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Abstract Book

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Free Paper Session 1 - Elbow

Does long-term surveillance of primary linked total elbow arthroplasty identify failing implants requiring revision?

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Purpose: Published scoping review has identified evidence paucity related to long-term follow-up of elbow arthroplasty. We aim to report effectiveness of primary linked total elbow arthroplasty (PL-TEA) surveillance in identifying failing implants requiring revision.

Methods: A prospective database recording consecutive PL-TEA and subsequent follow-up surveillance in an elbow unit was analysed. PL-TEA were performed by 4 fellowship-trained elbow surgeons for accepted elective and traumatic indications. The included PL-TEA were performed 01.10.2013-31.07.2022 with minimum 1-year follow-up. Surveillance program involves specialist physiotherapist review at 1, 2, 3, 5, 8 and 10 years postoperatively, including clinical examination, outcome scoring, and radiographs. Patient-initiated review could occur between time points if a patient requested assessment because of symptoms. Outcome measures include number of surveillance reviews offered and attended; and proportion that identified a failing implant requiring revision. An assessment of failing implants identified by surveillance and patient-initiated review was also made.

Results: 97 PL-TEA with minimum 1-year follow-up were performed (76 Discovery, 14 Nexel, 7 Coonrad/Morrey). PL-TEA indication was 29 inflammatory arthritis, 29 acute fracture, 28 osteoarthritis, 5 distal humerus non-union, 5 posttraumatic arthritis and 1 haemophilic arthropathy. 16 patients died prior to 31.07.2023. 3 PL-TEA required revision <1 year postoperatively. 290 of 328 offered surveillance appointments were attended (88.4%). 5 PL-TEA required revision ≥1 year postoperatively; with revision requirement identified by surveillance in all cases. No failure was identified via a patient-initiated review. 3 PL-TEA failures occurred 5-years postoperatively (1 aseptic loosening, 1 infective loosening, 1 bearing failure) and 2 PL-TEA failures occurred at 8-years postoperatively (2 bearing failures). 1.7% attended surveillance appointments identified a failing PL-TEA requiring revision.

Conclusion: This is the first series reporting effectiveness of PL-TEA surveillance in identifying implants requiring revision. Surveillance enrolment may influence patient-initiated review utilisation; therefore, similar studies using only patient-initiated follow-up would help inform recommendations.

Evaluation of the PROMIS Function and Pain Measures Against the Oxford Elbow Score in Elbow Arthroplasty

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Purpose: The Patient-Reported Outcome Measurement Information System (PROMIS) is a suite of domain specific measures that utilise state-of-the-science psychometric design, this study explores the upper extremity function and pain interference performance characteristics against a commonly used outcome measure in elbow replacement patients.

Methods: A retrospective analysis of outcomes from all patients undergoing total elbow replacement at a single institution was undertaken. Matched pre and postoperative PROMIS Upper Extremity (UE), Pain Interference (PI) short forms and Oxford Elbow Scores (OES) were retrieved. Instrument internal consistency (Chronbach's Alpha), construct validity (Spearman's rho), ceiling and floor effect was assessed for total and subscale scores. Exploratory Factor Analysis (EFA) assessing domain structure was performed on all instruments. Incomplete outcomes were excluded.

Results: 62 sets of comparative outcomes were retrieved. No significant ceiling or floor effects were encountered from all PROMs. All measures and subscale scores were internally consistent (Cronbach's > 0.8). Construct validity correlations were adequate to strong for all domains with the exception of PROMIS PI and OES Pain subscale (r = 0.58). EFA confirmed single factor structure of the PROMIS scores, but a two factor solution for the OES in this population.

Conclusions: This is the largest analysis of modern psychometric outcome measures against legacy measures in a total elbow replacement population. The PROMIS UE function score is appropriate for use in the population, but the PROMIS PI items do not correlate with elbow specific pain items and should be used with caution.

Custom Distal Humeral Replacement with Locked Flange for the management of Massive Distal Humeral Bone Loss in Re-revision Total Elbow Arthroplasty

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Introduction: Management of bone loss in both primary and revision total elbow arthroplasty (TEA) is surgically challenging. Techniques used include distal humeral replacements, large segment allograft struts and/or allograft prosthetic composites. However, these techniques have high complication and failure rates. We present a novel solution of a salvage TEA using a custom intramedullary humeral prosthesis with a locking flange.

Methods: We prospectively reviewed data on 11 complex cases performed between 2017 and 2023. Electronic patient records and patient recorded outcome measures (PROMS) database were reviewed.

Results: All eleven cases were revisions of previously failed prostheses; following trauma in 5 patients and inflammatory arthritis in 4 patients, osteoarthritis in 1 patient and following a tumour resection in another. Mean age at operation was 64 (range 40-75). The mean number of previous arthroplasty procedures per patient was 6 (range 3-10). At a mean follow up of 29 months (range 2-81) ten of eleven prostheses remain fully in situ; however all humeral components remained well fixed. Post-operative outcome data was omitted for one patient who died of an unrelated cause. Clinical satisfaction was high with an average improvement in visual analogue scale for pain (VAS) of 8 preoperatively to 1 postoperatively. Average function improved from 21% of normal function (SANE) pre-operatively to 75% following revision. The Oxford Elbow Scores improved from an average of 11 to 32. EQ-5D index improved from an average of 0.5 to 0.6. At most recent radiographic follow up there was no evidence of progressive radiographic lucency in any implant.

One patient required removal of the ulna component 43 months post-operatively for continued infection and remains on antibiotic suppression. The humeral component remains well fixed.

Conclusion: When faced with extensive humeral bone loss, customised distal humeral replacements with a locking flange offer an alternative solution with acceptable medium-term outcomes.

Supraclavicular and infraclavicular brachial plexus block in upper limb orthopaedic surgery: A systematic review of randomised-controlled trials

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Objective: We have conducted a meta-analysis to compare the infraclavicular (IC) and supraclavicular (SC) approaches in upper limb orthopaedic surgery.

Methods: A search was performed on the following databases: Ovid Medline, EMBASE and the Web of science from inception until 30.04.2023. All RCTs comparing SC and IC approaches in upper limb orthopaedic surgery were included. The primary outcome of interest was block success rate. Secondary outcomes were procedure time, sensory onset time, patient satisfaction, pain, complications (specifically Horner's syndrome and vascular puncture).

Results: 18 RCTs comprising 1389 patients were included for analysis. For the primary outcome, t he success rate of infraclavicular nerve blocks was higher than that of supraclavicular nerve blocks, with an odds ratio of 0.61 (95% CI 0.41-0.91, p=0.01). Only a small number of studies reported on the secondary outcomes. A significantly reduced rate of Horner's syndrome as a complication was observed in the IC group. Otherwise, no significant difference was noted between the IC and SC approaches in terms of procedure time, sensory onset time, patient satisfaction, pain and vascular puncture.

Conclusion: IC blocks demonstrate a higher overall success rate over SC blocks. Across all studies a large variance in outcome reporting and definitions was observed. Future studies should conform to an agreed definition-set to facilitate comparison.

Improving post-operative neuropathy rates in distal humerus surgery patients: A change in practice.

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Purpose: Higher than expected rates of neuropathy were observed in our patients following surgery for distal humerus fractures. This prompted, a thorough examination of current practice with a focus on implementing improvements.

Methods: We conducted a comparative study of patients undergoing osteosynthesis, total elbow replacement and hemiarthroplasty pre-intervention (n=38) to those post intervention (n=38). Our intervention was the cessation of tourniquet (TQ) use and the introduction of intravenous tranexamic acid at induction. Our analysis encompasses patient, aesthetic and surgical variables with the rate and severity of neuropathy as the primary outcome.

Results: The pre and post-intervention groups were similar in terms of age, gender, operation type, BMI, ASA, diabetic status, and operating surgeon. Pre-intervention, the post-operative neuropathy rate was 21% (n=8), comprising of 4 minor and 4 major cases. The mean TQ duration was longer for those with post-operative neuropathy versus those without (120 vs. 83 minutes, p=0.011). Post-intervention, the neuropathy rate improved to 9% (n=3), all mild cases, with no instances of newly developed neuropathy. Surgery duration was shorter pre vs. post-intervention (128 vs.149 minutes p=0.05) and a greater haemoglobin concentration drop was seen following cessation of TQ use during surgery (12.7g/L vs. 25.9g/L, p=0.03).

Conclusion: In patients who underwent surgery without a TQ, there were no observed cases of new neuropathy or deterioration of pre-existing neuropathy. This study highlights a notably high pre-operative incidence of minor neuropathy within this patient cohort and emphasizes the concept of vulnerable nerves.

'The Treatable Triad' An 18-year follow up of surgically treated acute, isolated terrible triad injuries

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Background: The terrible triad injury has historically been associated with poor functional outcomes. Surgical techniques developed 20 years ago have improved short-term functional outcomes. This case-series is the longest follow up of patients treated for acute, isolated terrible triad injuries using a standard treatment protocol and aims to identify their longterm functional outcomes.

Methods: 49 Patients with elbow instability who were surgically managed a university trauma centre between October 2001 and May 2008 at were screened for inclusion. 20 Patients had an acute, isolated, surgically managed terrible triad injury. 10 Of these patients were seen face-to face for a clinical and if required a radiological assessment. Mayo Elbow Performance Scores (MEPS) and Disability of the Arm, Shoulder and Hand (DASH) scores, grip strength, requirement for further surgery and posteriolateral instability were recorded.

Results: The average length of follow up was 18.8 years. The mean MEPS was 88 and the mean DASH score was 12.3. The average loss of pronation was 8 degrees. The average loss of supination was 13 degrees. The re-operation rate was 40%, only one of these was a functionally limiting operation. A trend towards osteoarthritis was observed but there were no conversions to total elbow replacement.

Discussion: The overall functional outcome was excellent. The low follow-up rate can be expected with such a long interval between treatment and assessment. A relatively high re-operation rate is largely made up of minor procedures (removal of metalwork and cubital tunnel release) which did not impact the patients' functional status.

Conclusion: This study adds to the evidence that the terrible triad of the elbow is surgically treatable to allow a high functional standard not only in the short-term but also in the long-term.

Distal biceps repair with all suture unicortical intramedullary anchors yields excellent clinical results

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Purpose: This single-center prospective study aimed to assess postoperative clinical outcomes following distal biceps repair utilizing intramedullary all-suture anchors through an anterior incision.

Methods: Biceps tendons were repaired with a whip stitch fed into an all suture anchor and tensioned then secured. Anchors were inserted using a transverse anterior proximal forearm incision at the level of the radial tuberosity. A second proximal incision over the distal biceps was used to retrieve the tendon if not possible from the distal aspect. Clinical and patient reported outcomes were evaluated pre-operatively, at 6 weeks, 3 months, 6 months, and 1 year postoperatively. Statistical analysis was conducted using the statistical program SPSS 29.

Results: The study included 38 male patients (38.79 ± 12.04 years) who met the inclusion criteria and underwent primary distal biceps tendon repair (29 acute, 8 chronic, 1 revision) with all-suture anchors. The assessment tools, OES, EQ5D-5L, and MSK-HQ revealed overall improvement in clinical outcomes. Whereas, the VAS demonstrated a notable reduction in pain and the postoperative ROM did not exhibit significant differences compared to the contralateral side. One patient experienced transient palsy in the lateral antebrachial cutaneous nerve distribution area, and another patient suffered a re-rupture within the initial six weeks post-operation due to fall with subsequent revision with the same technique.

Conclusions: This technique is all anterior and avoids potential complications of breaching the far cortex of the radius where the posterior interosseous nerve lies. It also negates need of intra or post operative xray. The procedure exhibited low complication rates and excellent clinical outcomes. Further investigations and extended follow-up studies are warranted to comprehensively assess the durability and sustained efficacy.

Surgical management of lateral epicondylitis: A scoping review of published literature

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Surgical intervention for lateral epicondylitis (LE) remains a controversial topic with its efficacy being debated. Literature has analysed all randomised trials investigating lateral epicondylitis, and found the quality of trials to be poor, and that surgery offered no benefit when compared to conservative measures. There have been recent UK guidelines published by BESS, concluding the evidence quality to be poor, with low methodological quality and few studies comparing surgery to conservative management. Thus, they concluded that surgery offers no benefit over conservative management.

A scopus review of all literature investigating surgical management of LE was performed. The primary questions addressed were: What surgical options are being utilised for lateral epicondylitis? Which study designs have been published on this topic? How long is conservative management being trialed before surgery is offered to patients? What outcomes are being investigated, and how are these being calculated?
Basic study demographics were extracted, as well as overall study findings.

35 studies were included incorporating 1564 patients. This included 12 trials and 23 observational studies. All studies were single-centre. Open surgery was performed in 19 studies of which the most commonly performed procedure was the traditional ERCB release. There was found to be no benefits of surgery compared to conservative management, nor was there any difference between open and arthroscopic technique. The majority of studies used a variety of outcome measures.

Optimum management for LE remains controversial, and surgical management is debated. This review has highlighted that despite published studies, there remains low included patient number, with no multi-centre studies being performed and varying study quality. With new UK guidelines stating that there is weak evidence on the role of surgery, it is recommended that further studies use collaboration between centres as well as validated outcome measures. This would allow for increased study synthesis and comparison.

Free Paper Session 2 - Shoulder Instability

Cadaveric Biomechanical Study of a Novel Shoulder Stabilisation Implant

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Purpose: We report a cadaveric biomechanical study of a novel shoulder stabilisation implant.

Method: An NIHR I4I grant was awarded to test a 3D printed titanium implant used to reconstruct the glenoid defect in unstable shoulders. Twenty scapulae from ten cadavers were used. Each scapula had a 20% glenoid defect created and was randomised to have this reconstructed with a Latarjet in one glenoid and the implant in the contralateral glenoid.

Post procedure, scapulae were potted in PMMA cement and placed onto a testing rig. The primary outcome was withstanding staircase loading from 50N to 350N with 100 cycles at each load. Failure was 5mm of displacement. Any specimen that passed this was loaded to failure. The testing rigs maximum limit was 2500N.

Results: Reconstruction of the glenoid defect was successful in all specimens except one which was withdrawn due to metastatic destruction of the glenoid. Ten glenoids were reconstructed with a Latarjet; three of these withstood staircase loading (30%). Nine glenoids were reconstructed with the implant; eight of these withstood staircase loading (89%). During staircase loading the Latarjet displaced a mean of 7.68mm and the implant displaced a mean of 2.73mm.

When loaded to failure the median force withstood by the implant was 1189N (753N - >2500N) and the Latarjet was 922N (830N-1116N).

The mechanism of failure of the Latarjet was screws cutting through the coracoid graft in eight specimens; screws cutting through the glenoid in one specimen and screws bending in one specimen. Failure of the implant was due to screws cutting through the glenoid in all specimens.

Conclusion: The weakest part of the Latarjet is the screw coracoid interface. The implant overcomes this so is stronger with less movement during loading. If clinical safety can be demonstrated the implant may offer a new treatment for shoulder instability.

The Open Latarjet Procedure in Athletes With a Minimum of 5 Years Follow Up: An Analysis of Factors Associated With Success

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Objective: The purpose of this study was to evaluate the outcomes of athletes 5-years post-operatively following the Open Latarjet (OL) procedure.

Methods: A retrospective review of a single surgeon series with a minimum of 5-year follow-up was performed. Recurrence, Visual Analogue Scale (VAS), SSV, Rowe score, Shoulder Instability-Return to Sport after Injury (SIRSI) score, desire to undergo the same surgery again, along with rate, level and timing of return to play (RTP), were evaluated. Multi-linear regression models were used to evaluate factors affecting postoperative satisfaction, and SSV level.

Results: Overall, 143 shoulders in 132 male athletes were included, with a mean age of 23.0 ± 5.6 years, and mean follow-up of 71.3 ± 9.9 months. At final follow up, 92.3% were satisfied/very satisfied, and the mean SSV was 85.7 ± 14.4. The mean SIRSI score was 68.6 ± 22.1, the mean Rowe score was 83.6 ± 16.3, while the mean VAS score was 1.9 ± 1.9. Overall, the rate of RTP was 91.6%, with 80.8% returning at the same level or higher level at a mean of 7.4 ± 3.0 months. There were 6 athletes (4.2%) who experienced further dislocation, all during collision sports of which 3 (2.4%) were for recurrent instability. Linear regression revealed that the SIRSI score ($p < 0.0013$), SSV ($p = 0.003$) and RTP ($p = 0.049$) were associated with satisfaction. While the SIRSI score ($p = 0.023$), VAS score ($p < 0.001$), Rowe score ($p = 0.028$) and RTP ($p = 0.013$) were associated with SSV score. 90.6% of athletes reported they would undergo the procedure again if required.

Conclusion: At a minimum 5-year follow-up, there was very high rate of satisfaction, with excellent patient-reported outcomes, low rates of recurrent instability and a high rate of RTP among athletes.

Anterior Shoulder Instability In Patients Older Than 40 Years Treated With Arthroscopic Bankart Repair

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Introduction: Anterior shoulder instability in older adults is frequently managed non-operatively. There is limited published evidence for the surgical management of these patients. This study aims to assess the risk of recurrence and functional outcomes in older adults after Arthroscopic Bankart Repair (ABR).

Methods: A retrospective review of patients who underwent ABR under a single surgeon with a minimum of 2-year follow-up was performed. Recurrence, Visual Analogue Scale (VAS) for pain, satisfaction, Subjective Shoulder Value SSV, Rowe and Constant scores, along with rate, level and timing of return to play and work were evaluated.

Results: Overall, 51 patients who underwent ABR were included, there were 35 males (69%). The mean age was 46.9 ± 6.4 years, with mean follow-up of 77.9 ± 32.6 months (range 25-138 months). At final follow up 88% (45/51) were either satisfied/very satisfied. The mean SSV was 87.1 ± 13.9, the mean Constant score was 73.1 ± 14.8, the mean Rowe score was 80.1 ± 19.7, while the mean VAS score was 2.4 ± 2.7. Overall, 45 of 48 (94%) patients returned to work at a mean of 5.1 ± 4.6 (0-16 weeks). Of the 42 patients involved in sport 35 (83%) returned to sports at a mean of 6.6 ± 4.2 months, 22 (52%) returned at the same or higher level. There were 5 patients (10%) who experienced postoperative dislocation, of which one required revision, in total 8 patients (15%) had further procedures.

Conclusion: In patients >40 years of age with medium to long term follow up after ABR there was a high rate of satisfaction with good functional outcomes and pain control. There was a high rate of return to sport and work, with a reasonably low recurrence rate.

Do PROM scores deteriorate with increasing number of dislocating events amongst athletes with shoulder instability?

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Introduction: Understanding the impact of shoulder instability on the quality of life and athletic performance is crucial for athletes. This research aims to assess the effectiveness of Patient-Reported Outcome Measures (PROMs) in evaluating shoulder instability.

Methods: Retrospective analysis of athletes with shoulder instability from a single surgeon series. Data collection included baseline demographics, number of dislocating events and PROMs - Western Ontario Shoulder Instability Index (WOSI), American Shoulder and Elbow Surgeons Shoulder Score (ASES) and The Shoulder Instability-Return to Sport after Injury (SIRSI) score.

Results: A total of 192 patients with a mean age of 21.7 (range 15-40 years) were included. 90% of patients played competitive collision sports including 55% playing Gaelic and 31% Rugby. Number of dislocating events were subdivided into subluxations (12%), 1 dislocation (21%), 2-5 dislocations (52%) and >5 dislocations (16%). Patients who suffered subluxations experienced the greatest pain VAS 2.52 vs. 1.73 vs. 1.19 vs. 2.13 (p=0.03). PROM scores differed between the dislocation groups with the average ASES being 76 vs. 77 vs. 84 vs. 77 (p=0.02). WOSI - 1238 vs. 1194 vs. 1125 vs. 1281 (p=0.22) and SIRSI – 63 vs. 58 vs. 57 vs. 55 (p=0.369). Correlation analysis identified moderate to high correlation between SSV, VAS, ASES and WOSI (rho 0.368, 0.585, 0.623, 0.830, 0.544 and 0.737 – p values <0.001) but none with SIRSI.

Conclusion: Our data would suggest that subjective PROMs scores correlate poorly to the objectivity of using a dislocating event as an outcome measure. Prior to analysis of our results, we hypothesised that PROM scores would identify a linear correlation of worsening PROMs with greater events of previous dislocations. However, this did not hold true between groups. SIRSI showed a worsening score with increasing dislocating events however this was not statistically significant.

Distal tibial allograft in the management of recurrent anterior instability - a systematic review of biomechanical, radiological and clinical outcomes

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Introduction: The aim of this review was to assess the clinical,radiological and biomechanical outcomes of distal tibial osteochondral allograft for reconstruction of glenoid with bone loss.

Methods: MEDLINE,Embase and pubmed databases were searched. Studies reporting any radiological,biomechanical,functional or clinical outcomes after the use of distal tibial osteochondral allograft were included.

Results: 12 studies met the inclusion criteria:eight were clinical studies(n=345)and four were biomechanical studies(n =68).The mean age was 32.8years(18–88)and mean follow-up was 26 months(16–47).Three biomechanical studies analysed radius of curvature(ROC)of DTA with mean of24.5±1.9(range 17.5 to 27.5 mm).This was similar to the ROC measurements of the glenoid with mean of26.1±2.8(range 22.5 to 30 mm),when compared to the ROC of other autografts and allografts such as inferior coracoid(24.0±2.1[20-27.5]),lateral coracoid(13.2 ± 1.9[10-15]),distal radius(20.7±2.1[20-27.5])and iliac crest autograft(>35, P=< 0.05).One study reported that DTA(4.20cm2, 2.70 kg/cm2)successfully restored contact-area and contact-pressure when compared to an intact glenoid(4.87cm2,2.63kg/cm2)and these values were higher than after a Laterjet procedure(3.52cm2,2.83kg/cm2).Seven clinical studies compared the results of DTA against either an alternative allograft or coracoid autograft.Combining all studies for DTA,subluxation was reported in sixteen patients(3.5%)whilst recurrent dislocations in two patients(0.4%).Functional outcomes were reported in four studies and all demonstrated a statistically significant improvement post-operatively for patients who underwent DTA however recurrence rate and functional outcomes were not significantly different between the DTA and other cohorts in the comparative studies.

DTA radiological outcomes demonstrated a mean union-rate of 97.5%,varying rate of resorption(6%-83%)and improvement in anteroposterior glenoid measurement(mean 32.26mm).Overall complication rate was 4.4%(range 0 to 2.5%);the most common were hardware related(1.3%)and nerve injury(1.04%)with majority of revisions(2.3%) being for hardware failure(1.3%).

Conclusion: Patients undergoing bone block with DTA for ASI,have significantly better post-operative functional scores,high union rate with low complication and revision rates.DTA also has a good radius of curvature with better contact-pressure and contact-area making it an ideal allograft choice for glenoid.

Free Paper Session 3 - AHP/Rehabilitation

Which exercise is best for Rotator Cuff-Related Shoulder Pain? A systematic review and meta-regression

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Aim: To compare the efficacy of flexibility, strengthening, or proprioception-dominant exercise to better establish a treatment hierarchy for rotator cuff-related shoulder pain (RCRSP).

Materials and Methods: A systematic review including meta-regressions with comparative standardised mean difference effect sizes (g) was conducted. Trials including an exercise therapy only arm were included and based on the available data, categorised into three dominant therapy classes (flexibility, strengthening or proprioception) across core outcome domains (pain, disability and range of motion). Hierarchical Bayesian models were conducted to account for reporting of multiple data points within trials. A primary meta-regression was conducted for each outcome domain, comprising all relevant measurements. Sensitivity analyses were conducted by separating measurements into short (≤12 weeks) and medium to long (>12 weeks) categories, with the analysis combined across all outcomes.

Results: A total of 58 studies comprising 64 exercise treatments and 2249 participants were included. Across all three outcome domains, greater mean improvements were observed with proprioception-dominant exercises compared to strengthening-dominant exercises. The primary meta-regressions were: 1) pain (strengthening: 22 trials; proprioception: 16 trials; flexibility: 5 trials) g(Strengthening:Proprioception)=0.15 [95%CrI: -0.14 to 0.45; p(>0)=0.852]; 2) disability (strengthening: 37 trials; proprioception: 19 trials; flexibility: 6 trials) g(Strengthening:Proprioception)=0.19 [95%CrI: -0.02 to 0.41; p(>0)=0.967]; 3) range of motion (strengthening: 11 trials; proprioception: 8 trials; flexibility: 2 trials) g(Strengthening:Proprioception)=0.22 [95%CrI: 0.08 to 0.36; p(>0)=0.998]. Evidence also suggested greater improvements with flexibility-dominant exercises compared to strengthening-dominant exercises for range of motion g(Strengthening:Flexibility)=0.15 [95%CrI: -0.00 to 0.30; p(>0)=0.972]. Sensitivity analyses did not alter any conclusions.

Conclusion: Exercise therapies to manage RCRSP frequently combine strengthening, flexibility, and proprioceptive activities. Evidence from this meta-analysis emphasises the importance of proprioceptive training for people with RCRSP as part of a multi-component exercise intervention. Future research is required to determine the optimum combination of exercise types and dosage for this population.

Effects of Arm Sling Immobilisation on Gait: A pilot study

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Our objective was to investigate the effect of upper limb immobilisation on gait of both a young and elderly population.

Design and Methods: Our single-centre exploratory crossover pilot study investigated two populations of healthy volunteers: five volunteers aged >60 years old and five aged <40 years old. Our intervention involved arm immobilisation using a polysling (both dominant and non-dominant) with our control being unrestrained.

Our primary outcomes were 26 spatiotemporal parameters obtained using a GAITRite® electronic walkway and software and our secondary outcomes were function assessments using timed up and go (TUG) test.

Non-parametric Freidman test was used for within group comparison of 3 different levels. Statistical analysis was performed using SPSS software.

Results: Within the over 60 group, immobilisation of the dominant arm resulted in reduced gait velocity, cadence, stride length and step length as well as an increased double support time when compared to both non-dominant arm immobilisation and the unrestrained control. However only the reduction in velocity was found to be significant (P-value 0.02). Furthermore, immobilisation of the non-dominant arm had a statistically significant increase in double support time to the right lower limb (P-Value 0.04).

However, within the <40 group there were no statistically significant difference between the three levels in any 26 parameters, furthermore no significant difference between timed up and go test times between the 3 levels in both groups.

Conclusion: The results of our pilot study demonstrate that arm immobilisation has a subtle but significant impact on the ambulation of older populations leading to slower more cautious gait. This finding was not reproducible in our younger population signifying an increases susceptibility to arm immobilisation related gait disturbances in older age.

A systematic review of the contents and outcomes of Virtual Reality-assisted interventions for musculoskeletal shoulder pain management

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This study aimed to systematically review the contents and outcomes of Virtual Reality (VR) interventions targeted for the management of MSK shoulder pain.

Methods: A systematic review was conducted in accordance with PRISMA guidelines. A search strategy using key words and MeSH headings was initially conducted in Medline, then adapted for PubMed, Web of Science and Cinahl, from inception until June 2023. Two independent reviewers screened articles by title and abstract, followed by full text articles according to study eligibility criteria, ie: studies evaluating any VR intervention for adults with MSK shoulder pain. Data on intervention content and outcomes were then extracted, before a narrative synthesis was performed. The Template for Intervention Description and Replication (TIDieR) was used to assess quality of reporting, while risk of bias was assessed using the Cochrane Risk of Bias tool (ROBINS-2).

Results: Five RCTs met the eligibility criteria, involving 113 people with a wide range of shoulder conditions, including (but not limited to): rotator cuff rupture and impingement syndrome. All interventions lasted between 2-6 weeks, employed semi or non-immersive VR systems, which facilitated strategies to enhance engagement with progressive exercises. Only one study altered the perception of joint position. Intervention frequency and session duration ranged from 2-3 per week and 30-45 mins respectively. Studies reported significant improvements in outcomes related to pain (n=5), ROM (n=4), disability (5) and quality of life (n=2), however all studies had a high risk of bias and none fulfilled all twelve elements of the TIDieR checklist.

Conclusions: Despite preliminary evidence suggesting the potential for VR to enhance multiple shoulder-related outcomes with minimal safety risks, these findings should to be interpreted with caution in light of the high risk of bias and substantial heterogeneity amongst the studies. Future, high-quality mixed-methods trials with longer follow-ups are warranted to confirm these findings.

Just one question to assess upper limb function: Psychometric evaluation of an independent Single Alpha-Numeric Evaluation (iSANE) in healthy populations.

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Purpose: This study investigates the effect of changing the upper anchor of the modified Single Assessment Numeric Evaluation (mSANE) score from a score of 10 indicating normal function to being the function of “an elite athlete”. The hypothesis is that this independent score (iSANE) would retain the reproducibility of the mSANE but address its ceiling effect and skewness.

Methods: A two-phase study was conducted. Phase 1 evaluated the ceiling effect and distribution of iSANE amongst 103 healthy participants who rated their dominant arm function. Phase 2 compared the ceiling effect and distribution of iSANE to mSANE in 105 participants who did not participate in Phase 1. To assess the intra-observer reliability, participants were asked to score their arm function twice with at least two weeks in between.

Results: Of the 208 participants who took part, 130(63%) were female and the right arm was dominant in 180(87%) participants. The mSANE was highly skewed (-4.4) with a 93% ceiling effect. The iSANE was normally distributed (Shapiro-Wilk p=0.48, kurtosis=2.86, skewness=-0.35) with a mean score of 8 (sd=1.27). The highest iSANE score was selected by 26 participants (12.5%), demonstrating no ceiling effect. The iSANE reduced across increasing age-bands, with a mean score of nine in participants <21 years compared with seven in 61-70 years old.

In Phase 1, 103 (100%) rated their arm function twice and 97 (92%) rated it in Phase 2. The iSANE had a substantial intra-observer reliability (kappa 0.62) whereas mSANE had a slight intra-observer reliability (kappa 0.13).

Conclusion: A single question can be used to assess arm function. The iSANE score is reliable and has a normal distribution, and no significant ceiling effect in a healthy population, making the iSANE a more useful tool for comparing interventions. Future studies will assess its responsiveness in the context of upper limb surgery.

Does grip strength predict functional outcome in first time traumatic anterior shoulder dislocations?

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Background: This study was to investigate the correlation between grip strength (GS) and functional outcome (FO), defined by patient reported outcome measures (PROMs) in patients after first time traumatic anterior shoulder dislocation (TASD). Furthermore, to determine if GS could be used as a diagnostic test to determine rotator cuff injury and request for Magnetic Resonance Investigation (MRI).

Method: Shoulder range of motion was recorded and PROMs; EQ5D, Oxford shoulder stability score (OSS), Western Ontario shoulder stability Index, Numeric Pain Rating scale (NRPS) and Shoulder Subjective Value (SSV) were completed. GS of both shoulders were measured with first time TASD using a Jamar hand dynamometer with a standardised protocol. Pearson correlation was used to examine the relationship of GS and PROMs from first assessment to 6 months. All other assessment, treatment and investigations were as standard practice.

Results: The results showed a statistically significant association between the GS on the side of the dislocated shoulder at baseline as a percentage of normal GS value and both the NRPS (p= 0.02) and SSV (p=0.04) scores at 6 months and low correlation with improved scores of the Western-Ontario Index (p= 0.05).

Conclusion: The results support the hypothesis that GS on first assessment post TASD is associated with patient functional outcomes.

The findings suggest that GS is a simple and quick test that can be used to determine which patients may require more intensive Physiotherapy rehabilitation but it is not an indicator of rotator cuff tears following a TASD.

Free Paper Session 4 – Miscellaneous

Should all patients with Adhesive Capsulitis be screened for Diabetes Mellitus?

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Purpose: To determine the prevalence of DM and prediabetes in adhesive capsulitis, and their effect on disease severity.

Methods: All patients diagnosed with AC in the outpatient clinic of a teaching hospital between October 2022 and May 2023 were included. HbA1c levels recently checked in primary care were recorded. Those without a recorded level within 6 months of the appointment underwent HbA1c testing. Additionally, patients completed an Oxford Shoulder Score (OSS) questionnaire.

Results: 48 patients were included (23 male: 25 female). Mean age was 58 years. 22 (45.8%) with AC were found to have DM. 20 (41.7%) already had a diagnosis of DM. HbA1c testing confirmed two new DM diagnoses (4.2%) and six new diagnoses of pre-diabetes (12.5%). Patients with DM and pre-diabetes had a lower OSS (15.3 ± 6.7) than those with a normal HbA1c (21 ± 10.5) (p=0.068). Those with an abnormal HbA1c also had a reduced range of motion compared to those with normal HbA1cs, for forward flexion [86.3° (±30.4) vs. 92.4° (± 26.7), (p=0.487)], abduction [77.2° (± 35.9) vs. 80.9° (± 33.8), (p=0759)], and external rotation [11.3° (± 13.3) vs. 20.5° (± 17.7), (p=0.049)].

Conclusion: In our study, 63% of the patients presenting with AC had DM or pre-diabetes. 28.5% of these diagnoses were a new diagnosis determined by raised HbA1c levels at the time of presentation. As patients with DM may experience poorer outcomes and increasing rates of recurrence, its diagnosis is important to guide treatment and manage patient expectations. Due to the high prevalence of DM and pre-diabetes in AC, we recommend screening to ensure early detection. Further investigation is required to determine whether HbA1c levels affect outcomes following treatment for AC.

Hydrodistension for Frozen Shoulder - A Multicentre Retrospective Study

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Background: Adhesive capsulitis affects 2-5% of the general population. Patients with diabetes have a five times higher prevalence and have a less favourable prognosis. Treatment options include physiotherapy, capsular release, intra-articular steroid injections and hydrodistension.

Aims: 1) To assess the effectiveness of hydrodistension as a treatment for adhesive capsulitis; and 2) to evaluate any influence the presence of diabetes, insulin and HbA1c may have on treatment effectiveness.

Methods: Data was retrospectively collected at six NHS trusts across Yorkshire offering hydrodistension as a treatment for adhesive capsulitis. Minimum follow-up was 18 months. Effectiveness of hydrodistension was measured by re-intervention rate (either in the form of a subsequent steroid injection, capsular release or repeat hydrodistension). Patient's diabetic status, insulin usage and HbA1c was recorded. Chi-squared statistical analysis was used.

Results: 750 patients underwent hydrodistension between 2018-2021 (461 female, 289 male). Mean age was 54.4 (range 22-87). Mean duration of symptoms was 12.7 months (range 1-120). 74.0% of patients required no further intervention (555/750). 25.4% of patients were recorded as being diabetic (188/741). Of these, 38.3% took insulin (72/188). There were statistically significant higher rates of re-intervention in diabetics compared to non-diabetics (33.3% vs 23.1%, p=0.002) and patients who took insulin compared to those that didn't (35.3% vs 24.4%, p=0.05). Patients with a HbA1c of ≥48 had a higher re-intervention rate than those with a HbA1c <48 however this was not statistically significant (30.6% vs 22.9%, p=0.20).

Conclusion: Hydrodistension is a successful treatment for adhesive capsulitis with the majority of patients requiring no further intervention. Patients with diabetes are more likely to require further treatment. It is unclear what the best first line treatment is, however hydrodistension offers an effective, cheap, widely accessible and non-invasive consideration. A prospective randomised control trial would help to remove the selection bias seen in this study.

Fracture Assessment, Management and Outcomes in Upper limb study during Covid-19 (FAMOUS C-19)

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Introduction: This study was a natural experiment investigating the impact of COVID-19 on management and outcomes of common upper limb fractures in the UK.

Methods: Adults presenting with radiologically confirmed proximal humerus (PH) and distal radius (DR) fractures during COVID-19 pandemic (15th Mar 2020 to June 2020) and pre-pandemic (1st Dec 2019 to 14th Mar 2020) were recruited to this multicentre observational cohort study from 15 acute UK NHS hospitals. Patient reported outcomes (OSS, PRWE, EQ-5D, EQVAS) were collected with a minimum of 12 month follow up alongside collecting patient experiences in accessing health care; treatment preference, satisfaction; and days off work.

Results: Out of 508 recruited, outcome data was available for 469 patients (354 DR; 115 PH). Patient demographics and injury characteristics were similar pre- and during pandemic. More patients with PH preferred non-operative treatment during the pandemic. Lesser number of patients received operative treatment during the pandemic in PH group (15.4% vs 20.6%) and DR group (21.1% vs 24.6%). There was increased provision of remote physiotherapy during the pandemic. We found no statistically significant or clinically important differences at 12 and 24 months between pre- and during pandemic groups in PRWE (22.8 vs 23.9, p = 0.33 and 14.0 vs 15.6, p = 0.79), OSS (33.8 vs 37.8, p=0.85 and 40.2 vs 37.6, p=0.46), EQ5D-5L (0.75 vs 0.72, p=0.25 and 0.81 Vs 0.78, p=0.24) and EQ-VAS (74.2 vs 70.9, p=0.10 and 77.7 vs 75.0, p=0.81). Patient treatment satisfaction and Covid status were similar in both groups. The mean number of days off work following injury was higher during pandemic (44.9 vs 75.5 days).

Conclusions: This study found no significant differences in patient outcomes or satisfaction despite service changes in the NHS during COVID-19 for treatment of PH and DR fractures.

Proximal Humeral Fractures with Vascular Compromise

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Purpose: We aimed to assess the incidence of vascular compromise in a large cohort of patients sustaining proximal humerus fractures (PHF) at a single tertiary trauma centre, and to identify any demographic and radiological risk factors at presentation that might help to identify this complication earlier.

Methods: A total of 3,497 adult patients (mean age 66.7 years, 72% female) with PHF were managed between 2015 and 2022 at our centre. We compared the demographics, clinical features and fracture configuration of patients with PHFs complicated by vascular compromise, with the remainder of the fracture population. The incidence of this complication was calculated from national population data and predictive factors for its occurrence were identified using multivariable regression analysis.

Results: During the study period, 18 patients (0.5%) sustained PHF with clinical evidence of vascular compromise giving an annual population incidence of 0.29 per 100,000. Their mean age was 68.7 (45-92) years and 10 (56%) were females. Multivariable analysis identified complete separation of the proximal shaft from the head with medial displacement (p<0.001, OR 91.6)) and evidence of mixed pattern neurological deficit (brachial plexus palsy) (p=<0.001, OR 683.8) as strong independent predictors of vascular compromise. Male gender was also more weakly associated with an increased risk of this complication (p=0.04, OR 5.9). A policy of fracture reduction and reconstruction prior to any vascular surgical intervention was associated with favourable post-operative outcomes and the absence of vascular sequelae.

Conclusion: The classic signs of distal limb ischaemia are often absent in patients with proximal major vessel injury. Our study identified specific clinical and radiographic “red flags” which, when used in combination, should increase the suspicion of a fracture with associated vascular injury and facilitate early diagnosis and intervention.

Percutaneous Ultrasound Guided Long Head of Biceps Tenotomy

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Aim: This study retrospectively assessed functional outcomes following percutaneous ultrasound guided (pUSG) long head of biceps tendon (LHBT) tenotomy for osteoarthritic rotator cuff arthropathy in medically unfit patients with LHBT pain.

Methods: 10 patients with symptomatic osteoarthritic rotator cuff arthropathy who were deemed unfit for a general anaesthetic were included in this study (mean age: 74years). The procedures were performed by a single surgeon, using the same, reproducible operative technique. Ultrasound guidance was used to locate the LHBT and a local anaesthetic was infiltrated in the skin and soft tissues and around the LHBT. Using a scalpel, the LHBT was cut percutaneously under ultrasound guidance.

Shoulder Pain and Disability Index (SPADI) scores before and after surgery were retrospectively calculated at least 9 months after surgery via telephone consultation. The SPADI score considers both pain during certain activities, as well as functionality.

Results: 9 out of the 10 patients responded to the survey. Mean preoperative pain and disability scores were 37/50 and 56.5/80 respectively, with a mean total SPADI score of 93.9/130 preoperatively. The mean postoperative pain and disability scores were 19/50 and 29.7/80 respectively, with a mean total SPADI score of 48.6/130 postoperatively.

Conclusion: Percutaneous ultrasound guided long head of biceps tenotomy provides significant improvement in pain and functional outcomes in patients with osteoarthritic rotator cuff arthropathy. This procedure should be considered as an appropriate management option for patients who are too medically unfit to receive a general anaesthetic.

Early clinical outcomes and engagement in a prospective multi-centre registry for patients undergoing rotator cuff repair using a bioinductive collagen implant

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Aim: To establish a soft-tissue registry with an objective to gather real-world evidence for evaluation of clinical effectiveness, health-economic impact, and patient-reported outcomes of rotator cuff repairs performed with a bioinductive collagen implant (BCI).

Methods: All patients who present with a full or partial thickness rotator cuff tear (FTT/PTT) and undergo surgical treatment with a BCI are invited to participate in the registry, which is currently active in the United Kingdom (UK), with plans to expand across Europe and Australia.

Outcome data collected include Oxford Shoulder Score (OSS), Visual Analogue Scale (VAS) pain, QuickDASH (Disabilities of Arm, Shoulder and Hand), Single Assessment Numeric Evaluation (SANE) Score, as well as quality of health measures (EQ-5D-5L) and post-operative complications.

Results: Since establishing the registry in October 2020, 11 sites and 13 surgeons have enrolled for recruitment of patients. This reflects 20.0% of the total number of surgeons carrying out this procedure in the UK. To date, 132 patients (mean age 59.3 years, 68.9% male) undergoing rotator cuff surgery with biological augmentation have been included in the registry.

The registry has shown a significant improvement in OSS and VAS at 6 months post-operatively for patients with FTT. Mean OSS improved from 28 to 39 ($p<0.01$) meeting the minimally important clinical difference (MCID). VAS improved from 49 to 25 ($p<0.01$).

In patients with PTT, OSS improved from 28 to 42 at 6 months post-op ($p<0.01$), with VAS pain improving from 43 to 18 ($p=0.02$).

The most frequently observed complications are ongoing pain, stiffness, and numbness, occurring at rates of 5.3% for FTT and 0.9% for PTT 6-months post-op.

Conclusion: These early post-operative results demonstrate that this soft-tissue registry is growing with increasing clinician engagement. Initial analysis demonstrate that rotator cuff surgery augmented with a BCI is associated with a safe and satisfactory post-operative outcome.

Free Paper Session 5 - Shoulder Arthroplasty

Conservative treatment of traumatic periprosthetic humeral fractures in stemless reverse TSA is a safe and viable option

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Purpose: Increased use of reverse total shoulder arthroplasty (rTSA) in an aging population, results in an increased risk of post-operative traumatic periprosthetic humeral fracture (TPHF) secondary to falls. Risk of periprosthetic humeral fracture after TSA is reported to be 1-3%, and patients may require revision surgery, a significant undertaking in a frail patient demographic. This study reports clinical and radiological outcomes of a series of post-operative TPHF around a stemless metaphyseal rTSA (SLMrTSA) managed conservatively.

Methods: A retrospective analysis of a prospectively collated database of patients treated with SLMrTSA was performed. Demographics, radiographs, complications, and revision surgery data were analysed. Range of motion, subjective shoulder value (SSV), pain score and Constant Score (CS) were recorded preoperatively, routinely preinjury, and at final follow-up.

Results: 16 patients (12 female) were found to have sustained a post-operative TPHF out of 891 patients (1.8%) treated with SLMrTSA. Mean age was 77 years (range 57-88). Mean follow-up was 44 months (range 6-100). Indications for rTSA included cuff arthropathy (9), primary osteoarthritis (2) and rheumatoid arthritis (5). In 2 cases the SLMrTSA was implanted as a revision implant (1 from resurfacing and 1 from stemmed TSA). 13 patients were treated conservatively, and 3 patients were revised due to degree of fracture displacement. In all 13 patients treated conservatively, the fractures healed. No lucencies, loosening, subsidence, or bone resorption was radiographically evident. CS improved from 17.9 preop to 47.4 in last follow up (adjusted CS 25.8 to 71.1); SSV improved from 1.5 to 7.5/10; pain decreased from 11/15 to 2.9/15; elevation improved from 66.3□ to 104.4□.

Conclusion: Successful conservative treatment was possible in most cases of TPHF performed with SLMrTSA, with healing of the fracture and restoration of shoulder function, comparable to the preinjury levels, avoiding the need for further surgery in this elderly patient group.

Mid-term results of stemless anatomical shoulder arthroplasty (ATSA) with reverse articular bearing surface (full metal glenoid and non-spherical PE humeral head).

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Purpose: Clinical results of stemless ATSA with both, non-spherical design and full metal glenoid resurfacing in osteoarthritis with intact rotator cuff and eccentric glenoid deformity <30°.

Methods: From 2019-2022 we operated on 102 shoulders of 98 patients after 3D pre-OP planning and followed our first 20 cases prospectively till 12/2022 with a mean FU of 2.7 years (3.1-4.7 years) to evaluate the clinical and radiological results of this new type of implant. The mean age was 65 years (53-81). Retroversion and superior inclination were corrected by reaming and autologous bone graft. The clinical FU included the DASH and Constant score, the radiological FU X-rays in 3 planes.

Results: We found an improvement of CS score from 24.6 to 66.2 P, DASH score from 66 to 26. Active elevation improved from 110° to 161° and VAS score from pre-OP 7,3 to 1.2. There were no signs of aseptic loosening nor PE wear. Healing of the bone grafts occurred in all cases. In the total series of 102 cases, in which we extended our indication up to 30° of retroversion we had no aseptic loosening but 3 revisions (2.9%): One 2-stage exchange for LG-infection and two successful partial conversions to RSA (1 LG infection and 1 subscap insufficiency). To our knowledge it is the first clinical study presenting mid-term clinical results of reverse bearings in anatomical shoulder arthroplasty

Conclusion: The new design fulfilled in the mid-term all our expectations. No specific complications of the new design were observed.

In-vitro glenoid wear in hemiarthroplasty: metal versus ceramic as implant materials

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This study aimed to compare the in-vitro wear of natural concave glenoids against metal and ceramic counterfaces using a shoulder wear simulator. 17 fresh-frozen human cadaveric shoulders (MedCure) were assigned to the Al2O3 ceramic group (4 males, 4 females, age 58.3 ± 3.7 years) and the CoCr metal group (4 males, 5 females, age 61.7 ± 3.4 years). The resected glenoid and the size-matched humeral head implant (Mathys) were set up in a dedicated shoulder wear simulator to simulate 'washing the opposite axilla', a low-load daily activity, by replicating the relevant joint motion and loading profiles. The joint was kept lubricated in diluted calf serum. Each wear test was performed for a total of 500,000 cycles at 1.2Hz. At intervals of 125,000 cycles, micro-computed tomography scans of each glenoid were taken to characterise and quantify glenoid wear by calculating the change in cartilage thickness. At the completion of the wear test, total cartilage thickness had significantly decreased in both the ceramic and metal groups by 27% ($p = 0.019$) and 29% ($p = 0.0075$), respectively. However, differences between the two groups were not significant ($p > 0.05$), and the wear patterns across the specimens were unpredictable. Female shoulders exhibited 20% more cartilage wear than male shoulders ($p > 0.05$), yet no significant correlation was found between cartilage wear and various factors, including age, head size, joint mismatch, native cartilage thickness, or surface roughness (all $p > 0.05$). Overall, this study did not find evidence that the use of ceramic in shoulder hemiarthroplasty with healthy cartilage is a better alternative to conventional metal humeral heads. However, the observed outcome may be a consequence of both the limited sample size used in this study and potentially many other compounding factors.

Preoperative Risk Factors For Pain After Reverse Total Shoulder Arthroplasty: A Systematic Review

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Purpose: To identify preoperative risk factors for pain following reverse total shoulder arthroplasty (rTSA) so as to encourage evidence-based interventions, inform clinicians and aid in surgical planning.

Methods: Retrospective cohort studies that reported preoperative risk factors and pain after rTSA were included. Studies which reported outcome measures that incorporated pain scores yet did not display them independently, studies reporting intraoperative risk factors, and those involving participants under 18 were excluded. The search was conducted on 31 May 2023 across the following databases: PubMed, Web of Science, Embase, Scopus and Cochrane Central Register of Controlled Trials. Four independent researchers conducted this literature review and a descriptive analysis was subsequently performed.

Results: Twenty-six studies were included following evaluation of full-text articles, involving a total of 9,470 shoulders. Preoperative risk factors identified were categorised into the following groups: BMI, smoking, radiographic findings, age and sex, prior surgery, functional ability and pain, and psychosocial. The strongest associations identified were preoperative opioid use and smoking, which were both associated with worse pain outcomes following rTSA; other preoperative risk factors highlighted in this review showed either weak or no correlation.

Conclusion: Preoperative opioid use and smoking are likely risk factors for the development of pain after rTSA. Although the studies included varying levels of quality, the identification of modifiable risk factors is useful in optimising management prior to surgery and guiding patient expectations. The lack of evidence regarding associations with non-modifiable risk factors further reinforces the potential benefits of the procedure on diverse population groups and is useful in itself for assessing candidacy of patients for the procedure, particularly when postoperative pain is a factor being considered.

Machine Learning Algorithms for Prediction of Hospital Outcomes of Shoulder Arthroplasty: A Systematic Review

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In this systematic review, we aimed to assess the utility of machine learning (ML) models in predicting the clinical outcomes after shoulder arthroplasty.

Methods: We searched PubMed, Scopus, Embase, and Cochrane databases of the diagnostic accuracy studies assessing the predictive value of ML models in patients undergoing shoulder arthroplasty from January 2010 to May 2022. The diagnostic accuracy measures were extracted in the form of the area under the curve.

Results: The present systematic review retrieved four studies assessing patients who underwent either anatomic total shoulder arthroplasty (n = 4895 patients) or reverse total shoulder arthroplasty (n = 10618 patients). All included studies used extreme gradient boosting (XGBoost) and linear regression to develop the ML models. Besides, the Wide and Deep technique was used in one study. The included studies utilised a full range of baseline variables to build the predictive models. In addition, two studies developed abstracted models by omitting preoperative functional scores and morphological features. The following outcomes were assessed: American Shoulder and Elbow Surgeons, pain scores, internal rotation score, and postoperative complications. The full XGBoost models showed high accuracy in predicting ASES (77-94%), Internal rotation score (85-90%), and postoperative complications (68.1%), and patient-reported outcome measures.

Conclusions: ML models accurately predicted functional outcomes 2-3 years after shoulder arthroplasty. Both full and abstracted models achieved high accuracy in the prediction of global functional scores, pain scores, and rotation. Nonetheless, the current literature also suggests full ML models have higher accuracy than abstracted models in predicting clinical outcomes. Such findings highlight that implementing ML models in clinical evaluation and preoperative decision-making can help stratify the risk of patients with poor outcomes after shoulder arthroplasty.

Antibiotic-loaded dissolvable calcium sulfate beads with uncemented TSA for single-stage revision of infected shoulder arthroplasty

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Purpose: Assessing clinical and radiographic outcomes for patients undergoing single stage revision total shoulder arthroplasty (TSA) for infection, with uncemented implants and antibiotic-loaded calcium sulfate dissolvable biodegradable (ALCSDB) beads.

Methods: Patients were identified from a single centre from 2010-2017. Single stage technique included removal of the infected implants, meticulous debridement and washout, insertion of the ALCSDB beads into bony and soft tissue cavities, and implantation of the revision (uncemented) implants. Demographics, radiographs, and intraoperative cultures were prospectively collected. Constant Score, Subjective Shoulder Value, and range of motion were recorded. Radiographic analysis was performed at each follow up appointment.

Results: 27 patients underwent revision TSA for suspected infection using ALCSDB beads. 26 patients underwent single-stage revision, all to reverse TSA, with 1 patient excluded (had debridement, antibiotics, and implant retention (DAIR) following acute infection, and subsequent 2-stage revision using ALCSDB beads). Mean age was 66.5 years. Primary procedures included anatomic TSA, resurfacing, plating, and resection arthroplasty. Perioperative cultured pathogens included Cutibacterium acnes, Staphylococcus aureus, and Streptococcus oralis. Several cultures of clinically low-grade infection failed to grow an organism.

1 patient of the 26 (3.8%) had a subsequent infection, and was managed with a DAIR, then 2-stage revision. At 12 month follow up, infection was biochemically and clinically eradicated, and a good range of motion restored in all patients.

Radiographs demonstrated resorption of the beads within 6 weeks post-operatively. No lucencies were observed around the implants, and there was no evidence of loosening, subsidence, nor stress shielding. Beads in bone-deficient areas were substituted by bone formation.

Conclusion: The use of ALCSDB beads is an effective and practical option for single-stage revision with cementless implants for infected TSA, with excellent outcomes and timely recovery.

Outcomes following revision of a failed primary reverse shoulder replacement: A systematic review & meta-analysis

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Aims: Reverse shoulder arthroplasty (RSA) has become the most common type of shoulder replacement used in the United Kingdom, and a better understanding of outcomes after revision of a failed implant is essential. The aim of this study is to systematically review the current evidence base to determine PROMS, re-revision and complication rates for patients undergoing a revision of an RSA.

Methods: MEDLINE, EMBASE, CENTRAL and the Cochrane Database of Systematic Reviews were searched. Studies in adult patients receiving a revision of a primary RSA for any indication were included. Patients were excluded if they had an RSA for failure of a Total shoulder arthroplasty or Hemiarthroplasty. Pre and post-operative shoulder scores were synthesized in a random effects meta-analysis to determine mean difference. Incidence of re-revision and complications were calculated.

Results: The search elicited 3165 results and following removal of duplicates and screening; 12 studies were identified with a total of 1027 shoulders. In all studies there was an increase in shoulder scores pre to post-operatively. Following revision of an RSA to a further RSA there was a significant increase in American Shoulder and Elbow Score (mean difference 20.78(95% CI 8.16, 33.40) p=0.001). Studies reported a re-revision rate at final follow up of 9-32% (range) and a 1 year re-revision rate of 14% and 5-year re-revision rate of 23%. There was a complication rate of 18.5-36% (range) across the studies with an overall incidence of 29%.

Conclusion: This is the largest systematic review of the outcomes following a revision of an RSA. There is improvement in functional outcomes after revision surgery, but complications rates are high and warrant consideration when planning on undertaking a revision procedure.

Standard vs Short Stem Total Shoulder Arthroplasty: Does it make a difference to radiographic findings and revision?

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Background: Short humeral stems are increasingly being used in total shoulder arthroplasty (TSA) in clinical practice. To date, other than reduced blood loss intra-operatively, the theoretical advantages of short stem arthroplasty have not been definitively established in clinical cohorts. This study therefore aimed to assess in 1) overall revision rate and 2) radiolucent line (RLL) development on plain radiographs , between both stem types in a large clinical cohort.

Methods: A multicentre retrospective study of prospectively collected data with a minimum follow-up of 2 years (range 2-6 years) was undertaken for a single implant system and parameters compared between standard length (SL) and short (SS) humeral stems. Multivariate logistic regression models were employed to evaluate the difference between SS and SL with regards to revision rate and presence of radiolucent lines, adjusting for age, sex, height, weight and TSA type (reverse; anatomic).

Results: A total of 1740 SL stem and 1413 SS stem procedures were included. No difference in revision rates were observed, with rates of 1.49% (n=21) SS and 1.15% (n=20) SL respectively (OR 1.02 (95% CI 0.0.54 – 1.93), p=0.943using a random-effects model adjusted for age, sex, height, weight and TSA type). There were significant differences in RLL rate between stem cohorts, 6.8% SL and 3.2% SS stems (p=0.001) and stem type was found to be a significant predictor of RLL when adjusting for age, sex, height, weight and TSA type (OR 2.01 (95% CI 1.33 – 3.01), random-effects model).

Conclusions: Our findings demonstrate that development of radiolucent lines is twice as likely in standard length stems compared to short humeral stems, however revision rate in these groups does not appear to be affected. Future work should analyse distribution of zones affected in the respective stem type cohorts.

Functional outcome of mini-open Outerbridge Kashiwagi (OK) procedure in patients with Elbow osteoarthritis.

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Purpose: The objective of this retrospective study was to examine pain and functional outcomes resulting from mini-open surgical debridement of Elbow Osteoarthritis using OK procedure.

Methods & Results: This study comprised thirty-two consecutive patients who underwent OK procedure for their elbows between September 2013 and April 2022. Thirty individuals underwent primary OK procedures, while two underwent revisions following prior open debridement performed elsewhere. Referrals were made by GPs following failure of conservative treatments. Gender distribution consisted of 30 males and 2 females, with ages ranging from 27-80 years. Evaluation criteria comprised: pre- and post-operative assessments of flexion and extension range, Visual Analog Pain Score (VAS), Oxford Elbow Score, identification of intra and post-operative complications. All patients underwent preoperative X-ray assessments, and each had at least one post-operative follow-up at 3 months or until achieving satisfactory discharge.

We observed a mean improvement in flexion of 16.1° (range 0°-40°), contrasting with literature findings averaging 19.2° (range 11°-29°). Our results showed a modest 3° reduction compared to published meta-analysis. Notably, our patients who underwent removal of loose bodies experienced a more favourable outcome, with an average flexion increase of 19.4°. The average age of our patients, at 61.4 years, exceeded that reported in meta-analysis (49.9 years). Furthermore, our extension range surpassed published results, registering an average 11.1° compared to 10.2°, respectively. Oxford elbow score improved an average 14.6 points. Our study demonstrated a higher pain improvement with a VAS of 4.3, compared to 3.6 previously reported.

Conclusion: OK Procedure is proven to be an effective approach for alleviating pain and improving range of motion. Our study revealed a substantial improvement in flexion range, especially when addressing the removal of loose bodies. Our study highlights the importance of early referral, facilitated by GP education, to ensure that patients receive timely and suitable treatment.

AO Type-C Distal Humeral Fractures in the Over Fifties – To Fix or Replace?

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Background: Distal humeral fractures make up 2% of all fractures. Restoring the articular surface of complex intra-articular fractures in elderly patients with poor bone quality can be particularly challenging. Surgical treatment options include open reduction internal fixation (ORIF), total elbow replacement (TER) and distal humerus hemiarthroplasty (DHH).

Aims: To compare outcomes between ORIF, TER and DHH for AOC fractures of the distal humerus in patients aged 50 years or older.

Methods: We performed a retrospective analysis of acute AOC distal humerus fractures in patients aged 50 years or older treated surgically in our Major Trauma Centre between 2016 and 2022. The following outcomes were measured: complication rate, re-operation rate, Oxford Elbow Score (OES), Mayo Elbow Performance Score (MEPS) and range of movement (ROM). Chi-squared, Kruskal-Wallis and ANOVA statistical analysis were used.

Results: Sixty-five patients met the inclusion criteria (20 males, 45 females). Mean age was 64.4, 77.1 and 61.3 years old for ORIF, TER and DHH respectively. There were higher rates of complications and re-operations in the ORIF group compared to the TER and DHH groups (complication rate: ORIF 54.6%, TER 11.5%, DHH 23.5%, p=0.02; re-operation rate: ORIF 31.8%, TER 3.9%, DHH 11.8%, p=0.03). There was no statistically significant difference in OES or MEPS between groups (OES: ORIF 37.6, TER 41.4, DHH 42.1, p=0.56; MEPS 84.4, TER 86.3, DHH 88.2, p=0.78). Mean flexion/extension arc was lower in the fixation group, but this was not statistically significant (ORIF 95.0, TER 105.3, DHH 100.7, p=0.38).

Conclusion: TER offers a reliable option with predictable results in the older, lower demand patient. In the younger patient, DHH may have lower rates of complications and re-operations compared to ORIF, but function remains similar. Further work is required to ascertain the long-term outcomes. A prospective randomised control trial would reduce selection bias seen in this study.

Virtual fracture clinics: be vigilant for the ligamentous elbow injury

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Virtual fracture clinics (VFC) have been introduced across the United Kingdom seeking to streamline orthopaedic care through remote review of emergency department presentations. This study outlines injury mechanisms, examination findings and subtle radiographic abnormalities which orthopaedic surgeons must be vigilant for to avoid missing significant underlying ligamentous elbow injury.

We present a case of a 15-year-old showjumper referred to VFC with an undisplaced radial neck fracture after falling from a horse. At VFC, the patient was discharged with a broad-arm sling and advised to mobilise as tolerated. At 4-weeks post injury, the patient re-presented due to ongoing pain and limited range of movement. Repeat radiographs demonstrated anterior dislocation of the radial head. At 6-weeks post injury, surgery was performed via a Boyd approach. The annular ligament and lateral ulna collateral ligament (LUCL) were ruptured and repaired via transosseous drill-holes through the ulna. This was augmented with an internal brace construct using Fibertape suture. At 8-months, the patient had resumed full activities (including showjumping) with no pain or limitation in range of movement.

Using video footage of the initial injury, we present an overview of history, examination and subtle radiographic findings which should raise suspicion for ligamentous elbow injury in VFC and mandate face-to-face clinical assessment.

In conclusion, VFCs are here to stay having improved orthopaedic efficiency and provided clear cost-saving benefits. However there remains a paucity of education addressing the provision of remote review of elbow trauma. By highlighting the subtle signs of underlying ligamentous injury, we aim to provide clinicians with the skillset to reduce risk of missed elbow injury in VFC.

Long-term Outcomes of Grammont Style Reverse Shoulder Arthroplasty at a Minimum of 10-year Follow-up: a Clinical and Radiographic Study

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Purpose: This clinical study aimed to establish the survival, clinical and radiographical outcomes at a minimum 10-year follow-up for a Grammont-style reverse shoulder prosthesis.

Methods: A single centre, retrospective case series of 86 patients, who underwent 101 primary RSAs between 1999 and 2012 was conducted. The primary outcome measure was all-cause revision, while secondary outcomes included the Oxford Shoulder Score (OSS) in surviving patients contacted in January 2023. OSS scores over time and radiological outcomes on the latest radiographs were also assessed.

Results: Patients were a mean age of 76 years (SD ± 7.29) at the time of surgery and survived a mean of 8 years (95% CI 7.21 to 8.79, range: 0-19 years) following surgery. The 15-year implant survival was 93.2% (95% CI 87.8–98.6). The mean OSS was 33 (range 17-48, 95% CI 29.1-36.9) with a minimum of 10-year follow-up (n=21). Among the available radiographs, scapular notching was observed in 79% of implants over 10 years old, but no radiolucency was seen in humeral implants.

Conclusion: Rates of RSA survivorship are high at 15 years and most patients died with their primary implant in-situ. However, functional outcome scores were less predictable over time. High rates of scapular notching were noted, but low rates of glenoid loosening and no cases of humeral loosening. These findings allow realistic data to be used for the consent of patients considering a RSA and provides reassurance on the longevity of this implant.

A Life of Stress: Long-term Risk of Scapular Fracture Following Reverse Shoulder Arthroplasty

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Purpose: This study aimed to identify at long term follow-up, the impact of age, timing, and incidence of acromial and scapular stress fractures (ASF/SSF) following reverse shoulder arthroplasty (RSA).

Methods: A retrospective consecutive case series was conducted of all primary RSA performed between 1999-2018 at a single centre, with a minimum follow-up of four years. Notes and radiographs were reviewed to identify symptomatic radiologically confirmed scapular fractures. Associated demographics, presence of risk factors and timings were collected.

Results: 339 RSAs were performed in 308 patients. 15 cases of ASF/SSF were identified (4.4%). Mean age at time of surgery was 76 ± 7.1 years. 90 RSAs were in men (27%) and 249 in women (73%). 12 cases were located on the acromion, 3 at the scapular spine. Mean time to fracture was 29 months (range 2-127). 53% of fractures occurred within 1 year of surgery (n=8) and 47% (n=7) occurred within 4 months. Increasing age did not increase likelihood of fracture (OR 1.016, 95% CI -0.06, 0.09).

Conclusion: The majority of ASF/SSF occur within the first year, with a peak at 4 months postoperatively. A high index of suspicion should be maintained during this time. The overall incidence is around 4%, regardless of age, and persists throughout the implants' lifetime. This information can be utilised by clinicians to help inform patients during the consenting process of this difficult complication, prior to surgery.

Patient and healthcare professional perspectives on which potential prognostic factors for failure of total elbow replacement should be investigated

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Purposes of the study: This study presents the views of patients and healthcare professionals on which potential prognostic factors for total elbow replacement failure should be investigated.

Methods: This study comprised two focus groups and a survey. Focus group 1 consisted of five patients (from a patient research advisory group) and helped develop a survey assessing the importance of potential prognostic factors to investigate. The survey was shared electronically with BESS members and clinicians internationally. In Focus group 2, 15 patient participants listed factors they recommend investigating, and 12 completed the survey.

Results: The potential factors listed in the survey were based on results from Focus group 1 and published literature. They were grouped into patient, implant, surgical factors, and surgeon/hospital factors. Patient factors included age, ASA, co-morbidities, ethnicity ,frailty, hand dominance, surgery indication, occupation, sex, socioeconomic status, and weight/BMI. Implant factors included design, model/generation, fixation type, and implant stem length. Surgical and surgeons/hospital factors included approach, technique, VTE prophylaxis, antibiotics use, surgeon's volume, hospital's volume, and primary surgeon grade.

Patients and healthcare professionals agreed that most factors in the survey should be investigated. More of the healthcare professionals disagreed that ethnicity (49% v 33%) and VTE prophylaxis (42% v none) are important to be investigated, whilst more of the patients disagreed that socioeconomic status is important to be investigated (54% v 17%). Patients suggested other factors not listed in the survey with pre-operative pain level being the most suggested factor. Healthcare professionals also suggested other factors including bone health, previous elbow surgery, intra-operative factors, and implant positioning.

Discussion: Although patients and healthcare professionals agreed on the importance of investigating most prognostic factors, some factors were favoured by only one group. The results of this study could help researchers decide which prognostic factors to investigate and which to routinely collect.

Custom 3D Printed Glenoid Guides Allow for Precise Guidewire Placement in Deformed Glenoid Faces: A Cadaveric Study

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Introduction: Correct implant placement in shoulder arthroplasty is important to provide optimal function and to reduce the risk of component failure. The initial guidewire placement during glenoid preparation is crucial as it determines the final position of the glenoid implant. However, it is challenging to achieve optimal placement in patients with heavily deformed glenoid faces as the usual glenoid reference surface cannot be relied upon.

To circumvent this, 3D printed custom guides can be utilised to allow for wire placement as per preoperative planning on CT scans. However, this technology relies on a normal glenoid face to determine the optimal glenoid axis and currently no method exists for defining this in deformed glenoid faces. Additionally, the current guides may not have enough stability during usage due to their design and thus affect the precision of wire placement.

Purpose: To assess the precision of guidewire placement using custom 3D printed glenoid guides in deformed cadaveric glenoid specimens.

Methods: 9 cadaveric specimens were prepared with unique glenoid face deformities. Custom 3D glenoid guides were then created based on “preoperative” CT scans. The specimens then underwent guidewire insertion using the guides. “Postoperative” CT scans were obtained from which four measurements were taken. The measurements were deviation angle between optimal and wire axes in the coronal and transverse planes and horizontal and vertical deviation from the optimal axis in millimetres.

Results: Deviation angles in the transverse and coronal planes were 2.3±1.6° and 2.2±1.7° respectively. Horizontal deviation was 1.4±1.2mm. Vertical deviation was 1.1±0.6mm.

Conclusion: Our cadaveric data demonstrates high precision in these custom 3D printed glenoid guides for initial guidewire placement. Clinical studies are required to determine the efficacy of this type of guide in shoulder arthroplasty. Further studies are also required to define the optimal glenoid axis in deformed glenoid faces.

Long term evaluation of patients who have sustained a grade 3 acromioclavicular joint dislocation, treated without an operation

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Study purpose: In this study we demonstrate the long-term functional outcomes in patients who have a grade 3 (Rockwood classification) acromioclavicular joint (ACJ) injury treated without an operation.

Background: ACJ dislocations are common injuries affecting 10% of shoulders in young and active patients. Low-grade (1&2) injuries are commonly treated conservatively and high-grade (4,5&6) operatively. There is consensus regarding the management of grade 3 injuries, based on the Rockwood classification.

Methods: We performed a retrospective review of all patients attending the accident and emergency department of a large teaching hospital with an ACJ dislocation between 2008 to 2013. Radiograph assessment demonstrated 143 eligible patients who sustained a grade 3 injury.

Patients were contacted by both postal and electronic survey to assess current function relating to the Oxford Shoulder Score (OSS), VAS pain score, EQ-5D-5L quality of life assessment and Leicestershire arthroplasty tool range of movement (ROM) assessment.

Results: 73 patients responded to our survey and were included in the study. The mean follow up was 11.7 years (8.9 to 14.8 years).

PROMs demonstrated median OSS of 45 (IQ range 39-48) and median VAS score was 1 (IQ range 0-2). Assessing current shoulder ROM, median shoulder flexion was 180 degrees (IQ range 150-180 degrees), median abduction was 180 degrees (IQ range 180-180 degrees) and median external rotation was 80 degrees (IQ range 80 -80 degrees). 93% of respondents achieved internal rotation from the mid to upper back. Median shoulder flexion and abduction with a 2kg weight was 90 degrees (IQ range 90-90 degrees).

Assessing quality of life of respondents; 88% demonstrated no issues with mobility, 89% demonstrated no issues with self-care, 70% demonstrated no issues with usual activities and 87% demonstrated no pain.

Conclusions: Non-operative treatment can be considered a good long-term management option in patients with grade 3 ACJ dislocation.

Early outcomes of arthroscopic bone block shoulder stabilisation with femoral neck allograft and cerclage suture fixation for subcritical bone loss

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Purpose: This study investigates the patient- reported, clinical and radiologic outcomes of patients with subcritical bone loss after recurrent anterior shoulder instability, managed with an arthroscopic femoral neck allograft all suture bone block procedure.

Methods: The number of dislocations, previous stabilisation procedures and medical comorbidities were documented. A comprehensive analysis was performed, assessing the patient reported clinical outcomes as well as radiologic examinations for graft position, union, resorption and degenerative changes.

Results: A total of 7 patients (4 males, 3 females) with a mean bone loss 16.8% underwent surgery with a mean age of 27.14 ± 6.64 years and a mean time of follow-up of 37.2 ± 33.35 weeks. All patients sustained recurrent dislocations, 3 due to epilepsy and 4 due to complex instability requiring reduction at A&E. A previous stabilization operation was documented in 2 patients. 6 remained stable at short term follow up (min 6 months) with good functional outcomes (EQ5D-5L, OSIS, MSK-HQ, WOSI, range of motion), with improved satisfaction and reduced pain (Visual Analog Scale). One patient suffered traumatic re-dislocation playing rugby at 5.5 months postoperatively, leading to revision with open Latarjet stabilisation. No other complications were reported. Post-operative CT scans showed signs of mild (<50%) bone block resorption but this did not appear to impact clinical outcome.

Conclusions: Short term outcomes reveal that femoral neck allograft is a viable graft solution in patients with subcritical bone loss and avoids the need to violate the pelvis for autograft. In high failure risk cases including epilepsy this suture cerclage technique negates the need for metal screw fixation near the glenoid. Longer follow ups is needed to examine ultimate graft resorption and the implication in clinical stability.

Functional Outcome After Nonoperative Management of Minimally-Displaced Greater Tuberosity Fractures And Predictors Of Poorer Patient Experience

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Purpose: To prospectively evaluate the functional outcome of patients following non-operative management of minimally-displaced greater tuberosity fractures, and identify factors associated with a poor patient experience

Methods: One-hundred-and-one patients with minimally-displaced GT fractures were recruited to a prospective observational cohort study. During the first year after injury, patients underwent experiential assessment using the Disabilities of the Arm, Shoulder and Hand (DASH) score and assessment of associated injuries using Magnetic Resonance Imaging (MRI) performed within two-weeks of injury. The primary outcome was the one-year DASH score. Multivariate analysis (MVA) was used to assess the effect of patient demographic factors, complications, and associated injuries, on outcome.

Results: The mean age of the cohort was 50.9 (range 19-76) years, and 53 were female. The mean DASH score improved from 42.3 (SD 9.6) at 6-weeks post-injury, to 19.5 (14.3) at one-year follow-up ($p<0.001$), but outcomes were mixed, with 30 patients having a DASH score >30 at one-year. MRI revealed a range of associated injuries, with a full-thickness rotator cuff (RC) tear present in 19 patients (18.8%). Eleven patients (11%) developed complications requiring further operative intervention. Twenty patients (21%) developed post-traumatic secondary shoulder stiffness (PTSS). On MVA, a high-energy mechanism ($p=0.009$), tobacco consumption ($p=0.033$), use of mobility aids ($p=0.047$), a full-thickness RC tear ($p=0.002$), and the development of PTSS ($p=0.035$) were independent predictors of poorer outcome.

Conclusion: The results of non-operative management of minimally-displaced GT fractures are heterogeneous. Whilst many patients have satisfactory early outcomes, a substantial sub-group fare much worse. There is a high prevalence

of RC injuries, and PTSS, and their presence is associated with poorer patient experience. Furthermore, patients who have a high-energy injury, smoke, or use walking aids, have worse outcomes.

Management of Chronic Acromioclavicular Joint Dislocations with knotless coracoclavicular ligament reconstruction: Clinical and radiologic outcomes

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Purpose: The purpose of this study is to investigate the impact of the knotless low profile tightrope implant without graft reinforcement in the stabilization of chronic acromioclavicular joint dislocations (ACJD).

Methods: A case series of patients with chronic (>3 months) acromioclavicular instability were managed with minimal invasive open stabilization with a modified knotless tightrope device excluding a reinforcement with auto-/allograft. The patient reported, clinical and radiologic scores were monitored before and after the operation at 6 weeks, 3 months, 6 months and 1 year.

Results: A total of 22 patients (18 males, 4 females) with a mean age of 37.59 ± 13.24 years sustained a chronic ACJD were managed with a mean value 6.57± 2.02 months after initial injury. The mean follow up was 14.64 ± 8.62 weeks, with patient reported outcomes showing an improvement in EQ5D-5L, MSK-HQ and Oxford Shoulder Score assessment tools, with no significant differences with the uninjured shoulder. Further to postoperative improvement of the acromioclavicular distance (Zanca), no complication were noted. 1 patients stabilization radiologically failed after high energy trauma but no revision surgery was required.

Conclusions: The knotless low profile tightrope implant provides a solid stabilization of chronic acromioclavicular joint stabilization with minimal bone tunnel widening. Medium term follow up x-rays reveal slight loss of initial reduction for some cases but this does not appear to affect clinical outcome.

The Application of Large Language Models in Tennis Elbow Management: An Evaluation of ChatGPT Knowledge and Clinical Scenarios Triage

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Purpose: To explore the knowledge of large language models such as ChatGPT regarding tennis elbow and its potential as a tool in the evaluation and assessment of clinical scenarios, including recognition of red-flags as per the BESS Tennis Elbow Patient Care Pathway.

Methods: Four questions specifically regarding tennis elbow investigation, management options and their comparative efficacy were posed to ChatGPT, with the 'regenerate response' feature disabled. The model was specifically asked to provide five high-level evidence sources to justify their responses. Five clinical scenarios were also posed to the model, simulating a consultation with typical features and consultations presenting with red-flag features. Responses were subsequently analysed and evaluated by three upper limb specialists (consultant n=2, post-CCT upper limb fellow n=1).

Results: Information provided by the ChatGPT model was unanimously found to be comprehensive and scientifically accurate. The references stated to justify the information provided within the model's response were appropriate and accurate. However, it was noted that while the references provided accurate evidence, more up-to-date literature was not referenced. The model identified red-flag features in scenarios and sign-posted accordingly, however the ability of the model to understand complex clinical scenarios was limited in the opinion of expert reviewers.

Conclusions: Large language models such as ChatGPT are a source of scientifically accurate and comprehensive information regarding the management of tennis elbow. The model can justify the information it provides with accurate evidence, however the evidence upon which it draws conclusions is not the most up-to-date and therefore should be interpreted with caution, particularly in the clinical context where novel data may conflict with previous literature and understanding. The model's application in the clinical setting is not yet justified due to limitations in complex clinical scenarios and the further evaluation required to ensure the safety of its triage according to red-flag features.

A pilot study to investigate the normal shoulder microbiome

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Objective: Understanding the microbiome of the shoulder skin is an important step in defining what may be the cause of post-operative infections in patients undergoing shoulder surgery. This BESS funded pilot study aimed to provide the first description of the shoulder skin microbiome, and explore variations by age and gender

Methods: Patients undergoing routine arthroscopic surgery were approached for informed consent to have punch biopsies taken from their anterior, lateral and posterior arthroscopy portal sites. DNA was extracted from these samples and underwent Illumina sequencing, focusing on the V3-4 regions of the 16S rRNA gene. Amplicon sequence variants were generated using Deblur workflow and used for taxonomic assignment. The influence of age and gender on the variation in the microbiota community was analysed at the genus level using the Bray-Curtis dissimilarity index.

Result: 60 patients (23 female, 37 male) aged 18 to 69 were recruited, resulting in 180 punch biopsy samples for analysis. Following removal of low-prevalence taxa (those present in fewer than 50 sequences and accounting for less than 0.01% of the samples) 600 bacterial taxa were identified. The top 20 most abundant genera accounted for 73.5% of the overall sequence count. Acinetobacter was the most abundant genus, followed by Bacteroides, Corynebacterium and Finegoldia. There was a significant difference in the Bray-Curtis dissimilarity when compared by gender. Males displayed a greater proportion of gram positive and aerobic bacteria while females exhibited a greater proportion of gram negative and stress tolerant bacteria.

Conclusion: This pilot study has demonstrated feasibility in recruiting patients to provide skin biopsies at the time of surgery for investigations of the skin microbiome. It has further identified the most abundant genus present in the skin around the shoulder and highlighted differences between the microbiome based on gender.

Greater tuberosity fractures associated with an anterior glenohumeral dislocation: outcomes and predictors of displacement

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A fracture of the greater tuberosity complicates 15% of anterior glenohumeral dislocations. This study assessed rates and timing of tuberosity displacement after closed and aim to define patient outcomes in the mid term.

The study comprises two arms; a retrospective radiological analysis of anterior glenohumeral dislocations with an associated greater tuberosity fracture between 2008 and 2014, and a further prospective analysis between 2014 and 2018. Electronic records and radiographs were analysed at a minimum of two years after injury to assess rates of tuberosity displacement, nerve injury, adhesive capsulitis, interventions or any complications. Functional and quality of life assessments were collected at least two years after injury for the prospective cohort.

Results. Of the 337 patients, 124 (36%) had greater tuberosity displacement greater than 5mm after glenohumeral reduction. Of the 124, 74 (22%) patients had tuberosity displacement immediately after reduction (early displacement), while in 50 (15%) the displacement was apparent after two weeks (late displacement). Adhesive capsulitis was reported in 40 (11%) cases. Patient reported outcomes were dependent on tuberosity healing.

Conclusion: Over a third of greater tuberosity fractures associated with an acute anterior glenohumeral dislocation displace over time. Late displacement is common but will be evident on radiographic evaluation two weeks post injury. Good outcomes are expected when healing of the tuberosity occurs whether by conservative or operative treatment.

How long is the arm immobilised after a conservatively managed displaced proximal humerus fracture and does early mobilisation effect complication rates: A systematic review

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Purpose: Conservative management of Displaced Proximal Humerus Fractures (DPHF) involves a period of rest in a sling followed by physiotherapy. Benefits of mobilisation are well known, but some fear increased complications if removing slings and commencing exercises early. A systematic review was performed on evidence of how non-operative

DPHF are managed, to provide a narrative synthesis of how long immobilisation is used, types of slings, when and how exercises are introduced, and if complications may be associated with these components.

Method: The protocol for this review was registered on the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42023394139) and conducted and reported according to the PRISMA guidelines. A systematic search of the literature was undertaken. Two researchers screened relevant articles using Covidence software, a third reviewer consulted for consensus. Data was extracted and a narrative synthesis presented. Displaced fractures were defined using Neer's criteria (displacement of >1cm or angulation of >45 degrees).

Results: 39 studies were included (3059 studies screened, 159 full text review). This included a cohort of 2664 patients with a mean age of 70.9yrs. Time immobilised in sling ranged from 1-6 weeks. 12 different types of slings were reported, with variable levels of support. Passive and pendular exercises were introduced first, but only 2 studies allowed these to be commenced immediately. The majority delayed until 2-4 weeks. Full active exercises were most commonly commenced at 4-6 weeks. Complications were reported in 243 incidences (9.1%). No association between early mobilisation and complication rate was identifiable.

Discussion: There was vast variation in how long patients were immobilised for, types of slings used, when and how exercises were introduced and progressed. No relationship was found between complications and these components. Research to identify the most effective approach is required.