ABSTRACT SUBMISSIONS - January 2022

FACTORS ASSOCIATED WITH VENOUS THROMBOEMBOLISM FOLLOWING ACUTE ACHILLES TENDON RUPTURE

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The aim of this study was to identify factors independently associated with symptomatic venous thromboembolism (VTE) following acute Achilles tendon rupture (ATR), and to suggest a clinical VTE risk assessment tool for patients with ATR.

From 2010-2018, 984 consecutive adults (median age 47yrs, 73% male) sustaining an ATR were retrospectively identified. There were 95% managed non-operatively (below-knee cast 52%, n=507/984; walking boot 44%, n=432/984), with 5% (n=45/984) undergoing primary operative repair (<6wks). VTE was diagnosed using medical records and national imaging archives, reviewed at a mean of 5yrs (1-10) post-injury. Regression was performed to identify factors independently associated with VTE.

Incidence of VTE within 90 days of ATR was 3.6% (n=35/984; deep vein thrombosis 2.1% [n=21/984], pulmonary embolism 1.9% [n=19/984]). Age ≥50yrs (adjusted OR [aOR] 2.3, p=0.027), personal history of VTE/thrombophilia (aOR 6.1, p=0.009) and family history of VTE (aOR 20.9, p<0.001) were independently associated with VTE. These non-modifiable risk factors were incorporated into a VTE risk assessment tool. 23% of patients developing VTE (n=8/35) had a relevant personal or family history, but incorporating age into the tool identified 69% of patients with VTE (n=24/35). Non weight-bearing ≥2wks after ATR was also independently associated with VTE (aOR 3.2, p=0.026).

Age ≥50 years, personal history of VTE/thrombophilia and a positive family history were independently associated with VTE following ATR. Incorporating age into our suggested VTE risk assessment tool enhanced sensitivity in identifying at-risk patients. Early weight-bearing in an appropriate orthosis may be beneficial in VTE risk reduction.

THE LIFETIME RISK OF REVISION AFTER PRIMARY KNEE ARTHROPLASTY: A POPULATION-LEVEL COHORT STUDY OF 90,039 PATIENTS FROM THE SCOTTISH ARTHROPLASTY PROJECT

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This study aims to determine the lifetime risk of revision surgery after primary knee arthroplasty (KA).

The Scottish Arthroplasty Project dataset was utilised to identify all patients undergoing primary KA during the period 1998-2019. The cumulative incidence function for revision and death was calculated and adjusted analyses utilised cause-specific Cox regression modelling to determine the influence of patient-factors. The lifetime risk was calculated for patients aged between 45-99 years using multiple decrement lifetable methodology.

The lifetime risk of revision ranged between 32.7% (95% Confidence Interval (CI) 22.62-47.31) for patients aged 45-49 years and 0.63% (95%CI 0.1-4.5) for patients aged over 90 years. Adjusted analyses demonstrated the converse effect of age on revision (Hazard Ratio (HR) 0.5, 95%CI 0.5-0.6) and death (HR 3.5, 95%CI 3.4-3.7). Male sex was associated with increased risks of revision (HR 1.1, 95%CI 1.1-1.2) and death (HR 1.4, 95%CI 1.3-1.4). Patients with inflammatory arthropathy had a higher risk of death (HR 1.7, 95%CI 1.7-1.8), but were less likely to be revised (HR 0.85, 95%CI 0.74-0.98) than those treated for osteoarthritis. Patients with greater number of comorbidities and greater levels of socio-economic deprivation were at increased risk of death, but neither increased the risk of revision.

The lifetime risk of revision knee arthroplasty varies depending on patient sex, age at surgery and underlying diagnosis. Patients aged between 45 and 49 years have a one in three probability of revision surgery within their lifetime. Conversely, patients aged 90 years or over were very unlikely to experience revision.

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THE INFLUENCE OF BODY MASS INDEX ON LONG TERM SURVIVORSHIP OF PRIMARY KNEE ARTHROPLASTY

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There is a longstanding presumed association between obesity, complications, and revision surgery in primary knee arthroplasty. This has more recently been called into question, particularly in centres where a high volume of arthroplasty is performed. We investigated the correlation between Body Mass Index (BMI), mortality, and revision surgery.

This was a cohort study of at least 10 years following primary knee arthroplasty from a single high volume arthroplasty unit. Mortality and revision rates were collected from all patients who underwent primary knee arthroplasty between 2009 and 2010. Kaplan Meier analysis was performed.

There were 1161 female and 948 male patients with a mean age of 69 (21 to 97). All cause survivorship excluding mortality was 97.2% up to 13yrs with a minimum of 10 years. The revision rate in this series was 2.8% with no significant difference in revision rates after 10 year between patients with BMI above and below 40 ($p=0.438$). There was no significant difference in 10-year mortality between patients above and below a BMI of 40 ($p=0.238$).

This study shows no significant difference in the long term survival of total knee replacement between patients with normal and high BMI. Careful consideration should be given before rationing surgery based on BMI alone.

INVESTIGATING MIRELS SCORING FOR UPPER LIMB METASTASIS – SHOULD THE CUT-OFF FOR PROPHYLACTIC SURGERY BE DIFFERENT?

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Mirels' score predicts the likelihood of sustaining pathological fractures using pain, lesion site, size and morphology. The aim is to investigate its reproducibility, reliability and accuracy in upper limb bony metastases and validate its use in pathological fracture prediction.

A retrospective cohort study of patients with upper limb metastases, referred to an Orthopaedic Trauma Centre (2013-18). Mirels' was calculated in 32 patients; plain radiographs at presentation scored by 6 raters. Radiological aspects were scored twice by each rater, 2-weeks apart. Inter- and intra-observer reliability were calculated (Fleiss' kappa test). Bland-Altman plots compared variances of individual score components &total Mirels' score.

Mirels' score of ≥ 9 did not accurately predict lesions that would fracture (11% 5/46 vs 65.2% Mirels' score ≤ 8, $p<0.0001$). Sensitivity was 14.3% &specificity was 72.7%. When Mirels' cut-off was lowered to ≥ 7, patients were more likely to fracture (48% 22/46 versus 28% 13/46, $p=0.045$). Sensitivity rose to 62.9%, specificity fell to 54.6%. Kappa values for interobserver variability were 0.358 (fair, 0.288-0.429) for lesion size, 0.107 (poor, 0.02-0.193) for radiological appearance and 0.274 (fair, 0.229-0.318) for total Mirels' score. Values for intraobserver variability were 0.716 (good, 95% CI 0.432-0.999) for lesion size, 0.427 (moderate, 95% CI 0.195-0.768) for radiological appearance and 0.580 (moderate, 0.395-0.765) for total Mirels' score.

We showed moderate to substantial agreement between &within raters using Mirels' score on upper limb radiographs. Mirels' has poor sensitivity &specificity predicting upper limb fractures - we recommend the cut-off score for prophylactic surgery should be lower than for lower limb lesions.

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RE-INTERVENTION RATES ARE LOW AFTER DIRECT DISCHARGE FROM THE EDINBURGH TRAUMA TRIAGE CLINC: OUTCOMES OF 6,709 PATIENTS

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The Trauma Triage clinic (TTC) is a Virtual Fracture clinic which permits the direct discharge of simple, isolated fractures from the Emergency Department (ED), with consultant review of the clinical notes and radiographs. This study details the outcomes of patients with such injuries over a four-year period.

All TTC records between January 2014 and December 2017 were collated from a prospective database. Fractures of the radial head, little finger metacarpal, fifth metatarsal, toe phalanges and soft tissue mallet finger injuries were included. Application of the direct discharge protocol, and any deviations were noted. All records were then re-assessed at a minimum of three years after TTC triage (mean 4.5 years) to ascertain which injuries re-attended the trauma clinic, reasons for re-attendance, source of referral and any subsequent surgical procedures.

6709 patients with fractures of the radial head (1882), little finger metacarpal (1621), fifth metatarsal (1916), toe phalanges (920) and soft tissue mallet finger injures (370) were identified. 963 (14%) patients were offered in-person review after TTC, of which 45 (0.6%) underwent a surgical intervention. 299 (4%) re-attended after TTC direct discharge at a mean time after injury of 11.9 weeks and 12 (0.2%) underwent surgical intervention. Serious interventions, defined as those in which a surgical procedure may have been avoided if the patient had not undergone direct discharge, occurred in 1 patient (0.01%).

Re-intervention after direct discharge of simple injuries of the elbow, hand and foot is low. Unnecessary deviations from protocol offer avenues to optimise consumption of service resources.

DEVELOPMENT OF COMPOSITE BIOINKS THAT CAN BE INJECTED OR 3D BIOPRINTED TO AID OSTEOCHONDRAL DEFECT REPAIR

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As arthroplasty demand grows worldwide, the need for a novel cost-effective treatment option for articular cartilage (AC) defects tailored to individual patients has never been greater. 3D bioprinting can deposit patient cells and other biomaterials in user-defined patterns to build tissue constructs from the "bottom-up," potentially offering a new treatment for AC defects.

Novel composite bioinks were created by mixing different ratios of methacrylated alginate (AlgMA) with methacrylated gelatin (GelMA) and collagen. Chondrocytes and mesenchymal stem cells (MSCs) were then encapsulated in the bioinks and 3D bioprinted using a custom-built extrusion bioprinter. UV and double-ionic ($BaCl_2$ and $CaCl_2$) crosslinking was deployed following bioprinting to strengthen bioink stability in culture. Chondrocyte and MSC spheroids were also bioprinted to accelerate cell growth and development of ECM in bioprinted constructs.

Excellent viability of chondrocytes and MSCs was seen following bioprinting (>95%) and maintained in culture, with accelerated cell growth seen with inclusion of cell spheroids in bioinks ($p<0.05$). Bioprinted 10mm diameter constructs maintained shape in culture over 28 days, whilst construct degradation rates and mechanical properties were improved with addition of AlgMA ($p<0.05$). Composite bioinks were also injected into *in vitro* osteochondral defects and crosslinked in situ, with maintained cell viability and repair of osteochondral defects seen over a 14-day period.

In conclusion, we developed novel composite bioinks that can be triple-crosslinked, facilitating successful chondrocyte and MSC growth in 3D bioprinted scaffolds and *in vitro* repair of an osteochondral defect model. This offers hope for a new approach to treating AC defects.

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OUTCOME AND COMPLICATIONS AFTER 1ST METATARSOPHALANGEAL JOINT FUSION AT AN AVERAGE OF 10 YEARS

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Arthrodesis of the 1st metatarsophalangeal joint (MTPJ) is a common procedure used for the treatment of end stage arthritis. We studied a cohort of patients who underwent an isolated 1st MTPJ Fusion for the treatment of hallux rigidus. Here we report the 10-year clinical outcomes, complication rate, requirement for further surgery and patient experience.

All patients, who underwent an isolated 1st MTPJ Fusion for osteoarthritis from June 2008 until November 2011 were included. Demographics, clinical outcome data and subsequent procedures performed were collected from a departmental database (Bluespier). Patients were contacted and asked to complete the MOxFQ questionnaire and rate their satisfaction using pain, function and if they would undergo the surgery again. Mean follow up was 10.85 (range 9-12) years.

A total of 161 patients (183 feet) underwent an isolated 1st MTPJ fusion during this time period. 156 of the feet showed a successful arthrodesis (85.2% fusion rate); 27 patients required revision surgery, 19 (10.4%) for a symptomatic non-union and 8 (4.4%) for mal-union. Those patients with co-morbidities (diabetes and gout) required revision earlier than those without ($p<0.01$). Average MOxFQ score was 16.6 (0-64) and 28 out of the 38 (73.6%) said they would have the operation again.

Overall, the long-term results of the 1st MTPJ fusion had good outcomes with a successful fusion rate and minimal complications, both in line with the corresponding literature. In this series, fusion provided high patient satisfaction with the majority of patients opting to undergo fusion with the gift of hindsight.

NON-RESPONSE TO HIP AND KNEE ARTHROPLASTY PATIENT REPORTED OUTCOME QUESTIONNAIRES

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This study aims to determine satisfaction rates after hip and knee arthroplasty in patients who did not initially respond to PROMs, characteristics of non-responders, and contact preferences to maximise response rates. We performed a prospective cohort study of 709 patients undergoing THA and 737 patients undergoing TKA in a single centre in 2018. EQ-5D health related quality of life score and Oxford Hip/knee scores (OHS/OKS) were completed preoperatively and at 1year postoperatively via post when satisfaction was also assessed. Univariate, multivariate and receiver operator curve analysis were performed.

151/709 (21.2%) hip patients were non-responders, 83 (55.0%) of whom were contactable. 108/737 (14.6%) knee patients were non-responders, 91 (84.3%) of whom were contactable. There was no difference in satisfaction after arthroplasty between initial non-responders and responders for hips (74/81 vs 476/516, $p=0.847$) or knees (81/93 vs 470/561, $p=0.480$). Initial and persistent non-response was associated with younger age, higher BMIs and significantly worse preoperative PROMS for both hip and knee patients ($p=0.05$). Multivariate analysis demonstrated that younger age, higher BMI and poorer pre-operative OHS were independently associated with persistent non-response to hip PROMs ($p<0.05$). For the entire cohort ($n=1352$) patients <67 years were less likely to respond to postal PROMs with OR 0.63 (0.558 to 0.711). Using a threshold of >66.4 years predicted a preference for contact by post with 65.4% sensitivity and 68.1% specificity (AUC 0.723 (0.647-0.799 95%CI, $p<0.001$)).

Most initial non-responders were ultimately contactable with effort. Satisfaction rates were not inferior in patients who did not initially respond to PROMs.

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OUTCOME AND COMPLICATIONS AFTER CHEILECTOMY FOR HALLUX RIGIDUS AT AN AVERAGE OF 6 YEARS

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Cheilectomy is a recommended procedure for early stage osteoarthritis of the 1st metatarsophalangeal joint. Although improvement in symptoms has been reported in many studies, long term performance is not well understood. It is thought that significant numbers of patients require subsequent arthrodesis or arthroplasty. We report on a large cohort of patients receiving this procedure and on complications, and mid-term outcome.

This is a retrospective study looking at all patients undergoing cheilectomy for hallux rigidus between November 2007 and August 2018. Departmental database was used to record outcome measures including: postoperative wound infection, patient reported improvement in pain and incidence of further surgical interventions like revision cheilectomy, conversion to arthrodesis and arthroplasty. Osteoarthritis was staged radiographically using PACS (Hattrup and Johnson classification).

A total of 240 feet in 220 patients (20 bilateral surgeries) were included with 164 females (75%) and 56 males (25%), the median age being 55 years (range 22-90 years). Radiological assessment showed 89 stage 1 arthritis (42%), 105 stage 2 (50%), 17 stage 3 (8%) and 9 patients were excluded due to unavailable radiographs. 5 patients (2%) had superficial wound infections. There were 16 further surgeries (7%); 12 arthrodesis (5%), 3 revision cheilectomy and 1 conversion to arthroplasty. 157 patients were found to be pain-free at the latest post-operative visit (77%), 48 reported minimal pain (23%), 15 patients were excluded due to incomplete data.

Cheilectomy appears to effectively reduce pain with low complication rates. Rates of conversion to arthrodesis/arthroplasty are lower than in many reported studies.

OUTCOMES OF POOLE TRACTION SPLINTING FOR HAND PHALANGEAL FRACTURES: A SINGLE REGION EXPERIENCE

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The Poole Traction Splint (PTS) is a non-invasive technique that applies dynamic traction to the affected digit using materials readily available in the outpatient department. The primary aim of this study was to document the outcome of the PTS for hand phalangeal fractures.

Over a four-year period (2017-2021), suitable patients were reviewed and referred for PTS to the hand physiotherapists. Functional outcome measures included range of motion (ROM), return to work, and a DASH score. In addition, a healthcare cost analysis was carried out.

A total of 63 patients were treated with a PTS from 2017 to 2021. Data was analysed for 54 patients with 55 digits. The mean age was 43 years (17-72) and 53.7% (n=29) were female. There were 43 fractures involving the proximal phalanx and 12 involving the middle phalanx. The mean final composite range of movement averaged 209˚ (110-270°), classified as 'good/excellent' by ASSH criteria. The mean DASH score was 13.6 (0-43.2; n=45). All patients were able to return to work. Only two (3.7%) digits required conversion to surgical fixation. The PTS resulted in approximate savings of £2,452 per patient.

The PTS is a cost-effective non-invasive low risk outpatient treatment method which provides a functional ROM and good functional outcomes in the treatment of complex phalangeal hand fractures, with minimal risk of surgical intervention being required.

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PLATING OF DISTAL TIBIAL EXTRA-ARTICULAR FRACTURES: IS THERE A LESSON TO BE LEARNT?

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The surgical care of extra-articular distal tibial fractures remains controversial. This study looks at the radiological outcomes of distal tibial fractures treated with either a direct medial or anterolateral plate, with or without plating of the fibula, to assess the outcome and complications associated with these 2 approaches.

This is a retrospective review of 80 patients with distal tibial extra-articular fractures, treated with an open reduction and plating, between 2008 and 2019 at Glasgow Royal Infirmary. Case notes and x-rays were reviewed.

Of those tibial fractures fixed with only a medial plate, 78% united (28/36), 5% (2/36) had a non-union and 17% (6/36) a malunion. In the group treated with a combination of medial tibial and fibular plating, the figures were; 71% (15/21), 19% (4/21) and 10% (2/21). However, in the group treated with anterolateral plating of the tibia alone, only 53% (8/15) united, with a 20% (3/15) non-union and 13% (2/15) malunion rate. Additionally in this group, there were 2 patients (13%) with loss of fracture reduction within the first two months of fracture fixation, requiring revision surgery. Interestingly, of the 8 patients treated with anterolateral tibial and fibular plating, 88% (7/8) showed full union and only one (12%) had a non-union, with no malunions is this group.

It would appear that medial tibial and a combination of medial tibial and fibular plating, have superior outcomes compared to anterolateral plating. Results suggest, if anterolateral plating is done, this should be augmented by fixation of the fibular fracture as well.

PATIENTS WAITING FOR MORE THAN 6-MONTHS FOR A TOTAL HIP OR KNEE ARTHROPLASTY HAD A CLINCALLY SIGNIFICANT DETERIORATION IN THEIR QUALITY OF LIFE AND AN INCREASED LEVEL OF CLINICAL FRAILTY: A MULTICENTRE STUDY ACROSS SCOTLAND

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The primary aim was to assess whether patients waiting 6-months or more for a total hip (THA) or knee (KA) arthroplasty had a deterioration in their health-related quality of life (HRQoL). Secondary aims were to assess change in level of frailty and the number living in a state worse than death (WTD).

Eight-six patients waiting for a primary TKA or KA for more than 6-months were selected at random from waiting lists in three centres. Patient demographics, waiting time, EuroQol 5-dimension (EQ-5D) and visual analogue scores (EQ-VAS), Rockwood clinical frailty score (CFS) and SF-36 subjective change in HRQoL were recorded at the time of and for a timepoint 6-months prior to assessment. The study was powered to the EQ-5D (primary measure of HRQoL).

There were 40 male and 46 female patients with a mean age of 68 (33 to 91) years; 65 patients were awaiting a THA and 21 a TKA. The mean waiting time was 372 (226 to 749) days. The EQ-5D index deteriorated by 0.222 (95%CI 0.164 to 0.280, $p<0.001$). The EQ-VAS also deteriorated by 10.8 (95%CI 7.5 to 14.0, $p<0.001$). CFS progressed from a median of 3 to 4 ($p<0.001$). The number of patients WTD increased from seven to 22 ($p<0.001$). Thirty-one(36%) patients felt their HRQoL was much worse and 28 (33%) felt it was somewhat worse.

Patients waiting more than 6-months had a clinically significant deterioration in their HRQoL and demonstrated increasing level of frailty with more than a quarter living in a health state WTD.

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VIRTUAL MANAGEMENT OF CLINICALLY SUSPECTED SCAPHOID FRACTURES

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This study describes the introduction of a virtual pathway for the management of suspected scaphoid fractures and reports patient-reported outcome measures (PROMs) and satisfaction following treatment with this service.

All adult patients that presented with a clinically suspected scaphoid fracture that was not visible on presentation radiographs over a one-year period were eligible for inclusion in the pathway. Demographics, examination findings, clinical scaphoid score (CSS) and standard four view radiographs were collected at presentation. All radiographs were reviewed virtually by a single consultant hand surgeon, with patient-initiated follow-up on request. PROMs were assessed at a minimum of one year post presentation and included the QuickDASH, EQ-5D-5L, the Net Promoter Score (NPS) and return to work.

There were 221 patients referred to the virtual pathway. The mean age was 41 (range 16-87; SD 18.4 years) and there were 99 men (45%). There were 189 (86%) patients discharged with advice and 19 (9%) patients were recalled for clinical review (seven undisplaced scaphoid fractures, six other acute fractures of the hand or wrist, two scapholunate ligament injuries, and four cases where no abnormality was detected). Thirteen patients (6%) initiated follow-up with the hand service; no fracture or ligament injury was identified within this group. PROMs were available for 179 (81%) patients at a mean of 19 months follow-up (range: 13 – 33 months). The median QuickDASH score was 2.3 (IQR, 0-15.9), the median EQ-5D-5L was 0.85 (IQR, 0.73-1.00), the NPS was 76, and 173 (97%) patients were satisfied with their treatment. There were no documented cases of symptomatic non-union one year following injury.

This study reports the introduction of a virtual pathway for suspected scaphoid fractures, demonstrating high levels of patient satisfaction, excellent PROMs, and no detrimental effects in the vast majority of cases.