

Free Papers 1 Wednesday, 7 November 2018

FP1

Autologous matrix induced chondrogenesis (AMIC) aided reconstruction of osteochondral lesions of the talus - Five year follow-up

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Introduction: Autologous Matrix Induced Chondrogenesis (AMIC) for surgical treatment of osteochondral lesions of the talus (OCLT) has shown excellent clinical and radiological results at short term follow up two years after surgery. However, no mid-term follow up data is available.

Aim:

1. To evaluate the clinical outcome after AMIC-aided reconstruction of osteochondral lesions of the talus at a minimum follow up time of five years.
2. To evaluate the morphology and quality of the regenerated cartilage by magnetic resonance imaging (MRI) at on at a minimum follow up time of five years.

Methods: Seventeen patients prospectively underwent surgery receiving a AMIC-aided repair of OCLT consisting of debridement, autologous grafting, and sealing of the defect with a collagen scaffold (Chondro-Gide, Geistlich Surgery, Wolhusen, Switzerland). Clinical and radiological assessment was performed before and after a minimum of 60 months after surgery (average 78 months, range, 60-120). Clinical examination included the American Orthopaedic Foot & Ankle Society (AOFAS) ankle score and the Visual Analogue Scale (VAS). Radiological imaging consisted of MRI. The Magnetic Resonance Observation of Cartilage Repair Tissue (MOCART) score was applied.

Results: The AOFAS ankle score improved significantly from a mean of 60 points preoperatively (range, 17-79) to 91 points (range, 70-100) postoperatively ($p < 0.01$). The preoperative pain score averaged a VAS of 5 (range, 2-8), improving to an average of 1.1 (range 0-8) ($p < 0.01$).

The MOCART score for cartilage repair tissue on postoperative MRI averaged 71 points (range, 50-90).

Conclusion: The AMIC-procedure is safe for the treatment of OCLT with overall good clinical and magnetic resonance imaging results at five years follow up.

FP2

Biopatch grafting of large or recalcitrant osteochondral defects of the talus

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Introduction: Large osteochondral defects (OCD) of the talus present a difficult management conundrum. We present a series of Maioregen xenograft patches applied through an open approach, early lessons from the technique and good early outcomes, in patients who are otherwise looking at ankle salvage techniques.

Results: 16 patients underwent open patch procedures, performed by a single surgeon, over a 30 month period. 12 males, and 4 females with age at presentation from 21-48. The majority were young, male, in physical employment with active sporting interest.

MoxFQ, and E5QD were collected preop, 3, 6, 12 month postoperatively.

There were significant improvements in ROM, pain, and scores in the cohort.

3 cases returned to Theatre, 1 for a concern about late infection, which settled with good outcome, and a further 2 with metalwork / adhesions.

Conclusion: Early results suggest that this patch technique may be useful in prolonging the longevity of the TTJ, where micro fracture has failed, or the lesion is so large that it would likely be futile.

Patients rescoped demonstrated good integration of the patch material, with stability and functional improvement.

There may be a place for this technique in the management of large lesions, particularly in young patients where preservation is desired over joint salvage.

FP3

The arthroscopic management of talar body fractures

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Talar body fractures are high energy intraarticular injuries that are best management by anatomical reduction and secure fixation to improve outcomes. The talus is relatively inaccessible surgically and requires extensive soft tissue dissection and/or osteotomies to gain adequate open visualisation. There are a small number of case

reports on arthroscopic assisted fixation in the literature. This case series reports on the technique and early outcomes of six patients all of whom presented with significant intraarticular displacement and who were managed entirely arthroscopically.

The fractures were of the main body of the talus involving the ankle and subtalar joints and all had preoperative CT scans. All six patients underwent posterior ankle and subtalar arthroscopy with cannulated screws used to stabilise the fractures after reduction. Visualisation of the fracture reduction was excellent. After 10 days in a backslab, the patients were protected in a boot and encouraged to actively move their ankles. Weight bearing was permitted once union appeared complete.

There were no early complications of infection, avascular necrosis or VTE. There was one patient that had a non-clinically significant migration of a screw. Two patients were lost to follow up early due to being visitors. The mean length of follow up was 12 months in the remainder. The remaining four patients all returned to their preoperative level of activity. All had demonstrable subtalar stiffness. There was no early post-traumatic arthritis.

This series represents the largest so far published. The main flaw in this report is the lack of long term follow up. While this report cannot state superiority over open techniques it is a safe, effective and acceptable technique that has significant conceptual benefits.

FP4

Short term outcome of complex revision total ankle arthroplasty

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Introduction: Total ankle arthroplasty (TAA) is an increasingly popular treatment option for patients with end-stage ankle arthritis. However, for most implant systems, failure rates of 10-20% have been reported within the first 10 years after primary TAA. Pain is the primary symptom that indicates failure of TAA but cause of it can be difficult to establish.

Methods: All patients who underwent a primary TAA at our center were included in the study. The clinical outcomes were studied for patients requiring a further revision procedure following primary TAA. The reasons for revision surgery and outcomes of surgery were analyzed using appropriate inferential statistical tests.

Results: Between 2007 and 2018, 42 primary TAA required revisions in 40 patients. There were 25 men (59.5%) and 15 women (35.7%) with mean age of 57.5 years the time of primary TAA. All patients had undergone primary procedure at a mean duration of 3.5 years previously (range: 3 months to 10 years). Of the total revision procedures, 12/40 (30%) of revisions were carried out due to malalignment, 10/42 (23.8%) due to loosening of the implants or bone subsidence, 5/42 procedures (11.9%) following infection, 4/42 (9.5%) due to polyethylene migration, 1/42 (2.3%) due to fracture and 1/42 (2.3%) due to Charcot arthropathy. In 9/42 (21.4%) cases, imaging showed no objective reason for pain.

50% of patients who underwent revision TAA reported 78.5% satisfaction with results of surgery at 2 years follow up post-operatively.

Conclusion: Major reasons for revising primary TAR at our centre are mal-alignment, implant loosening / bone subsidence and suspicion of infection and pain. In spite of undergoing a complex revision surgery, patients report 78.5% satisfaction from outcomes of surgery.

FP5

Outcomes of revision total ankle replacement- A minimum of 2 year follow up

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Introduction: Total ankle replacement as a valid treatment for end stage ankle arthritis, is gaining popularity and every year there is an increasing number of procedures. With revision rates as high as 21% at 5 years and 43% at 10 years there is a need for understanding and reporting the outcome of revision ankle replacement.

Our aim was to study the patient reported outcomes following revision TAR with a minimum of 2 year follow up. **Methods:** All patients that underwent a revision total ankle replacement between 2012 and 2016 were included in the study. All patients received a post-operative questionnaire comprising of MOX-FQ score, EQ-5D (UK) and Foot and Ankle outcomes scores (FAOS) and patients satisfaction questionnaire with a minimum of 2 years follow up.

Results: 33 patients had a revision total ankle replacement between 2012 and 2016. 2 patients were deceased therefore 31 patients were included in the study. 4 patients declined participation for completing questionnaires. We received 15/27 (55.5%) completed questionnaires. The mean MOX-FQ average domain score for pain was (50.6 ± 26.9), walking/standing (62.4 ± 36.5) and social function was (43.7 ± 31.0). The mean FAOS scores were (52.5 ± 30.6; pain), (54.5 ± 29.2; symptoms), (62.1 ± 30.5; ADL) and (35.5 ± 28.2; for quality of life). The mean overall health score today for EQ-5D was 73.9/100. 50% of patients were satisfied with the pain relief and return to sports and recreation obtained following the operation, 57% were satisfied with the improved in daily activities. 78.5% were overall satisfied with the results from surgery.

Conclusion: Revision total ankle replacement gives overall satisfactory results demonstrated from patients

reported outcomes at a minimum of 2 years following surgery.

FP6

Isolated ankle fusion for failed total ankle replacement using a spine cage and anterior plating construct

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Background: Total ankle replacements (TARs) are becoming increasingly more common in the treatment of end stage ankle arthritis. As a consequence, more patients are presenting with the complex situation of the failing TAR. The aim of this study was to present our case series of isolated ankle fusions post failed TAR using a spinal cage construct and anterior plating technique.

Methods: A retrospective review of prospectively collected data was performed for 6 patients that had isolated ankle fusions performed for failed TAR. These were performed by a single surgeon (IW) between March 2012 and October 2014. The procedure was performed using a Spinal Cage construct and grafting in the joint defect and anterior plating. Our primary outcome measure was clinical and radiographic union at 1 year. Union was defined as clinical union and no evidence of radiographic hardware loosening or persistent joint lucent line at 1 year.

Results: The mean follow-up was 37.3 months (SD 13.2). Union was achieved in 5 of the 6 patients (83%). One patient had a non-union that required revision fusion incorporating the talonavicular joint that successfully went on to unite across both joints. Another patient had radiographic features of non-union but was clinically united and asymptomatic and one required revision surgery for a bulky symptomatic lateral malleolus with fused ankle joint.

Conclusion: The failing TAR presents a complex clinical situation. After removal of the implant there is often a large defect which if compressed leads to a leg length discrepancy and if filled with augment can increase the risk of non-union. Multiple methods have been described for revision, with many advocating fusion of both the ankle joint and subtalar joint. We present our case series using a spinal cage and anterior plating that allows preservation of the subtalar joint and a high rate of union.

FP7

All component revision for failed total ankle arthroplasty - Early results and complications

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Aim: Surgical options for management of a failed ankle arthroplasty are currently limited; typically conversion to fusion is recommended with only a few patients being considered for revision replacement surgery. This paper presents our experience of revision ankle replacements in a cohort of patients with failed primary replacements.

Method: A total of 18 revision TAR in 17 patients were performed in patients with aseptic loosening. The technique was performed by a single surgeon (CSK) over a 4 year period between July 2014 and August 2018 using the Inbone total ankle replacement system. Patient demographics and clinical outcomes were collected retrospectively using - MOXFQ, EQ5D, VAS pain score and patient satisfaction questionnaires.

Results: 12 right and 6 left ankle replacements were revised in 17 patients (11 male/ 6 female). The mean age at revision was 69.1 years (range 56-81 years) with a mean BMI of 31. The mean surgical time was 171 minutes with 22% of cases requiring bone grafting. 6 patients had early wound complications, all superficial and settled with dressings. There were no deep infections, 2 patients had further surgery for exploration for possible nerve injuries. At a mean follow up of 20.6 months, 4 patients had mild/moderate ongoing pain with the majority of patients being satisfied with the outcome of their surgery.

Conclusion: This study represents one of the largest group of patients reported to have undergone revision total ankle arthroplasty. Our experience shows that this results in acceptable level of complications and provides satisfactory function in most patients. We feel revision TAR is a viable option in patients with failed primary arthroplasty who wish to continue to maintain mobility at the ankle joint.

FP8

Outcome of trans-metatarsal amputations in patients with diabetes mellitus. A multi-disciplinary foot care service approach

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Aim: This retrospective case series reports the reoperation, major amputation, survival rates and mobility status in diabetic patients who underwent a trans-metatarsal amputation (TMA) managed within a multi-disciplinary diabetic foot care service.

Methods and patients: Forty-one consecutive patients (37 men, 4 women) underwent a TMA between January 2008 to December 2017. They were retrospectively reviewed. The mean age at the time of surgery was 63 years (range 39 - 92).

Results: Eighty-eight per cent (36/41) of the patients were followed-up. Four (11%) of the 36 patients required reoperation, including three major amputations (8%). All the patients requiring a reoperation were vasculopaths. The four-year patient survival rate following a TMA was 69% (25/36). Ninety-six per cent (21/22) of the surviving patients not requiring revision to a major amputation were fully mobile in bespoke orthoses, of whom a third required a stick.

Conclusion: This study shows that transmetatarsal amputation in patients with diabetes, managed in a multi-disciplinary diabetic foot care service, is effective for limb salvage.

FP9

Prevalence of venous thrombo-embolism in patients with total contact cast

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Background: Venous Thrombo-Embolism is a recognized complication of lower limb immobilization. In the neuropathic patient total contact casting (TCC) is used in the management of acute charcot neuroarthropathy and/or to off-load neuropathic ulcers, frequently for long time periods. To our knowledge there is no literature stating the prevalence of VTE in patients undergoing TCC. We perceive that neuropathic patients with active charcot have other risk factors for VTE which would predispose them to this condition and would mandate the use of prophylaxis. We report a retrospective case series assessing the prevalence of VTE in the patients being treated with TCCs.

Methods: Patients undergoing TCC between 2006 and 2018 were identified using plaster room records. These patients subsequently had clinical letters and radiological reports assessed for details around the TCC episode, past medical history and any VTE events.

Results: There were 143 TCC episodes in 104 patients. Average age at cast application was 55 years. Time in cast averaged 45 days (range 5 days - 8 months, median 35 days). 3 out of 4 patients had neuropathy as a consequence of diabetes. One TCC related VTE (0.7% of casting episodes) was documented. This was a proximal DVT confirmed on USS 9 days following cast removal. No patient received VTE prophylaxis while in TCC.

Conclusion: Despite these complex patients having a multitude of co-morbidities the prevalence of VTE in the TCC setting remains similar to that of the general population. This may be due to the fact that TCCs permit weight bearing. This case series suggests that, while all patients should be individually VTE risk assessed as for any lower limb immobilization, chemical thromboprophylaxis is not routinely indicated in the context of TCCs.

Free Papers 2

Thursday, 8 November 2018

FP10

Classification of Freiberg's disease - A guide for management

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Introduction: The current treatment for Freiberg's osteochondrosis centres around either: simple debridement or debridement osteotomy. The main principle of the osteotomy is to rotate normal articular cartilage into the affected area. We recommend the use of CT scanning to delineate the amount of available, unaffected cartilage available to rotate into the affected space.

Methods: We retrospectively reviewed 32 CT scans of new Freiberg's diagnoses in Sheffield over a 10 year period using the PACS system. We identified the sagittal CT slice that displayed the widest portion of proximal articular margin of the proximal phalanx and measured the diseased segment of the corresponding metatarsal head as an arc (in degrees). This arc segment was divided by 360°. This gave a ratio of the affected arc in the sagittal plane.

Results: 28 out of 32 cases involved the 2nd metatarsal with the remaining 4 involving the 3rd metatarsal head. Of 32 cases, 18 had fragmentation. Surgically, 20 had debridement only, 5 also had an osteotomy and 1 had a fusion. 6 of the 32 cases were managed non-operatively. 11 cases out of 32 had an arc ratio of < 0.3. Of these, only 3 had an osteotomy, 3 had no procedure and 5 had a simple debridement. Of those that had osteotomies (5/32), 3 of the 5 cases had an arc ratio of < 0.3 with the other 2 being 0.42 and 0.38.

Discussion: We hypothesise that those cases with an arc ratio of less 0.3 would be amenable to a dorsal closing wedge osteotomy and those with a ratio of more than 0.4 would be better suited to a simple

debridement. For those cases between 0.3-0.4, we feel either option is viable. Further work to prove or disprove outcomes related to our classification is required.

FP11

Five-year outcomes of a synthetic cartilage implant for the first metatarsophalangeal joint in advanced hallux rigidus

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Introduction/Purpose: A randomized clinical trial of first MTP joint hemiarthroplasty with a synthetic cartilage implant demonstrated equivalent pain, function and safety outcomes to first MTP joint arthrodesis at 2 years. Recognizing that many hemiarthroplasty and total toe implants have initially good results that deteriorate over time, the purpose of this study was to prospectively assess the safety and efficacy outcomes for the synthetic cartilage implant population and to determine if the excellent outcomes were maintained at >5 years.

Methods: One hundred nineteen patients were evaluated at 5+ years; 23 could not be reached for follow-up, but implant status was available for 7 of these subjects. Patients completed a pain visual analogue scale (VAS) and Foot and Ankle Ability Measure (FAAM) Sports and Activities of Daily Living (ADL) scores, preoperatively and at 2, 6, 12, 26, 52, 104 and 260 weeks postoperatively. Minimal clinically important differences are: $\geq 30\%$ difference for pain VAS, 9 points for FAAM Sports, and 8 points for FAAM ADL. Great toe active dorsiflexion, weight-bearing radiographs, secondary procedures, and safety parameters were evaluated.

Results: Of 119 patients available at mean 5.8 years follow-up (SD ± 0.7 ; range: 4.4-8.0), 9 underwent implant removal and conversion to fusion in years 2-5, leaving 106 patients. The implant survival rate was 92.4% at 5.8 years. Pain and function outcomes at 5.8 years were similar to those at 2 years. VAS Pain, FAAM Sports, ADL Scores were maintained or improved at 5.8 years. No evidence of avascular necrosis, device migration or fragmentation was observed. There were no unanticipated safety events through 5.8 years. Ninety-three (93%) percent would have the procedure again.

Conclusion: The synthetic cartilage hemiarthroplasty implant continues to demonstrate safety and efficacy for the treatment of advanced first MTP joint osteoarthritis with evidence of therapeutic effect and acceptable safety profile at 5.8 years.

FP12

The role of the lateral ankle complex in controlling laxity of the ankle joint: A biomechanical investigation

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Background: Lateral ankle instability is a common problem, but the precise role of the lateral ankle structures has not been accurately investigated. This study aimed to accurately investigate lateral ankle complex stability for the first time using a novel robotic testing platform.

Method: A six degrees of freedom robot manipulator and a universal force/torque sensor were used to test 10 foot and ankle specimens. The system automatically defined the path of unloaded plantar/dorsi flexion. At four flexion angles: 20° dorsiflexion, neutral flexion, 20° and 40° of plantarflexion; anterior-posterior (90N), internal-external (5Nm) and inversion-eversion (8Nm) laxity were tested. The motion of the intact ankle was recorded first and then replayed following transection of the lateral retinaculum, Anterior Talofibular Ligament (ATFL) and Calcaneofibular Ligament (CFL). The decrease in force/torque reflected the contribution of the structure to restraining laxity. Data were analysed using repeated measures of variance and paired t-tests.

Results: The ATFL was the primary restraint to anterior drawer ($P < 0.01$) and the CFL the primary restraint to inversion throughout range ($P < 0.04$), but with increased plantarflexion the ATFL's contribution increased. The ATFL had a significant role in resisting tibial external rotation, particularly at higher levels of plantarflexion, contributing 63% at 40° ($P < 0.01$). The CFL provided the greatest resistance to external tibial rotation, 22% at 40° plantarflexion ($P < 0.01$). The extensor retinaculum and skin did not offer significant restraint in any direction tested.

Conclusion: This study shows accurately for the first time the significant role the ATFL and CFL have in rotational ankle stability. This significant loss in rotational stability may have implications in the aetiology of osteophyte formation and early degenerative changes in patients with chronic ankle instability. This is the first time the role of the lateral ankle complex has been quantified using a robotic testing platform.

FP13

Do rugby boots with a bladed stud increase contact pressures through the fifth metatarsal compared to a rounded stud? A biomechanical study

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Fifth metatarsal fractures in sport are known to be associated with acceleration and cross cutting movements when running. It is also established that playing surface has an impact on the ground reaction forces through the foot, increasing the strain through the fifth metatarsal. But what impact does boot design have on these forces? Current thought is that boots that utilise a blade stud design resist sideways slipping of the planted foot more than boots with a rounded stud. This study aims to compare ground reaction forces through the fifth metatarsal in 2 two different designs of rugby boot to assess what impact stud design might have. The forces across the foot were measured using Tekscan in-shoe pressure plates in 24 rugby players. Each player was asked to complete an agility course to measure acceleration, cutting and cross-cutting in the two different designs of rugby boot, reproducing true playing conditions. The boots used were the Canterbury Phoenix Club 8 Stud boot and the Canterbury Speed Club Blade boot. The trial was conducted on an 4G artificial pitch at the Cardiff Arms Park rugby ground. Ethical approval was obtained from Bath University and a research grant was provided by British Orthopaedic Foot and Ankle Society. The blade boot had significantly higher contact pressures than the stud boot on the fifth metatarsal in the combined movements (17.909 ± 10.442 N/cm² Blade Vs 16.888 ± 9.992 N/cm² Boot; $P < .0125$; $n = 864$ steps in each boot group). The blade boot also produced higher pressure during cross-cutting (32.331 ± 13.568 N/cm² Vs 27.651 ± 15.194 N/cm² $p < 0.007$). Pressures were also higher in both acceleration and cutting, although not significantly so. These results will guide clinicians advising athletes in shoe design, especially those predisposed to or rehabilitating from a fifth metatarsal fracture.

FP14

Simulated weight reduction with an anti-gravity treadmill: a pilot study to assess pain reduction in foot and ankle arthritis

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Introduction: Osteoarthritis in the foot and ankle affects approximately 30,000 patients annually in the UK. Evidence has shown that excess weight exacerbates foot pain, with significant increases in joint forces. However, despite the current trend for Clinical Commissioning Groups to ration surgery for obese patients, studies have not yet determined the effect of weight loss in obese patients with foot and ankle arthritis.

Aim: Pilot study to investigate the effect of simulated weight loss on pain scores in obese patients with symptomatic foot and ankle arthritis.

Methods: Following ethical approval, a prospective study of 17 obese patients (mean BMI 39.2, range 31.2 - 50.3) with foot and ankle arthritis was undertaken (BOFAS funded). Under physiotherapist supervision, patients walked for one minute on an anti-gravity treadmill, which allowed simulated weight reduction. Following baseline assessment, reduced BMI was simulated, starting at 20, rising in increments of 5, until each patient's usual BMI was reached. Pain was assessed using a Visual Analogue Scale (VAS). Repeated measures ANOVA was used to assess for significant changes in pain, comparing baseline with each simulated BMI category (significance set at $p < 0.05$).

Results: Simulated weight loss caused a significant reduction in pain ($p = 0.005$, power 0.91). Mean VAS pain scores improved by 24% ($p = 0.003$) and 17% ($p = 0.040$) for BMI categories 20 and 25, compared with baseline. Pain scores were not significantly different comparing BMI categories of 25 and 20.

Conclusion: Simulated weight loss to normal BMI significantly decreased pain in obese patients with foot and ankle arthritis. The use of the anti-gravity treadmill to demonstrate the feeling of normal BMI has also provided motivation to several patients to lose weight. The current study could be used to power future studies to investigate the effects of weight loss in foot and ankle patients.

FP15

Multi-center, randomized, controlled study of subtalar arthrodesis using AlloStem versus autologous bone graft

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Introduction: AlloStem/Cellular Bone Allograft and autologous bone graft are accepted methods for managing hindfoot degenerative arthritis. The purpose was to evaluate outcomes of AlloStem and autograft in subtalar arthrodesis and compare overall fusion rates.

Methods: This study was conducted in IRB compliance. Patients between 18-80 years who qualified for a subtalar fusion were randomized 1:1 to AlloStem or autologous graft. The AOFAS hindfoot ankle scale, FFI-R and SF-12 were collected pre-operatively, 6 weeks, 3 & 6 months, 1 and 2 year. Weight-bearing 3-view ankle X-rays were done at the same intervals. A CT scan was obtained at 6 months.

Results: 140 patients were enrolled; 124 patients had surgery (60-AlloStem and 64-Control). Withdrawals included 14 voluntarily before surgery and 2 intra-operative failures. 19 were lost to follow-up. Mean age for AlloStem was 56.69(20.3-79.6) and Autograft was 54.60(20.74-80.07).

59 AlloStem patients completed their 6 month visit and 45 completed 2 years. AOFAS score improved: 40.02 at pre-op to 72.16(6 mo) to 79.51 at 1 year and 80.38 at 2 year. SF-12 improved 58.29 at pre-op to 65.67 at 6 month and 71.59 at 2 year. FFI-R improved 236.88 at pre-op to 203.53 at 6 month 149.93 at 2 year.

60 Autograft patients completed their 6 month visit and 51 patients completed their 2 year. AOFAS score improved 42.89 at pre-op to 75.67 (6 mo) to 79.75 at 1 year and 78.62 at 2 year. Autograft SF-12 improved 60.55 at pre-op to 70.40 at 6 month and 75.26 at 2 year. Autograft FFI-R improved 217.16 at pre-op to 166.77 at 6 month and 145.43 at 2 year.

AlloStem patients had a mean posterior fusion rate of 28.9% at 6 months whereas the Autograft had 46.3%(p=.049). Non-union rates were AlloStem(9/57)(15.7%) whereas Autograft was 3/60(5%).

Conclusion: AlloStem trended to be inferior to Autologous graft.

FP16

High ankle sprains with syndesmosis instability: Time to MRI matters

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Introduction: Early clinical examination combined with MRI following a high ankle sprain allows accurate diagnosis of syndesmosis instability. However, patients often present late, and for chronic injuries clinical assessment is less reliable. Furthermore, in many centres MRI may not be readily available. The aims of the current study were to define MRI characteristics associated with syndesmosis instability, and to determine whether MRI patterns differed according to time from injury.

Methods: Retrospectively, patients with an unstable ligamentous syndesmosis injury requiring fixation were identified from the logbooks of two fellowship trained foot and ankle surgeons over a five-year period. After exclusion criteria (fibula fracture or absence of an MRI report by a consultant radiologist), 164 patients (mean age 30.7) were available. Associations between MRI characteristics and time to MRI were examined using Pearson's chi-square tests or Fisher's exact tests (significance set at p < 0.05).

Results: Overall, 100% of scans detected a syndesmosis injury if performed acutely (within 6 weeks of injury), falling to 83% if performed after 12 weeks (p=0.001). In the acute group, 93.5% of patients had evidence of at least one of either PITFL injury (78.7%), posterior malleolus bone oedema (60.2%), or a posterior malleolus fracture (15.7%). In 20% of patients with a posterior malleolus bone bruise or fracture, the PITFL was reported as normal. The incidence of posterior malleolus bone bruising and fracture did not significantly differ according to time.

Conclusion: For unstable ligamentous syndesmosis injuries, MRI becomes less sensitive over time. Importantly, posterior malleolus bone oedema or fracture may be the only evidence of a posterior injury. Failure to recognise instability may lead to inappropriate management of the patient, long term pain and arthritis. We therefore advocate early MRI as it becomes more difficult to 'grade' the injury if delayed.

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Friday, 9 November 2018

FP17

Outcomes of peroneal tendoscopy: The Bristol experience

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Tendoscopy in the treatment of peroneal tendon disorders is becoming an increasingly safe, reliable, and reproducible technique. Peroneal tendoscopy can be used as both an isolated procedure and as an adjacent procedure with other surgical techniques. The aim of our study was to review all peroneal tendoscopy that was undertaken at the AOC, by the senior authors (IGW, SH), and to determine the safety and efficacy of this surgical technique.

Methods: From 2000 to 2017 a manual and electronic database search was undertaken of all procedures by the senior authors. Peroneal tendoscopy cases were identified and then prospectively analysed.

Results: 51 patients (23 male, 28 female) were identified from 2004-2017 using a manual and electronic database search. The mean age at time of surgery was 41.5 years (range 16-83) with a mean follow-up time post operatively of 11.8 months (range 9-64 months). The main indications for surgery were lateral and/or

postero-lateral ankle pain and lateral ankle swelling. The majority of cases showed unstable peroneal tendon tears that were debrided safely using arthroscopy. Of the 51 patients, 23 required an adjacent foot and ankle operation at the same time, 5 open and 17 arthroscopic (12 ankle, 5 subtalar). Open procedures included 2 first ray osteotomies, 2 open debridements of accessory tissue, one PL to PB transfer. One patient also had an endoscopic FHL transfer. Complication rates to date have been low: 2 superficial wound infections (4%) and one repeat arthroscopy for ongoing pain. A small proportion of patients with ongoing pain were treated with USS guided steroid injections with good results.

Conclusion: Our series of peroneal arthroscopy has a low complication rate with high patient satisfaction at discharge. Results of arthroscopic treatment are similar to open techniques, however its advantages make arthroscopic procedures an excellent method to treat peroneal tendon disorders.

FP18

Platelet rich plasma for acute achilles tendon rupture: Results of the PATH-2 study, a double-blind multicentre randomised placebo-controlled trial

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Background: Disability and slow return to sport and work after tendon rupture are major challenges. Platelet Rich Plasma (PRP) is an autologous supraphysiological concentration of platelets from whole blood that has demonstrated positive cellular and physiological effects on healing in laboratory conditions but evidence from adequately powered robust clinical trials is lacking. We aimed to determine the clinical efficacy of PRP for treatment of acute Achilles tendon rupture.

Methods: In a placebo-controlled, participant- and assessor-blinded, trial at 19 NHS hospitals we randomly assigned 230 adults starting acute Achilles rupture non-surgical management to PRP injection or dry-needle insertion (placebo) to the rupture gap under local anaesthetic. Patients with confounding or contraindicated concurrent medical conditions were excluded. The primary outcome was muscle-tendon function, assessed by the limb symmetry index (LSI, uninjured limb/injured limb x 100, higher scores better) of the work (Joules) performed during the heel-rise endurance test at 24 weeks. Secondary outcomes were: Achilles Tendon Rupture Score (ATRS, 0-100, higher scores better), quality of life (SF-12), pain, and goal attainment. Trial registration: ISRCTN54992179

Results: Participants were aged mean 46 years and 57 (25%) were female. 103/114 (90%) of the PRP group and all (n=116) in the placebo group received allocated treatment. At 24 weeks, mean LSI was 34.4 for the PRP group and 38.8 for placebo (adjusted mean difference -4.4 95% CI -11.2 to 2.5, n=201) and ATRS was mean 65.2 PRP vs 65.8 (adjusted mean difference -0.6, 95% CI -4.9 to 3.7, n=224). There were no differences between groups in the other secondary outcomes.

Conclusion: We found no evidence of PRP efficacy for improving muscle-tendon function or patient-reported recovery after acute Achilles tendon rupture. Our findings challenge the increasing global use of PRP for acute tendon injury and indicate that robust evaluations are required in other applications.

FP19

Treatment of pediatric arthrogryptic clubfoot. 20 years of clinical experience

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Background: Treatment of arthrogryptic clubfoot (AC) presents a challenging problem. Over time many different methods have been proposed, with variable rates of success, recurrence and other complications. In this study we describe our 20-year experience in treatment of AC.

Materials and methods: Between 1996 and 2016, 165 AC in 90 children (51 males and 39 females) were treated in our department. Their mean age was 7.6 years (3 months-16 years). Ponseti casting and Achilles tendon release (PCATR) was performed on 38 children (68 feet) and soft tissue release and casting (STRC) on 35 children (67 feet). The remaining 17 children (30 feet) underwent wide soft tissue release and correction using the Ilizarov method (STRIL). The results of each subgroup were graded according to clinical (pain, foot appearance, residual deformities, walking and standing status and shoe modifications) and radiological (anteroposterior and lateral talocalcaneal angles, the angle between longitudinal axes of talus and the first metatarsal and the position of talus in the lateral view) criteria.

Results: The average follow up was 6.4 (2-10) years. Results were excellent (plantigrade, painless, properly loaded feet, without deformities, adapted to common shoes) in 56 PCATR group feet, 59 STRC group feet and 23 STRIL group feet. Good results (required orthopaedic shoes) were obtained in 10 PCATR group feet, 6 STRC group feet and 7 STRIL group feet. Fair results (residual temporary pain and/or mild deformity) presented 2 PCATR group feet and 1 STRC group foot, while bad results (reoccurrence of clubfoot) were found in 1 STRC group foot.

Conclusions: On the basis of our 20-year clinical experience we believe that pediatric AC can be successfully

treated with PCATR in the age of less than 1 year old (y.o), with STRC between 1-5 y.o. and with STRIL in children over the age of 5 y.o.

FP20

Ankle fracture fixation in over 60's: Fibular-pro-tibia V's hindfoot nailing

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Introduction: Ankle fractures in the elderly are an increasing problem with our aging population. Options for treatment include non-operative and operative with a range of techniques available. Failure of treatment can lead to significant complications, morbidity and poor function. We compared the outcomes of two operative techniques, intramedullary hindfoot nailing (IMN) and fibular-pro-tibia fixation (FPT). This is the largest analysis of these techniques and there are no comparative studies published.

Method: We retrospectively reviewed patients over the age of 60 with ankle fractures who were treated operatively between 2012 and 2017. We identified 1417 cases, including 27 patients treated with IMN and 41 treated with FPT. Age, sex, co-morbidities and injury pattern were collected. Primary outcome was re-operation rate. Secondary outcomes included other complications, length of stay and functional status.

Results: The IMN group had a higher average co-morbidity score compared with the FPT group (estimated 10-year survival, 21% vs 53%, p=0.03). Re-operation rate was higher in the IMN group compared with FPT (12 v 1, p< 0.0001). There were more complications in the IMN group compared with the FPT group (23 v 11, p< 0.0001). Length of stay was longer in the IMN group (17 v 29 days, p=0.02). Mobility tended to return to baseline in the FPT patients but decreased in the IMN patients.

Conclusion: Outcomes were worse in the IMN group compared with the FPT group in terms of re-operation, complications and length of stay. However, the IMN group tended to have increased comorbidities and poorer soft tissues.

We believe that both techniques have a role in the management of elderly ankle fractures, but patient selection is key. We suggest FPT should be the first-choice technique when soft tissues permit. We discuss the indications, risks and benefits of each method based on our experience and literature review.

FP21

The natural history of undisplaced Lisfranc-type injuries initially treated conservatively

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Background: Undisplaced Lisfranc-type injuries are subtle but potentially unstable fracture-dislocations with little known about the natural history. These injuries are often initially managed conservatively due to lack of initial displacement and uncertainty regarding subsequent instability at the tarsometatarsal joints (TMTJ). The aim of this study was to determine the secondary displacement rate and the need for delayed operative intervention in undisplaced Lisfranc injuries that were managed conservatively at initial presentation.

Methods: Over a 6-year period (2011 to 2017), we identified 24 consecutive patients presenting to a university teaching hospital with a diagnosis of an undisplaced Lisfranc-type injury that was initially managed conservatively. Pre-operative radiographs were reviewed to confirm the undisplaced nature of the injury (defined as a diastasis < 2mm at the second TMTJ). The presence of a 'fleck' sign (small bony avulsion of the second metatarsal) was also noted. Electronic patient records and sequential imaging (plain radiographs/CT/MRI) were scrutinized for demographics, mechanism of injury and eventual outcome.

Results: The mean age of the patients at the time of injury was 42 years (19 Female). 96% (23/24) were low energy injuries and 88% (21/24) had a positive 'fleck sign'. The secondary displacement rate in this group of patients was 62.5% (15/24) over a median interval of 14 days (range 0 to 482 days). 12 patients underwent open reduction internal fixation after a median interval of 29 days (range 1 to 294 days) from their initial injury. One patient required TMTJ fusion at 19 months and two patients were managed non-operatively. The injury remained undisplaced in 37.5% patients (9/24) with only one patient requiring subsequent TMTJ fusion at 5 months.

Conclusion: Undisplaced Lisfranc injuries have a high rate of secondary displacement and warrant close follow-up. Early primary stabilisation of undisplaced Lisfranc injuries should be considered to prevent unnecessary delays in surgical treatment.

FP22

Case comparison study of two surgical approaches for fixation of calcaneal fractures

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Background: Traditionally, the extended lateral approach (ELA) was the favoured approach for calcaneal fractures, but has been reported to have high incidence of wound complications. There has been a move amongst surgeons in the United Kingdom towards the sinus tarsi approach (STA) due to its minimally invasive nature, attempting to reduce such complications.

Aims: To evaluate outcomes of ELA and STA for all consecutive calcaneal fracture fixation in our institution over a 10yr period.

Method: Retrospective cohort study of all calcaneal fractures surgically treated with either approach between January 2008 and January 2018. Anatomic restoration was assessed radiologically by the change in Gissane's and Bohler's angles and calcaneal width. Post-operative complications including metalwork removal were recorded.

Results: 35 calcaneal fractures were managed surgically via either approach during this period (21 STA and 14 ELA). There was a statistically significant improvement in the radiological markers when the post-operative films were compared to pre-operative ones. When the post-operative films from the 2 groups were compared against each other, there was no significant difference ($p < 0.05$) in any of the radiological markers. In the ELA group, 2 patients (14.3%) developed deep infections requiring metalwork removal and 1 had delayed wound healing (7.1%). No deep infections occurred with the STA; 1 patient (4.8%) had a superficial infection, treated with antibiotics. Of patients who had metalwork in situ for more than 1 year, 37.5% of the STA group required removal due to pain compared to only 16.7% with ELA.

Conclusions: We have moved from ELA to STA. Our results have shown no difference in restoration of calcaneal anatomy but with a decrease in post-operative wound complications including infection. However, we have shown an increase in metalwork removal in the STA group and it is important to ascertain the cause and significance of this.

FP23

Anatomy of the insertion of the posterior inferior tibiofibular ligament and its relevance to posterior malleolar rotational pilon fractures

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Introduction: The treatment of posterior malleolar fractures is developing. Mason and Molloy (Foot Ankle Int. 2017 Nov;38(11):1229-1235) identified only 49% of posterior malleolar rotational pilon type fractures had syndesmotic instabilities. This was against general thinking that fixation of such a fragment would stabilize the syndesmosis.

Methods: We examined 10 cadaveric lower limbs that had been preserved for dissection at the Human Anatomy and Resource Centre at Liverpool University in a solution of formaldehyde. The lower limbs were carefully dissected to identify the ligamentous structures on the posterior aspect of the ankle. To compare the size to the rotational pilon posterior malleolar fracture (Mason and Molloy 2A and B) we gathered information from our posterior malleolar fracture database. 3D CT imaging was analysed using our department PACS system.

Results: The PITFL insertion on the posterior aspect of the tibia is very large. The average size of insertion was 54.9x47.1mm across the posterior aspect of the tibia. Medially the PITFL blends into the sheath of tibialis posterior and laterally into the peroneal tendon sheath.

78 posterior lateral and 35 posterior medial fragments were measured. On average, the lateral to medial size of the posteromalleolar fragment was 24.5mm in the posterolateral fragment, and 43mm if there is a posteromedial fragment present also. The average distal to proximal size of the posterolateral fragment was 24.5mm and 18.5mm for the posteromedial fragment.

Conclusion: The PITFL insertion on the tibia is broad. In comparison to the average size of the posterior malleolar fragments, the PITFL insertion is significantly bigger. Therefore, for a posterior malleolar fracture to cause posterior syndesmotic instability, a ligamentous injury will also have to occur. This explains the finding by Mason and Molloy that only 49% of type 2 injuries had a syndesmotic injury on testing.

FP24

Muller-Weiss disease; proposed classification and treatment algorithm

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Muller-Weiss disease is an uncommon condition with unclear etiology and no gold standard treatment. The question arises; which joints to fuse? Although no consensus prevail, one must postulate fusion should include those affected. Consequently, to establish an algorithm for its surgical management we set out to study clinical and radiographic features with use of SPECT-CT and a literature review.

57 consecutive feet presenting with Muller-Weiss disease analysed; 15 men, 25 women, age 22-84. Condition bilateral in 17, left side 16, right in 7 patients. Specific history and examination by senior author. Radiographic series and SPECT-CT obtained with surgery performed on significantly symptomatic feet. Measurements of Meary-Tomeno angles, anteroposterior thickness of navicular at the midpoint of each naviculo-cuneiform, alongside the medial extrusion distance and percentage of compression in each case performed. Poor correlation between Meary's angle and 1) degree of compression at naviculo-cuneiform joints, 2) degree of extrusion 3) compression vs extrusion using R^2 coefficient of determination (invalidating Maceira et al. classification). In unilateral cases, extrusion significantly greater on affected side 94.7% ($P < 0.001$ Fisher exact test). Degree of extrusion significantly greater in bilateral than unilateral cases ($p=0.004$ unpaired T test). Valgus hindfoot and Meary's negative most common pattern with no correlation between heel alignment and Meary's $R^2 = 0.003$. SPECT-CT useful to determine subtalar involvement in 'stage 2 disease.' Following review of cases and published literature we propose the following classification for Muller-Weiss disease with treatment algorithm. 3 Stage delineation; Stage 1 (Normal hindfoot alignment); 1A. Talonavicular disease only - Isolated Talonavicular arthrodesis 1B. Talonavicular + Subtalar; double medial or triple arthrodesis. Stage 2. Talonavicular + Naviculocuneiform; 2A. Adequate bone stock - Talo-naviculo-cuneiform arthrodesis, 2B. Inadequate bone stock +- subtalar disease; Talo-naviculo-cuneiform arthrodesis with tricortical bone graft (Mayich). Stage 3; Asymmetric ankle varus. Pantalar arthrodesis Double/triple/TNC/TAR arthrodesis with hindfoot re-alignment.

FP25

Arthroscopic arthrodesis of the isolated talo-navicular joint

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Background: Whereas arthroscopic arthrodesis of the ankle is commonplace and of the subtalar joint is established, reports of arthroscopic talo-navicular fusion are a rarity.

Aim: To review a case series to establish if arthroscopic talo-navicular arthrodesis is a feasible surgical option.

Methods: Arthroscopic decortication of the talo-navicular joint is performed via x1-2 sinus tarsi portals and x1-2 accessory talo-navicular portals using a standard arthroscope and a 4.5 barrel burr. Internal fixation is by a 5mm screw from the navicular tuberosity and x2 headless compression screws introduced under image intensification from the dorsal navicular to the talar head.

Between 2004 and 2017 a consecutive series of 164 patients underwent arthroscopic hindfoot arthrodeses of which 72 involved the talo-navicular joint. Only 13 procedures were of that joint alone in unsullied feet. The medical records of these 13 patients were reviewed to assess radiological fusion, complications and improvement of pre-operative state.

Results: All Talo-navicular joints were successfully decorticated. All united radiologically by a mean 4.4 months (range 3-8). There were no major complications. All patients reported improvement to their pre-operative symptoms but one patient developed lateral column pain requiring fusion.

Conclusions: Arthroscopic Talo-navicular arthrodesis is technically feasible with good rates of union.

Complications were rare, making the technique attractive when encountering a poor soft tissue envelope. The surgery cannot be used if bone grafting is required. Long term discomfort can arise from adjacent joints. Accurate alignment is critical.

Posters

P1

Minimally invasive distal metaphyseal metatarsal osteotomy (DMMO) for symptomatic forefoot pathology - Short to medium term outcomes from a retrospective case series

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Introduction: Distal metaphyseal metatarsal osteotomy (DMMO) may be used to treat metatarsalgia and other forefoot pathology by shortening the lesser metatarsals and reducing plantar pressures. It may be performed percutaneously, but there are few large series reporting its results. We report the radiographic and clinical results of a cohort of patients treated with percutaneous DMMOs at our unit.

Methods: This was a single-centre retrospective study looking at the outcome of consecutive patients undergoing percutaneous DMMOs over a 52-month period at our District General Hospital. We analysed demographics, radiological and clinical outcomes, complications and patient reported outcome measures.

Results: We included DMMOs on 106 toes in 43 feet. The mean age of patients was 60.2 ±10.2 years and 41 patients were female (95.3%). The median duration of follow-up was 38 months. The indication was metatarsalgia in 31 patients (72.1%) and MTPJ subluxation in 12 patients (27.9%). Concurrent procedures were performed in 26 cases (60.5%). DMMO was performed on multiple toes in 42 cases (96.7%). Mean shortening achieved was 3.6 ±2.2 mm, 4.1 ±1.6 mm, and 3.6 ±1.6 mm for the 2nd, 3rd and 4th toes respectively. Mean time to fusion was 11.4 ±7.8 weeks and union occurred in 105 toes (99.1%). The single non-union was asymptomatic at 12 months. Two patients (4.7%) required a subsequent additional DMMO for transfer metatarsalgia. Overall, minor complications were seen in 14 patients (31.1%). At final follow-up the mean MOxFAQ was 28.8 ±27.6, the mean EQ-5D was 0.789 ±0.225, the mean EQ-VAS was 68.5 ±20.3, the mean VAS-Pain was 3.1 ±2.8, and 41 patients (95.3%) were satisfied overall.

Conclusions: We have demonstrated excellent radiological and clinical outcomes, with relatively few complications in the short to medium term with percutaneous DMMOs.

P5

Acute deformity correction with simultaneous ankle fusion and lengthening using a retrograde lengthening nail

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Introduction: Revision ankle fusion for failed primary surgery or malunion often results in a residual limb length discrepancy (LLD). Restoring ankle and hindfoot alignment with simultaneous lengthening can optimize function and diminish LLD. The purpose of our study was to evaluate whether ankle fusion and limb lengthening can be achieved simultaneously by insertion of a retrograde intramedullary lengthening nail (Precice) combined with ankle fusion.

Methods: This was a retrospective review of 18 limbs in 17 patients who underwent simultaneous ankle fusion and tibial lengthening with an internal lengthening nail. All patients had preoperative leg length discrepancy and ankle deformity. Deformities were corrected acutely with ankle fusion through lateral and/or medial approaches with internal fixation and a retrograde Precice lengthening nail. The osteotomy was performed proximal to the ankle fusion.

Results: Clinical, subjective, objective and radiographic analyses were performed with an average follow-up over 12 months. The mean lengthening was 3.95 cm (1.8-7.2) and the average final LLD was 1 cm (0.7-1.1 cm). The foot was plantigrade with neutral hindfoot alignment and the foot was rotated 5-15 degrees external in all cases. At final follow-up no patient had pain and all claimed to be walking much better than before surgery.

Conclusion: Acute correction of residual deformity from failed ankle fusion or malunion can be successfully combined with ankle fusion and simultaneous retrograde distal tibial lengthening with an intramedullary lengthening nail.

P6

Comparison of clinical and functional outcomes of open reduction internal fixation and circular external fixation in the management high-energy tibial pilon fractures: a systematic review

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Background: In high-energy tibial pilon fractures, combination of articular impaction, metaphyseal comminution and soft-tissue injury often result in poor outcomes. We conducted a systematic review of the literature to compare clinical and functional outcomes of open reduction internal fixation (ORIF) and circular external fixation (CEF) for treatment of high-energy tibial pilon fractures.

Methods: A comprehensive search of PubMed, MEDLINE, Embase, Scopus and Cochrane library was undertaken. Identified studies were peer-reviewed and screened against a strict eligibility criteria. Studies published in English, comparing ORIF with CEF for treatment of AO/OTA Type 43B and 43C fractures were included.

Results: 195 studies were identified, of which 4 studies met the inclusion criteria. Danoff et al. demonstrated comparable clinical and functional outcomes in open pilon fractures treated with ORIF or CEF. Bacon et al. showed no significant difference in time to union, rates of union, malunion, non-union, post-operative infections, or iatrogenic nerve injuries between the treatment groups. Harris et al. found lower post-operative complication rates and higher functional outcome scores in the ORIF group, though the authors acknowledged that 88% of patients treated with CEF sustained Type 43-C3 fractures. Watson et al. showed no statistically significant difference in the Modified Mazur score between both groups, but higher rates of non-union, infections and secondary procedures in the ORIF group.

Conclusion: This systematic review demonstrates that high-energy tibial pilon fractures remain a therapeutic challenge, and highlights lack of high-quality evidence in the literature. Conflicting results in the literature may

be due to variation in study methodologies and outcome reporting. Therefore, recommendations for the best fixation method of these complex injuries cannot be made. In order to generate high-quality evidence regarding best treatment modality for high-energy tibial pilon fractures, UK Major Trauma Networks need to work collaboratively to undertake well-designed large multi-centred prospective studies.

P7

Are all Weber A ankle fractures benign?

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Introduction: Ankle fractures are a common injury with an incidence of 168.7/100,000/year. The Danis-Weber classification helps describe fibula fractures and guide treatment. Reports of non-unions in Weber A fractures are extremely rare. We present a case series of large, transverse avulsion type fracture (Weber A, Lauge-Hansen SAD stage 1 injury) which progressed to non-union and required surgical intervention. We aim to determine how commonly these fracture patterns progress to non-union.

Methods: Following initial identification of the injury pattern we searched through theatre and PACS databases to identify all similar ankle fracture non-unions that required surgical intervention. From November 2007 onwards, we also reviewed PACS imaging of all ankle radiographs reported as Weber A fractures or non-unions to try and estimate an incidence.

Results: 116 radiographs were reviewed. 19 patients were found with a fracture pattern similar to our index case. Four patients were identified with an established non-union and required surgery. These cases were dealt with by internal fixation with or without bone graft and all progressed to union.

Discussion: Three of the 4 cases reported a re-injury following their initial management. This could be a factor in the progression to non-union or a response to the already pre-existing condition. A number of theories for the development of a non-union in these cases have been proposed but no definite cause identified. If a symptomatic non-union is diagnosed then in our experience they progress to union following surgical debridement and stabilisation with or without bone graft. This injury pattern should promote thought from the treating clinician and shouldn't just be dismissed. We recommend no change to treatment applicable to any stable ankle fracture but that patients should be warned of the possibility of symptomatic non-union.

P8

Anatomy of the lateral plantar ligaments of the transverse metatarsal arch: The lateral Lisfranc ligament

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Introduction: The anatomy of the Lisfranc complex is well understood. In contrast, the lateral tarsometatarsal ligamentous structures are under investigated. A number of classifications have previously been proposed, noting homolateral and divergent subtypes of midfoot fracture dislocations. These subtypes indicate intact metatarsal connections of the middle and lateral rays (as illustrated clinically in figure 1), however little is understood in regards to these connections. Our aim was to identify the plantar ligamentous structures of the lateral tarsometatarsal joints and their significance in tarso-metatarsal joint injuries.

Methods: We examined 10 cadaveric lower limbs that had been preserved for dissection at the Human Anatomy and Resource Centre at Liverpool University in a solution of formaldehyde. The lower limbs were carefully dissected to identify the ligamentous structures of the plantar aspect of the transverse metatarsal arch.

Results: In all specimens, the long plantar ligament blended with a transverse metatarsal ligament (lateral Lisfranc) spanning from the 2nd to the 5th metatarsal. This transverse metatarsal ligament formed the basis of the roof and distal aspect of the peroneus longus canal. The separate short plantar ligament formed the floor of the peroneus longus canal. In addition, separate intermetatarsal ligaments were identifiable connecting each metatarsal. The long plantar ligament provides a connection through the transverse metatarsal ligament, connecting the transverse and longitudinal arches of the foot.

Conclusion: The plantar ligamentous structures of the lateral tarsometatarsal joints are a combination of individual intermetatarsal ligaments and a transverse metatarsal ligament. This explains the homogenous nature of a divergent tarsometatarsal joint injury and why middle and lateral columns move as one. It also has clinical significance in the observation that in some cases lateral column instability can be overcome when the middle column is stabilised.

P9

Calcaneal fracture epidemiology and fixation trends in England, 2000 to 2017

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Background: The primary aim is to document the epidemiology of admitted calcaneal fractures in England since the year 2000 in adults (age >18 years). The secondary aims are to determine whether the UK Heel Fracture Trial (UK HeFT) has impacted on the proportion of admitted calcaneal fractures being surgically fixed and whether there has been any change in the surgical technique used.

Methods: In England the Hospital Episode Statistics (HES) data is recorded annually. Between 2000/01 and 2016/17 the number of adults admitted to an English NHS hospital with a diagnosis of a calcaneal fracture and whether they were treated with surgical fixation was determined.

Results: Over the 17-year period 62,858 patients were admitted to hospital with a calcaneal fracture. The male to female ratio was 2.66:1. The mean annual incidence for males is 10.5 / 100,000 and for females 3.8 / 100,000. UK HeFT was published in July 2014. The percentage of patients with an admitted calcaneal fracture undergoing internal fixation pre-publication was 7.31% (3,792/51,859). Post-publication the internal fixation rate was 7.38% (534/7,229), which was not significantly different ($p=0.94$). Nevertheless of those calcaneal fractures that were internally fixed there has been a significant increase ($p<0.001$) in the percentage treated by closed reduction as opposed to open reduction subsequent to the publication of UK HeFT, from 8.32% (292/3511) pre-publication to 13.29% (71/534) post-publication.

Conclusion: This study documents the epidemiology and fixation trends of calcaneal fractures in England. We have established that surgeons did not change their clinical practice in terms of offering surgery for calcaneal fractures in response to UK HeFT. Surgeons though continue to innovate to find better ways of surgically treating calcaneal fractures, with a recent increase in less invasive procedures.

P10

Clinical and patient reported outcomes following low intensity pulsed ultrasound (Exogen) for established post-traumatic and post-surgical non-union in the foot and ankle

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Background: Contention exists as to the efficacy of Low Intensity Pulsed Ultrasound (Exogen) on bony healing following non-union. We examine clinical and patient reported outcomes following Exogen treatment, in patients following post-traumatic or post-surgical non-union in the foot and ankle.

Methods: Demographics, clinical and patient reported outcomes (pre and post treatment MOXFQ, EQ5D-5L and VAS scores) were gathered for 50 consecutive patients (February 2015 - February 2018) who underwent Exogen treatment for symptomatic and radiological non-union for a variety of foot and ankle pathology. The economic impact was also analysed.

Results: There were 15 fracture non-unions (tibia, ankle), 20 non unions from midfoot/forefoot procedures (talonavicular, tarsometatarsal, base 2nd metatarsal, base 5th metatarsal) and 15 from hindfoot procedures (ankle/triple/TTC nailing). 13 patients (2,8,3) had diabetes mellitus and 6 (4,0,2) were smokers. 40 patients (14/16/10) clinically united, 4 (0,1,3) patients noticed no significant improvement but did not want to consider surgical intervention and 6 (1,3,2) patients failed treatment and progressed to revision surgery. Xray or CT scan was used to define radiographic confirmation of union post-treatment. Of those that clinically healed, radiographic union was found in 72% (29/40). PROM data showed statistically significant improvements ($P < 0.05$) at an average of 6 months post treatment. Exogen healed 93% in the fracture group, 80% in the midfoot/forefoot group and 67% in the hindfoot group. Significant cost savings were realised with the use of Exogen for this cohort of patients.

Discussion: Overall, 80% of patients with foot and ankle non-union improved clinically to discharge, (with no need for further intervention), with significant improvements in PROM scores. Poorer results may be observed in hindfoot procedures. The appropriate use of Exogen for established non-union in the foot and ankle is a safe, valuable and economically viable clinical option as an alternative to revision surgery.

P11

Tibiotalar arthrodesis- Is union rate and time to union influenced by preoperative deformity, patient related factors or open/arthroscopic procedure and what do patients perceive?

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Background: Arthroscopic ankle arthrodesis(AAA) is an established procedure for treatment of end stage ankle arthritis. It has the potential advantage of faster time to union, lower morbidity ,faster rehabilitation, less blood loss and shorter hospital stay when compared to open fusion.The purpose is to analyse if union is affected by deformity, patient related factors and measure PROMS.

Materials and methods: Between January 2005 and December 2015, 124 Ankle Arthrodesis (OAA-27; AAA-

97) procedures were performed by fellowship trained foot and ankle surgeons in a single institution. Based on preoperative deformity, (AAA- 28 degree valgus to 26 degrees varus; OAA- 41 degree valgus to 28 degree varus) they were subdivided into 2 groups based upon deformity more than 15 degrees. Union rates, time to union, length of stay, PROMS (EuroQol pain and Johnson 's satisfaction scale).

Results: Mean age of patients was 60years (Range-20-82 years)(Male:Female-92:32).Overall fusion rate was 93% in AAA and 89% in OAA (p=0.4).On sub group analysis of the influence of preoperative deformity, there was no difference in union rates of AAA versus OAA. Average time to union was 13.7 in AAA and 12.5 weeks in OAA (p=0.3). Average hospital stay was 2.6 days in AAA and 3.8 days in OAA (p=0.003) 40% had no pain on EuroQol and 32% were completely satisfied with their procedure.

Conclusion: Although both AAA and OAA showed good union rates,hospital stay was significantly shorter in AAA. A larger deformity did not adversely affect union rates in AAA. 40% of patients reported a good outcome for pain relief. Lifestyle risk factors did not have cumulative effect on union.

Our study shows that AAA is reproducible method of treating end stage arthritis of tibiotalar joint irrespective of preoperative deformity and patient related factors, however PROMs show there is still areas for improvement, upto 5 years post procedure.

P12

FORFoot: Forefoot offloading shoes vs rigid flat shoes in patients undergoing surgery of the first ray: A randomised controlled trial of clinical and radiological outcomes

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Background: It is common for patients undergoing hallux rigidus or hallux valgus surgery to be prescribed six weeks of postoperative immobilisation using either flat or reverse camber postoperative shoes. Currently, evidence is lacking to demonstrate if there is a difference between these two forms of immobilisation in either patient satisfaction or clinical outcomes.

Methods: One hundred consecutive patients undergoing Scarf/Akin osteotomies or 1st MTPJ arthrodesis were recruited. Patients were randomised to either flat or reverse camber postoperative shoes, fifty patients in each group. Patients undergoing ancillary procedures on lesser toes were not excluded. Satisfaction with each form of postoperative shoe was reviewed by patient reported VAS pain scale and Likert satisfaction survey. Radiographic outcomes were reviewed at 1-year observing differences in fusion rates (Arthrodesis) or deformity recurrence (Hallux valgus).

Results: At completion of the study there were 47 patients in the reverse cam and 43 in the flat shoe group. No difference in primary forefoot operation, additional operation, age at surgery or pre-op VAS pain score was seen between groups. At the 6 week follow up there was no difference in post op VAS pain score between the groups. However, the flat shoe group were significantly more likely to be satisfied with their general mobility in the shoe (86.0% vs 61.7%, p=0.01) and satisfied with their stability in the shoe (90.7% vs 69.6%, p=0.03) than the reverse cam shoe group. There was no statistically significant difference seen between groups for non-union or hallux valgus recurrence rates.

Conclusions: Both forms of postoperative footwear were effective in enabling patients to mobilise and in preventing adverse outcomes. Patients are more likely to be satisfied with a flat postoperative shoe due to improved stability and ease in mobilising. The results of this study aid surgeon decision making for postoperative footwear type in forefoot surgery.

P13

Early results of Complete Cartilage Regeneration (CCR) technique for Talar Osteo-Chondral defects (OCD)

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Aim: To provide on going evidence and monitoring for a new surgical technique. In the single stage treatment of patients with cartilage defects of the talus.

Method: Bone marrow aspirate (35mls) is harvested from the posterior or anterior superior iliac spine of the pelvis. This is spun down into a Mesenchymal Stem Cell (MSC) rich concentrate. The concentrate is mixed with a Fibrin gel and hyaluronic acid. The resulting adherent mixture is glued onto the prepared defect, to form a MSC rich patch.

Results: Total number of patients to receive CRR to date is 52. There have been no serious adverse incidents to date.

Average MOX-FQ summary index pre op was 68 and improved to 47 at 6 months, 39 at 12 months and 39 at 18 months post procedure.

Average EQ5d-5L VAS pre op was 67 and improved to 73 at 6 months, 77 at 12 months and 73 at 18 months

post procedure.

Average AOFAS pre op was 57, this improved to 74 at 6 months, 81 at 12 months and 75 at 18 months post procedure.

Average EQ-5d-5L index was 0.51 pre op, this improved to 0.65 at 6 months, 0.66 at 12 months and 0.79 at 18 months post procedure.

Conclusion: The early data gathered on this technique shows it to be safe and these early results are promising especially considering the trend towards continuing improvement.

P14

Is operative treatment of delayed Achilles tendon rupture presentation essential? Mid and long-term follow-up of conservatively treated patients

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Surgical treatment of delayed Achilles tendon rupture is strongly advised in the literature, but is it always required? The purpose of this study was to report the outcomes of patients with a delayed presentation of Achilles tendon rupture treated conservatively via a dedicated treatment pathway.

All Patients with a delayed presentation who had been conservatively treated between 2008 - 2014 were identified. The conservative management pathway was the Swansea Morrison Achilles Rupture Treatment (SMART protocol) as used for the acute ruptures. Following ultrasound diagnosis, patients were immobilised in equinus and followed up in a dedicated Achilles tendon clinic along strict rehabilitation guidelines.

Outcome measures included complication rates; Achilles Tendon Total Rupture Score (ATRS) and Achilles Repair Score (ARS) repeated at mid (mean of 3 years) and long follow-up (mean of 6 years); and muscle function dynamometry assessing plantarflexion torque of the ankle. MRI of ruptured and non-ruptured legs allowed measurement of Achilles tendon length. Comparisons between the two sides were made (2-tailed t-test).

19 patients with a mean age of 60 years and a mean delay to treatment of 61 days were identified. The mean ATRS at mid-term follow-up was 65/100 and ARS was 71/100. The mean plantarflexion torque for the injured side was 19.5 N.m compared to 25.7 N.m on the uninjured side, with a significant difference between the two sides ($p = 0.001$). The mean length of the injured Achilles tendon was 104.9mm and uninjured 97.3mm, with no significant difference ($p = 0.111$). At long-term follow-up ATRS was 81/100 and ARS was 73/100. There were no re-ruptures. One patient had a pulmonary embolus. One patient went on to surgery.

A conservative management regime for patients with a delayed presentation Achilles tendon rupture provides a satisfactory outcome in the majority of cases.

P15

Identification of stable supination external rotation ankle fractures - A consensus opinion

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Background: The British Orthopaedic Association Standards for Trauma (BOAST) guidelines highlight the importance of identifying stability in the treatment of ankle fractures within 2 weeks of injury. In practice, it is the supination external rotation (SER) injuries when stability remains unclear and further assessment is required.

We sought to form a sub-speciality, consensus opinion from British Orthopaedic Foot and Ankle Society (BOFAS) members, on how to determine stability in SER injuries.

Methods: We performed an electronic survey of all 456 BOFAS full members in autumn 2017. The survey contained two scenarios on how to determine stability in a young healthy patient with an isolated Weber B fracture and no talar shift: -

1. With medial tenderness
2. Without medial tenderness

Results: The response rate was 61%. In the presence of medial tenderness 71% of members would test for stability/talar shift by using weight-bearing (WB) radiographs. When medial tenderness was absent, 67% would still test stability in the same manner. The exception to this was when patients had no medial tenderness and had walked on their fracture prior to presentation. In this case 65% used the presentation radiograph, to look for talar shift and determine stability.

The method and timing of WB radiographs varied, however the majority performed standing radiographs, barefooted at approximately 1 week following injury.

Conclusion: This survey provides a consensus on determining the stability of SER ankle fractures.

Patients with un-displaced SER injuries who have not walked prior to presentation should undergo standing radiographs regardless of the presence or absence of medial tenderness, at approximately 1 week from injury. Medial tenderness does not determine stability.

Implications: To ensure early WB, individual units should ensure they have a pathway highlighting which ankle fractures should get WB radiographs including when and how they should be performed.

P16

An investigation of the damage to flexor tendons incurred by different minimally invasive proximal phalangeal closing wedge osteotomy surgical techniques in cadaveric feet

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Background: Minimally invasive surgery (MIS) for hammer toe correction has become increasingly popular in the United Kingdom. The proximal phalangeal closing wedge osteotomy component of hammer toe correction can be performed by passing the burr via a plantar incision through the flexor tendons (transtendinous) or passing the burr adjacent to the flexor tendons (paratendinous).

Aim: To investigate damage to the flexor tendons by transtendinous and paratendinous techniques in cadaveric feet.

Method: Institutional approval was granted. Alternating between right and left feet of 8 donors, MIS proximal phalangeal osteotomies were performed transtendinous (n=24) and paratendinous (n=24) using the 2nd, 3rd and 4th toes. Osteotomies were performed by 2 experienced surgeons using a 2mm x 8mm wedge burr. Toes were then dissected by an independent observer to assess damage to the flexor tendons.

Results: Using the paratendinous technique, significantly more damage to the flexor tendons was noted compared to the transtendinous technique (47% vs 4%, p< 0.05). The position of the osteotomy at or distal to the metaphyseal/diaphyseal junction was assessed. There was a significant difference in flexor tendon damage in the paratendinous group when the osteotomy was sited at the junction compared to more distally (67% vs 27%, p< 0.05). There was no significant difference accordingly to site using the transtendinous technique (7% vs 1%, p>0.05).

Conclusion: The least damage to the flexor tendon in MIS proximal phalangeal osteotomy is achieved with a transtendinous technique regardless of osteotomy site. The most damage to the flexor tendon occurs with a paratendinous technique at the metaphyseal/diaphyseal junction.

P17

A prospective study of 493 Ankle Fractures in a UK trauma unit: What lessons can be learnt?

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Introduction: Ankle fractures represent 10% of the fracture workload and are projected to increase due to ageing population. We present our experience and lessons learnt in the management of ankle fractures in a large UK Trauma unit.

Methods: Prospective data collected between 2013 and 2017 was retrospectively analysed. A total of 493 patients entered into the database were divided into Stable ankle fractures (Group A) and unstable ankle fractures treated with surgical fixation (Group B).

Petronne's criteria were used to assess quality of reduction in Group B. Pre and post injury PROMs were compared using Olerud-Molander Ankle Scores (OMAS) and Lower Extremity Functional Scales (LEFS).

Results: In Group A, 132 patients matched the criteria for the "stable ankle pathway" and were allowed weight bearing in a cast or boot. Two patients required surgery due to talar shift on weight bearing x-rays at one week and two patients had delayed union.

In Group B, of 351, data was available for 302 patients for final analysis. The mean age was 46.7, with comorbidities 186 (72.1%) overweight, 14 (4.7%)diabetes, 65 (23%) smokers, 33 (11.6%) alcoholics and 1 steroid use. Seventy-three (34%) had inadequate reduction in 2014-2015; this figure reduced to 12 cases, 13.8% in 2016-17, after introduction of a simple educational tool. There were 8 (3.1%) post-operative wound infections. Pre- and post-op OMAS and LEFS were compared which showed mean reduction of 14.7 and 11.3 respectively. Multiple regression analysis did not reveal any significant co-relation between patient demographics, co-morbidities, radiological outcomes and post-op PROMS.

Conclusion: Our 'stable ankle pathway' is safe and effective. We recommend a simple educational tool to improve trainees and general trauma surgeon's awareness in treating this injury adequately. Patients should be counselled for general decline in ankle function due to the injury regardless of adequate fixation.

P19

Posterior approaches to the ankle - An analysis of 3 approaches for access to the posterior distal tibia

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Aim: With the increase in the use of CT scanning and fragment specific fixation for complex ankle fractures, utilisation of multiple surgical approaches has increased. Our aim in this study was to analyse three posterior-ankle approaches to find their use and efficacy in accessing the posterior tibia.

Methods: We examined 5 fresh frozen cadaveric lower limbs at the University of Keele anatomy laboratory. Three posterior ankle approaches (posterolateral (PL), posteromedial (PM) and medial posteromedial (MPM) approaches were performed, using a consistent repeatable incision of 7cm. Kirchner wires were then placed parallel to one another at 4 points in the posterior tibia (proximal, distal, medial and lateral). The ankles were imaged using an image intensifier and the distances measured.

Results: The PL approach allowed an average 746.9 mm² diamond of access (DOA) to the posterior tibia (46.2 x16.2mm). The PM approach allowed an average 1101.9mm² DOA to the posterior tibia (56.8x19.4mm). The MPM approach allowed an average of 1184.7mm² DOA to the posterior tibia (55.1x21.5mm).

We compared the areas of access for each incision to 149 posterior malleolar fractures on our database. Only 56% of fractures could be fully exposed using the PL incision. In comparison, 78% of fractures could be exposed using the PM incision. Only 19% of patients had posteromedial fractures that could be visualised using the MPM incision, but it did not allow access to the constant posterolateral fragment, thus its usage is primarily as a supplementary incision.

Conclusion: We conclude that the most commonly used approach (the PL approach) gives the least amount of access to the posterior tibia. In comparison to fracture fragment size, almost half of fractures would not be fully exposed through the PL approach, and if fixing such fractures the surgeon should be comfortable with multiple approaches.

P20

Prolotherapy as a treatment choice for ATFL injuries in elite athletes: A case series

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Anterior talofibular ligament (ATFL) complex injuries in professional football and rugby players are common and can cause significant time off sport at elite level competition. Prolotherapy is effective in treating refractory tendinopathies, but inadequate clinical evidence exists to recommend its use as a treatment for acute ankle sprains. Importantly there is no literature about its use in elite athletes and ankle injuries. Our series documents grade 2 or 3 ATFL tears in 10 professional elite level athletes who were injected with a solution of P2G (dextrose, glycerol and 1% phenol mixed with local anaesthetic) under ultrasound guidance and using aseptic technique weekly either twice or three times dependant on their symptoms and recovery. All athletes in combination with prolotherapy and physiotherapy returned to elite level sport without any complications and with only one reinjury. These results show that in this elite athlete population prolotherapy can be safe and effective tool to treat ATFL injuries.