



Combined Services Orthopaedic Society Meeting

Leeds



Programme

Friday 14th May 2010

7th Floor

Worsley Medical & Dental Building
University of Leeds

Lower Limb

WHITE ON WHITE MENISCAL TEARS; TO FIX OR NOT TO FIX?

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Background: The mechanical disadvantage and detrimental effect to articular cartilage following meniscectomy has been well documented in the literature. Meniscal repair in the avascular (white on white zone) is controversial and would be deemed inappropriate by many.

Methods: Prospective data collection on all meniscal repairs between 1999 and 2008. 423 patients underwent meniscal repair at our unit during this time. We identified 88 patients who underwent a meniscal repair of a non peripheral tear (white on white zone) where there was no co-existent ACL injury or instability. There were 74 males and 14 females with a mean age of 26 years (13-54). There were 50 medial meniscal tears and 38 lateral tears, all in the non peripheral area of the meniscus. The criterion for failure was any reoperation on the same meniscus requiring excision or re fixation.

Results: The mean follow up was 44 months (5–106). Twenty nine patients required further surgery on their repaired meniscus. There were nine re-repairs and twenty partial meniscectomies. Of the nine re-repairs only one has gone on to have a further procedure with meniscectomy. This represents a success rate of 67% (59/88). The mean pre-operative Lysholm score was 61 (4-88) which rose to 75 (12-100) postoperatively, (p=0.002). The mean pre-operative Tegner score was 6 (3-10) and this did not change significantly post operatively, mean 6 (0-10) (p=0.4).

Conclusions: Isolated white on white avascular meniscal tears can be successfully repaired in the majority of cases with a good clinical and functional result.

The CALEDonian Technique™ : Changing Post-operative Recovery following Total Knee Arthroplasty

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The CALEDonian Technique™, promoting enhanced recovery after surgery, is a multimodal multidisciplinary technique. This has demonstrated excellent analgesic control allowing early mobilisation and discharge following TKA, whilst maintaining patient safety.

All patients follow a planned programme beginning with pre-operative out-patient education at the pre-assessment visit. An anaesthetic regimen consisting of pre-emptive analgesia is combined with a spinal/epidural with propofol sedation. Intra-articular local anaesthetic soft tissue wound infiltration by the surgeon under direct vision is supplemented by post-operative high volume intermittent boluses via an intra-articular catheter. Early active mobilisation is positively encouraged.

A prospective audit of over 1000 patients demonstrated 35% of patients mobilised on day 0 and 95% by day 1, with rescue analgesia required in only 5% of cases. 79% of patients experienced no nausea or vomiting helping reduce length of stay from six to four postoperative days. A catheterisation rate of 7%, a DVT rate of 0.6% and a PE rate of 0.5% remained within or below previously published levels.

Laboratory studies examining the performance of the epidural filter and injection technique used for the post-operative intra-articular injections demonstrated this to be robust and effective at preventing bacterial ingress. This in-vitro data is supported by clinical results demonstrating no increase in the deep infection rate of 0.7% since the implementation of the technique at our institution.

We conclude that the CALEDonian Technique™ effectively and safely improves patient post-operative recovery following TKA.

THE EARLY RESULTS OF OPEN FEMOROACETABULAR IMPINGEMENT SURGERY IN MILITARY PERSONNEL

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Introduction: Femoroacetabular impingement (FAI) is a relatively recent recognised condition and a potential cause of anterior hip pain in the young military adult population. Both Cam and Pincer type FAI may lead to inflammation, labral tears, and or damage to the smooth articular cartilage of the acetabulum leading potentially to early osteoarthritis of the hip. Open Surgical hip dislocation using the Ganz Trochanteric Flip approach is an accepted technique allowing osteoplasty of the femoral neck and acetabular rim combined with labral repair if required. We present our results of this technique used in military personnel. Methods: All Military personnel who underwent FAI surgery in our unit since August 2006 were included in the study. Functional outcome was measured using the Oxford hip and McCarthy non-arthritic hip scores pre and post-operatively. Results: 13 hips in 11 patients with an average age of 36 years(21–45) underwent surgical hip dislocation for treatment of FAI. Average time of downgrading prior to surgery was 9.3(3-18) months. 6 out of the 11 patients have been upgraded to P2. Average time to upgrading was 6.8(3-17) months. There were no infections, dislocations, or neurovascular complications. Mean Oxford Hip Score improved from 22.8(range 8–38) to 39.5(11–48) and mean McCarthy hip score from 49.6(33.75–80) to 79.2(36.25–100) with an average follow up of 19.4 months(range 4– 42 months). Discussion: The early results of surgical hip dislocation in military personnel are encouraging. Long-term follow-up is required to see if this technique prevents the natural progression to osteoarthritis.

Failure of hip resurfacing arthroplasty – the phenomenon of slow neck failure in post-menopausal female patients.

Beech, ZKM; Trompeter A; Singleton J; Cooper, G; Hull, J

Hip resurfacing arthroplasty is an established and effective intervention for osteoarthritis of the hip in the young active patient¹, relying on the principle of femoral bone-stock preservation. A recognised mode of failure is neck thinning leading to radiological evidence of neck collapse and clinical failure. We report on a series of these slow-neck-failure patients and highlight the increased incidence of this phenomenon in post-menopausal female patients. This is a single operator, single implant series; 172 cases were identified from databases at our institution. 76 were female, mean (SD) age 52 (7) years. 96 were male, mean (SD) age 51(12) years. 15 (8.7%) patients required revision. 12 (80%) were female, 9 (75%) of these were due to slow neck failure. In the men one patient developed ALVAL requiring removal of his bilateral hip resurfacings, the other failure mode was early femoral neck failure. Mean time to failure was 6 months in men and 37 months in women. This difference in failure rates is also seen in the NJR figures². This review confirms the relatively high incidence of premature failure in post-menopausal females². NICE guidance in 2003, currently under review, stated that resurfacing is indicated in male patients up to 65 and female patients up to 60. As a result of this study we are currently advising post-menopausal patients that this risk of early failure may make total hip replacement a preferable option to resurfacing arthroplasty.

Spinal Fractures in Current Military Deployments

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Introduction This is the first study to illustrate spinal fracture distribution and the impact of different injury mechanisms on the spinal column during contemporary warfare. **Methods** Retrospective analysis of Computed Tomography (CT) spinal images entered onto the Centre for Defence Imaging (CDI) database, 2005-2009. Isolated spinous and transverse process fractures were excluded to allow focus on cases with implications for immediate management and prospective disability burden. Fractures were classified by anatomical level and stability with validated systems. Clinical data regarding mechanism of injury and associated non-spinal injuries for each patient was recorded. Statistical analysis was performed by Fisher's Exact test. **Results** 57 cases (128 fractures) were analysed. Ballistic (79%) and non-ballistic (21%) mechanisms contribute to vertebral fracture and spinal instability at all regions of the spinal column. There is a low incidence of cervical spine fracture, with these injuries predominantly occurring due to gunshot wounding. There is a high incidence of lumbar spine fractures which are significantly more likely to be caused by explosive devices than gunshot wounds ($p < 0.05$). 66% of thoracolumbar spine fractures caused by explosive devices were unstable, the majority being of a burst configuration. Associated non-spinal injuries occurred in 60% of patients. There is a strong relationship between spinal injuries caused by explosive devices and lower limb fractures **Conclusion** Explosive devices account for significant injury to both combatants and civilians in current conflict. Injuries to the spine by explosions account for greater numbers, associated morbidity and increasing complexity than other means of injury.

Upper Limb

Isolated Hand Injuries Requiring Repatriation In Military Personnel On Operational Deployment

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Hand injuries are common in military personnel deployed on Operations. We present an analysis of 6 years of isolated hand injuries from Afghanistan or Iraq. The AEROMED database was interrogated for all casualties with isolated hand injuries requiring repatriation between April 2003 and 2009. We excluded cases not returned to Royal Centre for Defence Medicine (RCDM). Of the 414 identified in the study period, 207 were not transferred to RCDM, 12 were incorrectly coded and 41 notes were unavailable. The remaining 154 notes were reviewed. 69% were from Iraq; only 14 % were battle injuries. 35% were crush injuries, 20% falls, 17% lacerations, 6% sport, 5% gun-shot wounds and 4% blast. Injuries sustained were closed fractures (43%), open fractures (10%), simple wounds (17%), closed soft tissue injuries (8%) tendon division (7%), nerve division (3%), nerve/tendon division (3%) complex hand injuries (4%). 112 (73%) of the casualties required surgery. Of these 44 (40%) had surgery only in RCDM, 32 (28%) were operated on only in deployed medical facilities and 36 (32%) required surgery before and after repatriation. All 4 isolated nerve injuries were repaired at RCDM; 2 of the 4 cases with tendon and nerve transection were repaired before repatriation. Of the 10 tendon repairs performed prior to repatriation 5 were subsequently revised at RCDM. This description of 6 years of isolated hand injuries in military personnel allows future planning to be focused on likely injuries and raises the issue of poor outcomes in tendon repairs performed on deployment.

Surg Lt Cdr Anton Fries RN, Lt Col Steve Jeffery RAMC

Hand fasciotomies in military trauma – a case series

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 1/9. 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.

The Arthroscopic Tightrope Technique for Stabilisation of Distal Clavicle Fractures

Maj David J Cloke RAMC(V), Amjid A Ali, David Potter

Distal clavicle fractures have a significant non-union rate, and are often managed operatively. Many of the fixation devices used have a high complication rate or require removal. An arthroscopic technique using the Tightrope device (Arthrex) has been used in our institution. We aimed to describe our initial results. Eighteen cases were identified retrospectively, and the notes and radiographs reviewed. Twelve patients were male, six female, with mean age 33 years. All fractures were displaced, lateral to the coraco-clavicular ligament complex: six showed marked comminution. Mean follow-up was thirteen weeks. Fifteen fractures united, with a mean radiological time to union of 8 weeks (range 6-13 weeks). There were three surgical complications. In one, the clavicular button was not seated correctly on bone, and early failure required revision surgery. In another, there was inadequate reduction, radiographic non-union at five months and subsequent device failure. In the last, there was radiographic non-union, but the patient was asymptomatic. The arthroscopic tightrope device provides minimally invasive stabilisation and reliable union. The complications seen were related to incorrect technique, and anticipate the complication rate to diminish as the technique is developed. We recommend the use of this technique for the stabilisation of distal clavicle fractures.

OXFORD ELBOW SCORES IN THE SOUTH WEST PENINSULA POPULATION
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Introduction: Patient-reported outcome measures (PROMs) are increasingly being used to assess the quality of healthcare delivery in the United Kingdom. It is important when using PROMs to know the score of the background population against which any clinical intervention maybe benchmarked. The purpose of this study was to measure an elbow-specific PROM for the population of the South West Peninsula. Methods: We undertook a cross-sectional survey study of patients and healthcare professionals. Participants were asked to complete a simple demographic questionnaire and an Oxford Elbow Score for each elbow. Respondents with a history of elbow surgery, elbow injury, chronic elbow problems or an incomplete dataset were excluded from the study. Results: A total of 1782 respondents (3564 elbows) completed the survey. 574 questionnaires were excluded leaving 1208 individuals (2416 elbows) for analysis. The median scores for each decade group ranged between 46.74 and 48 out of 48. There was no significant difference in the score for age, gender or hand dominance. Conclusion: When using the Oxford Elbow Score to assess outcomes after surgery, a normal score should be used as the benchmark. This benchmark is independent of age, gender and hand dominance.

The Winston Churchill Memorial Trust Travelling Fellowship Report:

MEDICAL LESSONS LEARNT FROM THE US AND CANADIAN EXPERIENCE OF TREATING
COMBAT CASUALTIES FROM IRAQ AND AFGHANISTAN.

Sqn Ldr Shreshth Dharm-Datta RAF, SpR Orthopaedics
Maj Raymond Anakwe RAMC, SpR Orthopaedics

The Winston Churchill Memorial Trust was established in 1965 on Sir Winston's death as a national memorial and living tribute to him, and funded by many thousands of people who contributed to a public subscription. This now funds Travelling Fellowships to allow Churchill Fellows to travel abroad and learn lessons that can be brought back to benefit the local community and ultimately the UK as a whole. Both authors were recipients of this prestigious 2009 Fellowship in the category of "Treatment & Rehabilitation of Traumatic Injuries".

Over fifteen weeks we visited hospitals in Germany, Canada, and the USA with expertise in the early care, reconstruction and rehabilitation of the combat casualties of our NATO Allies. We aimed to learn lessons from their experience, exchange ideas and to make contacts. We visited the US military hospital in Landstuhl Regional Medical Center, Germany, the University of Alberta Hospital and Glenrose Rehabilitation Hospital and the two major centres of US military care at the Walter Reed Army Medical Center/National Naval Medical Center in Washington DC, and the Brooke Army Medical Center in San Antonio Texas. We present our experience from this Fellowship, some of the lessons we have learnt and the problems that we face in common with our NATO allies.

Military

Combat Lower-Limb Amputation: The Contemporary British Military Experience.

Surg Lt Cdr Jowan G Penn-Barwell MRCS RN ,Surg Lt Cdr C Anton Fries MRCS RN, Gp Capt Ian D Sargeant FRCS RAF, Prof Keith Porter FRCS

We present the British Military's experience of treating devastating lower limb injuries in personnel returning from Iraq and Afghanistan. We evaluate current surgical practice of attempting to maximise stump length through sequential debridement, rather than early amputation outside the zone of injury. Following an observation that the frequency of sequential amputation had appeared to increase during spring 2009, it was speculated that there may be factors which would predict which patients would require a more aggressive early amputation. The Joint Theatre Trauma Registry was interrogated for all cases of amputation between Apr 06 and Sep 09. The following data were collected: demographics, mechanism of injury, requirement for massive transfusion, use of combat applied tourniquet, number of stump debridements and echelon of care performed at, all microbiology and final level of amputation. A regression analysis was performed to establish correlation between each data-set and final level of amputation. 95 cases were identified; 21 were either digits or upper limbs and excluded. Clinical notes of the remaining 74 cases were requested, of which 48 were available representing a total of 66 lower limb stumps. No significant relationships were established between sequential amputation and any of the variables we examined. It was not possible to identify factors with predictive value with respect to which patients would benefit from a more aggressive early amputation approach. These results support current practice by demonstrating that attempts to balance maximal stump length with sufficient debridement to eradicate infected tissue, does not expose patients to unnecessary operative "hits".

Ward NJ, Lasrado I, Walker N, Sharp RJ, Phillip RD, Cooke PH

Hindfoot trauma secondary to mineblast. A case series of late reconstruction of the hindfoot after injuries sustained in conflict zones of the middle east.

Changes in armour reinforcement of military vehicles have resulted in a changed injury pattern. Injuries which would previously have resulted in amputation are now less severe, and after initial debridement and temporary fixation the foot can now be saved. New patterns of injuries are emerging often as a part of potentially survivable poly-trauma. We describe a small series of these injuries. The techniques and results of late reconstruction are presented. We also discuss specific problems of managing patients with potential contamination with unusual organisms.

S MIDDLETON, J CLASPER

Compartment syndrome of the foot- implications for military surgeons

AIM: To review current military orthopaedic experience and establish if there exists a consensus of opinion in how and if to perform fasciotomy of the foot and to guide other clinicians.

METHODS: A questionnaire was sent to 10 DMS orthopaedic consultants to identify their experience with foot compartment syndrome and performing fasciotomies.

RESULTS: 50% had performed a foot fasciotomy (average 2, range 1-6) over an average of 6.2 years as consultant and an average of 7.3 months deployed. Most commonly two dorsal and a medial incision were used to decompress the foot, while one advocated not decompressing and accepting the contractures, a view consistent with some civilian literature.

DISCUSSION: The debate surrounding decompression stems from the rarity of the condition, the lack of consensus regarding the anatomy of the foot compartments and whether to accept the inevitable contractures by not decompressing. Given that foot compartment syndrome may not be seen during civilian training, then there is a requirement for guidance for the deploying military surgeon.

CONCLUSIONS: DMS clinicians need to remain vigilant to compartment syndrome of the foot and especially in cases of crush or blast injury or of multiple fractures. If diagnosed or even if an impending compartment syndrome is suspected then the foot should be decompressed and the deployed orthopaedic surgeon should be capable of performing it.

Lower Limb Traumatic Amputations – the importance of pelvic binding for associated pelvic fractures in blast injury.

A M Cross , C Davis, W de Mello, J J Matthews

A common injury pattern in current military experience is traumatic lower limb amputation from improvised explosive devices. This injury can coexist with pelvic girdle fractures. Of 67 consecutive patients with traumatic lower limb amputations treated in Camp Bastion Hospital Afghanistan, 16 (24%) had an associated pelvic fracture (10 APC / vertical shear and 6 acetabular or pubic rami fractures). Traumatic single amputees (n=28) had a 14% incidence of associated pelvic fracture with traumatic double amputees (n=39) increasing this association to 31%. However if the double amputations were above knee the incidence of associated open book fractures was 26% (6/23) with 39% (9/23) sustaining some form of pelvic bony injury. The majority of patients (95%) had a pelvic X-ray as part of the primary survey. Of these 51% (n=34) had a Sam sling® in situ but only fifteen were deemed appropriately applied. Given the high risk of pelvic fractures in patients with traumatic bilateral lower limb amputations, particularly those involving opening of the pelvic ring, it is imperative that the earliest and proper application of a pelvic binder be initiated.

An evaluation of two tourniquet systems for the control of lower limb haemorrhage.

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Haemorrhage is the main cause of preventable death on the modern battlefield. As IEDs in Afghanistan become increasingly powerful, more proximal limb injuries occur. Significant concerns now exist about the ability of the CAT tourniquet to control distal haemorrhage following mid thigh application.

Aim: To evaluate the efficacy of the CAT windlass tourniquet in comparison to the newer EMT pneumatic tourniquet.

Method: Serving soldiers were recruited from a military orthopaedic outpatient clinic. Participants' demographics and blood pressure were recorded and a short medical history obtained to exclude any arteriopathic conditions. Doppler ultrasound was used to identify the popliteal pulses bilaterally. The CAT was randomly self-applied by the participant at mid thigh level and the presence or absence of the popliteal pulse on Doppler was recorded. The process was repeated on the contralateral leg with the CAT now applied by a trained researcher. Finally the EMT tourniquet was 'self' applied to the first leg and popliteal pulse change Doppler recorded again.

Results: 40 consecutive patients were invited to participate in the study. 15 declined to participate. 1 was excluded via pre-determined exclusion criteria.

A total of 24 participants were recruited. The self applied CAT occluded popliteal flow in only 4 subjects (16.6%). The CAT applied by a researcher occluded popliteal flow in 2 subjects (8.3%). The EMT prevented all popliteal flow in 18 subjects (75%)

Discussion: This study demonstrates that the CAT tourniquet is ineffective in controlling arterial blood flow when applied at mid thigh level. The EMT was successful in a significantly larger number of participants.

Science and General

Kate V Brown, Bing Li, Teja Guda, Scott A Guelcher, Joseph C Wenke

Earlier Debridement and Antibiotic Administration Decreases Infection

Introduction: Despite the routine use of irrigation, debridement and systemic antibiotics, there is a high incidence of infection in severe open fractures. The synergistic use of local and systemic antibiotics appreciably reduces infection rates although the time window within which this is effective is unknown. The aim was to determine if delaying treatment of wounds causes higher levels of infection. **Methods:** A defect was created in the femurs of 90 Sprague-Dawley rats and inoculated with 10⁵CFUs *Staphylococcus aureus*. At 2, 6 and 24 hours following contamination, the defect was irrigated and debrided. The experimental groups had either vancomycin or tobramycin impregnated PMMA beads placed within the segmental defect. The controls received no further treatment. Two weeks after wound closure, the bacteria within the femur were quantified. **Results:** Delaying irrigation and debridement resulted in significantly more bacteria ($p < 0.01$) within the control group (2 hr < 6 hr < 24 hr). Both locally delivered tobramycin and vancomycin significantly reduced the bacteria ($p < 0.05$) when administered at the earlier time points (2 and 6 hours). Locally-delivered antibiotics were ineffective when delivered at 24 hours. **Conclusion:** Delaying treatment of contaminated defects reduces its effectiveness to eradicate infection. This is presumably because of the biofilm formation by the bacteria. Biofilms begin to form within a couple of hours and are mature within 12 hours. Early treatment of the wound allows the surgeon to physically remove the bacteria or have antibiotics present before a mature biofilm protects the bacteria.

Secondary reconstruction of war injuries involving peripheral nerves

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Introduction and aims. We present a series of patients who have had secondary reconstruction of war injuries to the upper and lower limbs, sustained during the Iraq and Afghanistan conflicts. **Material and Methods.** All patients were seen at the combined Peripheral Nerve Injuries Clinic at the Defence Medical Centre for Rehabilitation, Headley Court. All surgery was performed at Odstock Hospital. Procedures include scar excision and neurolysis (all patients), release of scar contractures, tenolysis, tendon transfers, revision nerve grafts, excision of neuroma, and soft tissue reconstruction using pedicled or free flaps. **Results.** 24 patients have been treated at the time of submission. We have using 13 free flaps (1 free groin flap, 9 anterolateral thigh, 3 parascapular, with 4 as through-flow flaps) and 1 pedicled groin flap, with no flap losses. There were 6 amputation stump revisions (1 above elbow, 5 below knee). The majority (n=23) have had nerve recovery distal to the level of injury following revision surgery. **Conclusions.** Nerve repairs recover following neurolysis (and revision nerve graft if necessary) with provision of good soft tissue cover. Release of scar contractures with flap cover allows healing of chronic wounds and permits mobilisation of joints. Thin fasciocutaneous flaps provide good contour and can be elevated more easily than skin grafted muscle flaps for secondary surgery. Free or regional flaps are preferable to local flaps in high energy-transfer military wounds. Immediate complex reconstruction is not always appropriate in multiply-injured patients.

Keeping a Cool Head - Therapeutic Hypothermia in Trauma

N Jacobs, H Bulstrode, S Harrison

The beneficial effects of therapeutic hypothermia have been capitalised upon in fields such as cardiac surgery for several decades. Hypothermia not only slows metabolism and consumption of metabolic substrates, but also confers cellular protection against ischaemia and reperfusion. Hypothermia has historically been considered as something to avoid in trauma casualties, with coagulopathy being the main concern. There is now increasing evidence for the role of controlled therapeutic hypothermia in trauma, particularly improved functional outcomes following brain injury and the utility of 'suspended animation' or 'emergency preservation' in the resuscitation of severe haemorrhagic shock. With the ongoing 'Eurotherm' trial of hypothermia in the treatment of traumatic brain injury, and the imminent launch of the 'Emergency Preservation and Resuscitation (EPR) for Cardiac Arrest From Trauma' clinical trial in the USA, this presentation will provide a timely overview of the developments of therapeutic hypothermia in trauma management.

THE DEVELOPMENT OF A MODEL TO INVESTIGATE THE MANAGEMENT OF MILITARY COMPLEX EXTREMITY INJURY

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Aim To develop a militarily relevant complex extremity wounding model. **Study Design** Controlled laboratory study with New Zealand White Rabbits. **Method** Phase 1: Injury Development. Under general anaesthesia, the flexor carpi ulnaris of the right forelimb was exposed and high energy, short duration impact delivered via drop test rig. Anaesthesia was maintained for three hours, the animal was recovered and saline soaked gauze and supportive bandaging applied. 48 hrs later, the animal was culled and muscle harvested for histological analysis. Analgesia was administered daily, animals checked by experienced staff at least twice daily and temperatures recorded by subcutaneous transponder. Phase 2: Contamination. Sequential groups of animals had inoculums of 1×10^2 , 1×10^6 and 1×10^8 /100 μ l of *Staphylococcus aureus* administered to the muscle immediately after injury. Animals were recovered as phase 1. At 48 hours, animals were culled, muscle harvested and axillary lymph nodes sampled. Quantitative microbiological analysis was performed on the muscle. **Results** Six animals given a loading of 0.5kg yielded consistent injury with 20% of the muscle becoming necrotic. Representative of injury from ballistic trauma, this was adopted as standard. Twenty-two subsequent animals were exposed to the injury and inoculated with the challenge doses. 1×10^6 /100 μ l *S.aureus* provided the greatest consistency in recovered yield. There were no adverse effects on animal welfare and body temperatures were always within normal limits. **Discussion** This model enables a consistent, contaminated soft tissue injury to be delivered in vivo. It will allow the investigation of complex wound management including wound coverage and fracture fixation.

A Biomechanical Comparison of Different Screw Configurations in Distal Tibial Locking Plates

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Background. Locking internal fixation through a relatively small surgical dissection presents an innovative technique for managing distal tibial extra-articular fractures. The aim of this study is to evaluate the biomechanical properties of one locking internal fixation plate used to treat these injuries. **Method.** An AO/OTA43-A3 fracture was created in synthetic composite tibiae. Locking internal fixation was achieved with an anatomically pre-contoured medial distal tibial locking plate. Comparisons were made between different screw configurations in holes proximal to the fracture and monocortical versus bicortical fixation. Axial stiffness was measured using a universal materials testing machine. Finite element analysis (FEA) was used to model the elastic deformation of the constructs. **Outcome measures** were axial stiffness under physiological loading conditions and compression load to failure. **Results.** A trend towards reduced mean axial stiffness from the bicortical to the monocortical fixation constructs was observed. The physical model demonstrated no difference in measured mean axial stiffness between constructs with all screw holes filled and constructs with 2 screws in the holes closest and furthest from the fracture site. There was a 19% reduction in mean measured axial stiffness between constructs with all holes filled and in constructs with 2 screws in adjacent holes furthest from the fracture site ($p < 0.05$). FEA predicted increased plate deflection and reduced construct axial stiffness with increasing distance of screw placement from the osteotomy site. **Conclusion.** Axial stiffness of distal tibial extra-articular metaphyseal fractures stabilized by locking internal fixation is dependent upon the configuration of the screw in the plate.