

MEETINGS AND ABSTRACTS

The 2010 Military Surgery meeting was once again organised by Lt Col Bowley and held at HMS Collingwood, Portsmouth, between 29-30th April this year. The meeting continues to grow into the multidisciplinary military surgical meeting of the year reflected this year by separate symposia for plastic and urological surgery, orthopaedic surgery and the surgery of the head, face, neck and eyes and international delegates and speakers from as far apart as Pakistan and the USA.

Over 300 delegates enjoyed a mix of high quality original research presentations, keynote speeches and posters over the two days, with a Formal Dinner night in the Officers Mess in the evening. The conference was closed by a Key Note address by Professor James Fawcett from the Cambridge Centre for Brain Repair entitled "Repairing Spinal Cord Injuries: Where are we? And What Are the Prospects for the Future" which gave an up to date overview of the state of this exciting area of regenerative medicine that may well have military application in the future. Prizes for the best podium presentation and poster were kindly provided by the Military Surgical Society. The abstracts of all oral presentations of original research are published below.

Comparison of Open Vascular Control Methods in a Large Animal Model of Non-Compressible Extra-Thoracic Torso Haemorrhage

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Introduction: Establishing vascular control in patients with end stage, non-compressible extra-thoracic torso haemorrhage remains debated. Current guidelines recommend emergency department thoracotomy (EDT) although transabdominal aortic control or direct vascular control of the injury are alternatives. This study compares the effectiveness of various methods of initial open vascular control. **Methods:** Animals randomized into 3 groups all of which sustained class III haemorrhagic shock. Group 1: EDT with thoracic aortic clamping (N=6), Group 2: intra-abdominal supra-celiac aortic clamping (SCC; N=6), and Group 3: direct vascular control (DVC) of bleeding site without aortic clamping (N=6). Following haemorrhage, EDT, SCC, or DVC was performed with subsequent exploration of the injury and placement of a temporary vascular shunt (TVS). All groups were resuscitated and monitored for 6 hours with repeated measures at standardized time points. **Results:** There was no difference in mortality among the groups and no TVS failures. Central and cerebral perfusion demonstrated increases in Groups 1 and 2 after application of the aortic clamp relative to Group 3 (p<0.05). During resuscitation, serum lactate levels were higher in Group 1 compared to Groups 2 and 3 (6.85 vs. 3.08 and 2.15, respectively; p<0.05) and serum pH in Group 1 reflected greater acidosis than Groups 2 and 3 (7.24 vs. 7.36 and 7.39, respectively; p<0.05). Groups 1 and 2 required significantly more intravenous fluid than Group 3 (2,166ml and 1,833ml, vs. 500ml respectively; p<0.05) and significantly more vasopressors were used in Groups 1 and 2 compared to Group 3 (52.1mcg and 43.5mcg vs. 10.3mcg, respectively; p<0.05). **Conclusion:** This study reports a novel model of non-compressible extra-thoracic torso haemorrhage comparing the effectiveness of EDT to SCC and DVC. Although EDT and SCC increased central and cerebral perfusion, DVC resulted in less physiologic derangement. Clinical studies evaluating DVC are warranted and require further investigation.

Quality of limb salvage following wartime extremity vascular injury: results of a novel patient-based outcomes study

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Introduction: As efforts are increasingly directed beyond statistical, to quality limb salvage, following extremity vascular injury, a patient-based outcomes measure is needed. The objective of this study is to describe a novel questionnaire, designed to assess quality of limb (QOL) in a cohort of combat wounded with limb threatening injuries. **Methods:** Clinical records from the Joint Trauma Theatre System (JTTS) were reviewed for a cohort with extremity vascular injuries between 2002 and 2009. A 21-point questionnaire addressing limb outcome (limb status, pain, functional impairment, satisfaction with current limb) was completed. Patient responses were stratified on a 30-point scale with 0 representing the poorest limb quality. **Results:** Contact was made with 104/256 (41%) of patients and survey responses for QOL questionnaire from 45 (45%). Eighty-seven percent (39/45) of respondents had lower limb injuries. Nine patients with lower extremity injury (23%) had an amputation and all could mobilize with a device. Lower limb salvage was 76% at 28 months, although 91% reported the extremity did not work normally (77% specifying pain with ambulation). Ninety-one percent report function adequate to enable walking; 53% required daily analgesia for their extremity injury and 32% report they would be better off having had an amputation. Six respondents had upper extremity injuries with no amputations, 100% reported neurologic disability; 1 respondent would have preferred

amputation. Overall 48% of the cohort were separated with disability benefits and 52% remain active duty with a profile. **Conclusion:** Results from this study demonstrate that patient-based outcomes following extremity vascular injury are limited by secondary amputation, pain and neurologic dysfunction. A novel QOL questionnaire aimed to better characterize functional limb salvage may allow correlation between in-theatre strategies and long-term function. Further study is warranted to correlate these findings with objective functional assessment.

Activated Recombinant Factor Seven in British Military Trauma: an audit of use against SGPL guidelines

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Introduction: Uncontrollable haemorrhage remains a leading cause of morbidity and mortality in the military population on operations. rFVIIa is a novel but expensive therapy, currently licensed for use in patients with haemophilia. The study aim was to examine use of rFVIIa in British Military trauma patients to ascertain whether it is being used accordance with the Surgeon General's operational policy letter (SGOPL 27Feb09) on management of massive haemorrhage. **Method:** Patients receiving rFVIIa were identified by cross referencing 3 datasets: (i) the returns to ADMST mandated in the SGOPL; (ii) the records held by pharmacy and (iii) the Joint Theatre Trauma Registry (JTTR). Information on each patient was then obtained from the JTTR. **Results:** A total of 95 patients received rFVIIa between January 2007 and November 2009. Of the 49 British Military casualties among them 37 survived (75.5%). The median ISS was 34 (IQ range 26-57). Ten patients had an ISS of 75, one survived. The SGOPL recommends that only patients thought to be salvageable, with ongoing haemorrhage, who have failed to respond to both surgical and non-surgical treatment receive rFVIIa. This is defined as having an ongoing transfusion requirement after 6-8 units of PRC. 45 patients (92%) received at least 6 units of blood prior to rFVIIa administration. The median number of units given was 23 (IQ range 17-32). The recommended dose of rFVIIa is 100mcg kg⁻¹, amount given ranged from 2.4mg-10mg (median 10mg). The number of doses given ranged from 1-5, 90% in accordance with recommended maximum of 2 doses. **Discussion:** Overall rFVIIa is being used in accordance to guidelines with good effect. Further investigation is required into the rationale behind rFVIIa use for other conditions e.g. blast lung. Final outcomes and complications are currently being studied to ascertain long term morbidity and mortality in this group of patients.

Surgical restoration of flow following prolonged ischemia inhibits neuromuscular recovery in a porcine (Sus Scrofa) model of extremity vascular injury

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Introduction: Despite advances in revascularization following extremity injury the relationship between time to restoration of flow and functional limb salvage is unknown. The objectives of this study are to describe a large animal model of hind limb ischemia/reperfusion and to define an extremity ischemic threshold from clinically relevant measures of neuromuscular recovery. **Methods:** Sus scrofa swine (N=38; weight[kg] ±SD 87 kg ± 6.2) were randomized to iliac artery injury and occlusion for 0 (Control), 1 (1HR), 3 (3HR), or 6 (6HR) hours followed by vessel repair and 14 days of recovery. Two groups underwent iliac artery division with no restoration of flow (Ligation), or exposure without intervention (Sham). A composite physiologic measure of recovery (PMR) was generated to assess group differences across 14-days of survival. PMR included hind limb function (Tarlov score) and electrophysiologic measures (compound muscle action potential

(CMAP) amplitude, sensory nerve action potential (SNAP) amplitude, and nerve conduction velocity (NCV)). These results were correlated with peroneus muscle and peroneal nerve histology. **Results:** Baseline physiologic characteristics were similar between groups. Neuromuscular recovery in groups with early restoration of flow (Control, 1HR, 3HR) was similar and nearly complete (92%, 98% and 88% respectively; $p > 0.45$). While recovery was diminished in both 6HR and Ligation; Ligation, rather than repair, exhibited greater recovery (68% vs. 53%; $p < 0.05$). These relationships correlated with the pathologic grade of degeneration, necrosis, and fibrosis ($p < 0.05$). Using the PMR, the ischemic threshold of the extremity is reached at 5 hours. **Conclusion:** This study reports a novel and translatable animal model of extremity ischemia and reperfusion correlating ischemic time to functional markers of recovery. In this model an ischemic threshold of 5 hours is defined after which Ligation is associated with less irreversible injury than surgical restoration of flow.

Vascular Injury Rates from the Wars in Iraq and Afghanistan

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Introduction: The rate of vascular injury in WWII, Korea and Vietnam was 2-3%; however, not since Vietnam has an account of the epidemiology of this injury pattern in war been possible. The objective of this study is to report the burden of vascular injury over 7 years of recent combat. **Methods:** The Joint Theater Trauma Registry was queried (2002-2009) for vascular injury in US Troops and groups defined. Group 1 (specific): Troops having sustained specific vascular injury and Group 2 (operative): Troops having undergone a designated operation for vascular injury. Group numbers were divided by battle related injuries to establish injury rates. **Results:** Group 1 included 1,597 Troops injured in Iraq (OIF) (n=1,417) and Afghanistan (OEF) (n=180). Mechanism included explosive (75%), gunshot (24%) and other (1%) with explosive more common in OIF than OEF ($p < 0.05$). During this period, 13,306 battle related injuries occurred resulting in a specific rate of 12% (1,597/13,306) which was higher in OIF than OEF (13% vs. 10% respectively; $p < 0.05$). Of Group 1, 60% (n=940) sustained injury to major or proximal vessels and 40% (n=630) to minor or distal vessels. Group 1 injury was categorized as arterial 64%, venous 16% or combined 20%. Group 2 comprised 1,212 Troops revealing an operative injury rate of 9% (1,212/13,306) and included ligation (n=660; 54%) or repair (n=552; 46%). Peak rates in OIF and OEF occurred in November 2004 (21%) and August 2009 (12%) respectively and correlated with changes in combat operational tempo. The died of wounds rate was 5.7% in OIF and 6.0 % in OEF ($p = 0.85$). **Conclusion:** The rate of vascular injury recorded in modern combat is 5 times previously reported in war. Despite advances in revascularization, ligation remains a common strategy especially for minor injuries. Differences in vascular injury burden can be discerned and anticipated.

Outcomes of Non-Compressible Haemorrhage on the Battlefield

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Introduction: Non-compressible haemorrhage is the leading cause of potentially preventable death on the battlefield. Whilst progress has been made in the understanding and management of extremity bleeding, torso haemorrhage remains poorly characterised. The objective of this study is to determine the incidence of non-compressible torso haemorrhage on the battlefield and define differences between survivors and non-survivors of this injury pattern. **Methods:** UK military casualties with non-compressible torso haemorrhage in the absence of significant neurological injury were identified using the Joint Theatre Trauma Registry. Demographics and mechanism, pattern and severity of injury were recorded along with interventions and outcomes. **Results:** Between March 2003 and August 2008 107/2032 (5.3%) of battlefield injuries were defined as having non-compressible torso haemorrhage without significant neurological injury. Median Injury Severity Score (ISS) for the cohort was 75 (Inter-Quartile Range (IQR) 45-75, Range 5-75) with a mortality rate of 85% (91/107). Seventy-nine of the 91 deaths (87%) occurred prior to an opportunity for surgical intervention. The median ISS for those dying prior to intervention (n=79) was 69 (IQR 63-75, Range 30-75) compared to 43 (IQR 36-75, Range 25-75) for those dying subsequent to surgical intervention (n=12). The median ISS of survivors (n=16) in the cohort was 20 (IQR 10-34, Range 5-59). Operative procedures included laparotomy in 12 patients, 2 of whom died. Thoracotomy was performed on 8 casualties (3 in the pre-hospital setting, 4 in the emergency room and 1 in the operating theatre), none of whom survived. **Conclusion:** Non-compressible torso haemorrhage is present in one in 20 battle related injuries and is associated with high mortality. The majority of patients with this injury do not survive to reach surgical intervention and may benefit from novel methods to be applied soon after injury, to support cerebral and cardiac perfusion while attenuating blood loss.

Head, Face and Neck injuries sustained by British servicemen in Iraq and Afghanistan: 01 Mar 2003 - 31 Dec 2008

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Introduction: Reviews from US forces in Iraq and Afghanistan in the 21st century describe incidences of head, face and neck injuries ranging from 21 - 29%. This is a significant increase from incidences published for conflicts in the 20th century. No review has to date exclusively analysed head, face and neck injuries sustained by UK personnel in the 21st century. **Method:** All head, face and neck (HFN) injuries sustained by British forces in Iraq and Afghanistan from 01 March 2003- 31 December 2008 were analysed. Data for this research was obtained from the Joint Theatre Trauma Registry (JTTR), the operating theatre log of the Multinational Field Hospital in Kandahar and the Defence Analytical and Statistical Agency (DASA). **Results:** During this period the HFN area accounted for 27% of battle injuries in 2006, 29% of battle injuries in 2007 and 30% of battle injuries in 2008. This gave an overall incidence during this period of 29%. 86% of HFN injuries were sustained in battle. Of those sustaining HFN injuries, 32% were killed in action and 6% died of wounds. 73% of injuries required evacuation back to the UK whilst 27% of injuries were managed definitively in the theatre of operations. **Discussion:** The rise in incidence of HFN injuries in comparison to 20th century conflicts most likely reflects improvements in body armour and the increased use of improvised explosive devices. It also reinforces the need for developing new methods of protecting the vulnerable head, face and neck regions in military conflicts.

Mine blast injuries: ophthalmic perspective

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Introduction: This study focuses on Afghan non-combatants engaged in mine clearing operations in Afghanistan in the aftermath of the Russo-Afghan war. Patterns injuries are described and experiences in prevention, management and rehabilitation are discussed. **Methods:** A retrospective study of 84 patients who sustained mine blast injuries during mine clearing operations in Afghanistan at a tertiary military hospital. The patients were divided into three groups on the basis of their injuries. Group 1 required only general surgical management; group 2 sustained only ocular injuries, while group 3 had combined ocular and general injuries. Patients were treated in two phases. The first phase was urgent surgeries, while restoration of function wherever possible was done in subsequently planned surgical procedures. **Results:** 51 of 84 patients (60.7%) sustained ocular trauma. The mean age of the victims was 29 years and they were all male. A total of 91 eyes of 51 patients (89.2%) had been damaged. Bilaterality of damage was seen in 40 (78.4%) patients. 34 (37.3%) eyes became totally blind (NPL). Only a few escaped with injury mild enough not to impair vision. Foreign bodies, small and multiple were found in the majority of eyes; most, however were found in the anterior segment and posterior segment injuries were proportionally less. **Conclusions:** The prevalence of blindness caused by mine blast injuries was high. Resulting psychosocial trauma to patients and families was tremendous. Prompt and appropriate treatment can save many eyes. These injuries were a great drain on the country's resources. Enforcement of preventive measures especially the use of protective gear and sophisticated equipment by the mine clearing personnel would prove to be far more economical in terms of human life as well as medical and economic resources. There is need for greater attention towards establishment of support groups and rehabilitation programmes for such individuals.

Development of a Facial Injury Severity Score: Do Military Casualties require additional consideration?

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Introduction: Current scoring systems such as Abbreviated Injury Scale (AIS) 2005, the Injury Severity Score and the current use of the International Classification of Diseases Clinical Modification Codes (ICD-9) used within the Joint Theatre Trauma Registry (JTTR), may not characterise the severity of head, face and neck wounds in a useful format that can be used to predict patient outcome, be used as a practical tool for communication between clinicians or be useful as a source of accurately recorded data for future research/audit. **Methods:** At the Royal London Hospital, a Maxillofacial Trauma and Emergencies database has been trialled on over 2500 civilian patients. This report describes the retrospective application of this civilian database tool to the JTTR records of 400 military casualties with head face and neck injuries, returning from Iraq and Afghanistan over a 2 year period. **Discussion:** In agreement with other similar international studies, the use of the ICD-9 Clinical Modification codes fail to fully characterise the severity of military head, face and neck wounds. The use of the civilian Maxillofacial Trauma and Emergencies database could be a useful tool in

the description of these injuries and may be of greater clinical relevance than the ICD-9 Clinical Modification Codes, currently in use on JTTR. A subject for further discussion would be to discuss whether military head, face and neck casualties warrant a separate facial injury severity scoring system to describe military facial injuries, or whether to acknowledge or denote that the score is of a military casualty, is sufficient.

Penetrating Neck Injury in Iraq and Afghanistan

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Introduction: While the head and torso may be protected by helmet and Kevlar plate the protection afforded to the neck of the soldier on the battlefield necessarily remains limited to allow for unrestricted movement of the head. **Methods:** The Royal Centre for Defence Medicine (RCDM) Birmingham data base of service personnel killed or injured in Iraq or Afghanistan between August 2004 and January 2008 was examined. The RCDM coding system was used to identify individuals with neck injury and the original hospital notes from the Role 2 Enhanced Hospital Facility were obtained and those with penetrating neck injury inspected. **Results:** A total of 75 individuals who had sustained penetrating neck injury were identified and examined in this study. Gunshot wounds were sustained in 19 cases (25%) and explosive injury in 56 cases (75%). All gunshot wounds were secondary to high velocity weapons. Explosive injuries were the result of improvised explosive devices (IED's) directed against mounted troops (34 casualties), indirect fire mortars (14 casualties), rocket propelled grenade (7 casualties) and a coalition bombing raid (1 casualty). The overall survival rate from this series of battlefield penetrating neck injury amounted to 37% (28 of 75 cases). **Discussion:** Several factors, as demonstrated by this study, are responsible for the high overall mortality rate following penetrating neck injury on the modern battlefield including the injury pattern of soldiers on the modern battle field has changed. Equivalent armour to protect the neck and face is not yet effective and requires development.

Computer aided sinus surgery: experiences gained in military centre 2001-09

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Introduction: Computer assisted navigation is the most significant advance in sinus / skull base surgery since the inception of the endoscopic approach in the mid 1980s. This technology enables the surgeon to follow the anatomical dissection of the sinuses on a visual display unit in real time. Important anatomic relationships can be more easily understood and treated with the assurance that the critical landmarks are secured. This theoretically results in a lower incidence of peri-operative complications and may improve the outcome of surgery. However, many reports in the literature have described small cohorts of patients with limited follow up. There is limited information on the long term safety and efficacy of this technology. MOD funding has enabled this equipment to be purchased in Portsmouth for both military and civilian patients. The result is the largest single centre case series in the UK. **Methods:** Retrospective review of all patient records 2001-2009 **Results:** A total 147 procedures were performed. Military patients comprised 39%. Indications for surgery included revision or complex nasal polyposis, barotrauma, mucocele formation and neoplasia. Average length of follow up was 17.6 months. Four patients (3.0%) had a major complication, one of whom had a confirmed cerebrospinal fluid (CSF) leak which was repaired using computer assisted navigation. No orbital complications were recorded. Fourteen patients (10.6%) underwent revision surgery. All military patients returned to full active duty. **Discussion:** This study provides some evidence that computer aided navigation in sinus surgery is safe and may decrease surgical revision rates. It is unclear at this stage whether or not the extra resources required to provide such a service are justified within the financial constraints of the NHS. There is a role for patients with a strong occupational requirement (e.g. aircrew) where the risk of major complication can be catastrophic.

Auditory processing in RAF Aircrew with a history of noise exposure but with normal hearing

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Introduction: Noise-induced hearing loss is an increasing problem in modern military warfare. However, little is known about the effects of chronic noise exposure on the central auditory processing of sound. This study assesses the central auditory processing ability of noise-exposed, but normally hearing, RAF Chinook aircrew (average in ear noise levels in flight 88.6 dB A), in comparison to controls. **Methods:** A prospective comparative study performed at RAF Odiham. Ten Chinook aircrew with a history of noise exposure, but normal hearing, formed the subject group. The controls were ten, age and sex matched, RAF administrators

with normal hearing and no noise exposure. Outcome measures: Cochlear function was assessed using pure tone audiometry and otoacoustic emissions. Tests of central auditory processing (the IMAP test battery) were performed on both groups as the primary outcome measures. **Results:** Cochlear function – assessed by audiometry and otoacoustic emissions – was normal in both groups. However, the noise-exposed aircrew had elevated thresholds in 'speech in noise' testing (IMAP VCV test) in comparison with the controls (49.7 dB SPL subjects vs. 45.8dB SPL controls). This difference of 3.9 dB SPL is both clinically important and statistically significant (p=0.02). **Conclusion:** Speech understanding in noise is significantly worse in those exposed to chronic noise. At the very least this may account for subjective hearing problems in those with normal audiometry. However, it may also have an effect on performance or productivity, and in the context of military aviation, even safety. If the changes are permanent, it would necessitate a review of opinion about what constitutes a safe level of noise exposure and could even affect legislation. Clearly, the auditory processing ability of the noise-exposed requires further evaluation.

Demographic and clinical characteristics of adults attending accident and emergency departments following mild traumatic brain injury

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Introduction: This study examined the characteristics of adults attending Accident and Emergency Departments (A&E) departments with mild traumatic brain injuries (mTBI). It considered demographic and clinical factors and examined which factors predicted a decision to admit the patient to hospital. **Methods:** 147 patients were recruited from two A&E departments in the UK. They were assessed by a clinician who collected information using a standardised questionnaire. Statistical analysis was conducted using PASW for Windows. **Results:** The results gave information on the mechanism of injury, clinical symptoms and demographics of the 147 participants, giving a cross-section of the types of A&E attendance following mTBI seen by both departments. Three factors were found to predict admission to hospital following mTBI. These were duration of loss of consciousness (LOC), the presence of fractures (not including the skull) and a prior history of head injury. Together these three factors explained 12.6% of the variance in admissions, with longer duration of LOC, the presence of one or more additional fracture and having a history of head injury being predictive of admission. No other clinical or demographic factor predicted admission following mTBI. When the two departments were compared, they were found to differ significantly in terms of percentage of patients admitted and by which factors predicted admission, with admissions to one department being predicted by patient age and the other by duration of LOC. The results also demonstrated significant differences between male and female attendees and in the characteristics of people attending following falls, assaults and sports related injuries. **Conclusion:** Clinical and demographic factors are poor predictors of medical decisions to admit patients following mTBI, which suggests that other factors are influencing this decision. There are also significant differences in factors associated with different A&E departments about which patients should be admitted following mTBI.

Unusual access for pelvic debridement; use of the Mini-Hoffman External Fixator for Anterior Pelvic Stabilisation

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Introduction: The Mini-Hoffman external fixation system is a stainless steel and carbon fibre frame designed for the fixation of small bone fractures such as in the hand. We describe a novel use for it in a soldier who was severely injured by an improvised explosive device. He sustained bilateral above knee amputations, perineal tissue loss, a flail left hemi-pelvis and right sacral foramina fractures. On arrival at role 4 he had a large Hoffman external fixator spanning between the iliac crests. Despite this the left hemi-pelvis swung open on the operating table. The access was used to fully debride the left SIJ, iliacus and piriformis muscles and to remove deep seated dirt and metal. **Methods:** After debridement, the pubic diastasis was reduced using 2 assistants to apply lateral pressure whilst the symphysis was opposed with bone reduction clamps. The left hemi-pelvis was clearly visible due to soft tissue loss anteriorly, whereas the right had good coverage. 3mm Mini-Hoffman external fixator pins were applied under direct vision to the left and percutaneously to the right side of the symphysis; a finger behind the symphysis guided pin placement. A single bar was used to join the pins. The large external fixator was reapplied, and with the anterior pelvis secured by the mini fixator, it was possible to close the posterior part of the pelvis without opening anteriorly. **Results:** The pelvic ring remained secure and fully closed anteriorly and posteriorly. **Discussion:** A mini external fixator can be removed more easily than a plate in order to allow further debridement. It reduces the risk of soft tissue necrosis, with less soft tissue dissection than plate placement, and can be more easily removed than a plate when skeletal stability has been regained after 3-6 months. We recommend its use for open book pelvis fractures.

Pelvic fractures in current military deployments

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Introduction: The nature of pelvic trauma in areas of conflict is unclear. This study details for the first time the fracture classification, mechanism and associated morbidity of this population. **Methods:** Retrospective analysis of the Centre for Defence Imaging database, 2005-2009. Fractures classified by region and stability with validated systems. Non-spinal, associated injuries were noted. Statistical analysis was by Fisher's Exact test. **Results:** 30 cases. 25 due to Gunshot wound (GSW) or explosion; the remainder from Road Traffic Accidents (RTAs). 22 patients had fractures confined to the pelvic ring, 1 was confined to the acetabulum and 7 had combined ring and acetabular fractures. AO classification of pelvic ring fractures: 13 'A', 10 'B' & 6 'C' fractures. For acetabular fractures: 6 'A' & 2 'B' fractures. 3 ring fractures were due to RTAs (2 'A', 1 'B'). 26 were due to ballistic causes: GSW – 8 (7 'A' 1 'B'). Explosion – 18 (4 'A', 8 'B' and 6 'C'). 'A' fractures are significantly more likely to result from GSW than 'B' or 'C' fractures. There is a trend in 'C' fractures being more likely to result from explosions than GSW. 17 cases had associated organ injury. There were 6 upper limb and 14 lower limb fractures. No significant association exists between pelvic fracture, associated injury and aetiology other than for lower limb fractures. For lower limb bony injury there was a highly statistically significant association with pelvic fractures caused by explosion. **Conclusion:** Fractures to the pelvic ring from ballistic injury predominate. GSW to the pelvis are associated with a stable injury pattern in comparison to those caused by explosion. Pelvic fractures resulting from explosions are significantly associated with lower limb fractures and it can be appreciated that the more unstable pelvic injuries are likely to have more complex limb injuries.

Early versus late surgery in 491 patients with traumatic spinal injury at a spine unit of tertiary care army hospital in Pakistan

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Introduction: Exact timing of surgery after traumatic spinal injury (TSI) is controversial. Generally it is assumed that surgery done within three days of injury produces better outcome. It is not possible to operate on all patients within three days due to multiple reasons. There is a need to develop a comprehensive approach to prioritize these patients for surgery. **Methods:** A retrospective study was conducted at our unit. Between January 2002 and December 2008, all patients with TSI, managed surgically were divided in three groups (surgery in less than 3 days, 4-14 days and more than 14 days). Outcome measures included; operation time, neurological improvement, correction of deformity, pain, and patient satisfaction. Groups were matched using Student's t test for continuous variables and Fisher's exact test for categorical variables, accepting $p < 0.05$ as significant. **Results:** There were 671 acute admissions with TSI. 491 patients were treated surgically. Average age was 35 years (range 5-80 years). 345 (70%) patients were males and 146 (30%) were females. Only 49 (10%) patients were operated within three days of injury. 176 (36%) were operated between 4 and 14 days. Rest, 266 (54%) were operated after two weeks of injury. Outcomes matched in groups 1 (within 3 days) and 2 (4-14 days), except for patients with cervical spine injury with neurological deficit, which fared better if operated within 3 days. There were more complications in group 3 (after 2 weeks). AO type C injuries were difficult to reduce after three days, taking more time to operate. Delaying surgery for more than two weeks sometimes necessitated spinal osteotomies and lengthy reconstructive operations. **Discussion:** Outcome in spinal injuries is not changed by delaying surgery up to two weeks after injury, except in cervical spine injuries with deficit and type C injuries, where surgery done within three days after injury carries better outcome.

Face and neck protection- adapting body armour to counter the changing patterns of battlefield injury

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Introduction: The increased use of improvised explosive devices in current conflicts together with proven thoraco-abdominal protection derived from modern body armour has resulted in greater proportions of face and neck injuries than seen in previous conflicts. The neck contains vital structures with little inherent anatomical protection such that low energy threats that would do minor harm to other body areas can often be fatal. Neck protection employed in all modern body armour systems can limit tactical ability as well as increasing the servicemen's heat burden. The long-term psychological effects of even minor facial disfigurement ideally necessitate the development of newer forms of facial protection. Protection of the face however will be harder to develop than that of the neck, with the need for retaining situational awareness overriding anatomical coverage. **Method:** A full review of the current literature in combination with materials science and ergonomics assessment of all current military body armour systems was

undertaken. **Discussion:** Surgeons are well placed to work with material scientists and biomechanical engineers in suggesting modifications to the design of both personal and vehicle mounted military protective equipment. In this paper we explore current methods of military face and neck protection and attempt to predict where future developments might lie.

Adequacy of existing guidelines for potential Army recruits with pre-existing orthopaedic problems

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Introduction: We set out to determine whether the current guidelines (Joint Service Publication 346, chapter 11) are sufficient to direct Medical Officers in their decision making when conducting entry medicals, regarding suitability of recruits with pre-existing orthopaedic conditions for enlistment. **Methods:** A retrospective study was conducted, looking at the correspondence referring to 119 cases referred by Medical Officers to an Orthopaedic Single Service Consultant Advisor (SCA), Col Clasper, over a 3 year period (Apr 06 – Mar 09), and highlighting areas where guidelines have either been overruled or are non-existent. **Results:** Of the 119, 12 cases were eliminated due to either pending further treatment/investigation, awaiting referral or already being in training, leaving a total of 107 for analysis. Of these, in 10 cases (9.3%) guidelines were overruled by the SCA and in 26 cases (24.3%) there were no specific guidelines identified to cover the conditions. **Discussion:** Results reveal conditions, discussed in more detail in the presentation, where the guidelines need altering. Overly strict or non-existent guidelines are at present resulting in a potentially significant number of individuals being inappropriately refused entry to the Army. A number of conditions have been suggested as P8, unfit for military service, when in fact many of these individuals have normal function and can perform at a level acceptable for military service. In most cases these individuals should be referred to the SCA to determine fitness for service. Function, and implication to both the individual and the military if something were to go wrong, are all important, rather than cosmetic appearance and diagnostic labelling. We suggest areas in which the existing guidelines should be altered to reflect this.

Exploring the role of Whole Body Computed Tomography (WBCT) in the early management of combat casualties from explosive devices

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Introduction: Improvised Explosive Devices (IED's) account for a significant proportion of casualties in contemporary warfare. This paper explores the use of early Whole Body Computed Tomography (WBCT) in this population. **Methods:** Consecutive, retrospective review of WBCT scans performed at a field hospital in Afghanistan over a nine-month period. Included were: civilian and military patients undergoing WBCT following injury by an indiscriminate explosive device prior to admission or progression to the operating theatre. Scans by region were interpreted as being either: normal, abnormal / confirmatory (known clinical finding pre-scan) or abnormal / occult. Statistical analysis was by McNemar's test. **Results:** 353 patients satisfied the inclusion criteria. 209 (58%) scans were either normal or confirmatory. 144 (42%) were interpreted as abnormal / occult. Of the latter, injury to the head and thoracolumbar spine regions predominate. Abnormal findings on these scans were significantly greater than that seen to the chest, neck or pelvis ($p < 0.01$). Of the head scans, intracranial haemorrhage and facial fractures are a feature of these casualties, whilst in the spine, explosion related lumbar fractures predominate. The lumbar spine is similarly the most common site for fractures of an unstable morphology. **Discussion:** Although a considerable number of scans in this series were normal, the value of a negative scan in terms of conservative management, surgical triage and operative strategy is well established in the civilian trauma literature. Significant injury to the head and thoracolumbar spine is highlighted. Whilst WBCT may be beneficial, this must be balanced against the considerable radiation risk involved. In an era of protocol driven resuscitation there is room for more direction yet in the use of WBCT in this population to prevent excessive radiation exposure. Focussed scanning of the head, neck and thoracolumbar spine, augmented by other regions based on clinical evaluation may be more appropriate.

Introduction of a Military Registrar on S4 at RCDM Selly Oak – An Early Experience

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Introduction: S4 is a military managed trauma ward at University Hospitals Birmingham Selly Oak site, providing care for civilians and injured servicemen.

Frequently the latter have suffered significant polytrauma, have deranged physiology and, due to the complex nature of their injuries, receive input from many different specialties. Previously, these patients have been primarily under the care of a trauma team, but the day to day management is often delegated to junior members of the team. **Methods:** A middle grade military doctor was introduced to provide support to the foundation year doctors. Based on the ward, and without regular operating or outpatient commitments, this post was designed to offer clinical leadership to more junior doctors, oversight of all the military patients, provide a conduit between the military and civilian healthcare teams and provide a direct line of communication to senior clinicians. 3 months after introduction of the post, semi-structured interviews were carried out with key stakeholders including patients, ward and specialist nursing staff as well as junior and senior clinicians to scope their views on the initiative. **Results:** Feedback was overwhelmingly positive. Junior medical staff appreciated having a readily available source of senior assistance; nursing staff highlighted easier access to middle grade doctors and consultants found the continuity provided by these posts extremely useful. Patients appreciated regular contact with a military doctor, particularly the increased time they were able to spend explaining their treatment plan and issues that might confound and alter it. The military registrars themselves found the attachments useful and rewarding due to the high concentration of military trauma seen. **Discussion:** The introduction of this post has provided increased support to all of those questioned, augmenting the existing service. In the future it is planned to further assess the impact of the post in a more quantitative way.

Perceived job security; a comparison between NHS and Military personnel

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Introduction: Drives towards a consultant delivered health service, reforms of postgraduate medical education under Modernising Medical Careers and an increase in the number of medical graduates have all contributed to an uncertain future for doctors in training. Many junior doctors now feel that military training offers a more certain future. The aim of this study was to examine the perception of job security amongst military and civilian junior doctors. **Method:** An e-mail questionnaire was sent to all foundation doctors within three foundation schools (n=718) and all foundation doctors in the Royal Army Medical Corps (n=106). A simple, double sheet survey with basic demographics, closed questions and an analogue scale from 1 to 10 were used to assess our endpoints. **Results:** 289 foundation doctors returned a completed questionnaire giving a response rate of 35.07%. Demographics including mean age and sex were similar in both groups. Mean level of job security based on our analogue scale was 8.54 in military and 6.28 in civilian trainees (p<0.0001). 97.14% of military trainees and 69.10% of civilian trainees believed that military trainees had a greater level of job security than their civilian counterparts. **Discussion:** Military trainees have a higher perception of job security than their civilian counterparts and further to this, civilian trainees feel military training offers greater job security. In a changing job market this may have a significant impact on recruitment to the armed forces.

Recreational Opioid Use In Afghan Patients admitted to Camp Bastion Role 3 Hospital

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Introduction: Opium is essentially a cash crop that can survive arduous conditions. It has found continued favour with the Afghan insurgency's financial aims despite governmental and security force efforts to disrupt the production and distribution chain. Potential access to opium in Afghanistan remains high. It had been observed that a proportion of Afghan patients had high opiate tolerance, withdrew from opiates on the hospital wards and subjectively required more opiate than anticipated. This study aimed to quantify the premorbid level of recreational drug usage in Afghan Nationals who were admitted to the hospital wards in order to inform clinicians managing their pain. **Method:** All Afghan national patients admitted to the Camp Bastion Role 3 Hospital between 09 November 2009 and 20 December 2009 inclusive were asked what their recreational drug consumption habits were over an average month. **Results:** There were 31 Afghan nationals admitted to the hospital wards over the six-week period of study. All were male and the average age was 26. Only one (a member of the ANP) admitted to unspecified opium usage and no witnessed opiate withdrawals were made. No patient admitted to alcohol consumption. 10/31 of the patients smoked cigarettes on a regular basis. One EF individual chewed tobacco however did not smoke cigarettes. 10/31 patients smoked cannabis. **Discussion:** Despite witnessing two persons withdrawing from opiates during the month prior to commencing this survey and anecdotally hearing of several accounts of widespread opiate use amongst some sections of Afghan society; only one individual admitted to recreational opiate use over this six-week survey period. We believe an opiate history, on admission to

Bastion Role 3 hospital, is nevertheless useful in guiding the perioperative analgesia package in Afghan patients. Such a history may also offer clues to unexplained physiological or behavioural changes in these patients.

The Management of Penetrating Abdominal Trauma at a Central London Teaching Hospital

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Introduction: Traditionally penetrating abdominal injuries with breach of the peritoneum required mandatory laparotomy. Over the last decade, with advancement in imaging and laparoscopic techniques there has been a move towards serial observation. To review our management of penetrating abdominal trauma we undertook this retrospective study. **Methods:** Retrospective review of the medical notes of patients with penetrating abdominal injuries from 01/01/2004 to 8/10/2009. Identified using ICD-10 coding. **Results:** 135 patients were identified, 65 were excluded (42 not penetrating abdominal injury, 20 unable to get clinical notes, 3 gunshot injuries) and 70 were included. 70% (49/70) were observed and 30% (21/70) had an operative procedure; laparotomy 20% (14/21) (laparoscopy converted to laparotomy (2/14)), laparoscopy 6% (4/21), other 4% (3/21). Laparotomy was therapeutic in 71% (10/14) and non-therapeutic in 29% (4/14). At presentation mean SBP was 126 mmHg (96-150) and HR 87 (66-104). Indication for laparotomy was penetrating injury 64% (9/14), peritoneal penetration 14% (2/14), peritonitis 7% (1/14), knife in-situ 7% (1/14) and other 7% (1/14). Mean time from admission to induction of anaesthesia was 5 hours (0.5 hours- 15.5 hours). The grade of surgeon was consultant 29% (4/14), SpR 7% (1/14), and not indicated 64% (9/14). The laparotomy rate is relatively low, in part reflected by the low injury severity and haemodynamic stability of the patients. Penetrating injury was the most common indication for laparotomy, contributing to the high non-therapeutic laparotomy rate. Only six patients had exploratory laparoscopy, despite the expertise at our institution. **Discussion:** The management of penetrating abdominal trauma may be improved by the development of guidelines to reduce the non-therapeutic laparotomy rate and its associated morbidity, ensure the timely delivery of laparotomy when indicated, and improve the quality and safety of laparotomy by the presence of a senior surgeon.

Hand Fasciotomies in Military Trauma - A Case Series

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Introduction: Hand fasciotomy is a rarely performed procedure which should be considered by military surgeons, and performed where necessary. Maximising hand function is vital in all military patients, but is even more significant in those who have lost multiple limbs and require maximal function from remaining hands, which are commonly injured too. It is vital that compartments are decompressed expediently to minimize muscle ischaemia. **Methods:** Cases were identified from the JTTR from March 2003. Data were collected prospectively from Aug 2009 to Feb 2010. Patient notes were analysed and the following recorded – demographics, mechanism of injury (MOI), associated injuries, echelon of care at which fasciotomy was performed, indication recorded by operating surgeon, and specialty of operating surgeon. **Results:** 9 patients were identified, median age was 23, MOI was IED in 8/9 and mine in one. All were multiply injured. 4/9 (44%) were performed at R3 and 5/9 (56%) at R4. All fasciotomies at R4 were performed at the first debridement, intrinsic muscles were found to be necrotic in 1 case. At R3 ¾ were performed by orthopaedic surgeons and ¼ by a plastic surgeon, at R4 all were performed by hand surgeons, either orthopaedic or plastic. **Discussion:** All fasciotomies performed at R4 were at the first debridement, and 1 revealed necrotic intrinsic muscles. This implies that some of these patients may have benefitted from earlier procedures. In upper limb injury where it is not possible to passively flex the metacarpophalangeal joints to 90 degrees, decompressing the hand should be considered.

An Audit of the Ketamine Shower Service on the Adult Burn Centre at Selly Oak Hospital, Birmingham

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Introduction: Prior to January 2009 major dressing changes were undertaken on burns patients using general anaesthetics in an operating room. It was felt that introducing a ketamine shower service in a heated facility in the unit would allow patients to be cleaned more effectively under running water, without the risks of a

full anaesthetic and liberating theatre time. The efficacy of the service was assessed with an initial audit(P1). Subsequently, a secondary audit(P2) was commenced to address further clinical questions identified in P1. **Methods:** P1 commenced in May 2009 and P2 in October 2009, both lasting 6 weeks. Chiefly, the Anaesthetist administering the ketamine collected data. Measurable variables were recorded (room temperature, patients' tympanic temperatures, the shower water temperature, length of procedure, number of staff attending), medical staff noted procedural complications, and patient feedback was obtained with pre-designed questionnaire. **Results:** P1 captured 18 shower sessions. The total body surface area (TBSA) of burn ranged from 4 - 67%. The mean length of the shower was 72 minutes (10-110), the mean number of staff attending was 4 (2-9). The average ambient shower room temperature was 30.60C (28-320C). The patient questionnaire demonstrated that over 90% of the patients preferred ketamine to alternate sedation. P2 captured 17 shower sessions. The TBSA of burn ranged from 7-85%. The mean procedure length was 61 minutes (30-150). Pre- and post-procedure tympanic temperatures were not significantly different. The ambient room temperature varied throughout the procedure. The shower water temperature ranged from 34.6 -38.80C. **Discussion:** We have been able to demonstrate that a ketamine shower service is of benefit when managing dressing changes in burns patients. Patient satisfaction was high, and no significant drop in tympanic temperature was noted. Presently, the military are considering the introduction of such a service for personnel requiring multiple dressing changes.

Right Turn or pause at the crossroads?

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Introduction: Right Turn (RT) resuscitation is the practice of immediate Operating Room (OR) resuscitation applied to Bastion Role 3 Hospital. The principle: to minimize time to definitive control of haemorrhage and restoration of physiology without attempt to define injury beyond that required for triaging the surgical strategy. Indicated for the most severely injured trauma casualties, RT resuscitation is informed by the prehospital process. A recent UK-US OP HERRICK clinician report recommended a review of RT resuscitation in order to determine case volume, injury complexes, indications and interventions. **Methods:** Between 01 July 2009 and 01 November 2009 all right turns at Bastion Role 3 Hospital, Helmand Province, Afghanistan, were identified and analyzed. A right turn was defined as a patient entry into the OR for resuscitation purposes immediately after entry in the hospital. Data was cross-referenced between the Joint Theatre Trauma Registry and the Theatre Log Book. Mechanism of injury, wounds, indication for right turn and outcome were reviewed. **Results:** There were 53 patients identified as having right turn resuscitation. Indications included ongoing Cardiopulmonary resuscitation, multiple traumatic amputations and severe penetrating neck trauma. Injury patterns were often complex, with a mean TRISS > 15 and associated with massive blood loss. Twenty percent of patients (10/53) undergoing Right Turn Resuscitation died within 24 hours. **Discussion:** RT resuscitation is a relatively new concept in Bastion Role 3 Hospital trauma care, designed with regard to the established ED and OR configuration. There are advantages and limitations to resuscitation in the ED compared to the OR. In some circumstances the most seriously injured trauma patients arriving at Bastion Role 3 Field Hospital may benefit from a right turn manoeuvre.

Continuous local anaesthetic wound infusion reduces pain, opiate requirement and length of stay after emergency laparotomy.

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Introduction: Providing optimal analgesia after emergency laparotomy remains a major challenge. Local anaesthetic infusion (LAI) is used in a variety of surgical applications and has been shown to be feasible and safe after laparotomy. This study examines the effects of adding LAI to a standard post-operative analgesia regimen. **Methods:** 20 patients undergoing emergency laparotomy were studied prospectively, with 10 patients in each group receiving either standard analgesia (SA) or standard analgesia with LAI adjunct (SA-plus). Postoperative Likert visual analogue scores, intra- and post-operative analgesia requirements and length of stay were assessed. Statistical analysis used Student's t-test or Mann-Whitney test as appropriate. **Results:** 7/10 SA patients were male; median age 51 years (range 21-76 years), 5/10 SA-plus group were male; median age 67 years (range 19-73). Mean pain scores within the first 24 hours post-operatively were 77.6/100 (SD 22.7) in the SA group compared with 58.9 (SD 22.8) in the SA-plus group (p=0.08). Mean total pain scores over the first 92 hours in the SA group were 54/100 (SD 33) compared to 33 (SD 25) in the SA-plus group (p=0.05). Mean total morphine requirements for the first 92 hours postoperatively in the SA group was 166mg (SD 113) compared to 76mg (SD 55.7) in the SA-plus group, (p=0.02). Median length of stay in the SA group; 10 days (range 4 - 19 days), compared to 7.5 days (range 4 - 12 days) in SA-plus group(p=0.07). There was one death each group. One patient in the SA group developed a wound infection,

one patient in the SA-plus group developed wound dehiscence. **Discussion:** Continuous local anaesthetic wound infusion is an effective analgesic adjunct after emergency laparotomy and can reduce postoperative pain, opiate requirement and post-operative length of stay.

Urethral injury due to blast; a new pattern of injury?

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Introduction: Exposure to blast from improvised explosive devices leads to a spectrum of, often severe, injury. Enhanced survival after severe blast injury is now being achieved due to a combination of modern ballistic protection, both personal and that afforded by modern military vehicles, and by the expediency of the casualty treatment process. This is leading to identification of injuries not previously reported from other conflicts. **Methods:** Patients with urethral injury repatriated to the Royal Centre for Defence Medicine [UK] from the Joint Force Role 4 hospital in Helmand Province, Afghanistan, over a six month period were identified. Data from the UK prospective military wounding database were recorded and a clinical record review was undertaken in conjunction with radiological findings. **Results:** Four patients were identified with proximal urethral injury; each patient had been injured by improvised explosive devices and had sustained extensive severe injuries, including in all cases bilateral above knee amputations, pubic symphysis disruption and massive transfusion of blood products. The location of all injuries was the bulbo /prostatic-urethral junction. 3/4 [75%] involved complete disruption of the urethra. All patients where treated with suprapubic catheter in the first instance, with urological reconstruction planned at a future date. **Discussion:** Current military ballistic protection and treatment paradigms achieve survivors from blast injury with complex, multi-system trauma. Blast urethral injury in association with severe bilateral lower extremity injury is an injury pattern that has not previously been described. The urethra is relatively mobile, with a fixed point at the junction of the prostatic and bulbo-urethra. We postulate that high energy blast trauma appears to cause injuries in this location in a similar manner to other deceleration injuries; such as the aorta or renal pedicle. Treatment options are challenging and long term effects on erectile dysfunction and continence are unclear.

Traumatic andropause after combat injury: a rare phenomenon

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Introduction: Trauma to the external male genitalia is an all too common feature of the pattern of injury caused by improvised explosive devices [IED]. Management of the patient is prioritised according to the associated, severe, life-threatening injury; however, loss of testicular tissue may precipitate abrupt andropause. **Case Report:** A male soldier was injured in an explosion from an IED in Helmand province, Afghanistan. He sustained bilateral above knee amputations, an open pelvic fracture with significant perineal injury, urethral disruption, rectal injury and bilateral orchidectomy. In addition, there were multiple fragment wounds to both hands. His wounds were debrided and a pelvic external fixator was applied; exploratory laparotomy with de-functioning colostomy and placement of a suprapubic catheter was undertaken. He was repatriated to the UK the day after the incident. The perineal and lower extremity wounds were managed by topical negative pressure dressings with multiple dressing changes under general anaesthetic; repeated tissue samples were sent for culture. These tissue samples grew several bacteria and fungi species. Although the acute problems stabilised, the patient continued to experience intermittent fevers, roughly tri-weekly. Blood cultures were persistently negative and inflammatory markers [that had initially been raised] fell to a baseline four weeks after admission and remained steady; the white cell count was consistently normal. Approximately six weeks post injury broad spectrum antibiotics and antifungals were stopped but he continued to spike temperatures and experience hot flushes. Testosterone replacement therapy was commenced 8 weeks after the injury, the fevers settled promptly and the patient's hot flushes ceased. **Conclusion:** Andropause is a well documented phenomenon in the elderly and has been described in patients undergoing surgery for bilateral testicular tumours. Traumatic andropause after combat injury is rare and, to our knowledge, has not been previously reported.

Military Treatment of Splenic Injury in the era of Non Operative Management

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Introduction: Management of blunt splenic injury (BSI) in battlefield casualties is controversial. Splenectomy is the traditional treatment, as setting the conditions for successful non operative management is difficult in the operational environment. On mature operations, it may be feasible to adopt a more conservative approach and manage the patient according to civilian protocols. The aim of this study was

to document the contemporary practice of deployed military surgeons when dealing with BSI and to compare this against a cohort of civilian BSI patients. **Methods:** The military trauma registry held at ADMEM was interrogated to yield patients with BSI. The study encompassed a 55 month period ending September 2009. Data abstracted included patient demographics, injury epidemiology, grade of splenic injury, treatment and outcome. This data was compared with a registry data taken from a civilian major trauma centre. **Results:** Of 1516 military trauma patients, 16 (1%) had splenic injury. Thirteen of these had a blunt component. Median Injury Severity Score (ISS) was 17. Nine underwent a splenectomy (median ISS = 16.5). Of this group, organ injury grades were documented in 8 (grade V injury = 4, IV = 1, II = 3). All patients survived surgery. Four did not undergo splenectomy; of these 2 died of overwhelming injury. There were no complications in survivors as a result of splenic conservation. Data from the civilian database showed splenic injury comprise 2% of all patients, of which 81% had a blunt mechanism. 22% and 6% underwent splenectomy and angio-embolisation respectively. **Discussion:** Patients with BSI - an uncommon finding in combat casualties - are occasionally selected for conservative management, contrary to standard military surgical paradigms but in keeping with the civilian shift to non-operative management. Guidelines to clarify the place of non-operative management are required to assist surgical decision making on deployed operations.

Pilot Investigation of a Single-Use Device, THORAQUIK® II, for the Pre-Hospital and Hospital Treatment of Pneumothorax and/or Hydrothorax Effusion

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Introduction: This report describes a single-centre, non-comparative, prospective, open label pilot study to evaluate the safety, clinical utility, and acceptability of a new device, the ThoraQuik® II, that has been designed and developed to be fit-for-purpose in the treatment of pneumothorax and pleural effusion. **Methods:** Twenty patients from a single centre, the Heart of England NHS Foundation Trust, Birmingham, UK, were recruited. The Clinical Study was reviewed and approved by the North Staffordshire Local Research Ethics Committee. **Results:** There were no Adverse Events or Serious Adverse Events during the study. The ThoraQuik® II device was evaluated both in acute and semi-acute settings in the Accident & Emergency Department and Thoracic Surgery Department. The qualitative assessments of the device were very favourable, with investigator's rating of Excellent or Good in most cases (91%). There are various kits and devices available which are used to aspirate and decompress pneumothoraces and pleural effusions. The majority of devices require assembly prior to use which could waste precious seconds in emergency situations. They also have constraints in two handed use, especially in the pre-hospital or military setting. Needle aspiration and needle decompression are the most frequently used treatment modalities. However, there are concerns about the efficacy of needle decompression with conventional needles as the cannula length may not be adequate to traverse the chest wall thickness. There is also the risk of the cannula kinking and bending after insertion which may be life threatening in conditions like tension pneumothorax. A very significant advantage of the ThoraQuik® II device is that it potentially addresses all of these shortcomings. **Discussion:** The study has demonstrated the utility, safety, and ease of use of the ThoraQuik® II device. In addition, key aspects of the device functionality have been validated in the acute clinical setting.

Management of Ballistic Thoracoabdominal Injuries: Analysis of Recent Operational Experience

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Introduction: To evaluate the management of ballistic thoracoabdominal injuries in the deployed military setting. **Methods:** Retrospective analysis of records of patients who sustained combined thoracic and abdominal injuries on operation HERRICK between October 2007 and September 2008, with particular reference to decision making and outcomes. **Results:** Thirty three patients (5% of combat related injuries) were identified. Twenty-one had sustained gunshot wounds, and twelve fragmentation wounds. Twenty five patients underwent immediate or urgent surgery, and eight underwent further investigation. Eleven patients

underwent combined thoracoabdominal exploration, and fourteen underwent immediate/ urgent laparotomy alone. Four underwent laparotomy following CT scanning. Five patients were initially managed non-operatively, but two ultimately required surgery. Five patients were admitted in cardiac arrest, and two survived following resuscitative surgery. In total, there were nine fatalities. **Discussion:** Ballistic thoracoabdominal injuries comprise a small and heterogeneous group of casualties whose treatment needs range from non-operative management to immediate combined thoracoabdominal exploration. Contemporary military outcomes compare favourably with civilian cohorts. A methodical approach to planning investigation and treatment is as important as technical proficiency. Cross-sectional imaging facilitates selection for non-operative management, but should never interfere with prompt, life-saving surgery.

The Psychology Involved in Preparing Senior Medical Personnel for War

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Introduction: Medical personnel who serve in Afghanistan display high levels of psychological dexterity in the face of extreme circumstances. But why are these people able to cope in unfamiliar circumstances and under intense levels of emotional and physical pressure? What makes them function so well in circumstances which many would break down in? How these individuals are prepared psychologically, both in terms of reducing risks of post traumatic stress disorder and also enabling them to function in the face of adversity, is extremely interesting. We ask what role training plays in psychologically adapting attitudes and personalities of people to cope? **Methods:** Observing the running of 205 (V) Field Hospital in their final HOSPEX before deploying to Afghanistan allowed us to infer and deduce conclusions. Watching how the realistic simulations of theatre affect the individuals involved and combine skills from NHS and military medical backgrounds alike to form a closely knit team, allowed us to form a hypothesis with regards the psychological mobilisation process. We also saw the personalities and attitudes involved being shaped by the military to ensure Camp Bastion field hospital provides only the best care. **Results & Discussion:** The conclusions are fascinating. Training throughout an individual's military career is conducted thoroughly and unpredictably in order that men and women get used to adapting and overcoming problems. Also the military instils an attitude of getting on with the job in its personnel. There is no sense of impossibility and the military encourages pushing the boundaries of modern technological pragmatism in order to achieve the desired goal. Enforcing these attitudes in medical personnel is key in the prevention of PTSD and in making sure individuals remain calm and collective when treating casualties as and when they present.

"TOE IN THE WATER". The use of competitive sailing in the rehabilitation of injured service personnel.

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Introduction: 'Toe in the Water' is a Tri-Service initiative, which was set up in 2008 with the aim of providing an alternative method of rehabilitation for injured service personnel. It was felt that the challenging nature of sailing, when combined with the element of competition in sail racing was the perfect vehicle for further rehabilitation of injured service personnel. **Methods:** The aims of the 'Toe in the Water' charity are to Re-inspire, Re-engage and Re-integrate service personnel following their injuries. Patients selected from the Defence Medical Rehabilitation Centre (DMRC) were given clear goals to achieve whilst partaking in the Toe in the Water events. **Results:** During the nine events undertaken during the 2009 racing season sixty-one injured service personnel from all three services were involved. Although the positive effects of the initiative were tangible, they are difficult to quantify. In an attempt to measure the effects of the initiative the SF-36 questionnaire was initially trialled, although following review, it is planned that for the 2010 season the Canadian Occupational performance measure will be more appropriate. **Discussion:** Anecdotal evidence suggests that the Toe in the Water initiative is a highly effective method of further rehabilitation for injured service personnel. This appears to be due to three main reasons. Firstly the clear pre-defined goals set by DMRC Headley Court, secondly the competitive nature of sail racing, and thirdly the teamwork required to achieve optimal results in the competitions. Given the current intensity of operations in Afghanistan, it is believed that the requirement for such initiatives will continue in the short-to-medium term.