

# Committee on Surgical Combat Casualty Care (CoSCCC)



**Journal Watch**

**2nd Quarter**

**FY 2025**

## Journal Watch Key Terminology Searched:

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

## Poor long-term outcomes and abnormal neurodegeneration biomarkers after military traumatic brain injury: the ADVANCE study

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### Abstract

**Background:** Traumatic brain injury (TBI) is common in military campaigns and is a risk factor for dementia. Armed Services Trauma and Rehabilitation Outcome-TBI (ADVANCE-TBI) aims to ascertain neurological outcomes in UK military personnel with major battlefield trauma, leveraging advances in quantification of axonal breakdown markers like neurofilament light (NfL), and astroglial marker glial fibrillar acidic protein (GFAP) in blood. We aimed to describe the causes, prevalence and consequences of TBI, and its fluid biomarker associations.

**Methods:** TBI history was ascertained in 1145 servicemen and veterans, of whom 579 had been exposed to major trauma. Functional and mental health assessments were administered, and blood samples were collected approximately 8 years postinjury, with plasma biomarkers quantified (n=1125) for NfL, GFAP, total tau, phospho-tau<sub>181</sub>, amyloid- $\beta$  42 and 40. Outcomes were related to neurotrauma exposure.

**Results:** TBI was present in 16.9% (n=98) of exposed participants, with 46.9% classified as mild-probable and 53.1% classified as moderate to severe. Depression ( $\beta=1.65$ , 95% CI (1.33 to 2.03)), anxiety ( $\beta=1.65$  (1.34 to 2.03)) and post-traumatic stress disorder ( $\beta=1.30$  (1.19 to 1.41)) symptoms were more common after TBI, alongside poorer 6 minute walk distance ( $\beta=0.79$  (0.74 to 0.84)) and quality of life ( $\beta=1.27$  (1.19 to 1.36), all  $p<0.001$ ). Plasma GFAP was 11% (95% CI 2 to 21) higher post-TBI ( $p=0.013$ ), with greater concentrations in moderate-to-severe injuries (47% higher than mild-probable (95% CI 20% to 82%,  $p<0.001$ )). Unemployment was more common among those with elevated GFAP levels post-TBI, showing a 1.14-fold increase (95% CI 1.03 to 1.27,  $p<0.001$ ) for every doubling in GFAP concentration.

**Conclusions:** TBI affected nearly a fifth of trauma-exposed personnel, related to worse mental health, motor and functional outcomes, as well as elevated plasma GFAP levels 8 years post-injury. This was absent after extracranial trauma, and showed a dose-response relationship with the severity of the injury.

**Keywords:** dementia; head injury; traumatic brain injury.

# The Effect of Environmental Hypothermia on Survival in Isolated Blunt Traumatic Brain Injury

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## Abstract

**Background:** Environmental hypothermia increases mortality in patients with major trauma; however, the impact of exposure hypothermia on outcomes in isolated traumatic brain injury (TBI) is underexplored in literature. The aim of this study is to determine the relationship between environmental hypothermia and survival in patients with isolated blunt TBI.

**Methods:** We analyzed data from the Trauma Quality Improvement Program database. We included patients who were aged  $\geq 15$  years, had an abbreviated injury scale  $\geq 1$  for the head/neck body region, an arrival Glasgow Coma Scale of  $< 14$ , an abbreviated injury scale of 0 for all other body regions, and a blunt mechanism. We defined hypothermia as  $< 35^{\circ}\text{C}$ .

**Results:** From 2020 to 2022, there were 16,697 patient encounters that met inclusion for this analysis. There were 670 (4%) patient encounters that met our definition of hypothermia. Hypothermic patients had lower unadjusted survival at 24 hours (79% vs. 92%) and throughout their hospital stay (47% vs. 77%, all  $P < 0.001$ ). In our multivariable logistic regression model, after adjusting for age, sex, arrival Glasgow Coma Scale, arrival shock index, mechanism of injury, and imaging findings, hypothermia was associated with lower survival at 24 hours (odds ratio: 0.59; 0.48-0.74) and lower total in-hospital survival (odds ratio: 0.44; 0.36-0.53).

**Conclusions:** Environmental hypothermia is associated with increased mortality at 24 hours and at hospital discharge in patients with isolated blunt TBI. Further investigation is needed to identify optimal treatment strategies for TBI patients with hypothermia and to determine whether hypothermia prevention decreases mortality.

**Keywords:** Brain; Head; Injury; TBI; Trauma; Traumatic.

# Blood far forward: A cross-sectional analysis of prehospital transfusion practices in the Canadian Armed Forces

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## Abstract

**Background:** Canadian Armed Forces (CAF) operate in environments that challenge patient care, especially trauma. Military personnel often find themselves in remote settings without conventional healthcare facilities. Treating traumatic injuries, particularly hemorrhagic shock, often necessitates prehospital blood transfusion. This study aims to present an overview of the current CAF prehospital transfusion practices. Furthermore, the study compared current and developing protocols against expert-recommended guidelines.

**Methods:** A cross-sectional survey design was employed to describe and compare CAF prehospital blood transfusion practices and protocols against expert recommendations. Topics included protocols, equipment, and procedures. An online survey targeted medical leadership and providers within CAF, with data collected from August 15 to December 15, 2023. Results were summarized descriptively. This study received approval from the Unity Health Toronto Research Ethics Board (REB 23-087).

**Results:** Units and teams with prehospital blood transfusion capabilities were contacted, achieving a 100% response rate. Within CAF, Canadian Special Operations Forces Command (CANSOFCOM), Mobile Surgical Resuscitation Team (MSRT), and Canadian Medical Emergency Response Team (CMERT) possess these capabilities, established between 2013 and 2018. These programs are crucial for military operations. CAF has access to standard blood components, cold Leuko-Reduced Whole Blood (LrWB), and factor concentrates from Canadian Blood Services (CBS), available for both domestic and international missions given adequate planning and favorable conditions. Key findings indicate high adherence to recommended practices, some variability in the transfusion process, and potential benefits of standardizing prehospital transfusion practices.

**Conclusions:** This study provided insights into CAF's implementation of prehospital transfusion practices, highlighting high adherence to national expert recommendations and the importance of structured protocols in military prehospital trauma management.

**Implications of key findings:** CAF's approach and adoption of prehospital transfusion protocols lay a strong foundation for managing trauma patients in remote settings and for expanding prehospital transfusion capabilities across CFHS deployed assets. Further research is needed to advance military trauma care by adapting prehospital blood transfusion to dynamic tactical landscapes and evolving technologies.

**Keywords:** Blood Transfusion; Canadian Armed Forces; Hemorrhagic Shock; Prehospital; Remote Damage Control Resuscitation; Tactical Combat Casualty Care; Trauma Care.

## Bioengineered Human Arteries for the Repair of Vascular Injuries

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### Abstract

**Importance:** Vascular injuries require urgent repair to minimize loss of limb and life. Standard revascularization relies on autologous vein or synthetic grafts, but alternative options are needed when adequate vein is not feasible and when clinical conditions preclude safe use of synthetic materials.

**Objective:** To evaluate the performance of the acellular tissue engineered vessel (ATEV) in the repair of arterial injuries.

**Design, setting, and participants:** Two open-label, single-arm, nonrandomized clinical trials, including 1 prospective civilian study (CLN-PRO-V005 [V005]) and 1 retrospective observational study in a war zone (CLN-PRO-V017 [V017]), were conducted from September 2018 to January 2024 (follow-up ongoing) at 19 level 1 trauma centers in the US and Israel and 5 frontline hospitals in Ukraine. Patients had vascular injury, no autologous vein available for emergent revascularization, and risk factors for wound infection. Data were analyzed from September 2023 to January 2024.

**Intervention:** The ATEV is a bioengineered vascular conduit grown from human vascular cells, available off the shelf, and implantable without immunosuppression.

**Main outcomes and measures:** Primary patency at day 30 was the primary outcome. Secondary outcomes included limb salvage, graft infection, and patient survival. A systematic literature review identified synthetic graft benchmarks in the treatment of arterial trauma for the same end points.

**Results:** The V005 and V017 studies evaluated 69 and 17 patients, respectively, and included 51 in V005 and 16 in V017 with noniatrogenic arterial injuries of the extremities. The majority were male (V005, 38 [74.5%]; V017, 16 [100%]), the mean (SD) ages were similar (V005, 33.5 [13.6] years; V017, 34.2 [9.0] years), and the mean (SD) Injury Severity Scores were similar (V005, 20.8 [10.5]; V017, 20.1 [18.9]). Penetrating injuries dominated (V005, 29 patients [56.9%]; V017, 14 patients [87.5%]). At day 30 for the V005 and V017 trials, respectively, ATEV primary patency was 84.3% (95% CI, 72.0%-91.8%) and 93.8% (95% CI, 71.7%-98.9%); secondary patency was 90.2% (95% CI, 79.0%-95.7%) and 93.8% (95% CI, 71.7%-98.9%); amputation rate was 9.8% (95% CI, 4.3%-21.0%) and 0% (95% CI, 0.0%-19.4%); ATEV infection rate was 2.0% (95% CI, 0.4%-10.3%) and 0% (95% CI, 0.0%-19.4%); and death rate was 5.9% (95% CI, 2.0%-15.9%) and 0% (95% CI, 0.0%-19.4%) (no deaths attributed to the ATEV). Day 30 synthetic graft benchmarks were as follows: secondary patency, 78.9%; amputation, 24.3%; infection, 8.4%; and death, 3.4%.

**Conclusions and relevance:** Results of 2 single-arm trials in civilian and real-world military settings suggest that the ATEV provides benefits in terms of patency, limb salvage, and infection resistance. Comparing ATEV outcomes with synthetic graft benchmarks demonstrates improved outcomes in the treatment of acute vascular injuries of the extremities.