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PRECISION IN FIXATION

Tibiototalcaneal nailing in trauma

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Introduction

Ankle and distal tibial fractures present a complex situation in the older adult population. This situation is further complicated if the fracture is open. Management options include total contact casting, open reduction and internal fixation, fibula nailing and Tibiototalcaneal nailing (TTCN).

Methods

We identified consecutive cases treated with TTCN for trauma over a 4yr 9mth period. We retrospectively recorded the fracture pattern, soft tissue injury, surgery undertaken, post operative weight bearing plan, complications, re-operation rate and mortality.

Results

77 cases were included. 60 unstable ankle fractures, 16 distal tibial fractures and 2 talar fractures. 68% were open fractures. In closed fractures, 2% suffered Fracture Related Infection (FRI). In open fractures, 11.5% suffered FRI with 1 patient progressing to amputation. 10 patients required removal of a locking bolt and 5 required removal of the nail. There was 14% mortality at 12 months.

Conclusion

TTCN fixation facilitates an early return to mobility for older adults with complex ankle and distal tibial fractures with a low re-operation and complication rate. Consideration is required as to whether a larger proportion of patients would do better when treated with a TTCN in place of standard ORIF.

Ankle Fracture Care Before and During COVID-19: A Service Evaluation

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Background

Suspected ankle fractures represent 3-5% of all emergency department visits in the UK. COVID-19 prevalence is 9 times higher in the orthopaedic trauma population and 7 times higher at acute hospital sites compared to elective sites. Decreasing the length of inpatient stay for ankle fractures has been critical during the pandemic.

Aims

To assess the impact the COVID-19 pandemic on the management of patients with ankle fractures in Southampton and how our performance compares to BOAST guidance.

Method:

In this retrospective service evaluation, a total of 105 patient notes were reviewed of patients admitted with ankle fractures in two consecutive 3-month periods one in 2019 and one in 2020 to compare the standard of care before and during the COVID pandemic.

Results

Contrary to our hypothesis, there were similar numbers of ankle fracture presentations before and during lockdown. However, 2.5 times as many day case procedures were performed during COVID-19 due to the establishment of new trauma theatre capacity at a separate “cold” site. Average length of stay decreased from 9.7 days in 2019 to 7.4 in 2020.

Conclusion

New trauma operating capacity at a separate site encouraged the provision of day case surgery, decreasing patient exposure to higher rates of COVID-19 at the acute site and cutting hospital costs with a shorter mean average hospital stay. Behaviour modification during lockdown has not contributed to any reduction in presentation of ankle trauma in Southampton.

Examining the outcomes of microfracture for osteochondral lesions of the talus in military personnel: a retrospective case series analysis.

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Background

Treatment for talar osteochondral lesions aims to reduce morbidity and allow patients to return to activity, function, and in the military population deployable service. Microfracture is the most widely practised surgical intervention and it is anecdotally felt that soldiers undergoing this procedure do poorly in comparison to their civilian counterparts.

Methods

Military patients undergoing arthroscopy and microfracture between 2011 and 2019 at Frimley Park Hospital were identified by electronic search. Primary and secondary care records were examined to document each case. JMES grading was chosen as the primary outcome, and any functional limitations were reviewed.

Results

17 cases were included in the analysis. The case population was predominantly male (94%) and of senior non-commissioned officer rank (n=10). The mean patient age was 34 (range 24-43). Lateral talar dome osteochondral defects were more common, and the mean lesion size was 68mm²; subchondral cysts were noted in 3 (18%) patients. 5 (29%) ankles underwent concurrent or delayed ligamentous repair. After rehabilitation 6 patients returned to full deployability, with 2 subsequently being downgraded because of persisting symptoms. At their most recent medical grading, 13 (76%) were limited or non-deployable (MLD/MND). All downgraded personnel were prevented from impact activity and carrying weight over undulating terrain by their occupational restrictions. Only 3/13 were able to pass mandatory fitness testing.

Conclusions

These results may help inform the shared decision-making process between service personnel and their clinicians when discussing functional outcomes and probable occupational implications in the context of these injuries.

An Analysis Of Virtual Fracture Clinics In Orthopaedic Trauma in the UK During The Coronavirus Crisis

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Purpose

Virtual Fracture Clinics (VFC) are advocated by new Orthopaedic (British Orthopaedic Association) and National Health Service (NHS) guidelines in the United Kingdom. We discuss benefits and limitations, reviewing the literature. As well as recommendations on introducing a VFC service during the Coronavirus pandemic and into the future.

Methods

A narrative review identifying current literature on virtual fracture clinic outcomes when compared to traditional model fracture clinics in the UK. We identify 9 relevant publications related to VFC.

Results

The Glasgow Model, initiated in 2011 has become the benchmark. Clinical efficiency can be improved, reducing the number of ED referrals seen in VFC by 15%-28% and face to face consultations by 65%. 33-60% of patients may be discharged after review in the VFC. Some studies have shown no negative impact on the Emergency Department (ED), the time to discharge was not increased. Patients satisfaction ranges from 91%-97% using a VFC service, and there may be cost saving benefits annually from £67,385-£212,705. Non-attendance may be reduced by 75% and there are educational opportunities for trainees. However, evidence is limited, 28% of patients prefer face-to-face consultations and not all have access to internet or email (72%).

Conclusion

We propose a pathway integrating the VFC model, whilst having Senior Orthopaedic decision makers available in ED, during normal working hours, to cope with the pandemic. Beyond the pandemic, evidence suggests the Glasgow model is viable for day to day practice.

The epidemiology of open tibial fractures

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Objective

To examine the epidemiology and clinical outcome of open tibia fractures in patients presenting to one major trauma centre with an established Orthoplastics collaboration between 2013 and 2020.

Methods

We retrospectively collected all patients who presented to the John Radcliffe Hospital, Oxford, for the management of their open tibia fracture. We captured both pediatric and adult cases. Radiographs were reviewed to capture the OTA/AO fracture classification and Electronic Medical Record was searched to obtain the postoperative Gustillo-Anderson classification for each injury. Patients who received any surgical treatment (i.e., external fixation) at a peripheral centre prior to arriving to our center were excluded for the purpose of this surgery.

Results

One-hundred and eighty-three open tibia fractures presented to our center during the study period, giving an overall incidence of 0.75/100,000 per year. There were 96 right-sided, 87 left-sided and four patients with bilateral tibia fractures. The gender split was 72%/28% male/female. The mean age for males was 37 years, compared to 49 years for females. 51% had Gustillo type-III wounds, 26% type-II and 23% type-I. 46% of open fractures were classified as OTA/AO type-A. The most common causes of injury were falls and motorcycle accidents, accounting for 30% and 20% of cases, respectively. In terms of fracture management, intramedullary nail fixation (45%) was the most common first-line approach, followed by external fixation (32%). The mean number of operations to manage the fracture was 2.1.

Conclusions

Open tibial fractures mainly affect young men. Although the incidence is relatively low, these fractures require intensive operative treatment, therefore placing significant demand on trauma surgery teams.

Limb salvage surgery: Progress since the Lower Extremity Assessment Project (LEAP) – a systematic review of the literature

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Introduction

Outcomes following limb salvage (LS) and amputation for lower extremity trauma were reported in LEAP as equivocal. Since LEAP, advances have occurred in LS techniques and amputee prosthetic design. LEAP excluded military patients; however complex trauma treatment seen during recent conflicts, has resulted in new data which may be used to ascertain whether amputation or LS results in superior outcomes. The aim was to perform a systematic review relating to outcomes from LS and amputation following lower extremity trauma since LEAP for civilians and military personnel. It was hypothesised that, due to the availability of advanced prosthetics within the military, amputation will have superior outcomes over LS for military personnel.

Method

PRISMA guidelines were followed to identify research related to outcomes in LS and amputation between 2006 and 2019. Data were collected on functional and patient reported outcome measures (PROMs).

Results

Thirty-nine studies were included reporting on 12,779 patients with a mean follow-up of 54-months. Improved walking distances were reported for amputees compared to LS patients in both civilian and military populations (564 vs 483m; $p<0.05$). Improved PROMs were found for military patients following amputation ($p<0.01$) but remain equivocal for civilian patients.

Discussion

There continues to be no difference in outcomes for civilian cohorts. In contrast, within military cohorts, amputees have superior outcomes compared to LS patients. Longer term follow-up is required to ascertain whether initial benefits from amputation are retained with advancing age. Advances in treatment and rehabilitation of LS patients are required to improve outcomes thus negating the need to amputate.

Longitudinal Study Of Medical Downgrades In The Royal Air Force

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Introduction

The primary aim of this study was to define the prevalence of morbidity leading to permanent medical downgrading of RAF personnel and the effect on deployability. The secondary outcomes were to determine at risk populations and identify areas for improvement. Risk analysis focused on patient demographics and occupational roles.

Method

Database of personnel referred to the RAF Medical Board was analysed from January 2012 to October 2013 and January 2017 to December 2019. Patients were excluded if they did not require a formal medical board; incomplete and duplicate entries were also excluded. The primary reason for medical downgrade was categorised with an ICD-10 code. Further sub-analysis compared musculoskeletal disease with age, individual trade groups and anatomic region.

Results

2% of RAF service personnel were permanently downgraded annually. Musculoskeletal disease was the leading cause for permanent downgrade across both periods; 58% and 49%. Female personnel were at a greater risk of musculoskeletal downgrade compared to males. Spinal and knee pathology were the leading cause for downgrading amongst 'high risk' personnel. Personnel downgraded due to musculoskeletal pathology were often retained in a limited role with 10% and 5% retained as medically fully deployable. 14% and 12% of personnel downgraded due to musculoskeletal pathology were medically discharged.

Conclusion

Musculoskeletal disease was the leading cause for medical downgrades in the RAF across both study periods. A greater proportion of downgraded personnel with musculoskeletal conditions were retained in service with medical limitations rather than medically discharged.

Cost utility analysis of bilateral osseointegration for trans-femoral amputations in military blast injury

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Aim

Perform cost utility analysis (CUA) for bilateral femoral osseointegration (OI) in trans-femoral amputation following blast injury in patients with unsatisfactory results using conventional prosthetics.

Methodology

Retrospective analysis of prospectively collected data(n=7). EQ5D-HUV calculated using SF-36 scores to produce QALY gain informing CUA. Pre-operative scores were used as comparator EQ5D-HUV.

Results

Median QALY cost at 2.4 years was £157,023.83 (range £142,568.14-£218,906.00). Extrapolation revealed that at 12.5 years cost will be £30,148.58/QALY and £18,842.86/QALY at 20 years.

Conclusion

The current data suggests that OI does not meet the NICE criteria for cost-effectiveness until 12.5 years. This is a 'worse case' estimate as the calculation does not take into account the cost of continued prosthetic fitting. It is our belief that patients HUV would have decreased over time without surgery and that modelling for this would further strengthen the case for osseointegration. The analysis does not take into account the wider socio-economic benefit of returning individuals to work or the wider preventative health benefits of increased physical activity. As with all new innovations, cost is likely to decrease with increased use. Additionally, the effect on the moral component of fighting power across Defence when converting wheelchair users to walkers in full employment must not be underestimated. Whilst this analysis needs to be refined the authors advocate the continued use of osseointegration despite the high CUA in early years.

Tourniquet Use in Orthopaedics and a New Tourniquet Pressure Safety Margin

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Tourniquets are widely used in orthopaedic surgery to reduce intra-operative time by limiting bleeding and improving the view of the surgical field. However, both systemic and local complications due to tourniquet use can occur. Tissue ischaemia can cause widespread endothelial cell injury from superoxide radical release. Local tissue damage such as nerve injury and muscle oedema following microvascular compression are also recognised. In digits, the inadvertent retention of tourniquets can have catastrophic consequences resulting in necrosis and amputation. Use of the correct size and type of tourniquet at an appropriate pressure for a limited duration can help to mitigate these risks. We present a literature review of orthopaedic tourniquet use, describe potential complications and make recommendations to avoid them based on up-to-date evidence. In addition, we propose a novel safety margin for pressure settings of limb tourniquets based on the Arterial Occlusion Pressure formula. We suggest that this new safety margin provides a practical and more scientific method for setting tourniquet pressures than current standards of practice.

Where does the time go?

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In order to evaluate how theatre time may be used more efficiently, different timings of patient flow through the trauma theatre were analysed for all cases in the trauma theatre in East Surrey Hospital for the months of January and February 2021. There was a total of 211 cases with an average anaesthetic time of 33 minutes, average surgical time of 76 minutes and average in-theatre recovery time of 17 minutes. While interesting to note, these are clinically critically steps and therefore cannot be hastened.

The average time between a patient leaving the theatre and the arrival of the next patient was 28 minutes. There were delays on numerous occasions as a result of patients in wards not being ready for theatre, change of anaesthetist, change of trauma lists and lunch breaks. There was also a wide variation in the time the first patient was sent for. On average, the first patient was sent for 29 mins after 0800hrs and arrived at the anaesthetic room 60 minutes after 0800hrs. Various aspects of trauma surgery such as anaesthetic and surgical time vary and are difficult to predict.

However, significant improvements could be achieved with a designated team brief time of 0815 hrs and the assignment of a golden patient. This would ensure a reliable start to the trauma theatre. Additionally, a pre-op checklist for ward patients would avoid frequent delays between cases.

Does avidity on FDG PET CT exclude the need for a percutaneous biopsy in the diagnosis of retroperitoneal liposarcoma? The emerging role of the metabolic biopsy.

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Background

The most common retroperitoneal malignancy is a liposarcoma. Traditional management of sarcoma involves imaging, biopsy and MDT discussion at regionalised centres. Wide excision is the primary management for retroperitoneal liposarcoma and delays to surgery can increase the morbidity and mortality. PET CT is often used in the pre-surgical phase to investigate the primary lesion and presence of metastasis.

Aim

We looked to investigate whether the avidity of a retroperitoneal liposarcoma on FDG PET can be used as a proxy for tumour grade and negate the requirement of percutaneous needle biopsy. The latter results in delays to surgery, risk of tumour seeding and diagnostic inaccuracy in heterogenous tumours.

Method

MDT records were reviewed to identify the final histology of all retroperitoneal sarcomas excised between 2009-2019 and cross referenced with FDG PET CT avidity to explore the concept of a metabolic biopsy.

Results

89 patients underwent surgical excision of a retroperitoneal tumour. 30 of these were liposarcomas on final histology. 19 were high grade / poorly differentiated. The mean avidity on PET CT for the poorly differentiated group was 14.9 (range 6.4 - 32.9) compared to 1.9 (range 0-2.8) for the well differentiated group ($p < 0.001$).

Conclusion

We believe that high avidity on FDG PET CT for suspected retroperitoneal liposarcomas can be used as a proxy for tumour grade and negate the requirement for biopsy to inform MDT discussion and urgency of surgical resection. This would save time, resources and remove the risk of tumour seeding or diagnostic inaccuracies of percutaneous needle biopsy.

An Introduction to the TULIPS Mnemonic: Six Simple Steps for Optimising Set-up in Orthopaedic Surgery

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Introduction

Conducting a thorough check to ensure that all equipment and personnel are positioned correctly at the start of any operation is essential for both the safety of the surgical team and the patient outcome. Orthopaedic surgery in particular carries a high risk of occupational injury and this group could benefit greatly from ergonomic improvements

Methods

We trialled a checklist mnemonic to aid surgical set up and improve the ergonomic environment in theatre. "TULIPS" was distributed to regional registrars with a pre and post intervention survey. We also conducted a review of the literature highlighting multiple factors that can influence safety of surgeons, surgical efficiency and patient outcomes.

Results

8/14 (57%) registrars reported they had a method of setting up the operating theatre, however only 2/14 (14%) reported using a checklist approach to help them set-up. 12/14 (86%) reported having experienced difficulties in surgery directly linked to poor theatre set-up. After a trial phase of 2 weeks, 13/14 (93%) reported finding TULIPS useful. 8/14 (57%) stated TULIPS had changed their practice for setting-up in theatre and they now incorporated this checklist approach into their standard practice.

Conclusion

TULIPS is a simple, memorable mnemonic that can be adopted in operating theatres and is easily understood and implemented by surgeons. Our results show that the TULIPS method of approaching surgical set-up was effective in changing practice and serves as a useful checklist for orthopaedic surgeons.

Morbidity and mortality of surgically managed orthopaedic trauma during the SARS-Cov-2 pandemic

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It is imperative to understand the risks of operating on urgent cases during the COVID-19 pandemic for clinical decision making and medical resource planning. The primary aim was to determine the mortality risk and associated variables when operating on urgent cases during the COVID-19 pandemic. The secondary objective was to assess differences in the outcome of patients treated between sites treating SARS-Cov-2 and a separate surgical site. The primary outcome measure was 30-day mortality. Secondary measures included complications of surgery, SARS-Cov-2 infection and length of stay. Multiple variables were assessed for their contribution to the 30-day mortality. 433 patients were included with a mean age of 65 years, 45% were male and 90% were Caucasian. Overall mortality was 7.6% for all patients and 15.9% for femoral neck fractures. The mortality rate increased from 7.5% to 44.2% in patients with fracture neck of femur and a SARS-Cov-2 infection. The SARS-Cov-2 infection rate in the 30-day post-operative period was 11%. SARS-Cov-2 infection, age and Charlson Comorbidity Index were independent risk factor for mortality. There was a significant risk of contracting the SAR-Cov-2 virus due to being admitted to hospital. Using a site which was not treating SARS-Cov-2 respiratory patients for surgery did not identify a difference with respect to mortality, nosocomial SARS-Cov-2 infection or length of stay. The COVID-19 pandemic significantly increases perioperative mortality risk in patients with fractured neck of femurs but patients with other injuries were not at increased risk.

Shoulder instability in UK Military personnel: Diagnosis and outcomes of arthroscopic stabilisation

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Introduction

Shoulder instability is very common in military personnel. However, there is little data on injury patterns and clinical outcomes in serving UK-military personnel who have undergone arthroscopic shoulder stabilisation.

Methods

Data were collected for patients listed for arthroscopic stabilisation between September 2016 and January 2019 at our institution. For service evaluation, PROMs data and occupational outcome data were gathered.

Results

41 patients were treated surgically. Only 24.4% had an isolated anterior repair, 41.5% had 2-zone and the remainder pan-labral repairs at arthroscopy. Clinical examination was as good, or better at diagnosing labral tear patterns compared to MRA. Mean pre-op OSIS was 18.58 (SE \pm 1.67), and mean post-op score was 41.4 (SE \pm 1.13). 74% returned to full deployability from a shoulder point of view during the study period. 82% had returned to sport (although 5 patients had not yet returned to rugby or martial arts). Mean VAS (pain) at rest was 0.8 (SE \pm 0.23), and 1.81 (SE \pm 0.54) during military fitness tests.

Conclusions

Complex glenoid labral tear patterns are very common in military personnel. Arthroscopic stabilisation yields significant improvement in OSIS, return to deployability and sports participation, regardless of chronicity of injury. MRA does not exclude labral tears. History and examination findings should guide clinicians treating military personnel. Clinicians treating military personnel should have a low threshold for specialist referral following traumatic dislocation or when labral injury is suspected.

THE FINANCIAL BURDEN OF REVERSE SHOULDER ARTHROPLASTY FOR PROXIMAL HUMERUS FRACTURES

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Introduction

The purpose of this study was to evaluate the cost of reverse shoulder arthroplasty (RSA) for patients with a proximal humerus fracture, using time driven activity based costing (TDABC) and to compare treatment costs with reimbursement under the Healthcare Resource Groups (HRG).

Method

TDABC analysis based on the principles outlined by Kaplan and a clinical pathway that has previously been validated for this institution was used. Staffing cost, consumables, implants and overheads were updated to reflect 2019/2020 costs. This was compared with the HRG reimbursements.

Results

RSA costs £7,007.46 (Max £8,824.67 & Min £6,130.67). Implants and staffing costs were the primary cost drivers. Implants cost £2,824.80 making up 40% of the costs. Staffing costs made up £1367.78 (19%) of overall costs. The total tariff, accounting for Market Force Factors and high co-morbidities, reimburses £4,629. If maximum cost and minimum reimbursement is applied the losses to the trust is £4,828.67.

Conclusion

RSA may be an effective and appropriate surgical option in the treatment of proximal humerus fractures, however a cost analysis at our centre has demonstrated the financial burden of this surgery. Given its increasing use in trauma, there is a need to work towards generating an HRG that adequately reimburses providers.

Does a large tertiary orthopaedic unit perform appropriately for the more common surgical interventions, or must NHS Trusts remain vigilant?

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Background

Carpal Tunnel Syndrome (CTS) reportedly affects between 1-6% of the population. Interventions provided follow a relatively fixed pathway. Units delivering this service tend to quote high levels of patient satisfaction, particularly associated with surgical intervention. However, without regular review, are Trusts performing appropriately or as it is a simple surgical intervention are we being complacent, and could our service be better?

Methods

In 2019, Portsmouth University Hospital NHS Trust undertook 354 carpal tunnel decompressions. Whilst as a hand group we were confident of the general overall results, it was decided to review patients at a minimum of 1-year post-surgical intervention using a well-recognised and previously validated Patient Evaluation Measure for CTS. An independent assessor identified patients via the Theatreman database. Patients were asked to complete a phone survey taking 10 minutes.

Results

Of the 354 patients, 17 were excluded due to recurrence, fractures, or death. 195/337 patients accepted phone calls and completed the survey. Average age 68 (range 28-95); 116 female/ 79 male. Of these, 48 patients were still working; 15 not employed officially; 132 retired. Average nerve conduction score pre-operatively was Grade 4. 176 (90%) of patients felt that they had improved. 36/195 still complained of scar pain, although this was considered mild. 169/195 were satisfied with the hand surgery they had received, 191/195 were content with the management from the team they had received overall.

Discussion

Outcomes fall within a recent published review of CTD. However, exploration of dissatisfaction and improvements to be made will be discussed.

Major musculoskeletal study limitations with military traumatic lower limb amputations.

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The number of military personnel severely wounded by ballistic and/or blast injury increased with the Iraq and Afghanistan conflicts. Modern battlefield medicine with improved soldier and vehicle protection increased survival rates but doubled lower-limb amputations. A review of work with this population exposes the issues in study design; it was hypothesised result differences will be observed between amputee and able-bodied cohorts in gait biomechanics and lower-limb strength assessment. It is complex to construct matched study cohorts due to differences in amputation aetiology, lack of defined inclusion criterion and small sample sizes unrepresentative of sub-populations of transtibial and transfemoral amputees. Further defence rehabilitation pathways are different to civilians, the first emphasises an interdisciplinary approach combining physical and psychological treatments and tailored to individual's recovery objectives. This translates as higher motivation in military participants and higher rates of physical activity in daily life as well as increased participation in studies. Magnetic resonance imaging is the gold standard for muscle size measurement, but has image acquisition and analysis time and cost issues and restricted application for those carrying metallic inclusions. Brightness-mode ultrasound imaging is a portable, safe, non-ionising, and rapidly accessible alternative. Strength testing studies show limitations in quantification when participants are performing at maximum capacity and there is nonreliable commercially available isokinetic adapter for this population. Gait research faces similar difficulties when comparing study results as a large variance is observed between ambulation parameters, prosthetics, markers and biomechanical models. These understanding gaps hinder the design of studies, monitoring protocols and rehabilitation programmes.

USE OF A BLAST WAVE REPRESENTS A NOVEL THERAPY FOR ENHANCING THE OSTEOGENIC CAPACITY OF MESENCHYMAL STEM CELLS

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Introduction

Combat related fractures have a high non-union rate. With limited treatment options, mesenchymal stem cells (MSCs) are emerging as a possible therapy. Blast victims present with a high incidence of Heterotopic Ossification, with the mechanism of action postulated as being transfer of energy from the blast wave stimulating osteoblastic transformation of MSCs.

The aim of this study was to investigate whether a blast wave can induce osteoblastic transformation in MSCs and therefore offer a novel therapy to aid fracture healing.

Methods

Human bone marrow-derived MSCs were exposed to four blast wave pressures (15, 30, 45 and 60psi) generated by a custom-made shock tube. The expression of three osteogenic genes (RUNX2, ITGAV, DLX5) was assessed at 24h. Calcium mineralisation was assessed at day 7 and 14.

Results

Analysis of osteogenic gene expression at 24 hours demonstrated a statistically significant upregulation of RUNX2 expression by 3 fold (3.03 ± 0.89 , $p < 0.05$) and ITGAV expression by almost 2.5 fold (2.41 ± 0.17 , $p < 0.05$) in the 45 psi test group compared to control samples (1.00 ± 0.35).

Calcium mineralisation assays at day 7 demonstrated a statistically significant rise in the 45 psi (4.05 ± 0.41 mg/dl, $p < 0.05$) and 60 psi test groups (4.37 ± 0.30 mg/dl, $p < 0.01$) compared to control samples (2.93 ± 0.75 mg/dl). At day 14, a statistically significant rise in calcium mineralisation was observed in the 60 psi test group compared to control samples (10.44 ± 2.18 mg/dl vs. 6.51 ± 2.03 mg/dl, $p < 0.05$).

Discussion

This study is the first to demonstrate the osteogenic potential of blast waves. Exposure of MSCs to a blast wave before implantation into a non-union can increase osteogenesis, and should be considered as a novel therapy for improving the chances of fracture union.

Therapeutic Potential of Mesenchymal Stromal Cells For Infected Fracture Non-union

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Introduction

Non-union is a well-recognised complication after open fractures. Fifty percent of open military extremity trauma returning from operations developed non-union. Aetiology is multi-factorial with infection reported as major contributory factor. The aim of this study was to investigate the *in-vitro* effects of human bone marrow derived MSCs (hBDMSC) on the growth of *Staphylococcus aureus* (*S.aureus*) in order to identify novel treatment strategies.

Method

MSCs isolated from human femoral heads (n=3) cultured in conditioned media (CM), fresh media or CM alone were co-cultured with *S.aureus* for six hours. Bacterial growth was measured using colony forming unit (CFU) counts. Real-time response of MSCs in the presence of infection was observed and measured using time-lapse microscopy and electric cell-substrate impedance sensing (ECIS).

Results

Mean CFU for MSC in conditioned media 1.7×10^6 , MSC in fresh media 1.8×10^5 , CM 3×10^6 and *S.aureus* 1.3×10^8 (all conditions $p < 0.05$). Time-lapse microscopy and ECIS demonstrated that the MSCs sequentially detached from each other, the electrode plate followed by cell membrane compromise. Using resistance (Ohms) mean time to MSC in conditioned media detaching 166.5mins (Range 147.6-182.4, SD 17.6), MSC in fresh media 186.0mins (Range 186-280, SD 47.72), ($p > 0.25$).

Discussion

This study demonstrated a significant reduction in bacterial growth due to the presence of MSCs and their conditioned media. This effect could be a direct effect from the MSCs or an excreted compound. Further studies are required to identify the underlying mechanism which could lead to a novel treatment for treating bacterial infections.

Predicting outcome with the Bespoke Offloading Brace in complex foot and ankle injuries using clinical and biomechanical data

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The Bespoke Offloading Brace (BOB) has been shown to improve outcomes for patients with a complex lower limb injury however, a third of investigated patients, abandon it. This cohort includes patients with a diagnosis of complex regional pain syndrome. Patients with a nerve injury at or proximal to the knee continue to use the BOB. Prediction of ongoing use for patients with neither of these diagnoses is desirable to prevent unsuccessful painful rehabilitation.

The aim was to ascertain whether it is possible to predict from gait which patients will continue to use the BOB, and which will abandon it. It was hypothesised, due to the energy storage and return characteristics of the BOB, individuals with asymmetry of power generation at pre-swing would continue to use the BOB.

Gait data were collected prior to prescription of the BOB for 16 individuals; 11 continued to use the BOB and 5 abandoned it. Vicon Plug-in Gait was used to process power data for the 11 individuals; data were normalised to weight.

A symmetry index for power generation at pre-swing more negative than -20% was predictive of ongoing BOB use ($p < 0.05$) in the absence of a proximal ipsilateral injury preventing use. Poor power generation (< 0.07 W/kg) bilaterally was also predictive of ongoing BOB use.

In addition to clinical indications, gait analysis can be used to predict outcome with the BOB. Using the aforementioned predictors on a different retrospective cohort and undertaking a prospective trial would allow to further refine and validate these results.

The Combined Services Orthopaedic Society gratefully acknowledge the support of the following industry partners who enabled this meeting to proceed

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