposition, and medications rendered. Injuries and outcomes were then compared between two groups; SMs who were seen for MSK complaints while BA was required (October 2023 to March 2024) and those during a period when BA was not required (No-BA = October 2022 to March 2023).

Results: A total of 2,805 encounters were evaluated. Non-SM visits were excluded (455) leaving 2,350 left for evaluation. In all, 969 (41.2%) were identified as encounters for MSK injury. No-BA had significantly fewer visits of MSK injury at 429 (38%) compared to the BA group at 540 (44%, P = .001). Active duty (AD) and National Guard (NG) SMs made up a larger portion of MSK visits in the BA group at 54% and 41%, respectively, compared to 35% Reserve (AR) and 36% NG in the No-BA group (P < .001). Service member were 12 times more likely to require a physical therapy treatment in the BA group (60%) vs. the No-BA (5%, P < .001). Prescriptions of non-steroidal anti-inflammatory medication were more common in the BA group at 11% of all visits compared to 4% in the No-BA group (P < .001). This was also true for muscle relaxers at 1% vs. 3% (P = .008). Shoulder and back injuries represented the largest proportion of MSK areas of concern at 22% and 24%, respectively, with only neck injuries being higher in the BA group at 8.5% vs. 5% (P = .03).

Conclusions: Required wear of BA was associated with an increase in MSK visits across all types of US SMs. Shoulder and back injuries were the most common with a significant increase in visits to physical therapy in the BA group. Anti-inflammatory and muscle-relaxing medications were prescribed more frequently in the BA group. A dedicated prospective study would help better elucidate the causality of these associations. Risk-benefit analysis of threat posture, with the knowledge of these health care associations, deserves serious consideration.

J Spec Oper Med. 2025 Apr 30;24(4):40-44.doi: 10.55460/NDC5-J2LU.

An Analysis of Junctional Tourniquet Use Within the Department of Defense Trauma Registry

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Abstract

Background: Junctional hemorrhage is a leading cause of battlefield death. Multiple FDA-approved junctional tourniquet (JTQ) models demonstrate effective hemorrhage control in laboratory settings. However, there are few real-world use cases within the literature.

Methods: We analyzed the Department of Defense Trauma Registry (DoDTR) for casualties with documented JTQ application (2007-2023).

Results: Of 48,301 encounters, 39 included JTQ placement. The most common injury mechanisms were explosives (23), followed by firearms (15). The most common (AIS >3) serious injury sites were the extremities (21), followed by the abdomen (4) and skin (4). Only one patient died. Of nine prehospital interventions, the most common were warming (21), limb tourniquet application (16), and intravenous fluid administration (11). The most common associated diagnoses were lower-extremity amputation (24), testis avulsion or amputation (11), pelvic fracture (9), and tympanic membrane rupture (9). The most common hospital procedures were a focused assessment with sonography in trauma (32), laparotomy (20), chest tube placement (13), fasciotomy (13), and arterial line placement (13).

Conclusion: JTQ application in the combat setting was rare. When it was performed, it was frequently in the polytrauma setting. Survival was high but DoDTR enrollment survival biases likely confounded this.

Keywords: Department of Defense Trauma Registry; battle injuries; combat; hemorrhage; junctional; military; operational medicine; prehospital care; tourniquet; trauma.

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Proof of concept of an Automated Battlefield Trauma System for large-scale combat operations

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Abstract

Background: Large-scale combat operations (LSCO) generate high casualty volumes, challenging battlefield trauma care and necessitating a synchronized approach that integrates medical operations with warfighting functions. Existing casualty management tools, such as the Medical Planners Toolkit and Joint Medical Planning Tool, provide static estimates and lack predictive capabilities for evacuation and medical resupply. The Automated Battlefield Trauma System (ABTS) was developed to address these limitations by automating casualty categorization, resource estimation, and Medical Common Operating Picture reporting.

Methods: Tested during the US Army I Corps' Warfighter Exercise (WFX) 25-02, ABTS used casualty data derived from the Russo-Ukrainian conflict to estimate critical resource needs for medical units across different echelons. Integrated with Warfighter Simulation data, ABTS provided automated dashboards to track casualty categories, estimate died-of-wounds rates, and predict resource shortages. Initially relying on Excel-based dashboards, late-stage integration with Palantir's Maven Smart Systems enabled enhanced real-time data visualization and decision support for commanders.

Results: Key takeaways from the proof of concept include the following: (1) automation significantly improves casualty care management in LSCO; (2) ABTS enhances predictive logistics for evacuation and medical resupply; (3) it serves as a critical risk management tool for commanders; and (4) integration with warfighting functions is essential for operational effectiveness. While successful, future iterations must refine casualty modeling, enhance data integration with emerging artificial intelligence and machine learning capabilities, and expand interoperability with Joint and allied forces.

Conclusion: The Automated Battlefield Trauma System demonstrated its potential to transform battlefield casualty management by leveraging automation and predictive analytics. Continued development will refine its capabilities, improve real-time data integration, and ensure its applicability across military operations, enhancing survivability and operational efficiency in LSCO environments.

Level of evidence: Proof of Concept; Level V.

Keywords: Trauma systems; automation; military medicine.

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Pancreatic Battlefield Injuries During Ukraine War

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Abstract

Introduction: Battlefield pancreatic injury (BPI) is rare and difficult to diagnose and treat. Publications on this topic are limited. The aim of this study was to analyze our initial experience in treating BPI since the beginning of the full-scale Russian invasion of Ukraine.

Materials and methods: We retrospectively analyzed the medical records of military personnel treated between February and December 2022. XLSTAT's variable characterization tool, using an indicator called test value (TV), was used to assess possible associations between variables.

Results: BPIs were found in 11 of 252 (4.4%) patients with an average age of 36.6 ± 10.1 years. The main cause of injury was explosion (6/11, 54.6%) and gunshot (2/11, 18.2%). Head of pancreas injuries were the most common (5/11, 45.5%), followed by distal pancreas injuries (4/11, 36.4%). Our treatment was predominantly interventional (5/11, 45.5%) and/or surgical drainage (4/11, 36.4%). Two patients (18.2%) were treated conservatively. One patient (9.1%) underwent cystojejunostomy for pseudocyst and another (9.1%) distal pancreatectomy. There was a positive association between the number of frontline operations and concomitant jejunal (TV 2.289; P = .022) and ileal (TV 2.211; P = .027) injuries. There was also a positive association between stoma formation at primary surgery and ileal injury (TV 2.000; P = .045) and pancreatic fistula and concomitant rib fractures (TV 2.484; P = .013).

Conclusions: BPIs would be expected in victims with explosive damage to the upper body, often located in the head of the pancreas. Concomitant small bowel injury and rib fractures are associated with increased frequency of stoma formation, number of primary surgeries, and pancreatic fistula. Most patients can be successfully managed with interventional or surgical drainage without resection.

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The Joint Trauma System: A critical lifeline facing an uncertain future

Reynold Henry [1], Jennifer Gurney, Scott Armen, Christopher D Barrett, Brian Gavitt, Philbert Van, Daniel Lammers, John McClellan, Martin Schreiber

Abstract

Abstract: The Joint Trauma System (JTS) has become a cornerstone of modern trauma care, revolutionizing battlefield treatment and saving countless lives through standardized, evidence-based protocols. Its development and success are rooted in lessons learned from the wars in Iraq and Afghanistan, where fragmented systems were transformed into cohesive, high-performing networks. The JTS has influenced not only military but also civilian trauma care, fostering a symbiotic relationship that advances innovation across both sectors. Despite its proven effectiveness, a growing movement within the US military questions its relevance during peacetime, threatening its existence. This article examines the history, impact, and future of the JTS while emphasizing the critical need for civilian advocacy to preserve its role as a key enabler of military readiness and trauma care innovation.

Level of evidence: Expert Opinion; Level V.

Keywords: Joint Trauma System; Walker Dip; combat casualty care.

Transfusion. 2025 May:65 Suppl 1:S40-S47.doi: 10.1111/trf.18172. Epub 2025 Feb 19.

Transfusion quantities associated with 24-h mortality in trauma patients

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Abstract

Introduction: Data on the correlation between transfusion volumes and trauma mortality are limited. The association between the total number of red blood cell (RBC) and low titer group O whole blood (LTOWB) units, as well as the total volume of all transfused products that were administered up to 4-h after admission and 24-h mortality was determined.

Methods: The Trauma Quality Improvement Program (TQIP) datasets from 2020 to 2022 were reviewed to identify patients aged ≥15 who received any volume of blood products. Receiver operating characteristic (ROC) were constructed along with the calculated area under the ROC curve (AUROC) to determine the association between the quantity of transfusion and 24-h mortality.

Results: There were 144,379 encounters that met inclusion, with 22,467 patients who died within the first 24 h. There was a 90% probability of 24-h mortality following the transfusion of 56 RBC/LTOWB units (AUROC 0.673), with the 90% specificity, Youden's index, and 90% sensitivity surrounding this probability occurring after the transfusion of 8, 4, and 2 units, respectively. In terms of the volume of transfusion, there was a 90% probability of 24-h mortality following the transfusion of 36,000 mL of all blood products combined (AUROC 0.662), with the 90% specificity, Youden's index, and 90% sensitivity surrounding this probability occurring after the transfusion of 4400, 2000, and 500 mL, respectively.

Conclusions: Both the total number of RBC and LTOWB units transfused and the total volume of all blood products transfused demonstrated poor predictive association with the risk of 24-h mortality in the civilian trauma population.

Keywords: futility; massive transfusion; mortality; red blood cell; survival; trauma.

BMJ Mil Health. 2025 May 21;171(3):262-268.doi: 10.1136/military-2023-002451.

Abdominal aortic junctional tourniquet (AAJT-S): a systematic review of utility in military practice

Stacey Webster [1], J E Ritson [2], E B G Barnard [3 2]

Abstract

Introduction: Haemorrhage is the leading cause of potentially survivable death on the battlefield. Despite overall improvement in battlefield mortality, there has been no improvement in survival following non-compressible torso haemorrhage (NCTH). The abdominal aortic junctional tourniquet-stabilised (AAJT-S) is a potential solution that may address this gap in improving combat mortality. This systematic review examines the evidence base for the safety and utility of the AAJT-S for prehospital haemorrhage control in the combat setting.

Methods: A systematic search of MEDLINE, Cumulated Index to Nursing and Allied Health Literature and Embase (inception to February 2022) was performed using exhaustive terms, in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline. The search was limited to English-language publications in peer-reviewed journals; grey literature was not included. Human, animal and experimental studies were included. Papers were reviewed by all authors to determine inclusion. Each study was assessed for level of evidence and bias.

Results: 14 studies met the inclusion criteria: 7 controlled swine studies (total n=166), 5 healthy human volunteer cases series (total n=251), 1 human case report and 1 mannikin study. The AAJT-S was demonstrated to be effective at cessation of blood flow when tolerated in healthy human and animal studies. It was easy to apply by minimally trained individuals. Complications were observed in animal studies, most frequently ischaemia-reperfusion injury, which was dependent on application duration. There were no randomised controlled trials, and the overall evidence base supporting the AAJT-S was low.

Conclusions: There are limited data of safety and effectiveness of the AAJT-S. However, there is a requirement for a far-forward solution to improve NCTH outcomes, the AAJT-S is an attractive option and high-quality evidence is unlikely to be reported in the near future. Therefore, if this is implemented into clinical practice without a solid evidence base it will need a robust governance and surveillance process, similar to resuscitative endovascular balloon occlusion of the aorta, with regular audit of use.

Keywords: accident & emergency medicine; surgery; trauma management.

Mil Med. 2025 Jun 30;190(7-8):e1398-e1402.doi: 10.1093/milmed/usae555.

The October 7, 2023, Attack on Israel Indicates a Change in Trauma Patterns of Terror Victims, due to the Use of Thermobaric Weapons

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Abstract

Introduction: The terror attack on October 7, 2023, in southern Israel resulted in approximately 1,200 civilians and security personnel killed. Of the civilians murdered, approximately 200 men, women, and children were murdered inside their homes, while the remaining casualties were murdered in an open field at a music festival, in their cars, or in the streets of local cities.

Materials and methods: Currently, official data have not yet been published regarding the types of injuries suffered by Israeli civilians during the terror attack. However, the massive damage found in buildings infiltrated by the terrorists, weapons found on neutralized terrorists, and the findings of the pathologists tasked with examining and identifying the casualties, as well as preliminary clinical evidence, suggested that many died from hand-held explosive devices or rocket-propelled grenades containing a "thermobaric"-type warhead.

Results: The use of thermobaric weapons has also been reported from the Russia-Ukraine war, suggesting that these weapons are becoming more common in their use. Thermobaric injuries differ from typical battlefield injuries due to their specific blast characteristics. Considering that thermobaric weapons are relatively cheap to manufacture and highly efficient, it can be assumed that their unique injury patterns will become more common in future battlefields.

Conclusions: This paper reports on a possible change in the nature of terror and battlefield injuries and alerts emergency organizations and military forces worldwide to prepare for the need of treating more blast injuries, burns, smoke inhalation, and asphyxiation.

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The incidence, outcome, and treatment of advanced organ failure and support after trauma: A review with implications for future large-scale combat operations

Elizabeth K Powell[1], Richard Betzold, Ronald David Hardin, Jeffrey Biberston, Emily Hathaway, Michael S Tripp, Valerie G Sams, John B Holcomb, Jennifer M Gurney, Matthew D Tadlock

Abstract

Abstract: Future large-scale combat operations could involve delayed patient evacuation because of contested theaters of operations where United States and allied forces are unlikely to have air superiority. Prolonged casualty care could be more prevalent with delays in evacuation, requiring personnel prepared to provide critical care for injured warfighters and innovation aimed at supporting patients for longer periods of time. We conduct a review on the incidence and mortality rates of organ failure, describe the potential benefits of organ support, and offer recommendations to improve the care of patients in future conflicts. We performed a review examining the incidence and mortality of organ failure and the documented use of advanced modalities in the care of patients with organ failure. The search was conducted from the database's inception to June 21, 2024. Primary literature from previous review articles was also incorporated into this review. Authors reviewed relevant abstracts and full manuscripts. Acute respiratory failure and the need for respiratory support are common in severely injured trauma patients. Acute renal failure and the need for advanced renal support were also found to be common after injury. Although less common, advanced extracorporeal support, when required, can improve patient outcomes. In order to prepare for future conflicts, investment in personnel training, sustainment, and innovative technology will be essential to saving lives.

Level of evidence: Systemic Review; Level IV.

Keywords: Battlefield medicine; battlefield surgery; organ failure; organ support.

Trauma Surg Acute Care Open. 2025 Jun 25;10(2):e001674.doi: 10.1136/tsaco-2024-001674. eCollection 2025.

Qualitative assessment of point of injury to Role 2+ combat casualty care in Ukraine

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Abstract

Background: The ongoing Russian-Ukrainian war created an extended battlefield with the prolific use of missiles and drones. Such tactics require placement of care facilities far from the frontline, thereby delaying definitive trauma care and necessitating prolonged casualty care (PCC).

Methods: Between June 2023 and February 2024, we conducted qualitative key informant interviews with Ukrainian healthcare personnel using an expanded version of the Global Trauma System Evaluation Tool. Analysis focused on identifying and understanding casualty care from point of injury through Roles 1, 2, and 2+. We included 36 civilian and military healthcare or healthcare-affiliated participants. Sampling continued until thematic saturation was achieved.

Results: Respondents indicated medics lacked a standardized formal training system for prehospital care across emergency services and regions. Reliance on "walking blood banks to collect fresh whole blood for blood banking and direct transfusion was noted frequently. Of respondents at Roles 1, 2, and 2+, 73% stated damage control resuscitation was done at their level, and 71% of respondents in these same Roles stated they were doing some level of damage control surgery. Security and the tactical situation were common limitations to prehospital care leading to PCC.

Conclusion: The experience in Ukraine shows that, in the face of large-scale combat, the effectiveness of Role 2+ and lower facilities degrades very quickly. Future attention should be focused on improvements to prehospital care training, safe and timely patient movement in the absence of air superiority, PCC, blood supply, and medevac coordination. Efficient combat casualty care may require enhancing the capabilities of current Role 2+ units, or moving Role 3 facilities closer to the battlefront.

Level of evidence: Level III.

Keywords: Combat; Ukraine; injury.

Clin Orthop Relat Res. 2025 Apr 15.doi: 10.1097/CORR.0000000000003498. Online ahead of print.

How Do Gunshot and Explosive Injuries to the Lower Extremities Differ in Severity and Treatment? A Comparative Study From the Israel-Gaza Conflict

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Abstract

Background: Lower extremity injuries are common in conflict-related trauma, with gunshot wounds (GSWs) causing localized damage and explosive trauma leading to extensive tissue injuries. Existing research lacks direct comparisons of injury severity and treatment outcomes between GSWs and explosive trauma in modern conflicts. This study clarifies these differences to improve triage strategies, surgical planning, and rehabilitation protocols.

Questions/purposes: (1) How did GSWs and explosive trauma differ in terms of injury severity, including the proportion of patients in each group who experienced open fractures, neurovascular injuries, and amputations, during the Israel-Gaza conflict? (2) What was the comparative frequency and type of surgical intervention performed for GSWs versus explosive trauma in lower extremities?

Methods: Between October 7, 2023, and December 31, 2023, a total of 1815 patients were entered into the Israel National Trauma Registry (INTR) as having been injured during the Israel-Gaza conflict. The INTR is a comprehensive national database that collects standardized injury and treatment information from all Level 1 and Level 2 trauma centers in Israel, ensuring high-quality, consistent reporting of war-related injuries. Of these, we considered patients with lower extremity injuries and ICD-9 E-codes E979 and E990-E999 (terror and war-related injuries) as potentially eligible. Based on this criterion, 1318 patients sustained extremity injuries, and 51% (674) met our inclusion criteria for this study. Among them, 53% (357 of 674) sustained GSWs and 47% (317) suffered explosive injuries. The groups did not differ in terms of mean ± SD ages (gunshot 28.5 ± 11.7 years, explosive 28.0 ± 11.4 years; p = 0.61). Most patients in both groups were men (gunshot 91%, explosive 95%; p = 0.09), with no between-group difference in terms of the proportion of patients who were men. Missing data were minimal in both groups, with complete data sets available for all primary outcomes. Comparisons were made between the two groups regarding the severity of injuries (such as open fractures and amputations), frequency and type of surgical interventions, and associated injuries (including those to the chest, abdomen, and face). Statistical analysis included chi-square tests for categorical variables and independent t-tests for continuous variables, with a significance threshold of $p < 0.01$ because of the large number of comparisons made.

Results: GSWs resulted in a higher proportion of patients with open fractures (32% [115 of 357] versus 20% [64 of 317]; p = 0.001), particularly in the tibia and fibula (17% [62 of 357] versus 10% [33 of 317]; p = 0.01), whereas explosive injuries led to more amputations (10% [31 of 317] versus 3% [11 of 357]; $p < 0.001$); neurovascular injuries did not differ (p = 0.14 for nerve and p = 0.54 for vascular). A higher proportion of gunshot injuries were treated surgically (73% versus 59%; $p < 0.001$).

Conclusion: Understanding the distinct injury patterns and outcomes of GSWs and explosive trauma is essential for improving patient care and resource allocation during conflicts. Given the high amputation rates in blast injuries, early rehabilitation and prosthetic support should be prioritized, while gunshot-related open fractures often call for expanded orthopaedic fixation and infection control. Trauma training should emphasize early surgery for GSWs and hemorrhage control for blast injuries. Future research should focus on long-term functional outcomes, protective gear efficacy, and improved battlefield evacuation strategies to enhance survivability and recovery.

Level of evidence: Level III, therapeutic study.

Mil Med. 2025 Apr 23;190(5-6):e1206-e1210.doi: 10.1093/milmed/usae576.

Recent Orthopedic Trauma Volume in the United States Military Health System

Nicholas M Panarello[1,2], Conor F McCarthy[1,2], Colin J Harrington[1,2], Daniel J Stinner[3,4], Christopher H Renninger[1,2]

Abstract

Introduction: As illustrated by the "Walker Dip," there is growing concern regarding the lack of combat casualty care during peacetime. Surgical volume and case complexity are paramount for training and skill sustainment. We sought to quantify the recent orthopedic trauma surgical case load of all military orthopedic surgeons across the Military Health System (MHS).

Materials and methods: We queried the United States MHS Data Repository for orthopedic trauma-related Current Procedural Terminology codes for which the Accreditation Council for Graduate Medical Education (ACGME) requires graduating residents to perform a minimum case volume: hip fracture, femur/tibia shaft fracture, pilon fracture, and ankle fracture. The search yielded all corresponding procedures performed between January 2017 and December 2023 within the MHS.

Results: There were 15,873 total ACGME-minimum orthopedic trauma procedures performed across the MHS during the study period (2,268 cases per year) for the fixation of 3,283 hip fractures, 805 femoral shaft fractures, 1,455 tibial shaft fractures, and 10,330 ankle or pilon fractures. The sole level I trauma center in the MHS, which accepts civilian trauma, performed 21% of all cases. Civilian trauma made up 70% of this military treatment facility's volume. For another military treatment facility that began accepting civilian trauma in the middle of the study period, the volume increased from 49 to 123 cases per year.

Conclusion: Across the MHS, there was a low volume of ACGME-minimum orthopedic trauma procedures performed. These data help to frame the current orthopedic trauma surgical volume in the United States MHS in support of efforts to maximize military surgeon training and readiness, ultimately in preparation for future conflicts.

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Early versus Delayed Timing of Primary Repair after Open-Globe Injury: A Systematic Review and Meta-analysis

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Abstract

Topic: The timing of primary repair of open-globe injury is variable in major trauma centers worldwide, and consensus on optimal timing is lacking.

Clinical relevance: Surgery is the mainstay of open-globe injury management, and appropriate timing of surgical repair may minimize the risk of potentially blinding complications such as endophthalmitis, thereby optimizing visual outcomes.

Methods: A systematic literature review was performed following Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines (International Prospective Register of Systematic Reviews identifier, CRD42023442972). The Cochrane Central Register of Controlled Trials, MEDLINE, Embase, and ISRCTN registries and ClinicalTrials.gov were searched from inception through October 29, 2023. Prospective and retrospective nonrandomized studies of patients with open-globe injury with a minimum of 1 month of follow-up after primary repair were included. Primary outcomes included visual acuity at last follow-up and the proportion of patients with endophthalmitis. Certainty of the evidence was assessed using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) approach.

Results: Fifteen studies met inclusion criteria, reporting a total of 8497 eyes. The most common injury types were penetrating and intraocular foreign body (IOFB). Meta-analysis found that primary repair less than 24 hours after open-globe injury was associated with 0.30 odds of endophthalmitis compared with primary repair conducted more than 24 hours after trauma (odds ratio, 0.39; 95% confidence interval [CI], 0.19-0.79; I^2 = 95%; P = 0.01). No significant difference was found in reported visual outcomes between patients whose open-globe injuries were repaired more than, compared with less than, 24 hours after trauma (odds ratio, 0.89; 95% CI, 0.61-1.29; I^2 = 70%; P = 0.52). All included studies were retrospective and nonrandomized, demonstrating an overall low certainty of evidence on GRADE assessment.

Discussion: Only retrospective data exist around the effect of timing of open-globe repair, resulting in low certainty of the available evidence. However, this review of current evidence, predominantly including penetrating and IOFB injuries, suggests that primary repair performed less than 24 hours after open-globe injury is associated with a reduced endophthalmitis rate compared with longer delays, consistent with delay to primary repair increasing endophthalmitis risk.

Keywords: Ocular trauma; Open-globe injury; Primary repair.

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War-related maxillofacial injuries in Ukraine: a retrospective multicenter study

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Abstract

Background: The invasion of Ukraine by Russian troops on February 24, 2022, had significant humanitarian consequences. This conflict provides valuable data on the types and characteristics of war-related injuries, their epidemiology under modern warfare conditions, and the effectiveness of medical support and treatment strategies applied under challenging military circumstances with limited staff and resources. Therefore, this study aimed to analyze the prevalence and characteristics of war-related maxillofacial injuries during the Russian- Ukrainian war.

Methods: This retrospective multicenter study examined the demographic features, etiology, and characteristics of ballistic injuries among military personnel and civilians. Data were collected from the maxillofacial departments of six specialized military and civilian medical institutions in Kyiv and its surrounding regions. The study analyzed 415 patients with gunshot and blast injuries admitted to these hospitals from February 24, 2022, to February 24, 2024. For each patient, parameters such as age, sex, social status, trauma-associated complications, concomitant injuries to other organs and systems, New Injury Severity Scores, and Facial Injury Severity Scale scores were recorded.

Results: Among the 415 patients, 96.9% were male. Isolated maxillofacial injuries were observed in 75 patients (18%), while ophthalmic injuries were present in 208 patients (50.1%). Primary care for the majority of patients was provided in military hospitals near the front line or in primary, secondary and tertiary regional medical institutions. Wound debridement and closure were performed as primary interventions in 358 patients (86.3%), and more than half of the patients received primary maxillofacial care within 24 hours of injury.

Conclusion: The primary cause of war-related maxillofacial injuries was high-energy blast trauma resulting from artillery strikes, mines, drones, rocket attacks, and bombings. War-related military trauma involved soft tissue damage in 97.1% of cases.

Keywords: Gunshot wounds; Health care surveys; Maxillofacial injuries; Military personnel; War exposure.

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Finger thoracostomy: Significant risks and unproven benefits in prehospital settings

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Abstract

Background: Trauma is a leading cause of preventable death, with a significant portion of trauma deaths occurring in the prehospital setting. Interventions such as chest drainage may play a critical role in managing life-threatening conditions but face challenges due to poorly defined indications and reliance on anecdotal evidence rather than rigorous studies. Among chest drainage techniques, finger thoracostomy (FT) is a well-described, but controversial, method for decompressing the pleural cavity in emergencies like tension pneumothorax or hemothorax. Despite its simplicity and minimal equipment requirements, FT carries risks, including bleeding, infection, organ injury, temporary effects, and procedural failure.

Study design and methods: This study examines eight FT procedures performed by Israel Defense Forces providers during the 2023-2024 "Swords of Iron" War in Gaza.

Results: All patients sustained severe penetrating injuries, with mixed outcomes. One case highlighted severe complications, including infection and empyema weeks later. Additionally, challenges in maintaining up-to-date knowledge and adherence to protocols among reservists led to unauthorized FT procedures, emphasizing the dangers of improvisation without evidence.

Discussion: Our findings, coupled with limited evidence for FT's effectiveness in prehospital settings, raise questions about its appropriateness in trauma care. These concerns highlight the critical importance of adhering to validated and evidence-based protocols in all aspects of medical practice. Deviating from such protocols not only introduces unnecessary risks but also undermines the standardization essential for optimal patient care. Further research is needed to clarify the role, if any, of FT in prehospital trauma management.

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Morbidity and mortality associated with ischemia-reperfusion injury after prolonged tourniquet use: A wartime single-center treatment algorithm

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Abstract

Background: The evolving warfare tactics used by near-peer adversaries are expected to increase the incidence of severe extremity injuries and delayed evacuations. Initial reports from combat in Ukraine suggest high complication rates associated with prolonged tourniquet use. This study aimed to evaluate the systemic effects of limb reperfusion following tourniquet application lasting 4 hours or more in patients with isolated extremity injuries. Patients were treated according to an evidence-based protocol designed to mitigate ischemia-reperfusion injuries.

Methods: This retrospective review was conducted at a forward surgical facility in Ukraine during combat operations from May 2023 to February 2024. Patients with tourniquets in place for at least 4 hours were included, while those with contraindications to limb salvage or significant confounding injuries were excluded. Short-term outcomes assessed included limb salvage, organ failure, and survival rates.

Results: Of the 1,945 casualties screened, 90 (4.6%) met the inclusion criteria. After excluding 16 patients, outcomes were analyzed for 74 males, with an average age of 41.6 ± 8.5 years and a mean tourniquet duration of 7.1 ± 2.9 hours. Among these, 19 patients (25.67%) had vascular injuries, and compartment syndrome was present in all cases. Hemodialysis was required for 58 patients (70.8%), while 27 (36.3%) needed a delayed limb amputation, and 5 patients (6.7%) died. Patients requiring dialysis underwent an average of 3 ± 2 sessions to recover kidney function. Longer tourniquet times increased the need for dialysis, which increased the likelihood of patient death.

Conclusion: We used a standardized ischemia-reperfusion algorithm to reduce the systemic effects of ischemia and reperfusion during attempts to salvage limbs following 4 hours or more of tourniquet time. Preliminary outcomes indicate that survival is probable, kidney function may improve with brief periods of dialysis, and limb salvage is possible in most cases.

Level of evidence: Retrospective Cohort Study; Level V.

Keywords: Tourniquet; combat medics; extremity injury; ischemia reperfusion injury; military medicine.