movement for UK troops is more likely to be mounted than dismounted, programmes should be developed aimed at preventing MSK disorders caused by prolonged vehicle movements.

3 LONGITUDINAL INCIDENCE, PROGRESSION AND PREDICTORS OF RADIOGRAPHIC KNEE OSTEOARTHRITIS AND PAIN IN A TRAUMA-INJURED COHORT – ADVANCE FOLLOW-UP FINDINGS

[1,2]Maj Oliver O'Sullivan, [3]Fraje Watson, [3]Anthony Bull, [4]Stefan Kluzek, [4]Ana Baldes, [1]Alex Bennett. *[1]Academic Department of Military Rehabilitation, DMRC Stanford Hall, Loughborough, UK; [2]Academic Unit of Injury, Recovery and Inflammation Sciences, School of Medicine, University of Nottingham, Nottingham, UK; [3]Imperial College London, London, UK; [4]University of Nottingham, Nottingham, UK*

10.1136/bmjmilitary-2025-colt.3

Background Chronic musculoskeletal injuries (MSKI) are the joint-most common cause of medical downgrade and discharge. Osteoarthritis (OA) contributes to one-third of US Military medical discharges, likely replicated in the UK military population. Understanding epidemiological trends and predictive tools enables OA prevention (primary, secondary or tertiary), minimising risk for Service Personnel. This study aims to understand rates of progression and incidence, and identify potential predictors, of knee radiographic OA (rOA) and pain (KP) in a military combat-injured cohort.
Methods ADVANCE is a longitudinal cohort study of Afghanistan-deployed UK servicemen (combat-injured, n=579; age, rank, role, service, frequency-matched comparison, n=565). Ninety-two-percent attended Follow-up (n=1052, n=526 per group). Participants completed knee radiographs, venous sampling for OA biomarkers, and Knee Injury and Osteoarthritis Outcome Score, 8- and 11-years post-injury/deployment. Correlation analysis was performed to identify potential predictors (demographic, injury-related, patient-reported, radiological, functional and molecular).
Results Radiographic OA incidence and progression rates increased over 3-years (by 12% and 16%, respectively), but this was not different between trauma-exposed and unexposed individuals (p=0.745 and p=0.443, respectively). However, those with a traumatic-amputation had 2.06x increased rOA incidence risk (p=0.002). Trauma-exposed participants were 1.44x more likely to KP incidence (p=0.024), with those sustaining a knee-specific injury 2.52x more likely to report KP progression (p=0.032). There were inconsistent results from potential predictor variables, with minimal overlap between those with and without a traumatic-amputation. Increased age correlated with increased rOA incidence and progression (both p=0.01), decreased time from injury to rOA progression (p=0.006) and KOOS to KP incidence (p<0.001).
Conclusions This study suggests an initial increased risk of rOA following injury, which plateaus within a few years, postulating a 'clinical window of maximal intervention' is required early after rehabilitation. Individuals with lower-limb traumatic-amputation displayed a different trajectory, likely due to altered biomechanics and mechanoinflammation. No potential predictors were consistent across groups, but initial injury-pattern influenced outcomes.

4 BIG HITS AND LITTLE MOLECULES: CHARACTERISING THE PROTEOMIC RESPONSE TO INCREASING ANATOMICAL INJURY SEVERITY

Jennifer Ross, Karim Brohi. *Centre for Trauma Sciences, Queen Mary, University of London, London, UK*

10.1136/bmjmilitary-2025-colt.4

Background Injured patients show higher rates of mortality and multiple organ dysfunction syndrome (MODS) as the severity of their injury increases. This study aimed to investigate the relationship between anatomical injury severity and the immediate underlying biological response to injury, developing our understanding this response and providing insight into the physiological processes potentially driving poor clinical outcomes in trauma patients.
Method Prospectively collected data and samples from a cohort of 413 trauma patients recruited to the ACIT-II study (REC approval: 07/Q0603/29) were used. ISS was used to categorise patients into groups of increasing anatomical injury severity (ISS 0-3 = Control, ISS 4-8 = Mild, ISS 9-15 = Moderate, ISS 16-24 = Severe, ISS 25-35 = Critical, ISS ≥36 = Super Critical). Proteomics analysis for 4979 proteins was performed on blood samples taken at presentation to the ED. Median change from Control was calculated for each protein in each injury severity group. Those showing significant change were utilised for pathway analysis, identifying enriched biological processes associated with higher injury severity groups.
Results The number of proteins showing change from Control increases cumulatively as injury severity increases, with 3865 proteins showing significant change in the Super Critical group. 496 of these are unique to this group. A total of 2118 proteins show significant change in only the Critical and/or Super Critical groups. Pathway analysis on both the Super Critical group (ISS ≥36) and combined Critical-Super Critical (ISS ≥25) group identifies a large number of processes, with the JAK-STAT signalling pathway most significantly enriched in both analyses.
Conclusion The biological response to trauma is massive and complex, however proteomic pathway analysis of patients with the highest levels of injury can highlight areas for further investigation, supporting future work on the potential identification of modifiable targets within these pathways and the optimisation of personalised care for trauma patients.

5 ABDOMINAL AORTIC JUNCTIONAL TOURNIQUETS – CLINICALLY IMPORTANT INCREASES IN PRESSURE IN AORTIC ZONE 1 AND ZONE 3 IN A CADAVERIC STUDY DIRECTLY RELEVENT TO COMBAT MEDICS TREATING NON-COMPRESSIBLE TORSO HAEMORRHAGE

Thomas Smith, Ian Pallister, Paul Parker.

10.1136/bmjmilitary-2025-colt.5

Background 'Non-compressible' torso haemorrhage (NCTH) is the leading cause of preventable battlefield death. UK Joint Theatre Trauma Registry (JTTR) analysis 2002–12 showed 85.5% NCTH mortality. Gas insufflation and hyper-pressure

intra-peritoneal fluid animal studies demonstrated significant reductions in blood loss in splanchnic injuries. We hypothesised that the non-invasive Abdominal Aortic Junctional Tourniquet-Stabilised (AAJT-S) would be a forward medic intervention to tamponade bleeding from coeliac trunk vessels in zone 1 by generating clinically significant proximal epigastric compartment pressure.

Methods Four cadaveric donors each had two balloon manometers placed intra-peritoneally: one epigastric and one retropubic. Baseline pressures of 8 cmH_2O were set (equating mean intra-abdominal pressure (IAP.)) AAJT-S was applied. Pressures were contemporaneously recorded. AAJT-S was removed, and 500 ml of water was added through the epigastric aperture to simulate blood. The manometer was replaced and reset to 8 cmH_2O. AAJT-S was re-applied, IAP steady pressures were again recorded.

Results Proximal compartment pressures reached a mean of 54.6 cmH_2O (40.2 mmHg); distal compartment pressures a mean of 46 cmH_2O (34 mmHg.) With 500 ml intraperitoneal fluid, proximal compartment achieved a mean of 52.25 cmH_2O (38.4 mmHg); distal compartment achieved a mean of 35 cmH_2O (25.7 mmHg.) BMI had a statistically significant inverse effect, in our range (16.7–22.9.) This proved clinically insignificant, with sufficient pressure still achieved in all tests.

Conclusion AAJT-S at 250 mmHg achieves proximal epigastric compartment pressures of 40mmHg, with or without 500 ml simulated free blood in the abdomen. This represents a highly significant and titratable reduction in blood flow in coeliac trunk branches. BMI does not have a clinically significant effect. AAJT-S application also produces Zone 3 aortic and inferior vena cava occlusion. AAJT-S may be a point of injury intervention for forward medics that contributes to non-surgical haemorrhage control and likely clot stabilisation for Zone 1 vascular and solid organ injuries.

6 A NOVEL INJURY RISK FUNCTION FOR AIRCREW HELMETS

Alasdair Mackay. *Human Experience, Analysis and Design Lab, Imperial College London, London, UK*

10.1136/bmjmilitary-2025-colt.6

Background Internationally, military aircrew helmet standards require helmets to demonstrate impact performance based on peak translational acceleration (PTA), which is associated with skull fractures but poorly predicts traumatic brain injury (TBI). Analyses of fast-jet ejections and rotary-wing crashes reveal that while skull fractures are rare, aircrew frequently sustain mild to moderate TBIs, with loss of consciousness being most prevalent. Even a brief incapacitation can have catastrophic consequences, especially due to the risk of post-crash fires, operating over water, or in non-permissive environments. This research introduces a novel tissue-level Injury Risk Function (IRF) that enables helmet assessment based on the risk of loss of consciousness.

Methods Kinematic data were calculated from 82 reconstructed NFL head impacts, 20 involving a clear loss of consciousness. This data was used to load a Finite Element Method (FEM) model of the human brain, where brain deformation was quantified using the 90th percentile maximum principal strain (MPS90), calculated for the whole brain, brainstem, and specific brainstem nuclei. Multiple IRFs were constructed using logistic regression, survival analysis, and machine learning techniques such as support vector machines and random forest. The performance of these IRFs was evaluated in accordance with ISO 18506:2014.

Results Whole brain strain and strain rate in three key brainstem nuclei were sensitive predictors of loss of consciousness, with a receiver operating characteristic (ROC) curve area under the curve (AUC) between 0.75 and 0.83. A survival analysis curve based on whole brain strain was constructed assuming a Weibull distribution.

Discussion A novel IRF has been developed for use in future military aircrew helmet impact standards. This IRF allows the development of a new injury criterion to assess helmet performance in protecting against significant brain injury, including loss of consciousness. Introducing this criterion would reduce the risk to life in aircraft crashes or ejections.