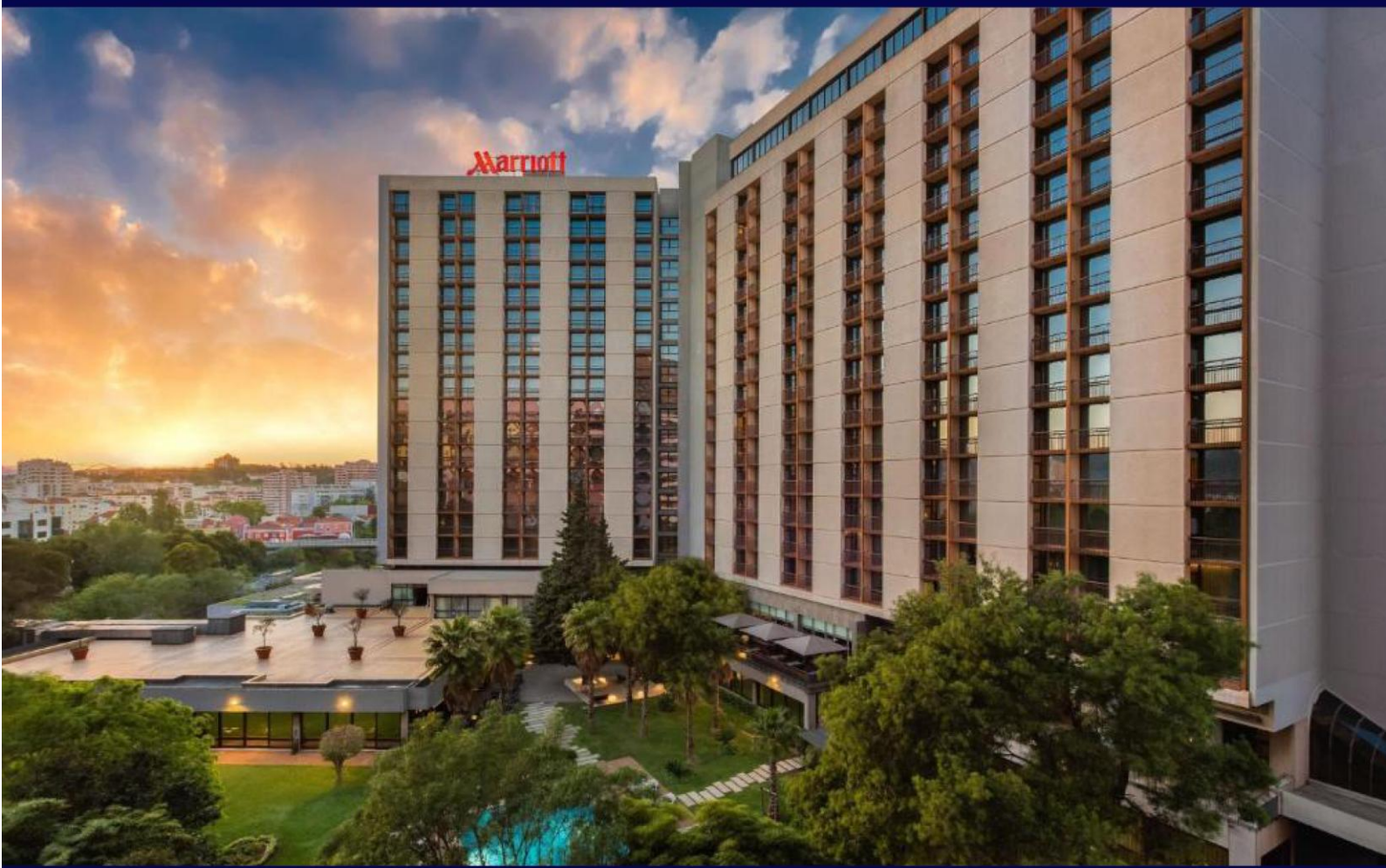




GLOBAL ELBOW NETWORK



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Abstract Book

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Thursday 5 November 2026 – Session 1B: Top Six Scientific Presentations

The Effect of Forearm Pronation on Radiocapitellar Joint Loading During Valgus Extension of the Elbow

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Introduction: Capitellar osteochondritis dissecans is commonly observed in young throwing athletes and is thought to result from repetitive mechanical overload of the radiocapitellar joint. During the throwing motion, the elbow rapidly extends while the forearm transitions into pronation. Although valgus and compressive stresses have been implicated in radiocapitellar overload, the direct effect of forearm pronation on radiocapitellar joint loading remains unclear.

Aim: To investigate the effect of forearm pronation force on radiocapitellar contact pressure, contact area, and center of force during simulated valgus elbow extension.

Methodology: Ten fresh-frozen cadaveric upper limbs were mounted in a custom gravity-valgus testing system. A thin-film pressure sensor was inserted into the radiocapitellar joint to measure contact pressure, contact area, and center of force. The biceps, brachialis, and triceps were loaded in a 1:1:2 ratio, and the elbow was passively extended from 90° to 0° under a constant valgus load. The pronator teres was loaded under three conditions: 0 N, 30 N, and 60 N. Data were recorded throughout elbow extension and analyzed using two-factor repeated-measures ANOVA with post hoc comparisons.

Results: Radiocapitellar contact pressure was significantly influenced by both elbow angle and pronation force. Contact pressure increased during elbow extension and peaked at 20° of elbow flexion under all pronation conditions. Higher pronation loads produced significantly greater mean contact pressure across the full range of motion: 336 ± 11 kPa at 60 N, 281 ± 9 kPa at 30 N, and 239 ± 8 kPa at 0 N. The highest pressure was observed at 20° of elbow flexion, reaching 375 ± 33 kPa under the 60 N condition. Contact area was also significantly increased by higher pronation force. Increasing pronation force shifted the center of force medially within the radiocapitellar joint, with a significant difference between the 60 N and 0 N conditions. The greatest center-of-force difference occurred at 50° of elbow flexion, with a 1.7-mm medial shift under 60 N compared with 0 N.

Conclusion: Forearm pronation significantly increases radiocapitellar contact pressure and contact area and shifts the center of force medially during simulated valgus elbow extension. These findings suggest that pronation may contribute to radiocapitellar overload during the acceleration phase of throwing. Excessive or repetitive pronation-related loading may be a biomechanical factor in the development of capitellar osteochondral lesions in throwing athletes.



Short- to medium-term outcomes of Mason type II and III radial head fractures. Analysis of a consecutive series of 244 patients treated surgically

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Introduction: The treatment of radial head fractures (RHF) varies according to fracture pattern, and includes fixation with free screws (SF), plates (PF), arthroplasty (RHA) or fragment removal (FR).

Aim: The main aim of this study was to report the short- to medium-term clinical outcomes of a large series of patients treated surgically by a single surgeon. Secondary objectives were to assess the impact of associated injuries on RHF treatment and outcomes, and to evaluate the clinical effectiveness of the Mason classification.

Methodology: A total of 338 consecutive patients who underwent surgery for RHF were identified. Of these, 244 cases were re-examined clinically and radiographically, including 48 isolated RHF and 196 RHF in the context of complex elbow instability (CEI). According to Mason's classification, 152 and 92 patients had type II and III fractures, respectively. For non-comminuted articular Mason II fractures, SF was performed. For reconstructible Mason II-neck and Mason III fractures, PF was performed. For unreconstructible Mason II-III fractures, RHA was performed. For unreconstructible marginal fractures (<25% of the head), FR was performed. A clinical and radiographic evaluation was performed. MEPS and rotational ROM were recorded alongside complications and reinterventions. A statistical analysis was performed.

Results: The mean follow-up was 55 months (range, 12-202). The mean age was 50.5 years (range, 14-87). Among Mason II fractures, 60, 36, 14, and 42 received SF, PF, FR, and RHA, respectively. Among Mason III fractures, 1, 20, and 71 cases were treated with SF, PF, and RHA, respectively. The mean final MEPS score was 97.7 (range, 55-100) with 240 excellent/good outcomes and 4 fair/poor cases; mean pronation and supination were 84.4° and 81.4°. No significant differences were found in outcomes between Mason fracture types, between isolated fractures or CEI, and between treatment types, except for a slightly lower rotational arc in Monteggia-like lesions. Radiographic results showed mild to moderate arthritis in 15.2% of cases, symptomatic heterotopic ossifications in 7.4%, and asymptomatic stress shielding in 79% of RHA cases. An 8.6% reintervention rate related to RHF was observed.

Conclusion: The surgical treatment of RHF yields satisfactory results in over 90% of cases with a low rate of complications and reinterventions, with no significant differences between Mason II and Mason III, between isolated RHF and CEI, or among the surgical techniques used. These results appear to be closely related to the surgeon's experience, as the Mason classification showed limited prognostic and therapeutic value.



A Cost Analysis of Continuous Passive Motion versus Physical Therapy After Arthroscopic Release of Elbow Contracture

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Introduction: The purpose of this study was to compare the direct and indirect costs of continuous passive motion (CPM) and physical therapy (PT) following arthroscopic release of elbow contracture.

Methods: A cost-analysis was conducted as part of a randomized controlled trial comparing CPM (n = 24) with PT (n = 27) in patients who underwent arthroscopic release of elbow contracture. The primary outcome of cost included the cost of index procedure, postoperative rehabilitation, and lost wages (indirect costs). Costs of the index procedure for the CPM group included a 3-day hospital stay, whereas for the PT group included only the date of surgery (same-day procedure). Lost wages were estimated for the first 6 postoperative weeks based on patient reported impairment of work activities using the Work Productivity and Activity Impairment (WPAI) Questionnaire. Weekly salaries for all patients were assumed to be the 2020 US median salary based on the US Bureau of Labor Statistics. Recognizing that work impairment after elbow contracture release would not be equal for all occupations, patients were stratified into manual laborers (n = 23, 9 CPM and 14 PT) and non-manual laborers (n = 28, 15 CPM and 13 PT).

Results: The CPM group had higher average direct costs than the PT group (\$14,688 vs \$9,834). The higher direct costs of CPM were mainly due to the room and board costs. When excluding all the in-hospital costs from the CPM group, the direct costs of CPM and PT were similar (\$10,664 vs \$9,834). Across the entire six-week period, the use of CPM resulted in lower impairment of work activities and indirect costs (lower wage loss) than PT (\$381 vs \$722); this difference was mainly driven by the manual laborers subgroup. Among manual laborers, those who received PT took longer to recover their wages and had nearly doubled the total wage loss than those who received CPM (\$1,160 vs \$590) over the first 6 postoperative weeks.

Conclusions: The use of CPM was associated with higher direct costs than PT, however, it resulted in lower impairment of work activities which translated to less lost wages and lower indirect costs among manual laborers. An outpatient CPM protocol should be considered as an actionable strategy for cost reduction given that room and board cost was the major driver of higher direct costs of CPM.



Comparable Outcomes of Early, CPM-Assisted, and Delayed Physiotherapy After Surgical Release for Posttraumatic Elbow Stiffness: A Multicenter Randomized Controlled Trial

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Introduction: Posttraumatic elbow stiffness can be challenging for physicians to treat due to its recurrent nature and its potential to severely limit elbow function. Non-surgical management includes physiotherapy and static-progressive or dynamic bracing. Open or arthroscopic arthrolysis is indicated when non-surgical treatment fails. Currently, the best evidence-based rehabilitation protocol is unknown and varies by surgeon, hospital, and country.

Aim: This study aimed to determine which of three often used rehabilitation protocols leads to superior one-year outcomes after surgical release for posttraumatic elbow stiffness.

Methodology: In this multicenter randomized controlled trial, patients with posttraumatic elbow stiffness unresponsive to ≥ 3 months of non-surgical treatment were randomized to early in-hospital physiotherapy (PT), in-hospital PT plus continuous passive motion therapy (CPM), or outpatient delayed PT starting 7–10 days postoperatively (DPT). The primary outcome was the improvement active flexion–extension arc at one year, analyzed with ANCOVA. Secondary outcomes included functional ROM (flexion $\geq 130^\circ$ and extension $\leq 30^\circ$), patient-reported outcome measures (PROMs). Longitudinal mixed-effects models assessed recovery trajectories. Subgroup analyses were performed by surgical procedure type (open or arthroscopic), soft-tissue or osteocapsular release, and for patients with longstanding stiffness (more than one year after trauma).

Results: All groups improved significantly in flexion–extension arc from baseline to one year (PT 37°, CPM 39°, DPT 30°; all $p < 0.001$), with no significant differences between groups. Significant overall improvements were also observed for PROMs, with no significant differences between groups. The proportion of patients achieving functional ROM at one year was comparable between groups. Subgroup analyses showed greater ROM with CPM in patients with longstanding stiffness, whereas no differences were observed in other subgroups.

Conclusion: No single postoperative rehabilitation strategy was superior in patients undergoing open or arthroscopic release for posttraumatic elbow stiffness. Outpatient supervised physiotherapy, starting 7–10 days after surgery is appropriate for all patients undergoing surgical release for stiff elbow.

There is limited evidence that in-hospital CPM for three days may provide small additional benefits for patients with longstanding stiffness.



Osteophyte Formation Following Distal Humeral Hemiarthroplasty: A retrospective cohort Study

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Introduction: Distal humeral hemiarthroplasty (DHH) is used for unreconstructable distal humeral fractures, preserving the native elbow articulation. Implant sizing is important for restoring joint congruency, and biomechanical evidence suggests that undersizing may adversely affect joint contact mechanics. Secondary osteophyte formation may occur following DHH, but its relationship with implant congruency and clinical outcome remains poorly understood.

Aim: The aim of this study was to evaluate the effect of implant positioning on the development of ulnar osteophyte formation and to assess impact on clinical outcomes.

Methodology: A retrospective cohort study was performed on consecutive patients undergoing DHH with available postoperative radiographic follow-up. Patients with pre-existing osteophytes were excluded. Standardised anteroposterior radiographs were analysed to assess implant sizing and postoperative osteophyte formation.

The difference between the width of the anatomical spool of the implant and the articular surface of the ulna was calculated as a proportion of native ulna articular length and termed medial articular undercoverage. Medial trochlear and radial head osteophyte formation were also recorded on sequential follow-up radiographs.

Interobserver reliability for radiographic measurements was assessed using intraclass correlation coefficients (ICC). Medial articular undercoverage was compared between patients with and without medial osteophytes using the Mann–Whitney U test. Associations between proportional medial articular undercoverage and medial osteophyte formation were evaluated using univariable logistic regression, with odds ratios reported per 5% increase in undercoverage. A sensitivity analysis adjusted for radiographic follow-up duration. Oxford Elbow Scores (OES) were compared between patients with and without medial osteophytes.

Results: Forty-three consecutive patients were included. Postoperative medial osteophytes developed in 29 patients (67%). Medial articular undercoverage was significantly greater in patients who developed postoperative medial osteophytes compared with those who did not ($p = 0.033$). Increasing medial articular undercoverage was associated with medial osteophyte formation (OR 1.95, 95% CI 1.08–4.03, $p = 0.044$). This association remained after adjustment for follow-up duration (OR 1.87, 95% CI 1.05–3.85, $p = 0.055$).

OES data were available for 29 patients, of whom 20 had medial osteophytes and 9 did not. Median OES was similar between patients with and without medial osteophytes (43.5 vs 43.0, $p = 0.523$). Linear regression demonstrated that medial osteophyte presence was associated with

a non-significant change in OES ($\beta = -1.57$, 95% CI -6.11 to 2.97, $p = 0.483$), and unchanged after adjustment for OES follow-up duration ($\beta = -1.57$, 95% CI -6.29 to 3.15, $p = 0.500$).

Conclusion: Greater medial articular undercoverage following DHH was associated with postoperative medial osteophyte formation. However, medial osteophyte formation was not associated with inferior OES.

These findings suggest that reduced coverage of the native ulnar articulation by the implant spool may alter joint contact mechanics and influence secondary bony remodelling, although these radiographic changes may not be clinically significant in the short term.



Effect of Virtual Reality on Anxiety in Children During Kirschner Wire Removal: A Randomized Controlled Trial

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Effect of Virtual Reality on Anxiety in Children During Kirschner Wire Removal: A Randomized Controlled Trial

Introduction: Fractures are common in children, with up to 42% of boys and 27% of girls sustaining at least one fracture before the age of 16. Some fractures require surgical fixation using Kirschner wires (K-wires), specifically elbow fractures, like the supracondylar humerus fractures.

These are typically removed in the outpatient plaster room without anaesthesia. Although minimally invasive, K-wire removal may provoke substantial procedural anxiety, negatively influencing patient cooperation, procedural experience, and overall satisfaction for both children and parents. Traditional approaches to anxiety reduction often have limited effectiveness in this setting. Virtual reality (VR) distraction techniques have emerged as promising non-pharmacological interventions during painful or anxiety-provoking paediatric procedures. Previous studies in paediatric orthopaedics demonstrated beneficial effects of VR during cast removal. However, evidence regarding VR use during K-wire removal remains limited.

Aim: To evaluate the effectiveness of VR goggles and headphones in reducing procedural anxiety in children undergoing outpatient K-wire removal.

Methodology: A single-centre randomised controlled trial was conducted at Amphia Hospital, the Netherlands. Children aged 5–17 years undergoing K-wire removal were randomised to either standard care with VR distraction or standard care alone. Randomisation was stratified by age group. Exclusion criteria included anxiety disorders, epilepsy, severe visual impairment, and inability to understand Dutch.

The primary outcome was post-procedural anxiety measured using the validated Children's Fear Scale (CFS). Secondary outcomes included anxiety reduction between pre- and post-

procedure measurements, pain scores using the Numeric Rating Scale (NRS), patient and parent satisfaction, and maximum heart rate during the procedure.

Children allocated to the intervention group used Oculus VR goggles and headphones showing age-appropriate immersive videos throughout the procedure. Statistical analyses included independent t-tests or Mann-Whitney U tests as appropriate. Subgroup analyses were performed based on age and sex. Statistical significance was set at $p < 0.05$ with Holm-Bonferroni correction for multiple comparisons.

Results: A total of 94 children, of which 92 upper extremity, were included (median age 10 years; 69.1% male), with 46 children assigned to the control group and 48 to the VR group. Baseline characteristics were comparable between groups.

Post-procedural anxiety was significantly lower in the VR group compared with the control group (median CFS 1.0 vs. 2.0; $p = 0.001$; $r = 0.354$). Furthermore, a substantially larger proportion of children in the VR group reported no anxiety following the procedure (37.5% vs. 6.5%). Anxiety reduction between pre- and post-procedure measurements was significantly greater in the VR group ($p = 0.001$; $r = 0.333$).

Conclusion: VR goggles and headphones significantly reduce procedural anxiety during paediatric K-wire removal, particularly in younger children. VR appears to be a simple, safe, and broadly applicable non-pharmacological intervention that may improve the outpatient experience in paediatric orthopaedic care.

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Friday 6 November 2026 – Scientific Papers: TRAUMA SESSION

Distal humerus, humerus, capitellum and radical head – Room A

Distal humerus fractures and salvage

Coronal Shear Fractures of the Distal Humerus – An Algorithmic Guide to Approach the Articular Surface

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Introduction: Surgical exposure for open reduction and stable fixation of complex coronal shear fractures remains challenging. Incorrect selection of patient positioning and surgical approach may compromise articular visualization, fracture reduction, and ultimately fixation. Yet, the instrumental accessibility offered by commonly used approaches remains poorly characterized. **Aim:** To establish a fracture-specific algorithm for articular exposure and instrumental accessibility of the distal humerus using common surgical approaches and their stepwise expansion.

Methodology: Eighteen fresh-frozen cadaveric elbows were assigned to lateral (n = 6), medial (n = 6), or posterior (n = 6) surgical approach groups. Each approach was progressively expanded in a stepwise manner. Instrumental accessibility, defined as perpendicular access to the articular surface, was marked after each expansion stage. Photogrammetry and three-dimensional modeling were used to quantify the accessible articular surface area.

Results: Radial-sided fractures without dorsal comminution (Dubberly IA) can be accessed through an extended lateral approach. For fractures extending into the trochlea (Dubberly IIA), further expansion can be achieved with a lateral epicondyle osteotomy. Multifragmentary fractures involving the capitellum and trochlea (Dubberly IIIA) can be addressed using a combination of extended lateral and extended medial approaches. In radial-sided fractures with dorsal comminution (Dubberly IB), a lateral extended approach with an anconeus-split/elevating (lateral column approach) allows joint reconstruction and plating. In more extensive fractures (Dubberly IIB and IIIB with dorsolateral comminution), an additional lateral epicondyle osteotomy can provide access to the trochlea. In multifragmentary fractures of the capitellum and trochlea (Dubberly IIIB) with involvement of the dorsomedial column, an extended medial elbow approach with medial epicondyle osteotomy provides access for instrumentation and plating. Fractures with bicolunar extension are addressed through a posterior approach in combination with an epicondylar osteotomy (often through pre-existing epicondylar fractures), allowing joint subluxation and fracture reconstruction. Circumferential

(360°) access to the distal humerus is possible by adding an olecranon osteotomy or bilateral epicondyle osteotomy/ligament release.

Conclusion: This fracture-specific algorithm based on articular accessibility may substantially facilitate preoperative planning and guide the stepwise expansion of surgical approaches required to achieve adequate exposure and successful treatment of distal humeral coronal shear fractures.



Coronal Shear Fractures of the Distal Humerus: Characteristics and Patient Outcomes Following Open Reduction Internal Fixation with Mean 5-Year Follow-up

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Introduction: Coronal shear fractures of the distal humerus (AO/OTA 13B3) are rare and heterogeneous injuries. Although open reduction and internal fixation (ORIF) remains the most common treatment, outcome data are limited.

Aim: This study reports a large series of coronal shear fractures treated with ORIF and evaluates clinical and radiographic outcomes.

Methodology: A retrospective review was performed of isolated coronal shear fractures treated with ORIF at a single institution between 2005 and 2025. Patients with other ipsilateral upper extremity fractures, periprosthetic fractures, or comminuted proximal ulna fracture-dislocations were excluded. Fractures were classified using the AO/OTA, Dubberly, and Jupiter Ring systems. Outcomes included fracture healing, post-traumatic arthritis, avascular necrosis (AVN), heterotopic ossification (HO), elbow range of motion, complications, and reoperations. Patient reported outcomes (PROs) collected included QuickDASH, Mayo Elbow Performance Score (MEPS), Single Assessment Numeric Evaluation (SANE) and overall elbow pain and satisfaction. Categorical outcomes were compared using Fisher exact tests and continuous variables using Wilcoxon rank-sum or Kruskal-Wallis tests, as appropriate.

Results: Thirty-five patients were included (mean age 56 years, range 26–79 years) with mean follow-up of 5 years. Healing was achieved in 89% of patients; four patients developed nonunion. Significantly higher nonunion/malunion rates were seen in patients with a posterior fracture component (Dubberley subtype B, $p=0.032$). On final radiographs, post-traumatic arthritis had developed in 60%, HO in 40%, and AVN was observed in 23%. Complications occurred in 71% of patients, including stiffness (43%), HO formation, moderate-severe arthritis (31%), and new ulnar neuropathy (29%). Seventeen patients (49%) underwent reoperation at a mean of 8 ± 5 months, most commonly for hardware removal or contracture release. Four patients (11%) required conversion to arthroplasty at a mean of 15 ± 3 months. Post-traumatic arthritis, AVN, and reoperations were associated with significantly worse MEPS and QuickDASH scores ($p<0.05$ for all). There was no difference in PROs between fracture classifications.

Conclusion: ORIF of coronal shear fractures displays high complication and reoperation rates. The development of AVN, post-traumatic arthritis, or reoperations following coronal shear fractures resulted in significantly worse PROs. The complexity of these injuries highlights the need for meticulous surgical planning and patient counseling.



Clinical Outcomes Following Open Reduction and Internal Fixation of Transcondylar Distal Humerus Fractures with Mean 8-Year Patient Reported Outcomes

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Introduction: Displaced, transcondylar fractures of the distal humerus (AO/OTA 13A2.2 and 13A2.3) are commonly managed with open reduction and internal fixation (ORIF); however, the ideal operative management and anticipated outcomes remain uncertain. Patient-reported outcomes (PROs) are infrequently described.

Aim: This study evaluates clinical and radiographic outcomes after acute ORIF of simple transcondylar distal humerus fractures.

Methodology: A retrospective review of adult patients with isolated transcondylar distal humerus fractures treated acutely with ORIF at a single institution between 2005 and 2025 was performed, with a minimum follow-up of 3 months. Fifty-six patients met inclusion criteria (68% female; mean age, 70 ± 13 years). Outcomes included radiographic healing, posttraumatic arthritis, heterotopic ossification (HO), and postoperative complications and reoperations. PROs were collected prospectively and included the Single Assessment Numeric Evaluation (SANE), Numeric Pain Rating Scale (NPRS), patient elbow satisfaction, Mayo Elbow Performance Score (MEPS), and Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) score. At the time of PROs collection, 50% of the cohort had passed away. Of the remaining patients, PROs were collected from 82% (n=23) at mean 8 years postoperatively (range 1–19 years). Categorical variables were compared using Fisher's exact test, and continuous variables were analyzed using Wilcoxon rank-sum and Kruskal-Wallis tests.

Results: At final follow-up, radiographic healing was seen in 95% of fractures (n=53), while 3 patients developed nonunion. Nonunion was associated with the requirement for bone grafting at the time of ORIF (p=0.019). The overall complication rate was 50%, most commonly HO formation (21%), new ulnar nerve symptoms (18%), elbow stiffness (16%), and posttraumatic arthritis (14%). Thirteen patients (23%) underwent reoperation at a mean of 9 months postoperatively (range 9–44 months). The most common indications for reoperation were infection and ulnar neuropathy. Two elbows progressed to arthroplasty due to nonunion and severe arthritis. Mean PROs included a MEPS of 88 ± 15, QuickDASH of 17 ± 18, pain score of 2 ± 2, SANE of 73% ± 31, and elbow satisfaction of 8 ± 3. Patients who underwent reoperation demonstrated significantly worse QuickDASH, pain, and SANE scores (p<0.05 for all).

Conclusion: Acute ORIF of simple transcondylar distal humerus fractures results in high rates of union. However, nearly one-quarter of patients underwent reoperation, which was associated with worse PROs despite overall satisfactory results.



Distal Humerus Hemiarthroplasty as a Salvage Procedure Following Failed Management of Distal Humerus Fracture

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Introduction: Management of complex distal humerus fractures remains challenging, particularly when initial treatment fails. Non-operative management and internal fixation may both result in complications such as non-union, and avascular necrosis leading to pain, stiffness and loss of function. Total elbow arthroplasty (TEA) is often considered in these cases, but outcomes for post-traumatic indications are less predictable than those for inflammatory arthritis or osteoarthritis. Distal humerus hemiarthroplasty (DHH) offers potential advantages over TEA, including preservation of the ulna and the absence of lifelong lifting restrictions. DHH has outcomes comparable to TEA in acute fractures, but its role as a salvage procedure after failed initial treatment remains unclear.

Aim: The aim of this study was to evaluate the clinical, functional, and radiological outcomes of DHH performed following failed treatment of distal humerus fractures.

Methodology: A retrospective review was performed of 36 consecutive patients treated across two centres. Patients were included if they underwent DHH following failed previous management of a distal humerus fracture, either after internal fixation or non-operative treatment.

The primary outcome was revision surgery to TEA. Secondary outcomes included complications, range of motion, patient-reported outcome measures (PROMs), and radiological findings. Patient-reported outcomes included the Oxford Elbow Score (OES) and Visual Analogue Scale pain score (VAS). Radiographs were assessed for implant loosening, heterotopic ossification, and wear of the radial head or greater sigmoid notch.

Results: Twenty-two patients (61%) were initially treated with internal fixation and 14 (39%) treated non-operatively. Mean age at DHH was 58 years (range 41–69). The median interval between initial treatment and DHH was 4 months (range 1–30). Symptomatic malunion was the most common indication (72%), followed by non-union (28%). Median follow-up was 88 months (range 3–180).

Four patients (11%) required conversion to TEA, all due to instability. Ulnar nerve paraesthesia occurred in eight patients (22%), with no motor deficits. Median OES was significantly higher in

the patients who were initially treated non-operatively compared with those treated with surgical fixation (43 vs 41, $p = 0.047$). Median VAS pain score was 10 (IQR 10–30). Extension deficit was lower in the non-operatively group (14° vs 24° , $p = 0.046$).

Radiographically, implant loosening occurred in one patient and asymptomatic heterotopic ossification in seven cases (20%). No deep infections were observed.

Conclusion: Salvage DHH offers a viable option for patients in whom initial fracture management has failed but instability is the primary complication. Functional outcomes were satisfactory and superior after failed non-operative management. In successful cases, adverse radiographic changes were limited with good midterm durability. While these findings are promising, surgeons should be very selective about offering DHH as a salvage, particularly after failure of internal fixation, and the decision for this treatment should be made through a multi-disciplinary approach.



Radical Head Replacement

Is anatomical radial head arthroplasty more effective for acute or for chronic traumatic lesions? A retrospective cohort study

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Introduction: Radial head arthroplasty (RHA) can achieve favorable outcomes in patients with radial head (RH) and neck fractures. Notably, it has proved effective in treating both acute fractures and traumatic injuries, where delayed treatment can lead to secondary degenerative changes, soft tissue contractures, and altered biomechanics. Yet, the outcomes of RHA performed in these two groups have never been compared. Anatomical RHA is designed to replicate the native RH geometry, providing stable elbow kinematics and correct load distribution.

Aim: This study aims to compare the clinical and radiographic results of anatomical RHA in patients with acute lesions and chronic post-traumatic conditions.

Methodology: We reviewed the data of 52 consecutive patients who were managed by anatomical RHA (Anatomical Radial Head; Acumed, Hillsboro, OR, USA) for acute RH fracture or chronic sequelae of traumatic injury at our institution. Assessments included range of motion and stability using the Mayo Elbow Performance Score, Quick Disabilities of the Arm, Shoulder, and Hand score, Visual Analog Scale score, and overall patient satisfaction. Radiographs were analyzed for signs of loosening, periarticular ossification, and degenerative changes of the ulnohumeral joint and capitellum.

Results: At a mean follow-up of 70 months, 23 (44%) patients had achieved excellent outcomes with a Mayo Elbow Performance Score greater than 90 points and a mean Quick Disabilities of the Arm, Shoulder, and Hand score of 7 (range, 0-18.2). The mean range of motion was 111 in flexion-extension (range, 70 -140) and 144 in pronation-supination (range, 100 -160). There were 13 (25%) complications requiring secondary surgery in the first 29 months. The implant revision rate was 7.7%. At the last follow-up, 42/52 patients (81%) were satisfied with their outcome. The clinical and radiological outcomes between the groups were not significantly different.

Conclusion: The anatomical RH system is a viable option for acute and chronic trauma patients. Despite these encouraging results, prospective studies with larger sample sizes are required to validate them.



Long term follow up of radial head replacements for acute fractures

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Introduction: The long-term clinical and radiographic outcomes for smooth stem metallic radial head replacements (RHR) used for acute radial head fractures are currently unknown. Short to medium term outcomes (mean 8 years) have been published on this population cohort.

Aim: This is an updated study reporting the long-term clinical and radiographic outcomes.

Methodology: A retrospective review was performed of patients who underwent a smooth stem RHR for acute comminuted fractures (<4 weeks from fracture date) at a single upper extremity referral center. Patients returned for validated patient reported outcomes measures (PROMs) including patient-rated elbow evaluation (PREE), Mayo elbow performance index (MEPI), single assessment numeric evaluation (SANE), and disabilities of the arm, shoulder and hand (DASH), short-form 12 (SF-12), physical examination and radiographic evaluation. Elbow and forearm motion and grip strength were measured where possible.

Results: 31 patients with 32 RHR returned for a comprehensive clinical and radiographic review at an average of 17 years. The mean age at injury was 51 and at follow up was 69. 71% of patients were female. 1 RHR was excised for infection. The mean PREE score, MEPI, SANE and DASH scores were 69/100, 87/100, 93/100 and 11/100. The mean elbow arc of motion was 8 – 133° and 87 and 76° pronation and supination. The mean percentage difference in grip and pinch strength between the affected and unaffected was 91% and 95%. The mean score for osteopenia, ulnar humeral arthritis, periprosthetic lucency and heterotopic ossification was 1 on a scale of 0 to 3, with 1 being mild.

Conclusion: The long-term outcomes for acute radial head fractures using a smooth stem metallic radial head replacement were favorable. Patients returned to excellent function in terms

of PROMs range of movement, achieving $\geq 91\%$ strength and satisfactory radiographs. Only one implant was removed, due to infection.



Outcomes of Implant Removal After Failed Radial Head Arthroplasty: An Average 7-Year Follow-up Study

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Introduction: Failure of radial head implants secondary to loosening, painful capitellar wear and other reasons is not uncommon. When radial head implants fail, the relative indications for implanting a new radial head implant versus implant removal with or without soft-tissue interposition remain unclear. Removal theoretically reduces the risk of radiocapitellar pain due to maltracking or capitellar arthritis. However, little is known about the outcomes following removal of failed radial head replacements in terms of elbow instability, proximal radius migration, and painful proximal radiocapitellar impingement, amongst others. The purpose of this study was to evaluate the mid- to long-term outcomes, complications, and rates of proximal radioulnar impingement pain following removal of failed radial head implants.

Methods: Our institution's Total Joint Registry database was queried to identify all elbows that had undergone removal of a failed radial head arthroplasty without implantation of a new prosthesis. Patients with radiocapitellar or total elbow arthroplasty at the index surgery were excluded. Thirty-seven elbows met inclusion criteria, but 12 were had less than 2 years of follow-up; the remaining 25 elbows form the basis for this study. Demographics, complications, reoperations, pre and postoperative range of motion, development of symptomatic proximal radioulnar impingement, and patient reported outcome measures were collected. The mean age at the time of resection was 50 years (range, 16–75 years). The mean follow-up was 7 years (range, 2–15 years).

Results: The mean time to removal following implantation was 31 months (range, 2–135 months). Implants removed included 21 press-fit, 3 loose-fit, and 1 cemented radial head implant. The most common indication for removal was painful loosening (17/25, 68%), followed by head/neck uncoupling (3/25, 12%), overstuffing (2/25, 8%), maltracking (2/25, 8%), and infection (1/25, 4%). All the patients with loose implants (n=17) reported radial-sided proximal forearm pain prior to resection, which was improved at final follow-up in 76% (13/17), unchanged in 6% (1/17), and not recorded in 3 patients. The mean flexion-extension and pronation-supination arcs improved following resection but these changes did not reach significance. Reoperations were performed in 6 elbows (24%): 3 (12%) for symptomatic proximal radioulnar impingement, 1 total elbow arthroplasty four years later for posttraumatic arthritis, 1 superficial I&D for a suture abscess, and 1 for ORIF of a coronoid fracture and reinsertion of a radial head prosthesis after a traumatic fall. There were no neurovascular complications.

Conclusion: Implant removal is a viable treatment strategy for failed radial head arthroplasty with good outcomes at mid- to long-term follow up. In our study, 76% of patients with loose painful implants reported improvement in proximal radial-sided forearm pain. However, patients should be counseled about the risk of developing symptomatic proximal radioulnar impingement following implant removal, as well as the occasional progression of osteoarthritis requiring further surgery.



Associated injury and outcome after trauma

Delayed Posterior Interosseous Nerve Palsy in Paediatric Radial Head and Neck Fractures

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Background: Nerve palsy following paediatric elbow trauma is not uncommon. However, delayed nerve palsy, with onset >24 hours following initial injury, is highly unusual.

Aim: We report a case series of four children with delayed posterior interosseous nerve (PIN) palsy following radial head or neck fractures.

Methods: This is a retrospective case series from a pediatric tertiary referral center. Four consecutive elbows in four children (age: 6-17) with delayed PIN palsy following radial head or neck fractures were identified over a 6-year period. Retrospective chart and imaging review was conducted. All patients were examined by either a senior orthopedic resident, fellow, or orthopedic attending.

Results: Three elbows sustained radial neck fractures, and one sustained a comminuted radial head fracture. All patients had intact PIN function at presentation, with PIN palsy developing between 1 and 9 days following injury, prior to undergoing any planned surgical intervention. Three of the four patients underwent open surgical treatment for their fractures, with concurrent PIN exploration and neurolysis. PIN was in continuity in all cases, without disruption to epineurium of fascicles. Tight compression was noted at Arcade of Fröhse and leading edge of extensor carpi radialis brevis (ECRB). At latest follow-up, all patients had full recovery of PIN function.

Conclusion: Delayed PIN palsy following pediatric radial head/neck fracture is uncommon. Careful re-examination and documentation of neurology prior to fracture surgery is crucial to avoid misattribution of neurological deficits observed post-operatively to iatrogenic causes. The etiology of delayed PIN palsy may be due to a secondary swelling phenomenon at the leading edge of ECRB and the arcade of Fröhse, rather than direct traction or bony compression of the nerve. The role of nerve exploration versus expectant management remains uncertain.



Ligament injuries associated with proximal radius fractures

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Introduction: Proximal radius fractures are common and often classified according to Mason. Radiographic classifications consider the fracture as an isolated injury, but associated ligament injuries have been found common. This may influence prognosis and treatment.

Aim: To investigate correlations between proximal radius fracture morphology and collateral ligament injuries.

Methodology: A prospective series included adult patients with an isolated proximal radius fracture and no elbow dislocation. Fracture morphology was assessed using CT or MRI, categorized as engaging the head or neck and further by dividing the articular surface into four quadrants related to the bicipital tuberosity. Displacement was measured as articular step or angulation of collum. Ligament injuries, categorized as complete or partial, were diagnosed by MRI (n=89) or ultrasound (n=26).

Results: 115 patients, 71 women, (median age 50 yrs (21-86)) were included. 51 fractures were Mason type I, 54 type II and 10 type III. An associated collateral ligament injury was found in 89%. Isolated medial injury in seven patients (6%), isolated lateral in 35 (30%), and bilateral in 60 (52%). The fractures displayed seven patterns. Fracture of anterior quadrants (with pronated radius) was most common, found in 50% (n=57) and associated with lateral injury in 81% and medial in 47%. Displaced neck fractures and radial head fractures engaging three or four quadrants had associated ligament injuries in 100%.

Conclusions: Ligament injuries were very common in association with a proximal radius fracture. Fractures involving the whole articular surface and displaced neck fractures were always associated with a collateral ligament injury.



PrEvention of posttraumatic contractuRes with Ketotifen 2 (PERK 2) - A multicenter randomized control trial

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Introduction: Elbow joint contractures following trauma have an undesirable effect on quality-of-life, with limited treatment options. Preclinical studies showed that Ketotifen Fumarate (KF) could decrease contracture severity following fractures.

Aim: We hypothesized that KF would effectively and safely reduce the severity of elbow joint contractures in adult participants with surgical elbow fractures and/or dislocations.

Methods: This Phase-III parallel-group, randomized trial evaluated participants ≥ 18 years who underwent surgery for elbow fractures or dislocations. Participants were randomly assigned to receive KF 2mg (KF2), KF 5mg (KF5), or lactose placebo (LP) in a 1:1:1 ratio. The primary outcome was the unadjusted difference in the flexion-extension range-of-motion (ROM) of the injured compared to the contralateral elbow between the three groups at 12 weeks post-randomization. Secondary outcomes included the efficacy of KF over LP with other ROM values, the patient reported outcomes measures (PROMs): Disability of the Arm, Shoulder, and Hand questionnaire (DASH), Pain Catastrophizing Scale (PCS) and Oxford Elbow Score (OES) at 12 and 52 weeks post-randomization. Adjusted outcome comparisons used a linear regression model to estimate the effects of KF dosage adjusting for sex, age, side of injury is the same as the dominant hand, type of elbow injury, and concurrent injury.

Results: Three hundred ninety-five participants were enrolled, and baseline characteristics were similar amongst the groups. There was no statistically significant difference between the injured compared to the contralateral elbow ROM at 12 weeks post-randomization amongst the groups. There were statistically significant differences in seven of the eight secondary outcomes at 12 weeks post randomization in favor of KF5 including injured elbow flexion-extension ROM and DASH, PCS, and OES elbow function, social, and total scores. There were no differences in these parameters at 52 weeks post-randomization. There were no differences in adverse or serious adverse events between the groups and no non-unions.

Summary: The KF5 group was associated with many improved ROM and PROM at Week-12 in a more severely injured population requiring elbow surgery. The safety of KF was established in this population and could be considered an adjunct to surgical stabilization and early motion to decrease post-traumatic elbow contractures.

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Monteggia and fracture-dislocation

Beyond Sagittal Correction: The Role of Coronal Plane Valgus in Ulnar Osteotomy for Neglected Monteggia Fractures

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Introduction: Neglected Monteggia fractures remain challenging injuries when radial head dislocation persists for several months after trauma. Ulnar osteotomy with restoration of radiocapitellar alignment is considered the key surgical step, often combined with annular ligament repair or reconstruction. Although surgical planning commonly focuses on sagittal correction, the role of coronal plane alignment after osteotomy remains insufficiently addressed.

Aim: This study aimed to evaluate whether postoperative coronal plane alignment, particularly valgus change after ulnar osteotomy, affects the sagittal flexion correction required and influences clinical or radiographic outcomes in traumatic neglected Monteggia fractures.

Methodology: Seventeen patients treated surgically for traumatic neglected Monteggia fractures between 3 and 12 months after injury were retrospectively reviewed. All underwent ulnar osteotomy and plate fixation. After radiocapitellar reduction through a lateral incision, annular ligament reorientation was performed. Preoperative and postoperative radiographs were assessed for coronal alignment, sagittal flexion correction, and radiocapitellar reduction. Coronal alignment change was calculated from anteroposterior radiographs. A postoperative coronal valgus change greater than 3 degrees was used as the predefined threshold for subgroup analysis. Sagittal correction was compared using the Mann–Whitney U test, and inferior MEPS distribution using Fisher’s exact test.

Results: Mean follow-up was 28 months (range: 14–64). Mean age at surgery was 7.3 years (range: 3.2–11.8), and mean time from trauma to surgery was 4.6 months (range: 3–10). Mean postoperative coronal alignment change was 2.2 degrees (range: 0–10), and mean sagittal flexion correction was 13.2 degrees (range: 6–28). Postoperative coronal valgus change greater than 3 degrees was observed in 7 patients. One patient had more than 3 degrees varus change, while 9 had coronal change within 3 degrees. Mean sagittal correction was significantly greater in patients with >3 degrees postoperative coronal valgus change than in patients with coronal change within 3 degrees (17.4 degrees vs. 11.0 degrees, $p = 0.042$). Radiocapitellar reduction was maintained in 15 patients, whereas redislocation or subluxation occurred in 2. Delayed union, extension limitation, and pronation limitation were each observed in 2 patients. No neurological complications occurred. Mean 1-year MEPS was 97.1 points (range: 75–100). Inferior MEPS scores occurred only in the >3 degrees valgus group, but this was not statistically significant (2/7 vs. 0/9, $p = 0.175$).

Conclusion: Coronal alignment appears to be an underrecognized factor in neglected Monteggia fractures treated with ulnar osteotomy and annular ligament reorientation. Postoperative coronal valgus change greater than 3 degrees was associated with higher sagittal flexion correction requirement. Although inferior MEPS scores occurred only in patients with greater valgus change, this was not statistically significant. Coronal alignment should therefore be considered during osteotomy planning. Given the rarity of this condition and strict inclusion criteria, these findings should be interpreted as exploratory.



Arthrogram Finding of Entrapped Annular Ligament in Paediatric Monteggia Injuries – Introducing The “Rose Thorn” Sign of The Elbow

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Background: In pediatric Monteggia injuries, ongoing radial head instability despite anatomic reduction of the ulna can lead to a difficult intra-operative dilemma. Presence of a displaced annular ligament has been reported as a potential cause of ongoing radial head instability. To date, no satisfactory intra-operative tests have been described for detecting a displaced annular ligament.

Aim: We describe a distinct novel arthrographic finding – the “Rose Thorn Sign of the Elbow”, that correlates with displacement of the annular ligament, potentially contributing to ongoing radial head instability.

Methods: A retrospective review was performed of skeletally immature patients with acute Monteggia injuries who underwent intraoperative arthrography at a tertiary referral pediatric center over a 12-month period. Arthrograms were analyzed for the presence of a characteristic wedge-shaped anterior contrast defect within the radiocapitellar space. Presence of a positive Rose Thorn Sign was correlated with findings of a displaced annular ligament in the radiocapitellar joint upon open reduction. Elbows with negative Rose Thorn Sign and stable radial heads were recorded for controls.

Results: Thirteen patients met the inclusion criteria, with six demonstrating positive Rose Thorn sign on arthrography following reduction of the ulna. All six patients had persistent anterior radial head instability, particularly in pronation and were found to have a displaced annular ligament upon open reduction of the radiocapitellar joint. Reduction of the annular ligament resulted in resolution of the Rose Thorn sign and restoration of radiocapitellar alignment and stability. Patients who were negative for the Rose Thorn sign did not demonstrate residual radiocapitellar joint instability. All patients had concentrically enlocated radial heads at the latest follow-up.

Conclusion: When present, the Rose Thorn Sign appears to be an indicator of annular ligament displacement. Furthermore, we propose an intra-operative algorithm using the Rose

Thorn Sign as an adjunct decision-making tool for ongoing radial head instability in the setting of pediatric Monteggia injuries.



Prognostic Value of the Osborne-Cotterill Lesion in Surgically Treated Elbow Fracture-Dislocations: A Retrospective Cohort Study

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Elbow fracture-dislocations are complex injuries that often require surgical treatment based on the specific injury pattern. Osborne-Cotterill (OC) lesions have been associated with elbow instability and may reflect injury severity; however, their prognostic value in surgically treated cases remains unclear. We hypothesized that the presence of an OC lesion would be associated with worse clinical and functional outcomes.

Materials & Methods: We performed a retrospective cohort study of consecutive adults with acute elbow fracture-dislocations treated surgically between January 2023 and June 2025 at a Level I Trauma Center using a standardized injury pattern-based protocol (posterolateral, posteromedial, or transulnar). Inclusion criteria were age ≥ 18 years, surgical treatment, and minimum 6-month clinical and radiographic follow-up. Patients with prior elbow trauma, osteoarthritis, or incomplete data were excluded. The primary independent variable was the presence of an OC lesion, classified as Type 1 (avulsive) or Type 2 (impaction) (3). Outcomes included ROM, elbow stability, complications, reoperations, MEPS, QuickDASH, and VAS pain scores. Continuous variables were analyzed with Mann-Whitney U or t-tests, and categorical variables with chi-square or Fisher's exact test. Statistical significance was set at $p < 0.05$. Subgroup analyses were performed according to OC type and radial head treatment.

Results: A total of 46 patients (47 elbows) were included, with a mean follow-up of 19.1 ± 9.0 months. Injury patterns were predominantly posterolateral (53.2%), followed by transulnar (36.2%) and posteromedial (10.6%). The Osborne-Cotterill lesion was identified in 16 elbows (34%), while 31 elbows (66.0%) showed no capitellar defect. Among the OC+ cohort, lesion morphology was evenly distributed between Type 1 (avulsion, $n=8$) and Type 2 (impaction, $n=8$). Functional outcomes were comparable between groups. The mean MEPS was 79.7 ± 15.0 in the OC+ group versus 78.9 ± 13.3 in the OC- group ($p=0.856$). Secondary outcomes also showed no significant differences: QuickDASH (28.8 vs 30.1, $p=0.645$), VAS pain (1.8 vs 1.9, $p=0.982$), and total flexion-extension arc (138° vs 139° , $p=0.899$). No patient in the OC+ group presented residual instability. Regarding safety, there were no statistically significant differences in complication rates (18.8% vs 22.6%; $p=0.924$) or reoperations (18.8% vs 19.4%; $p=1.000$). Subgroup analysis revealed trends: Type 2 (impaction) lesions showed higher mean MEPS scores (86.3) compared to Type 1 (avulsion) lesions (73.1) ($p=0.086$), and radial head arthroplasty trended toward superior scores compared to ORIF (83.0 vs 77.5, $p=0.299$).

Conclusions: Osborne-Cotterill lesions were present in 34% of surgically treated elbow fracture-dislocations and were not associated with worse clinical or functional outcomes. However, impaction-type lesions showed a trend toward better patient-reported outcomes than avulsive lesions, suggesting that lesion mechanism and radial head treatment may influence outcomes more than the OC lesion itself.



Screw Augmentation of a Suture Tension Band for Displaced Olecranon Fractures: A Three-Arm Comparison with Suture Tension Band and Plate Fixation

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Introduction: Plate fixation (PF) and suture tension band (STB) are two contemporary alternatives to K-wire tension band wiring for displaced olecranon fractures. PF reliably achieves union but carries the highest rate of symptomatic hardware and implant-removal surgery among modern constructs, while STB minimizes hardware burden but has slower osseous healing. However, augmenting STB with two obliquely placed 3.5 mm cannulated screws (STB+S) has been proposed to combine plate-like stability with the low-burden profile of suture-based fixation but has not been directly compared to both parent techniques.

Aim: To compare radiographic union, range of motion (ROM), patient-reported outcomes (PROMs), and hardware complications among screw-augmented suture tension band (STB+S), suture tension band (STB), and plate fixation (PF) for displaced olecranon fractures.

Methodology: Retrospective comparative cohort of adults with displaced transverse, short-oblique, and minimally comminuted olecranon fractures convertible to a simple pattern, treated 2021–2026 with STB+S (n=19), STB (n=27), or PF (n=47). Radiographic union was assessed on 6- and 12-week radiographs. A secondary cohort with ≥6 months follow-up (STB+S n=11, STB n=24, PF n=19) underwent ROM, QuickDASH, PREE, SANE, and radiographic assessment, with hardware outcomes recorded. Continuous variables were compared with Kruskal-Wallis and Mann-Whitney U; categorical with chi-square or Fisher's exact test.

Results: All results are reported in STB+S, STB, PF order. Mean age was 50±15, 59±19, and 57±21 years (p=0.10); mean follow-up in the secondary cohort was 13±4, 17±11, and 27±16 months (p=0.02). At 6 weeks, complete radiographic union was 68%, 19%, and 79% (p<0.001); STB+S was superior to STB (p<0.001) and comparable to PF (p=0.28). At 12 weeks, complete union was 79%, 44%, and 83% (p=0.003), with STB+S again outperforming STB (p=0.025) and equivalent to PF (p=0.78). Loss of reduction (0%, 7%, 11%; p=0.33) and revision surgery (0%, 4%, 11%; p=0.22) were proportionally lowest with STB+S but did not differ significantly between groups. In the secondary cohort, final union was 82%, 96%, and 100% (p=0.22). Elbow arc of motion was 132°±12°, 134°±10°, and 115°±15° (p<0.001), significantly greater in both suture-based groups than PF. QuickDASH

(9.1±8.1, 12.7±20.8, 10.5±9.6; p=0.80) and PREE (14.9±4.4, 18.3±13.4, 18.8±8.4; p=0.58) were comparable. SANE (94±7, 94±8, 86±13; p=0.05) was higher in suture-based groups, reaching significance for STB versus PF (p=0.03). Hardware irritation (18%, 4%, 63%; p<0.001) and hardware removal (0%, 0%, 26%; p=0.006) were dramatically lower with suture-based constructs.

Conclusion: Screw augmentation accelerates the radiographic trajectory of STB fixation, more than tripling complete union rates at 6 weeks compared with STB alone to match PF union rates, while preserving the superior elbow arc of motion and minimal hardware-removal burden of suture-only constructs. STB+S emerges as a promising fixation strategy for displaced olecranon fractures, particularly in young, active individuals in whom accelerated healing and minimal secondary downtime matter most.



The Posterior Ulna Medial Approach to the Elbow: An Exposure for Repairing the Coronoid and Posterior Medial Collateral Ligament

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Background: Varus posteromedial rotatory instability (PMRI) of the elbow disrupts key stabilizers the anteromedial coronoid facet, lateral ligament complex, and posterior band of the medial collateral ligament often requiring surgical stabilization. Although the posterior bundle (pMCL) is pivotal for stability, reproducible posterior approach for its direct repair has not been well described.

Objective: To describe the Posterior Ulna Medial Approach (PUMA) that permits safe exposure and repair of the anteromedial coronoid facet and pMCL in PMRI.

Methods: Six fresh-frozen upper limbs were dissected using an extension of the Smith medial interval . We assessed exposure, neurovascular safety, and feasibility of pMCL repair were assessed. Surgeons completed online pre-/post-cadaveric questionnaires assessing the approach's utility

Results: The approach consistently exposed the pMCL without detaching the main flexor-pronator origin, violating the anterior MCL, or requiring ulnar-nerve transposition. It enabled simulated repair of the pMCL and, when required, anterior MCL repair and anteromedial coronoid fixation. Neurovascular structures remained protected throughout.

Conclusion: The posterior ulna medial approach offers reproducible, safe access to the pMCL and adjacent medial elbow structures, supporting anatomic repair in PMRI and addressing a current surgical gap.

Keywords: The Posterior Ulna Medial Approach, Posterior medial collateral ligament. Varus posteromedial rotatory instability, Elbow instability, Elbow ligament repair.



Surgical treatment of trans-ulnar basal fracture dislocations: clinical and radiographic outcomes of 40 patients at 2 years follow-up

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Introduction: The recent Mayo Clinic classification of proximal ulna fracture-dislocations has identified different injury patterns based on the involvement of the coronoid: transolecranon fracture-dislocations, Monteggia-like and Transulnar basal coronoid (TUBC) that represent a fracture pattern in which the coronoid is detached from both the olecranon and the metaphysis. In light of this classification, we have evaluated the results obtained in 40 patients who underwent surgery in the last 8 years for TUBC that are known to be associated with severe instability, worse functional prognosis, and high reoperation rates.

Aim: This study aims to retrospectively review the clinical and radiographic outcomes of the patients treated for TUBC analyzing the fracture patterns, the associated lesions, the methods of fixation of the coronoid and the complications rate at a mid-term 2-years follow-up.

Methodology: A retrospective analysis of patients treated for TUBC between 2016 and 2024 was conducted. Post-operative clinical records were reviewed. Clinical outcomes were evaluated measuring the range of motion (ROM), and the MEPS and Broberg Morrey. Subjective evaluation was rated using the DASH and the SANE scores. Post-operative X-Rays were assessed for fracture healing and radiographic complications.

Results: Forty patients were included (21 men, 19 women), with a mean age of 52 years (range, 17–84) and a minimum clinical and radiographic follow-up of 12 months (12–140). At a mean follow-up of 2 years, the mean MEPS and B&M scores were 91.7 (SD $\pm$ 9.7) and 90.2 (SD $\pm$ 9.3), respectively. Mean flexion–extension ROM was 129° (SD $\pm$ 12.3) and 15.7° (SD $\pm$ 13.2), respectively. Mean forearm rotation was 160.7°, with mean pronation of 83.2° (SD $\pm$ 12.7) and mean supination of 77.5° (SD $\pm$ 20.8). The mean qDASH score was 16, the SANE score 87. Fourteen complications (35%) were observed, with revision surgery required in 7 cases (17,5%). 3 coronoid fixation failures were treated with revision surgery (ORIF with plate in two cases and external fixator in one case). Two patients sustained asymptomatic breakage of the coronoid plate. Radiographic union of ulna fractures was achieved in all cases but one, in which the coronoid fragment dislocated post-operatively. Post-traumatic osteoarthritis was noted in 27% of patients. Mild ulnar neuropathy was observed in 5 patients. 3 patients presented severe elbow stiffness; 1 case of early infection required hardware removal, debridement and antibiotic therapy.

Conclusions: The analysis of this case series, the largest published to date, highlights that stable fixation of the coronoid is the primary determinant of outcome in TUBC fracture–dislocations. Approach and fixation techniques should be based on the coronoid fracture pattern. Despite satisfactory clinical outcomes, a high rate of post-operative complications and post-traumatic osteoarthritis was observed especially in those cases in which the coronoid fixation was sub-optimal.



Coronoid reconstruction and medial ligament

Coronoid graft reconstruction in acute and chronic complex elbow instability: short to medium-term results of 24 cases

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Introduction: Coronoid process represents a primary elbow stabilizer; in CEI, when coronoid fixation is not achievable, CR is often required. The results of CR are scarcely reported in the literature.

Aim: To analyze short to medium-term clinical and radiographic results of coronoid reconstruction (CR) with autologous and homologous bone grafts in acute (a-CEI) and chronic complex elbow instability (c-CEI). Secondary aim was to report literature review.

Methodology: Between 2013 and 2023, 27 patients with a-CEI (6 patients, 25%) and c-CEI (18 patients, 75%) underwent CR. 24 patients were followed-up. The selected graft was a homologous radial head in 11 cases, autologous radial head in 8, autologous rib osteochondral graft in 4 and homologous coronoid in 1. Graft fixation was performed with threaded wires (TW) alone, TW + plate or TW + free screws in 19, 3 and 2 patients, respectively. The associated lesions were treated according to the current therapeutic algorithms. At the last follow-up, a clinical evaluation was performed with the MEPS, q-DASH, and ASES-E. Post-operative x-rays and CT were used to evaluate integration or resorption of grafts. Pubmed was used for literature review. **Results:** The mean follow-up was 46 months (range, 6-176). At the final follow-up, the mean MEPS, q-DASH and ASES-E were respectively 89,16.3 and 87, while mean extension, flexion, pronation and supination were 20°, 135°, 77° and 74°, respectively. CT and x-rays showed graft integration in 82% of cases and no resorption in 64%; Elbow stability was achieved even in 3 out of 4 cases with severe graft resorption. Asymptomatic osteoarthritis was observed in 46% of cases. In 2 cases complete graft failure was observed, with recurrence of chronic instability and total elbow arthroplasty was performed. 19 studies with 68 total patients were selected to assess literature review.

Conclusion: CR appears to be a viable therapeutic option to achieve stability in coronoid deficient elbows, providing in most cases satisfactory results at short to medium-term; even when graft displayed slow resorption, joint stability was maintained, provided that the other primary and secondary stabilizers of the elbow were repaired or reconstructed. The type of grafts and fixation affected results: large grafts and a stable osteosynthesis guarantee the best clinical results. In our study, autologous rib grafts and homologous coronoid grafts yielded the best clinical and CT results, while radial head grafts appeared easier to implant, but also showed the higher rate of resorption. Compression osteosynthesis with 3 or more TW seem to be a simple, fast and effective technique to achieve a stable graft fixation. Long term results are uncertain, considering the high prevalence of osteoarthritis.



Ipsilateral Olecranon Tip Autograft for Coronoid Reconstruction: Anatomical Fit and Axial-Load Biomechanical Testing

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Introduction: Osseous loss of the coronoid process may require reconstruction to restore elbow stability. Autograft options include the iliac crest, the radial head or the tip of the olecranon. The olecranon offers a cartilage-bearing surface, while iliac grafts allow for flexible and anatomic shaping.

Aim: The aim of this study was to assess the anatomical dimensions of an ipsilateral autologous olecranon graft and compare its biomechanical load properties to conventional iliac crest grafts.

Material and Methods: Eight fresh-frozen human elbow specimens were tested. The olecranon tip was osteotomized using a custom-made angle-specific cutting guide at 40° relative to the ulnar shaft axis, while preserving the anatomical insertion of the triceps tendon. Computer tomography (CT) imaging was performed to quantify native coronoid dimensions (height, width, depth) and olecranon graft dimensions (height, width, depth). A coronoid defect of approximately 40% of coronoid depth was then created and reconstruction was performed sequentially with olecranon tip graft and an iliac crest graft, using a buttress plate. Axial loading was applied at 20° elbow flexion using a material testing machine (Zwick/Roell GmbH & Co. KG, Ulm, Germany) and measured with digital pressure sensors (TekScan, South Boston, USA). After preconditioning, loads were increased incrementally from 50 to 400 N. Outcome parameters were peak intra-articular pressure, high pressure contact area (> 1 MPa) and total intra-articular contact area (> 0,07 MPa).

Results: CT measurements of the native coronoid showed a median coronoid width of 29.8 mm (IQR 27.8–31.9), a median coronoid depth from the tip to the anterior shaft axis of 16.7 mm (IQR 16.3–17.4) and to the posterior shaft axis a depth of 38.3 mm (IQR 34.8–39.3), while median coronoid height was 32.4 mm (IQR 29.5–35.5). In comparison, median graft depth was 6.0 mm (IQR 4.5–7.8), median graft width was 23.1 mm (IQR 21.5–24.8), and median graft height was 12.5 mm (IQR 12.1–14.1). This corresponded to a median potential replacement of the coronoid depth of 34.1% (IQR 26.0–49.25), a median proportional width replacement of 75% (IQR 70.5–95.95), and a median proportional height replacement of 39.5% (IQR 36.8–51.2).

In biomechanical load testing no differences were detected between reconstruction with olecranon tip versus iliac crest graft at any load level for peak pressure or high-pressure area ($p > 0,05$). Total contact area was greatest in the native state, however olecranon and iliac crest reconstructions did not differ significantly in contact area ($p = 0,117$ and $p = 0,097$).

Conclusion: The ipsilateral autologous olecranon tip provides anatomically relevant dimensions and demonstrates sound and similar biomechanical data under axial loading compared to an

iliac crest graft, suggesting it as a viable option for coronoid reconstruction in moderate defect size. Potential effects and limitations of olecranon tip harvest on elbow stability require further investigation.



Pathoanatomy of Traumatic Medial Collateral Ligament Injuries in the Elbow: a case-series

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Introduction: The medial collateral ligament complex (MCL) is considered the primary stabilizer against valgus forces of the elbow and is frequently injured in elbow dislocations and fractures. While tear location and tear completeness are known to influence outcomes in iterative MCL injuries, injury patterns in acute traumatic MCL ruptures have not been systematically described.

Aim: This study aimed to categorize MCL injury patterns in patients with elbow dislocations and/or fractures and to relate findings to concomitant skeletal injuries.

Methodology: A case series was analysed comprising 86 adults (median age 54, range 18–80 years) surgically treated for acute elbow trauma at Linköping University Hospital, Sweden, between April 2020 and September 2025. Intraoperatively observed MCL-injuries were recorded in a protocol and categorized by involved part of the complex (anterior/posterior), completeness (intact, partial, or total rupture), and location (proximal, intrasubstance, distal, or compound). Preoperative radiological imaging was used to evaluate and classify fractures.

Results: The posterior bundle (pMCL) had a proximal rupture in 81% of cases. The anterior bundle most often had a proximal rupture (43%), followed by a distal rupture (26%) and a compound rupture (26%). All compound ruptures displayed a characteristic “Z”-shaped configuration. A gender difference in rupture location was observed. All patients with an intact pMCL (8%) had a proximal radius fracture; all patients with an intact aMCL (4%) had a coronoid tip fracture.

Conclusion: This is the largest explorative study on traumatic MCL pathoanatomy. Findings include a predominance of proximal pMCL ruptures and a variety of aMCL patterns. The identified Z-shaped compound rupture pattern corroborates descriptions in previous reports. Fracture type appeared to correlate with specific MCL injury patterns, although the number of patients in subgroups was small. Further studies are warranted to determine how these patterns influence clinical outcomes.



Radiographic Findings Following Sequential Transection of the Medial Collateral Ligament and Flexor–Pronator Mass

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Background: Elbow valgus stability relies on both static and dynamic stabilizers. The medial collateral ligament (MCL), particularly the anterior bundle (AB), provides primary resistance to valgus stress, whereas the flexor–pronator mass (FPM) offers secondary, dynamic support. Combined disruption of these structures—especially following trauma—can result in significant elbow instability. This cadaveric study aimed to quantify radiographic changes in the medial ulnohumeral joint (UHJ) space and valgus alignment following sequential transection of the AB, posterior bundle (PB), and FPM.

Methods: Twelve cadaveric elbows were sequentially tested after sequential transection of the AB, PB, and FPM. Radiographs were obtained at 60° of flexion under standardized valgus stress. Changes in mean medial UHJ space and α -angle were compared across stages using the Friedman test with Wilcoxon post-hoc analysis ($p < 0.05$).

Results: The mean specimen age was 63 years (70% male). Mean medial UHJ space increased progressively from 5.4 ± 1.1 mm in the intact state to 12.4 ± 3.0 mm after AB transection, 16.1 ± 3.9 mm after combined AB + PB transection, and 26.4 ± 7.8 mm after additional FPM release. Correspondingly, mean α -angle rose from $2.8^\circ \pm 1.7^\circ$ to $3.4^\circ \pm 3.0^\circ$, $5.0^\circ \pm 4.2^\circ$, and $13.6^\circ \pm 8.6^\circ$, respectively. All comparisons were statistically significant ($p < 0.001$).

Conclusion: In this cadaveric model, UHJ opening ≈ 15 mm suggested full MCL disruption, and >20 mm or α -angle $\approx 13^\circ$ indicated additional FPM compromise; these values are experimental reference ranges for medial soft tissue injuries.

Keywords: Ulnohumeral joint space; valgus instability; medial collateral ligament; flexor–pronator mass; elbow stability; radiographic analysis; ulnar collateral ligament; elbow dislocation.

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Stiffness and arthroscopic release

Open Versus Arthroscopic Elbow Arthrolysis for Post-Traumatic Elbow Contracture: Early Prospective and Mid-Term Retrospective Outcomes with a Minimum 5-Year Follow-Up

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Introduction: Post-traumatic elbow contracture is a common cause of functional disability following elbow injury. When non-operative treatment fails, surgical arthrolysis may be performed using either open or arthroscopic techniques. Although both approaches are widely used, evidence directly comparing their long-term outcomes remains limited, particularly after post-traumatic stiffness.

Aim: To compare clinical and functional outcomes of open and arthroscopic elbow arthrolysis for post-traumatic elbow contracture using early prospective assessment and mid-term retrospective follow-up with a minimum follow-up of five years.

Methodology: This comparative non-randomized study included patients treated surgically between 2010 and 2020. Open arthrolysis was indicated when major implant removal and/or extensive heterotopic ossification excision was required, whereas arthroscopic arthrolysis was used in all other cases. Patients were evaluated preoperatively, prospectively during the first six postoperative months, and retrospectively at a minimum five-year follow-up.

Outcome measures included range of motion (ROM), Mayo Elbow Performance Score (MEPS), and patient satisfaction. Severity-matched subgroup analyses were performed for minimal-to-moderate contractures (arc >60°) and severe-to-very severe contractures (arc ≤60°).

Results: A total of 123 patients were available for final evaluation, including 62 open (OPG) and 61 arthroscopic (ASG) arthrolyses. Mean follow-up was 7.9 ± 3.4 years in the OPG and 6.5 ± 3.4 years in the ASG.

Both techniques significantly improved ROM and MEPS ($p < 0.0001$). Functional ROM (arc ≥100°) increased from 33% to 85% in the ASG and from 2% to 69% in the OPG. MEPS improved from 72 ± 11 to 96 ± 8 in the ASG and from 65 ± 16 to 87 ± 14 in the OPG (both $p < 0.0001$).

In the severity-matched minimal-to-moderate contracture subgroup, arthroscopic arthrolysis demonstrated superior preservation of correction, with loss of motion between intraoperative assessment and final follow-up averaging approximately 8° compared with 22° after open release. Final MEPS was significantly higher after arthroscopy (97.2 ± 7.1 vs 90.3 ± 10.9; $p = 0.003$),

with greater functional improvement (21.5 ± 12.6 vs 8.8 ± 13.5 points; $p=0.0005$). Functional ROM was achieved in 98% and 94% of patients, respectively.

In the severe-to-very severe subgroup, both techniques achieved comparable final ROM and functional outcomes. Final MEPS improved from 55.0 ± 11.6 to 91.3 ± 14.4 after arthroscopic release and from 56.9 ± 14.3 to 85.4 ± 15.8 after open release. No major complications, infections, or permanent nerve injuries were observed. Revision surgery was required in three patients (2.4%).

Conclusion: Both open and arthroscopic elbow arthrolysis effectively improve motion and function after post-traumatic elbow contracture. Arthroscopic arthrolysis provides superior preservation of intraoperative gains and better functional outcomes in minimal-to-moderate contractures, whereas both techniques appear similarly effective in severe contractures. When technically feasible, arthroscopic arthrolysis should be considered the preferred treatment option.



Clinical Outcomes of Arthroscopic Release for Post-Traumatic and Degenerative Elbow Stiffness: A Comparative Study

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Introduction: Elbow stiffness commonly results from trauma and degenerative osteoarthritis, leading to pain, loss of motion, and functional limitation. Post-traumatic stiffness is typically associated with capsular contracture, heterotopic ossification, and intra-articular adhesions, whereas degenerative stiffness is mainly caused by osteophyte formation and capsular fibrosis. Although arthroscopic release has become an established treatment for elbow stiffness, outcomes according to etiology remain unclear.

Aim: To compare clinical outcomes after arthroscopic release between post-traumatic and degenerative elbow stiffness and determine whether etiology influences postoperative recovery.

Methodology: A retrospective review was performed of 100 consecutive patients who underwent arthroscopic release for elbow stiffness between 2010 and 2024 at a tertiary referral center. Patients were classified into post-traumatic stiffness ($n=46$) and degenerative stiffness ($n=54$) groups. Exclusion criteria included prior open release, active infection, inflammatory arthritis, and incomplete follow-up. Clinical evaluation included flexion, extension, flexion-extension arc, Visual Analog Scale (VAS), and Mayo Elbow Performance Score (MEPS). Outcomes were assessed preoperatively and at 3 months, 6 months, and final follow-up.

Results: The mean follow-up duration was 38.5 months. The post-traumatic group demonstrated more severe preoperative stiffness, with a smaller flexion-extension arc than the degenerative group ($66^\circ \pm 25^\circ$ vs $90^\circ \pm 20^\circ$, $p<0.001$). However, both groups showed significant postoperative improvement in ROM, pain, and function (all $p<0.001$). At final follow-up, the post-traumatic group demonstrated a significantly greater flexion-extension arc ($127^\circ \pm 17^\circ$ vs $109^\circ \pm 21^\circ$,

$p < 0.001$), lower extension contracture ($6^\circ \pm 8^\circ$ vs $13^\circ \pm 11^\circ$, $p < 0.001$), and lower pain scores (VAS 1 ± 1 vs 2 ± 2 , $p = 0.018$). MEPS was also higher in the post-traumatic group (94 ± 8 vs 88 ± 12 , $p = 0.007$). Improvements in flexion-extension arc, extension, and flexion were significantly greater in the post-traumatic group (all $p < 0.001$), whereas improvement in VAS and MEPS was comparable between groups.

Conclusion: Arthroscopic release provided significant improvement in both post-traumatic and degenerative elbow stiffness. Despite more restricted preoperative motion, patients with post-traumatic stiffness achieved greater recovery in range of motion and demonstrated superior final functional outcomes. These findings suggest that etiology influences postoperative recovery and may assist prognosis and patient counseling.



Serial Comparison of Clinical Outcomes After Arthroscopic Circumferential Release for Severe and Non-Severe Post-Traumatic Elbow Stiffness

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Introduction: Arthroscopic release has become an increasingly accepted treatment for post-traumatic elbow stiffness because of its minimally invasive nature and favorable outcomes. However, severe elbow stiffness remains controversial because of technical difficulty and concerns regarding neurovascular injury. Limited evidence exists regarding whether severe stiffness results in inferior recovery after arthroscopic treatment.

Aim: To compare serial recovery of elbow motion, functional outcomes, and complication rates after arthroscopic circumferential release between patients with severe and non-severe post-traumatic elbow stiffness.

Methodology: A retrospective cohort study included 46 patients who underwent arthroscopic circumferential release for post-traumatic elbow stiffness between 2018 and 2024. Patients were classified into severe stiffness (flexion-extension arc $< 60^\circ$; $n = 18$) and non-severe stiffness ($\geq 60^\circ$; $n = 28$) groups according to the Mansat and Morrey classification. Clinical assessment included flexion-extension arc, extension, flexion, Visual Analog Scale (VAS), Mayo Elbow Performance Score (MEPS), QuickDASH, and Single Assessment Numeric Evaluation (SANE). Outcomes were evaluated preoperatively and at 3 months, 6 months, and final follow-up (≥ 12 months). Linear mixed-effects models were used to compare postoperative recovery trajectories. Functional arc achievement ($\geq 120^\circ$), Patient Acceptable Symptom State (PASS), complications, and revision procedures were evaluated.

Results: At a mean follow-up of 22.5 months, both groups demonstrated significant improvements in ROM, pain, and functional outcomes compared with preoperative values (all $p < 0.001$). Adjusted linear mixed-effects analysis demonstrated comparable postoperative recovery trajectories between severe and non-severe groups for flexion-extension arc, flexion, extension, VAS, MEPS, QuickDASH, and SANE. Preoperative stiffness severity was not an

independent predictor of achieving functional motion $\geq 120^\circ$ (OR 0.21, 95% CI 0.02–2.08; $p=0.183$). Functional arc achievement was observed in 94.4% of severe cases and 67.9% of non-severe cases ($p=0.077$). PASS achievement rates for pain, ROM, and functional scores were comparable. No neurovascular injuries occurred, and the overall complication rate was 4.3%.

Conclusion: Arthroscopic circumferential release achieved comparable recovery trajectories, functional outcomes, and complication rates in severe and non-severe post-traumatic elbow stiffness. Severe preoperative stiffness was not associated with inferior outcomes and should not be considered a contraindication when a standardized circumferential release technique is used.

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Arthroplasty & implant biomechanics

The Nexel total elbow replacement is associated with good functional outcomes and a low failure rate at mid-term follow-up

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Introduction: Total elbow arthroplasty generally provides good clinical outcomes. However, high complication rates are reported, with implant loosening representing one of the most concerning issues. New prosthetic designs have been developed with the aim of reducing loosening rates.

Aim: The aim of this study was to report the clinical and radiographic outcomes of a large series of patients treated with the Nexel total elbow prosthesis.

Methodology: This multicenter retrospective study included patients who underwent primary or revision total elbow arthroplasty using the Nexel total elbow prosthesis, with a minimum clinical and radiographic follow-up of 2 years. Patients were evaluated using the Mayo Elbow Performance Score (MEPS), the Oxford Elbow Score (OES), and the Quick Disabilities of the Arm, Shoulder, and Hand questionnaire (QuickDASH). Radiographic lucency was assessed according to Kamineni and Morrey, while heterotopic ossification (HO) was graded according to the Leyder classification. Implant failure was defined as removal of the prosthetic components.

Results: Of the 142 patients initially enrolled, 105 patients were finally included. The mean age was 70.2 ± 10 years, of whom 87.7% were female. The most common surgical indication was fracture (51.4%). The most commonly used surgical approach was the triceps-on approach (48.5%). After a mean follow-up of 55 months, implant survival was 90.5%. The most frequent complication was ulnar neuritis (21.9%). The rate of aseptic loosening was 3.8%. Eighteen patients (17%) underwent revision surgery, with acute infection representing the most common indication (5

patients). Causes of implant failure included septic loosening, aseptic loosening, acute infection, and postoperative periprosthetic fracture in 4, 3, 2, and 1 patients, respectively. Among the 10 patients with implant failure, 7 underwent revision with implantation of a new prosthesis.

Radiographic evaluation of patients without implant failure demonstrated 23 cases of HO (24.2%): 9 type I, 10 type II, and 4 type III. Radiolucent lines were observed in 22 patients (23.2%), with the humeral component more frequently affected than the ulnar component (17 vs 6 cases). Most cases demonstrated low-grade radiolucency, whereas grade 3 and 4 radiolucency were observed in 2 and 4 cases, respectively. MEPS was significantly higher in patients without implant failure compared with those who underwent revision surgery (86 ± 14 vs 70 ± 9 , $p = 0.002$), whereas no significant differences were observed in OES (35 ± 9 vs 35 ± 4 , $p = 0.8$) or QuickDASH scores (26 ± 17.5 vs 35 ± 11 , $p = 0.08$).

Conclusion: This represents the largest reported cohort of patients undergoing Nexel total elbow arthroplasty. Implant survival at nearly 5 years was 90.5%. The incidence of aseptic loosening is low. The Nexel prosthesis provided satisfactory functional outcomes and may be considered a reliable option in terms of clinical performance.



Effect of Humeral Stem Length on Cortical Bone Stress During Torsional Loading Following Total Elbow Arthroplasty

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Introduction: Aseptic loosening remains a leading cause of humeral component failure following total elbow arthroplasty (TEA). One driving factor is stress shielding, occurring when load is transferred primarily through the implant rather than the surrounding bone due to stiffness mismatches. Reductions in physiological loading can contribute to bone remodeling and resorption in accordance with Wolff's law, which can compromise long-term implant fixation. Stem length is an important design parameter because it influences load transfer along the humeral canal. However, the effect of humeral stem length on distal humeral cortical strain under off-axis loading is not well characterized.

Aim: The aim was to evaluate the effect of three different humeral stem lengths on cortical strain in a cemented TEA model under torsional loading.

Methodology: An adjustable smooth cylindrical stainless-steel implant was cemented into the intramedullary canal of five male cadaveric distal humeri (mean age 69 years) following resection of the distal articulation. Three stem lengths – short (20mm), mid-size (60mm), and long (100mm) – were evaluated by retracting a central rod that disengages the longer stem segments, allowing all lengths to be tested within each specimen. Cortical strain was measured using a rosette strain gauge affixed to the anterior cortex 2mm from the distal cut. Strain data

was recorded for each stem lengths under an applied 10.7Nm torsional moment, to mimic forces that occur with low-demand activities of daily living.

Results : A two-way repeated measures assessed the effect of stem length on the distal cortical strain under torsional loading. Under external torsion, stem length did not significantly influence cortical strain ($F(2,8)=0.50$, $p=.623$), indicating comparable strain magnitudes across the short, mid-length, and long stems. Under internal torsion, shorter stems demonstrated increased cortical strain but did not reach statistical significance ($F(2,8)=3.19$, $p=.096$). No significant interactions were observed between length and gauge strains, confirming a minimal measurable difference in distal cortical strain for the conditions tested.

Conclusion: In this model, humeral stem length had limited influence on distal cortical load transfer under torsional loading. Although a small increase in strain was seen with shorter stems, this can be attributed to the smaller effective load transfer area. The differences between stem lengths did not meaningfully alter cortical strain magnitude under torsional loading suggesting that stem length alone will not substantially change load transfer or the degree of stress shielding in the distal humerus. Clinically, maintaining physiologic distal strain may help support bone preservation, suggesting that shorter stems could offer an advantage without excessive loading. Further studies should evaluate the effect of stem length in titanium alloy stems and the effect of cement mantle thickness.



Shoulder Abduction Drives a Flexor-to-Extensor Shift in Elbow Muscle Activation: Implications for Physiologically Representative TEA Simulation

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Introduction: Total elbow arthroplasty (TEA) implants are subjected not only to compressive loading but also to considerable varus-valgus (VV) shear loading, which is associated with bushing wear and premature implant failure. VV forces vary with shoulder position and forearm rotation, increasing elbow torque during activities of daily life.

Current in-vitro simulators increasingly use posture-dependent muscle loading patterns, but these are derived from cadaveric experiments rather than in-vivo neuromuscular data. As a result, they cannot capture dynamic changes in muscle recruitment or stabilisation strategies across different limb positions. Posture-specific in-vivo quantification of elbow muscle activation is therefore required to support physiologically representative simulation protocols and improved TEA implant design.

Aim: This study aims to quantify changes in upper limb muscle activation distribution during statically loaded elbow flexion-extension under varying shoulder abduction and forearm rotations to inform physiologically representative in-vitro simulated active elbow flexion.

Methodology: In six healthy volunteers, static loaded elbow flexion-extension (0–135°, 15° intervals) was performed with a 2 kg weight in hand. Surface electromyography (sEMG) was recorded from seven muscles elbow flexors (biceps brachii, brachialis, brachioradialis, and common flexor group) and elbow extensors (triceps lateralis and medialis, and common extensor group). Each subject performed six conditions combining two shoulder positions (0° and 90° abduction) with three forearm rotations (neutral, pronated, supinated), following determination of maximum voluntary contraction (MVC) for each muscle. Muscle activity was expressed as relative contribution to total EMG. These data were statistically transformed and analysed using linear mixed-effects models that accounted for repeated measurements within subjects. Main effects and interactions were evaluated using likelihood-ratio tests and Type III ANOVA tests.

Results: Total muscle activation was comparable between shoulder positions (10.6% vs. 9.9% MVC at 0° and 90° abduction), indicating preserved overall muscular effort. However, shoulder abduction significantly altered activation distribution: the extensor contribution increased from 46.9% to 64.7%, while the flexor contribution decreased from 53.1% to 35.3% ($\eta^2=0.23$).

This was driven predominantly by the triceps, whose lateral and medial heads increased their contribution by 9.8 and 3.9 percentage points (pp) respectively, while brachioradialis, common flexors, and brachialis each decreased their activation by approximately half (–5.2, –6.1, and –2.9 pp). The biceps brachii was the only muscle unaffected. This redistribution was consistent across all forearm rotation conditions and uniform throughout the flexion arc.

Conclusion: Shoulder abduction transfers approximately 18 pp. of total elbow muscle activation from flexors to extensors without increasing overall muscular effort. This shift is driven primarily by triceps recruitment, further stressing the need for preservation of the triceps during TEA. Current elbow simulators apply flexor-dominant ratios that systematically underestimate extensor-driven VV shear during abducted-arm activities. Adopting a 35:65 flexor-to-extensor ratio for 90° abduction protocols would better replicate loading conditions during activities of daily life.

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Research, imaging and diagnostics

Readiness for International Collaborative Elbow Research: A Survey of Founding Members of the Global Elbow Network

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¹Global Elbow Network Research Committee

Introduction: Despite growing international interest in collaboration, high-quality multinational evidence in elbow surgery remains limited. Developing sustainable collaborative research requires an understanding of research readiness, infrastructure, and governance across participating sites.

Methods: A cross-sectional, web-based survey was distributed to the founding members of the Global Elbow Network (GEN), an international collaborative established to advance elbow care. Founding members were purposely selected to represent recognized clinical and academic leaders across diverse geographic regions. The survey, developed by the GEN Research Committee, assessed research infrastructure, governance and regulatory processes, outcome-measurement practices, perceived evidence gaps, and feasibility of standardized data collection. Responses were analyzed descriptively.

Results: Thirty-one of 53 successfully contacted founding members (59%) from six global regions responded. Fifteen of 31 (48%) reported prior involvement in multicenter elbow research, although experience with international collaboration was inconsistent. Access to research infrastructure varied substantially. While advanced imaging was widely available, access to dedicated research coordinators (13/31 [42%]), biostatistical support (16/31 [52%]), and patient registries (15/31 [48%]) was reported by approximately half or fewer. Governance-related barriers were common, with 15/28 (54%) institutions requiring formal data-sharing agreements and only 3/28 (11%) having completed the full pathway for a fully international elbow study. Outcome-measurement practices were heterogeneous, with wide variation in the use of patient-reported outcome measures and limited routine use of anchor-based assessments. Fracture management, degenerative elbow conditions, pediatric elbow pathology, and elbow instability emerged as priority areas with important perceived evidence gaps, particularly with regards to long-term functional outcomes and rehabilitation. Most respondents reported that implementation of a minimal standardized functional dataset would be feasible with immediate use or modest institutional adaptation.

Conclusion: Among founding members of the GEN, interest in international collaborative elbow research was high, but research infrastructure, governance requirements, and outcome-measurement practices varied across sites. These findings support a phased strategy centered on low-burden collaborative initiatives, including harmonized minimal datasets, consensus-based standardization, and observational multicenter studies.



MRI-based three-dimensional cartilage modelling in the elbow joint: a validation study with potential for biomechanical modelling

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Introduction: Three-dimensional (3D) assessment of elbow cartilage morphology is important for understanding joint biomechanics and osteoarthritis pathophysiology. However, no study has validated magnetic resonance imaging (MRI)-based 3D cartilage models of the elbow joint against high-precision reference models.

Aim: To validate the anatomical accuracy of MRI-based 3D elbow cartilage models using laser-scanned reference models and to investigate their biomechanical applicability through finite element analysis (FEA).

Methodology: Seven formalin-fixed cadaveric elbows without macroscopic osteoarthritic changes underwent high-resolution MRI using an optimized fat-suppressed 3D fast spoiled gradient-echo sequence (voxel size: 0.375 × 0.375 × 0.4 mm). Three-dimensional cartilage models of the distal humerus, radial head, and proximal ulna were reconstructed and compared with high-precision laser-scanned models. Validation metrics included cartilage thickness, surface-to-surface distance, and Dice similarity coefficient. In addition, in-vivo FEA was performed using CT-based bone models with and without MRI-based cartilage to evaluate intra-articular stress distribution under physiological loading conditions.

Results: MRI-based and laser-scanned models demonstrated comparable cartilage thickness distributions. Median cartilage thicknesses measured using MRI-based and laser-scanned models were 1.15 mm and 1.25 mm in the distal humerus, 1.15 mm and 1.03 mm in the radial head, and 1.06 mm and 1.05 mm in the proximal ulna, respectively, with no significant differences between methods. Surface-to-surface root mean square distances were less than 0.40 mm across all regions, and Dice similarity coefficients exceeded 0.96. Bland–Altman analysis demonstrated minimal bias, with limits of agreement within approximately one voxel. FEA incorporating MRI-based cartilage demonstrated localized stress concentration patterns corresponding to anatomical contact regions, whereas models without native cartilage showed broader and less physiological stress dispersion.

Conclusion: MRI-based 3D cartilage models of the elbow joint demonstrated high geometric accuracy and biomechanical validity compared with laser-scanned reference models. This non-invasive approach may provide a useful platform for future biomechanical investigations and quantitative evaluation of elbow joint disorders, including osteoarthritis.



Saline Load Test to Diagnose Elbow Arthrotomy in Living Patients: A Prospective Cohort Study

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Background: Accurate diagnosis of a traumatic open elbow wound is essential to reduce septic arthritis. Although the saline load test (SLT) is commonly used, recommended injection volumes are based largely on cadaveric studies and may not reflect in vivo conditions. This prospective cohort study aimed to determine the minimum saline volume required to detect intra-articular extravasation in living patients.

Methods: thirty elbows undergoing elective arthroscopy were evaluated. After standard portal creation and arthroscopic confirmation of intra-articular positioning, an 18-gauge needle was inserted through the lateral soft spot under direct visualization. Incremental sterile saline

injection began at 10 mL and continued until visible extravasation occurred at the lateral arthrotomy site. The volume at first extravasation served as the primary outcome. Percentile distributions and confidence intervals were calculated, and findings were illustrated using histograms and cumulative distribution analyses.

Results: thirty elbows met the final inclusion criteria. The mean detection volume was 4.71 ± 1.55 mL (95% CI, 3.83–5.59), with a median of 4.75 mL (range, 2.5–7.0 mL). Key percentiles were P90 = 6.85 mL, P95 = 7.0 mL. Extravasation was detected at ≤ 7 mL in 92.9% of elbows, identifying 7 mL as the volume required to diagnose $\geq 95\%$ of arthrotomies. No correlation was observed between detection volume and sex or BMI ($p > 0.05$).

Conclusions: Injection of 7 mL reliably identified $>95\%$ of arthrotomies, establishing a practical, low-volume threshold for clinical use. These findings provide the first in vivo validation of SLT parameters and support its role as an efficient diagnostic tool in periarticular elbow trauma.

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Room B – Soft tissue and the athletic elbow

Distal biceps

Primary Nonoperative Management of Distal Biceps Tendon Ruptures: Comparable Reintervention Rates and Reduced Complications Compared to Primary Repair

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Introduction: Acute distal biceps tendon (DBT) repair is advocated to reduce the risks of fatigue-related pain and minimise loss of forearm supination and elbow flexion strength. However, the outcome of primary non-operative management remains unclear.

Aim: This study aimed to compare the outcomes between primary surgical repair and primary nonoperative management for acute DBT ruptures.

Methodology: This retrospective comparative study included all adult patients with an acute DBT rupture presenting to an academic university hospital between 2018–2025. There were 19 (7.6%) patients that presented >6 weeks post injury and elected for ongoing non-operative management included. Partial injuries or those requiring delayed reconstruction were excluded. Patient demographics, injury characteristics and subsequent management were recorded. Diagnosis used a combination of clinical assessment and further imaging (96 [38.4%] ultrasound, 24 [9.6%] MRI). Treatment was determined with the patient after counselling by a specialist upper limb trauma surgeon. Non-operative management involved early active range of motion. Surgery used a bicortical Endobutton technique. The primary outcome was surgical reintervention.

Results: There were 250 injuries in 241 patients (249 male, 99.6%) with a mean age of 48.6yrs (SD11.6, 25–92). 104 (41.6%) were managed non-operatively and 146 (58.4%) surgically. The nonoperative group were older (52.9yrs [SD 12.1], mean difference 7.5yrs; $p<0.001$). Body mass index, smoking, anabolic steroid use, alcohol excess, and injury mechanism were comparable. Patient records were reviewed at a median 34.5 months (6–140). Reintervention rate was comparable (2.9% nonoperative vs 2.1% surgery; $p=0.673$). Complications were significantly higher post-surgery (38.4% vs 1.9%; $p<0.001$) and included lateral antebrachial cutaneous nerve neuropraxia ($n = 17$, 6.8%), superficial radial nerve neuropraxia ($n = 15$, 6%), wound infection ($n = 11$, 4.4%) and PIN injury ($n = 2$, 0.8%). The two complications (1.9%) in the nonoperative group were symptomatic tendinopathy and ulnar nerve paraesthesia.

Conclusion: Primary nonoperative management of distal biceps tendon ruptures is associated with a low frequency of reintervention and complications, even in a predominantly young and active population. Prospective randomised evaluation of functional outcomes is warranted.



Comparison of Clinical Outcomes and Complications of Unicortical versus Bicortical Button Fixation for Distal Biceps Tendon Repair

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Introduction: Distal biceps tendon ruptures impair elbow flexion and forearm supination strength. Cortical button fixation restores strength; however, traditional bicortical fixation requires dorsal cortical penetration of the radial tuberosity with risk of posterior interosseous nerve (PIN) injury. Unicortical intramedullary fixation was introduced to mitigate this risk, with previous literature demonstrating equivalent biomechanical strength to bicortical fixation. To our knowledge, this is the largest direct clinical comparison of these techniques to date.

Aim: To compare range of motion (ROM), strength, patient-reported outcomes (PROMs), and complications between unicortical and bicortical button fixation.

Methodology: Retrospective cohort study of consecutive distal biceps tendon repairs within 30 days of injury by three upper-extremity surgeons (bicortical predominantly 2019–2023, unicortical 2024–2025). ROM was measured with a goniometer; supination (from pronation/neutral) and flexion strength with handheld dynamometers reported as injured/uninjured ratios. PROMs included QuickDASH, PREE, and SANE. Nerve palsies, heterotopic ossification (HO) and failures were recorded. Continuous variables were compared with Welch's t-test or Mann-Whitney U, categorical with Fisher's exact test.

Results: Eighty-three patients were included (27 unicortical, 56 bicortical). Values are reported as unicortical vs bicortical. Groups were similar in time to surgery (12 ± 6 vs 12 ± 6 days, $p=0.75$),

dominant arm involvement (74% vs 59%, $p=0.31$), and age (45 ± 6 vs 49 ± 11 , $p=0.18$). Follow-up was shorter in unicortical (9 ± 2 vs 24 ± 8 months, $p<0.001$).

Elbow ($136^\circ \pm 8^\circ$ vs $137^\circ \pm 8^\circ$, $p=0.62$) and forearm arc ($151^\circ \pm 14^\circ$ vs $150^\circ \pm 14^\circ$, $p=0.84$) were comparable. Strength did not differ: supination from pronation 82% vs 91% ($p=0.19$), from neutral 67% vs 71% ($p=0.43$), flexion 94% vs 99% ($p=0.29$). PROMs were similar: QuickDASH 4.5 [1.1, 19.3] vs 6.8 [2.3, 13.6], PREE 17.0 [11.7, 26.7] vs 15.0 [10.0, 22.7], SANE 90 [75, 95] vs 90 [80, 98] (all $p>0.20$).

Residual LABCN (7% vs 20%, $p=0.21$) and superficial radial (4% vs 7%, $p=1.00$) paresthesia rates were similar. PIN palsy occurred in one patient per group (4% vs 2%); the bicortical case required neurolysis and implant removal, while the unicortical case resolved with time. HO was observed in 11% vs 27% ($p=0.16$), and re-rupture in 0% vs 4% ($p=1.00$). Button pullout occurred in 5/27 (19%) vs 0/56 (0%) ($p=0.003$); four occurred without intraoperative button-flip confirmation and showed tilted intramedullary buttons on later imaging.

Conclusion: Unicortical and bicortical fixation demonstrated comparable ROM, strength, and PROMs. Complication patterns differed: button pullout was more common with unicortical without intraoperative confirmation of button flip, while asymptomatic heterotopic ossification was more common with bicortical fixation. The low PIN incidence limits firm conclusions regarding relative risk. With routine intraoperative verification, unicortical may be a reasonable alternative; dual unicortical button fixation warrants further investigation alongside larger, adequately powered studies.



Postoperative Biceps Crease Interval Asymmetry Tracks Supination Strength and Cosmetic Outcome After Distal Biceps Tendon Repair

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Introduction: Patients frequently report asymmetry of biceps contour following distal biceps tendon repair. The Biceps Crease Interval (BCI), the distance from the elbow flexion crease to the distal myotendinous junction, is a validated clinical measurement for diagnosing distal biceps tendon rupture. Its postoperative reliability and relationship to patient-reported outcomes (PROMs), cosmesis, and isometric strength remain unstudied, leaving surgeons without evidence to interpret the side-to-side difference routinely seen in clinic.

Aim: To evaluate the interobserver reliability of postoperative BCI, and to evaluate whether BCI asymmetry is associated with PROMs, cosmesis, or isometric strength after primary distal biceps tendon repair.

Methodology: We retrospectively reviewed 103 consecutive primary distal biceps tendon repairs (102 male; mean age 49 ± 10 years; follow-up 17 ± 9 months) with cortical-button fixation by three fellowship-trained upper-extremity surgeons (2019–2025). At final follow-up, two independent observers measured BCI bilaterally. Interobserver reliability used two-way

random-effects intraclass correlation coefficients for absolute agreement (ICC(2,1) and ICC(2,k) with 95% CI); precision was characterized by Bland–Altman analysis, standard error of measurement and minimal detectable change at 95% confidence (MDC95). Associations between BCI asymmetry and QuickDASH, PREE, SANE, a 0–10 cosmetic-concern score, and supination (from neutral/pronation) and elbow flexion strength ratios were tested with Spearman correlation and Benjamini–Hochberg false-discovery-rate (FDR) adjustment ($q = 0.05$).

Results: The injured BCI exceeded the uninjured BCI (3.98 ± 1.34 vs 3.11 ± 1.08 cm; $p < 0.001$; $d = 0.86$), with mean asymmetry 0.88 ± 1.02 cm. Reliability was moderate for single measurements (ICC(2,1) injured 0.72 [0.61–0.80]; uninjured 0.69 [0.58–0.78]) and good for the two-observer mean (ICC(2,k) 0.84 and 0.82). Bland–Altman bias was ≤ 0.25 cm with 95% limits of agreement $\approx \pm 2$ cm; SEM was 0.75 cm and MDC95 was 2.08 cm. Only 12/103 patients (11.7%) had asymmetry exceeding MDC95, indicating most fell within measurement variability. After Fadjustment, greater asymmetry was associated with greater cosmetic concern ($\rho = 0.26$, $q = 0.048$) and reduced supination strength in forearm-neutral testing ($\rho = -0.24$, $q = 0.048$), with the same trend in pronated supination ($\rho = -0.21$, $q = 0.084$). No association was found with QuickDASH ($\rho = 0.09$), PREE ($\rho = 0.06$), SANE ($\rho = -0.07$), or flexion strength ($\rho = 0.03$).

Conclusion: Postoperative BCI is reproducible, and most side-to-side differences fall within measurement error. Greater asymmetry was associated with reduced supination strength – the principal role of the biceps – and greater patient-reported cosmetic concern. Elbow PROMs were insensitive to this isolated supination deficit, likely reflecting their limited sensitivity to forearm-specific demands rather than the absence of functional impairment. BCI is therefore a clinically meaningful indicator of biceps-specific recovery and should be used to identify patients with residual supination weakness and to set realistic cosmetic expectations.

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Epidemiology and applied anatomy

Epidemiology of Acute Distal Biceps Tendon Ruptures

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Introduction: The epidemiology of acute distal bicep tendon injuries remains poorly defined, and whether the incidence is changing over time is unknown.

Aim: This study aimed to define the epidemiology of acute distal biceps tendon (DBT) ruptures managed in a large academic trauma centre with a defined catchment population.

Methodology: A consecutive cohort of patients presenting between 2018 and 2025 with an acute (≤ 6 weeks) full-thickness DBT rupture were identified. Patients presenting >6 weeks post injury, those with partial injuries or patients undergoing delayed reconstruction were excluded. Patient

demographic and injury characteristics were recorded. Linear regression models were defined to predict temporal change in case volume.

Results: There were 234 cases in 224 patients (223 male, 99.6%) and the mean age was 48yrs (SD 11.5). Injury incidence was 3.26/100,000/year. The mean body mass index (BMI) was 31.1kg/m² (SD 5.9), 76 (32.5%) had ≥1 comorbidity, 31 (13.2%) were smokers, 14 (6%) used anabolic steroids and 9 (3.8%) had a history of alcohol excess. The population was employed predominantly in a manual trade (n = 48 [20.5%]) or transport (n = 24, [10.3%]). Injuries were typically isolated (n = 228, 97.4%) and sustained through heavy lifting (n = 106, 45.3%) or sports (n = 70, 29.9%). No predisposition towards hand dominance was observed, with the dominant hand injured in 121 cases (51.7%). Diagnosis was confirmed by the treating clinician using a combination of clinical assessment (n=117, 50%) with further imaging where indicated (n=94, 40.2% USS; n=23, 9.8% MRI). Mean tendon retraction was 44mm (SD 20). Patients primarily underwent repair (n = 143, 61.1%) or nonoperative management (n = 83, 35.5%). Eight patients (3.4%) required allograft reconstruction due to residual tendon quality. There was a significant increase in case frequency with time ($R^2=0.536$; $p<0.001$) with an associated increase in the utilisation of nonoperative management ($p=0.015$).

Conclusion: The incidence of acute distal biceps tendon ruptures is rising. Surgical repair remains the mainstay of treatment, although nonoperative management is growing in popularity and given the increasing number of cases further evidence regarding the optimal management of these injuries is needed.



Quantitative and Topographic Analysis of the Posterior Cutaneous Nerve of the Forearm: Implications for Lateral Elbow Surgery

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Introduction: Open and arthroscopic surgeries of the lateral elbow are commonly performed for a wide range of pathologies. These procedures can cause iatrogenic injury to cutaneous nerves, such as the poorly described posterior cutaneous nerve of the forearm (PCNF), resulting in persistent neuropathic pain or sensory disturbance. Currently, anatomical knowledge of the PCNF is scarce with values reported in absolute rather than normalised distances, limiting generalisability. Therefore, greater applicable knowledge of the anatomical variation of the PCNF and its branches is required to improve surgical planning and reduce complications.

Aim: This cadaveric study aims to quantitatively and qualitatively characterise the anatomic variation of the PCNF and its branches in the lateral elbow region using normalised morphometry techniques and nerve-trace mapping.

Methodology: Thirteen upper limbs (7 right) from seven cadaveric donors (4 female) underwent dissection of the PCNF and its branches. Standardised photographic images were used to quantify nerve positioning with respect to the lateral epicondyle and a representative inter-

epicondylar line (rIEL). Alongside absolute values, measurements were analysed and reported as fractions of the respective donor's inter-epicondylar line (IEL) (measured via calliper), generating "IEL units". This normalised the data for variation in upper limb morphology. The qualitative distribution was assessed using Computer-Assisted Surgical Anatomy Mapping (CASAM) to produce a normalised nerve trace map of all upper limbs with arthroscopy portal incision areas overlaid.

Results: A total of fourteen main PCNF branches coursed 13 ± 7.7 mm (mean $\pm$ SD) anterior to the lateral epicondyle (LE), corresponding to 0.19 IEL units. The PCNF hiatuses, where the PCNF pierces the deep fascia to become superficial, were located at a median of 1.3 IEL units proximal to the rIEL. All specimens had at least one nerve branch within 0.1 to 0.8 IEL units proximal to the rIEL. Nerve branch occupancy declined after 1.4 IEL units distal to the rIEL. Nerve terminations clustered near the level of the LE in both the proximal-distal and anterior-posterior axes. Ten out of thirteen limbs had terminal branches within 0.1 IEL units to the LE. The positioning of minor branches is highly variable compared to the main branches. The nerve trace mapping shows that seven out of the fourteen PCNF branches traversed the anterolateral portal incision area.

Conclusion: The larger main PCNF branches demonstrate a consistent trajectory that highlight regions of higher surgical risk in lateral elbow surgery. These regions include the lateral most quarter of the IEL along with distinct regions proximal to the LE. Out of the portal incisions studied, the anterolateral portal poses the highest risk of injury to the PCNF. These findings support careful portal placement and incision planning during lateral elbow surgery and suggest minor PCNF branches may contribute to the lateral epicondyle innervation.



Epidemiology and prevention of acute traumatic elbow injuries in regular UK sporting participants

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Introduction: Elbow injuries represent a common source of morbidity in sporting activities. Existing literature has largely focused on sport-specific injury patterns within professional athletic populations, with an emphasis on chronic or overuse-related pathology. The applicability of these findings to acute traumatic elbow injuries in the general sporting population therefore remains limited, and no studies have compared the relative risk of such injuries across different sports in the UK.

Aim: The primary aim of this study was to evaluate the relative risk of sustaining an acute traumatic elbow injury across common UK sports. Secondary aims were to assess operative burden and characterise anatomical injury patterns by sport, to inform targeted injury prevention strategies.

Methods: This retrospective cohort study analysed a prospectively maintained elbow injury database from a UK major trauma centre (2022–2025). All sport-related acute traumatic elbow injuries in adult (>16 years) and paediatric (5–16 years) participants were included. Sports were categorised using the Sport England Active Lives hierarchy, with national participation data used to calculate sport-specific cumulative risk, number needed to harm (NNH), and number needed to operate (NNO) for each cohort. Anatomical injury patterns and operative burden were analysed by sporting category and visualised using heatmaps.

Results: 501 adult and 262 paediatric sport-related elbow injuries were identified.

Among adults, roller and skating sports demonstrated the greatest relative injury risk (NNH 26; NNO 180), followed by winter sports (NNH 231; NNO 1,619), climbing (NNH 288; NNO 2,158), and cycling (NNH 360; NNO 1,414). Cycling accounted for the greatest absolute number of adult injuries and operations.

In children, active play carried the greatest relative risk (NNH 202; NNO 430), followed by adventure and outdoor activities (NNH 249; NNO 1,372), cycling (NNH 320; NNO 773), and gymnastics/trampolining/cheerleading (NNH 376; NNO 897). Active play also represented the greatest absolute injury and operative burden in the paediatric cohort.

Isolated radial head fractures predominated in adults, accounting for 42% of all fractures across most high-risk sports. In children, distal humeral fractures accounted for 49% of injuries and predominated across most sporting categories, with the exception of cycling, where proximal radial fractures predominated.

Conclusion: This study provides the first population-based epidemiological analysis of sport-specific acute traumatic elbow injury risk among regular UK sporting participants. These findings enable targeted prevention strategies – including fall-prevention education, safe-falling technique instruction, and protective equipment recommendations – tailored to the highest-risk sports and age groups.

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Instability & the athletic elbow

Early outcomes of lateral collateral ligament reconstruction: standard inlay docking fixation vs mini-invasive knotless onlay suture anchor fixation

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Background: High-grade Posterolateral rotatory instability (PLRI) warrants lateral ulnar collateral ligament reconstruction to restore rotatory stability. We aim to report the use of a muscle sparing, minimally invasive (MI) technique for LUCL reconstruction, through a mini-open (MO)

and an all arthroscopic (AA) approach. We hypothesize that return to functional range of motion (ROM) and return to sport (RTS) would be faster compared to standard docking (DO) technique.

Aim: The aim of the study was to evaluate the outcomes of LUCL reconstruction and compare standard DO technique with mini-invasive technique.

Methods. All patients with PLRI treated by isolated LUCL reconstruction, with a minimum follow-up (FU) of 6 months were included in this retrospective study. Patients undergoing combined LUCL and UCL reconstruction were excluded. Out of 43 patients, 13 were treated using DO, 21 using MO and 10 using AA technique. Pre- and postoperative ROM, functional scores (MEPS, EOS, VAS), time to functional ROM (Flexion-Extension (FE) arc $>130^\circ$), RTS (months), and complications were recorded.

Results. At 12 months, overall mean postoperative MEPS was 96.0 ± 7.6 , mean OES was 14.7 ± 4.9 , mean VAS was 0.5 ± 1.0 , and mean FE arc was $142.1 \pm 14.1^\circ$. Complication rate was 14% and recurrence of instability was 7% (all in the DO group). MI techniques were independently associated with earlier return to functional ROM ($\alpha\beta = -8.2$; 95% CI $[-14.7; -1.8]$, $p = 0.014$) and earlier RTS ($\alpha\beta = -6.2$; 95% CI $[-8.9; -3.4]$, $p < 0.001$), with both the MO ($p = 0.014$; $p < 0.001$) and AA ($p = 0.024$; $p < 0.001$) subgroups confirming these findings independently. Previous LUCL repair was independently associated with lower postoperative ROM ($\alpha\beta = -11.5$; 95% CI $[-19.9; -3.0]$, $p = 0.009$).

Conclusion: LUCL reconstruction provided good early ROM and functional scores regardless the approach. The mini-invasive techniques provided a significant faster recovery of motion and RTS than DO technique.



Radial head enlargement in capitellar osteochondritis dissecans is present preoperatively and associated with long-term clinical outcomes

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Introduction: Capitellar osteochondritis dissecans (OCD) commonly affects skeletally immature adolescent athletes, and some patients require surgical treatment. Although surgery generally yields favorable outcomes, some patients experience persistent pain and limited range of motion postoperatively. Recently, radial head enlargement has been reported in capitellar OCD, but its clinical significance and association with postoperative progression remain unclear.

Aim: To compare postoperative good and poor outcome groups in surgically treated capitellar OCD and identify factors associated with poor outcomes. We also examined whether radial head enlargement was already present preoperatively and whether it progressed postoperatively.

Methodology: Forty patients who underwent surgery for capitellar OCD with at least 3 years of follow-up and provided informed consent were included. Clinical outcomes were evaluated using the Timmerman-Andrews score; patients scoring ≥ 180 were classified as the good outcome group, and those scoring < 180 as the poor outcome group. Radial head ratio (%) was measured on anteroposterior (AP) and lateral radiographs as the affected-to-unaffected side ratio. Twelve adolescent baseball players without capitellar OCD were included as controls.

Results: The mean postoperative follow-up was 6.3 ± 2.7 years. The poor outcome group had a significantly higher preoperative radial head ratio on AP radiographs compared with the good outcome group ($115 \pm 4.5\%$ to $110 \pm 7.5\%$, $p=0.031$). Exploratory univariable logistic regression demonstrated that preoperative radial head ratio was significantly associated with poor postoperative outcomes (OR 1.17, 95% CI 1.04–1.39, $p=0.025$). Compared with controls, the OCD group demonstrated significant radial head enlargement preoperatively on both AP and lateral radiographs (AP: $112 \pm 6.0\%$ to $101 \pm 2.0\%$, $p<0.001$; lateral: $111 \pm 5.0\%$ to $101 \pm 1.9\%$, $p<0.001$).

Pre- to postoperative comparison showed significant progression on AP radiographs in the good outcome group ($110 \pm 4.5\%$ to $113 \pm 5.4\%$, $p=0.003$), whereas lateral radiographs showed no significant change ($109 \pm 4.7\%$ to $111 \pm 5.1\%$, $p=0.109$). No significant postoperative changes were observed in the poor outcome group on either AP or lateral views (AP: $115 \pm 7.5\%$ to $117 \pm 8.3\%$, $p=0.318$; lateral: $113 \pm 4.7\%$ to $114 \pm 5.9\%$, $p=0.883$).

Conclusion: Radial head enlargement was associated with poor postoperative outcomes in capitellar OCD. It was present preoperatively and progressed postoperatively in some patients. Assessment of radial head enlargement using simple radiographs may be useful for preoperative risk evaluation of poor postoperative outcomes.



Algorithmic Approach to First-Episode Medial Elbow Pain in Skeletally Immature Competitive Throwers

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Introduction: Medial elbow pain is a common overuse condition in youth baseball pitchers due to repetitive valgus stress acting on the immature medial epicondyle. Although the epidemiology, diagnosis, and rehabilitation of these injuries are well described, limited evidence exists regarding standardized return-to-throw strategies for skeletally immature athletes. Current interval-throwing programs primarily rely on throw count and subjective effort progression, with limited standardization of distance, volume, and intensity simultaneously. This study proposes a structured algorithm for the management and return-to-throw progression of young athletes presenting with a first episode of medial elbow pain.

Aim: To evaluate the outcomes of an algorithmic approach combining clinical assessment, imaging screening, conservative treatment, and a standardized return-to-throw protocol in skeletally immature competitive baseball pitchers with first-episode medial elbow pain.

Methodology: A prospective study was conducted in Valencia, Venezuela, following Institutional Review Board approval (S.M.C.C.I 00101). Male competitive baseball pitchers aged 12–14 years presenting with isolated first-episode medial elbow pain were included. Initial evaluation consisted of clinical assessment and bilateral elbow radiographs to exclude medial epicondyle avulsion, loose bodies, osteophytes, fractures, instability, and ulnar nerve pathology. All athletes underwent a 12-week conservative treatment protocol consisting of throwing cessation, kinesiology rehabilitation, and analgesics as required.

Following symptom resolution, athletes completed a standardized three-week return-to-throw protocol incorporating three progression variables: throwing distance, throw count, and perceived pitch intensity. Throwing distance progressed from 30 to 60 feet, while throw count increased daily from 5 to 25 throws. Two mandatory rest days per week were included. Recurrence of pain resulted in immediate cessation of throwing and reassessment, including magnetic resonance imaging (MRI).

Primary outcomes included successful asymptomatic return to competitive play and recurrence rate. Secondary outcomes included protocol completion and recovery of preinjury pitch velocity measured using a Bushnell® Velocity Speed Gun.

Results: Sixty adolescent baseball pitchers completed the study. Recurrence of medial elbow pain occurred in 6.67% of athletes ($n=4$). MRI demonstrated medial apophysitis in three athletes and flexor-pronator mass strain in one athlete. Among athletes completing the algorithm without recurrence ($n=56$), 85.71% matched their preinjury pitch velocity at final assessment. All participants successfully completed the return-to-throw progression without major complications.

Conclusion: This algorithmic approach for first-episode medial elbow pain in skeletally immature throwers resulted in low recurrence rates and high rates of successful return to preinjury performance. The proposed protocol offers a practical and reproducible framework for clinicians managing youth overhead athletes.

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Posters

A Simple, Novel Radiographic Tool for Assessing Elbow Bone Quality: Reliability and Computed Tomography Validation of the Radial Tuberosity Index

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Introduction

Poor local bone quality can complicate fixation in elbow trauma. Radiological measurements such as the corticomedullary index or computed tomography Hounsfield unit values can estimate local bone density; however, distal humerus-based measurements are often not feasible in distal humerus fractures. Because bone quality in the distal humerus and proximal radius may reflect similar regional skeletal characteristics, the radial tuberosity index may provide an alternative for estimating elbow bone quality from a standard lateral elbow radiograph.

Aim: The aim of this study was to introduce the radial tuberosity index, assess its reliability and association with computed tomography Hounsfield unit values, and propose thresholds for identifying low local bone quality.

Methodology: The radial tuberosity index was measured on plain radiographs at three predefined proximal radius levels (proximal, mid, distal) as the ratio of the outer cortical diameter to the inner endosteal diameter. A total of 150 adult elbows from 150 patients without fracture who had both radiographs and computed tomography examinations available were retrospectively reviewed. Radiographs with insufficient quality were excluded. Two surgeons performed measurements in two reading sessions. Computed tomography Hounsfield unit measurements were obtained at the distal humerus, radial neck, and radial tuberosity region. Reliability was assessed using intraclass correlation coefficients. Associations between averaged index values and Hounsfield unit measurements were evaluated. Receiver operating characteristic analysis was used to determine an optimal cutoff and gray zone.

Results: Hounsfield unit values showed moderate correlations across regions: distal humerus versus radial neck ($r = 0.444$) and radial neck versus radial tuberosity ($r = 0.462$; both $p < 0.001$), while distal humerus versus radial tuberosity showed a weaker association ($r = 0.299$, $p = 0.0002$). Hounsfield unit measurements demonstrated excellent interobserver reliability (ICC 0.961–0.974). The radial tuberosity index showed excellent interobserver reliability at all levels (ICC 0.946–0.974), with highest intraobserver reliability for the proximal measurement (0.887 and 0.867). The index correlated with distal humerus Hounsfield unit values, strongest at the distal level ($r = 0.405$, $p < 0.001$) and significant at the proximal level ($r = 0.366$, $p < 0.001$). Despite stronger distal-level correlations, the proximal measurement was selected for threshold determination because of higher reliability. Using the lowest quartile of distal humerus

Hounsfield unit values (215 HU), the optimal proximal index cutoff was 1.42 (AUC = 0.76), with gray zone of 1.39–1.45.

Conclusion: The radial tuberosity index is a highly reliable radiographic measurement associated with distal humerus Hounsfield unit values. Because distal humerus-based measurements may not be feasible in distal humerus fractures, the radial tuberosity region may serve as a practical alternative site for estimating elbow bone quality. A proximal index cutoff of approximately 1.42 may assist in identifying low local bone quality when direct distal humerus assessment is not possible.



Long-Term Survivorship and Functional Outcomes of Arthroscopic Debridement for Primary Elbow Arthritis

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Introduction: Arthroscopic debridement is a minimally invasive treatment for elbow arthritis, offering potential advantages such as reduced postoperative pain and accelerated recovery. However, long-term survivorship data remains limited. This study evaluates the durability and functional outcomes of arthroscopic debridement to better define its role in managing elbow arthritis. Methods: A retrospective review was conducted for 359 patients who underwent arthroscopic elbow debridement between November 2006 and November 2023. Survivorship, defined as freedom from revision debridement or conversion to total elbow arthroplasty (TEA), was analyzed using Kaplan-Meier curves. Functional outcomes (range of motion, Mayo Elbow Performance Score [MEPS]) were compared pre- and post-operatively using paired t-tests. Results: The cohort had a mean age of 51 ± 11 years and BMI of 30 ± 5 . Significant improvements were observed in flexion ($126^\circ \pm 13^\circ$ to $129^\circ \pm 14^\circ$, $p < 0.001$), extension ($28^\circ \pm 13^\circ$ to $17^\circ \pm 11^\circ$, $p < 0.001$), There was also a significant improvement in MEPS scores (67 ± 6 to 88 ± 9 , $p < 0.001$). The 10-year survivorship free from revision debridement was 96%, and free from conversion to TEA was 98%. Conclusion: Arthroscopic elbow debridement for osteoarthritis demonstrates excellent long-term survivorship and significant functional improvement with low revision and TEA conversion rates. These findings support its role as a durable and effective joint-preserving option for appropriately selected patients.



Total elbow arthroplasty for unreconstructible distal humerus fracture sequelae in patients less than 40 years old. Long-term outcomes

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Introduction: Total elbow arthroplasty (TEA) is generally discouraged in young patients due to the high risk of early failure.

Aim: The aim of this study was to analyze the long-term outcomes of a cohort of patients under 40 years of age who underwent linked semi-constrained TEA for unreconstructible distal humerus fracture sequelae.

Methodology: We retrospectively reviewed patients who received a Coonrad-Morrey prosthesis between 1993 and 2013. Only post-traumatic cases following failed distal humerus fracture unreconstructible joint surface and a minimum follow-up of ten years were included. Cases of inflammatory or rheumatoid arthritis were excluded.

A total of 16 patients aged 40 years or younger at the time of surgery were identified. One additional patient was lost to follow-up due to a deep elbow infection that required multiple revision surgeries and ultimately implant removal, without subsequent reimplantation, before reaching the minimum follow-up period of ten years. Clinical follow-up included the Mayo Elbow Performance Score (MEPS), the Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) score, the triceps function and assessment of overall patient satisfaction. Radiographs were analyzed for component loosening, bushing wear, and periarticular ossifications.

Results: The mean follow-up was 151 months (range, 125–225 months). Postoperatively, the mean flexion-extension arc was 99°, pronation-supination 103°, MEPS 82, and QuickDASH 12. At the last follow up, 10 of 16 patients (62%) required revision surgery, 5 for component loosening, 4 for isolated bushing exchange, and 1 for bushing exchange with triceps reconstruction. Despite this, 14 of 16 patients (87%) reported satisfaction with the procedure.

Conclusion: Semi-constrained TEA should be considered a salvage procedure in young post-traumatic patients after failed and unreconstructible distal humerus fractures. Our experience indicates that TEA can achieve satisfactory outcomes in terms of pain relief, stability, and range of motion. However, the long-term complication rate remains high (62%) at a mean follow-up of 151 months. Further studies with larger cohorts are required to validate these findings.



Transposition of the local extensor fascia for elbow lateral collateral ligament reconstruction: results in a group of competitive athletes

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Introduction: The lateral ulnar collateral ligament (LUCL) is a primary elbow stabilizer against posterolateral rotatory instability (PLRI). Direct repair is the treatment of choice in the acute setting, whereas reconstruction is the best option in patients with chronic PLRI. Several autograft/allograft solutions can be used to perform LUCL reconstruction, including a local extensor fascia septum autograft.

Aim: To evaluate outcomes of a new technique for lateral ulnar collateral ligament reconstruction.

Methodology: In this retrospective multicenter study, 38 patients (26 males, 12 females) with chronic PLRI of the elbow underwent LUCL reconstruction with a local extensor fascia septum autograft. Patients' mean age at the time of surgery was 35.5 ± 9.6 years. The right elbow was involved in 29 cases, the left elbow in 9 cases. The dominant arm was involved in 23 (61%) patients. All subjects were competitive athletes practicing different sports. Clinical assessments included range of motion and stability using the Mayo Elbow Performance Score (MEPS), the Quick Disabilities of the Arm, Shoulder and Hand score (QuickDASH score), the Visual Analog Scale (VAS), and the rate of return to sports. Radiographs were taken to evaluate joint congruency, heterotopic ossifications and grade of osteoarthritis.

Results: At a mean follow-up of 36.7 ± 7.8 months, the range of motion in flexion and extension was comparable to preoperative values, whereas the postoperative MEPS, the QuickDASH score and the VAS score showed statistically significant differences ($p < .001$). Before the procedure, the MEPS was 76 ± 12.6 , the QuickDASH score was 23 ± 5.6 , and the VAS score during the activities was 5 ± 3 . At the last follow-up, the MEPS was 97 ± 5.9 and the QuickDASH score was 1.3 ± 2.8 ; both showed a statistically significant improvement ($p < .001$). The VAS score was 0.34 ± 0.67 and was also statistically significantly improved ($p < .001$). The significant improvement in the functional scores enabled 33 of the 38 patients to return to their previous sports level.

Conclusion: The high rate of return to previous sports level of our cohort of athletes demonstrates that the local extensor fascia septum autograft is a viable LUCL reconstruction option for patients with chronic PLRI. Further prospective studies are needed to validate these encouraging results.



Internal Joint Stabilizer (IJS) of the elbow. A monocentric study of 22 cases with a short- to mid-term follow-up: clinical, radiographic and histological findings

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Introduction: In difficult cases of elbow instability, the Internal Joint Stabilizer (IJS) has proved to be very useful as it preserves joint stability while soft tissues are healing. However, few studies have focused on the potential complications related to its use.

Aim: To describe the clinical, radiographic, and histological findings of a consecutive series of 22 patients with acute and chronic elbow instability in whom the IJS was implanted.

Methodology: Twenty-two consecutive patients treated with IJS for elbow instability were analyzed. IJS indications included obesity, poorly-compliant patients, muscular patients, bilateral lesions or polytrauma. Range of motion (ROM) was serially recorded at each F-up. MEPS, q-Dash and ASES-e were evaluated at the last F-up. Osteolysis around the pin (i.e. radiolucency thickness - RT) was quantitatively measured on anteroposterior radiographs at each radiographic F-up in four standardized points: lateral border of the capitellum (LC), central point of the capitellum transverse diameter (CC), trochlear notch (TN) and medial border of the trochlea (MT). During IJS removal, one superficial and one deep sample of the tissue surrounding the IJS pin at the level of the lateral epicondyle were collected for histological analysis.

Results: The F-up was 26 months (range, 6-41). The IJS was removed after a mean period of 10 months (range, 2-16). At the last F-up, the mean MEPS, q-Dash and ASES-e were 95.3, 12.8 and 93.9, respectively, while the ROM in E-F and P-S was 16° (range, 0°-35°)-138° (range, 120°-150°) and 75° (range, 70°-80°)- 85° (range, 80°-90°), respectively. During F-up, the RT showed a significant linear progression in all the points analyzed. At the last F-up before IJS removal surgery the mean osteolysis around the axial pin in the four standardized points was 7.05 mm (LC)(range, 3.01-10.8), 6.33 mm (CC)(range, 3.1-8.9, 4.93 mm (TN)(range, 3.1-7.1) e 5.77 mm (MT)(range, 3.1-10.4) After IJS removal, the RT remained stable over time. Two non-compliant patients experienced hardware failure associated with recurrence of instability. The histological examination revealed pathological tissue changes in all samples. Degenerative aspects such as collagen fibers disorganization, increased cellularity and neoangiogenesis were observed in tendons and ligaments whereas degenerative/inflammatory changes consisting in hyperplasia, increased vascularization, fragmentation and fibrin deposition were detected in the synovium. The tissue changes were more marked in samples harvested at later time points when areas of heterotopic ossification also appeared.

Conclusion: In the short- to mid-term, IJS is associated with satisfactory clinical results in the majority of patients. However, the progression of the radiographic and histological findings suggest that the IJS may require early removal.



Is post-operative recovery of rotational stiffness of the elbow affected by the simultaneous treatment of extension-flexion stiffness? Mid-term comparative study of 87 patients operated on by a single surgeon

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Introduction: Elbow stiffness represents the most frequent post-traumatic complication, with a significant impact on upper-limb function. While the surgical treatment of flexion-extension stiffness has been extensively investigated, few studies have focused on rotatory stiffness (RS) treatment.

Aim: To evaluate the mid-term clinical and radiographic outcomes of surgical treatment for post-traumatic isolated rotational (IRS) and combined stiffness (CS) of the elbow in order to verify: 1) whether the surgical treatment of rotational impairment is effective, 2) whether the simultaneous treatment of extension-flexion contracture affects RS recovery. The secondary aim was to create a therapeutic algorithm for RS.

Methodology: A retrospective study on a prospective database was conducted on 334 patients who underwent surgery performed by a single surgeon (G.G.) between 2005 and 2025. Eighty-seven patients with clinically significant rotational stiffness and a minimum follow-up of 6 months were included and divided into two groups: Group I (CS, n=55) and Group II (IRS, n=32). Etiologies, previous treatments, and surgical procedures were recorded. All patients followed a standardized rehabilitation protocol and were clinically and radiographically assessed through ROM and functional scores (MEPS, q-DASH, ASES-e). Statistical analysis with Fisher and Mann-Whitney tests, mixed-effects models and post-hoc tests with Bonferroni correction was performed.

Results: Seventy-nine patients (49 in Group I and 30 in Group II) were analyzed. The mean F-up was 77.3 months (range, 6-212). The main causes of RS and the types of surgery performed were recorded. A significant clinical improvement was observed in each group, with no significant differences between groups. A mean increase of 50° and 56° in E-F ROM and P-S ROM was observed in Group I, whereas in Group II the mean increase in P-S ROM was 66°. MEPS, q-DASH and ASES-e significantly improved in both groups, with a mean increase of 35, 48 e 45 in Group I and of 18, 42 and 37 in Group II, respectively. Eleven reinterventions were recorded (9 in Group I, 2 in Group II), none of which was related to the RS recurrence.

Conclusion: Surgical treatment of rotational elbow stiffness is effective, with a low incidence of recurrence. The simultaneous treatment of flexion-extension stiffness does not affect RS recovery. The most marked functional increases observed in CS point to the efficacy of simultaneous treatment of both types of contractures. A tailored surgical treatment based on the etiology of RS, including procedures such as arthrolysis, HO and hardware removal, radial head resection and replacement, and radial diaphyseal osteotomy, is needed to achieve good functional outcomes.



Medium- to long-term results of press-fit radial head arthroplasty in acute fractures and post-traumatic conditions

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Introduction: Radial head arthroplasty (RHA) is a valid treatment option in unreconstructible radial head fractures and post-traumatic elbow disorders. Several studies reported satisfactory outcomes of loose-fit and cemented implants in the long term, while clinical results and causes of implants failure of press-fit implants are less-known, especially in the mid-long term.

Aim: to assess the clinical results and the causes of implant failure of an anatomical and a bipolar press-fit RHA in the mid- to long-term.

Methodology: 97 consecutive patients treated with a press-fit RHA by a single surgeon were analyzed. According to the type of implant they received there were 56 patients with a bipolar RHA with conical stem (RHS, Tornier) and 41 patients with an anatomical RHA with cylindrical stem (ARHS, Acumed). At the last follow-up, the patients underwent X-rays and clinical evaluation based on the Mayo Elbow Performance Score (MEPS), the patient-assessed American Shoulder and Elbow Surgeons score-Elbow (p-ASES-E), and the Disabilities of the Arm, Shoulder and Hand questionnaire (Q-DASH). The causes of reintervention and implant failure were recorded.

Results: The mean follow-up was 9 years (5-17 years); 24 patients were followed up for longer than 12 years. At the last follow-up, the average flexion, extension, pronation and supination were 139°, 15,2°, 82° and 81,2° in the whole cohort of patients, respectively. The MEPS, Q-DASH and p-ASES-e were 94,3, 6,7 and 93,6, respectively. Four patients underwent reintervention due to implant-related causes during the follow-up. Three of these four patients suffered a bipolar implant disassembly due to a new trauma after 4, 5 and 10 years from index procedure: only the head component was replaced as the stem appeared well integrated in all cases. The forth patient had an anatomical implant that showed asymptomatic progressive loosening with impending fracture of the radial neck after 9 years; it was revised with a cemented long stem.

Conclusion: Both press-fit radial head arthroplasty implants analyzed yielded satisfactory clinical and radiographic results in the medium to long-term in most patients, with a very low incidence of implant-related reinterventions (4.1%). In the absence of a pre-specified non-inferiority framework, no formal equivalence claim between the two implant designs can be made on the basis of the present study.



Tailored Surgical Management of Chronic Unreduced Elbow Dislocation: A Three-Case Series

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Introduction: Chronic unreduced elbow dislocation is a challenging condition because prolonged dislocation is frequently associated with soft-tissue contracture, joint stiffness, collateral ligament insufficiency, articular incongruity, and variable osseous pathology. Unlike acute elbow dislocation, no single standardized surgical procedure is suitable for all chronic cases. Individualized surgical decision-making is therefore essential to restore concentric reduction, stability, and functional motion.

Aim: The aim of this study was to present three distinct cases of chronic unreduced elbow dislocation treated with different surgical strategies and to summarize a practical treatment concept based on the pathological characteristics of each case.

Methodology: Three patients with chronic unreduced elbow dislocation were retrospectively reviewed. Preoperative assessment included clinical examination, radiographs, computed tomography, and evaluation of elbow stiffness, joint congruity, associated bony lesions, and instability pattern. Surgical treatment was individualized according to the chronicity of dislocation, degree of soft-tissue contracture, reducibility of the joint, condition of the articular surface, and intraoperative stability after reduction. The surgical strategies included extensive soft-tissue release and open reduction, management of associated osseous pathology, collateral ligament repair or reconstruction, and protective stabilization when required. Postoperative rehabilitation was adjusted according to the stability of the reconstructed elbow.

Results: All three elbows achieved successful reduction after individualized surgical management. Each case demonstrated a different pathological pattern and required a different operative strategy. In cases dominated by soft-tissue contracture and stiffness, adequate anterior and posterior release was critical for reduction. In cases with associated osseous deficiency or deformity, restoration of the bony stabilizers was necessary to obtain joint congruity. In cases with persistent instability after reduction, ligament reconstruction and protective stabilization were required. At follow-up, all patients showed improvement in elbow alignment, stability, pain, and functional range of motion. No recurrent dislocation was observed during the follow-up period.

Conclusion: Chronic unreduced elbow dislocation should not be treated with a uniform surgical approach. Successful management depends on careful analysis of chronicity, joint reducibility, soft-tissue contracture, osseous involvement, and ligament competence. A tailored surgical strategy can restore elbow reduction and stability while improving functional motion. The three cases highlight the importance of individualized decision-making in the treatment of chronic unreduced elbow dislocation.



Arthroscopic All-Suture Fixation of Kocher–Lorenz Fractures: Surgical Technique and Clinical Outcomes

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Introduction: The Kocher–Lorenz fracture is a rare capitellar injury characterized by a thin osteochondral fragment with minimal underlying bony support. Due to its rarity, no standardized treatment algorithm has been established, and both conservative and surgical management strategies have been described.

Aim: The aim of this study was to describe an arthroscopic all-suture fixation technique for isolated Kocher–Lorenz fractures and to evaluate its clinical and radiological outcomes.

Methodology: Arthroscopic reduction of the capitellar fragment was performed, followed by percutaneous fixation with three Kirschner wires in a triangular configuration. The Kirschner wires served as guides for drilling the tunnels through which two PDS sutures were subsequently passed.

A total of four patients diagnosed with isolated Kocher–Lorenz fractures underwent arthroscopic all-suture percutaneous fixation at a single institution between 2015 and 2025. Functional evaluation included postoperative elbow range of motion and Mayo Elbow Performance Score (MEPS) assessment, while radiological evaluation was performed using standard elbow radiographs. Patients were followed for a minimum of 12 months.

Results: The study included 4 patients, 3 males and 1 female, with a mean age of 34.25 years (range 25–50). At final follow-up (12 months), mean elbow flexion was $131^\circ \pm 4.9^\circ$, while mean extension deficit was $13^\circ \pm 4^\circ$. According to the Mayo Elbow Performance Score, outcomes were excellent in 2 patients and good in 2 patients. All patients returned to their preinjury activities at a mean of 3.1 months postoperatively (range 2–6 months). No neurological complications or reoperations were reported at final follow-up.

Conclusion: Arthroscopic all-suture fixation appears to be a safe and effective option for the treatment of isolated Kocher–Lorenz fractures, providing satisfactory functional outcomes and low complication rates.



The Clinical and Patient-reported Outcomes of Lateral Collateral Ligament Reconstructions of the Elbow

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Introduction: Posterolateral rotatory instability (PLRI) of the elbow results from insufficiency of the lateral collateral ligament (LCL) complex and can lead to instability and functional impairment. Although ligament reconstruction is commonly used to restore stability, patient-reported outcome measures (PROMs) remain limited.

Aim: To evaluate clinical outcomes and PROMs following LCL reconstruction for elbow instability.

Methodology: A retrospective review of consecutive patients with chronic PLRI of the elbow, undergoing LCL reconstruction between April 2018 and May 2025, was performed across three orthopaedics units. All patients included underwent LCL reconstruction using allograft, autograft or internal brace reconstruction.

The primary outcome was elbow function assessed using the Oxford Elbow Score (OES). Secondary outcomes included reported elbow symptoms, return to work and leisure, range of motion (ROM) and complications.

Clinical data were obtained from medical records and PROMs were collected using questionnaires. Descriptive statistics were performed, with continuous data presented as mean $\pm$ standard deviation or median with interquartile range (IQR).

Results: Eighty-four patients underwent LCL reconstruction. Mean age at surgery was 43 $\pm$ 14.9 years, and 48 patients (57%) were male. Median follow-up was 6 months (range 1.5–101). Allograft was used in 44 (52%) cases, internal brace in 26 (31%) cases and autograft in 14 (17%) cases.

Most patients presented with chronic complex elbow instability and underwent concomitant procedures during the same operation. This included radial head replacement (n=17), delayed radial head fixation (n=6), distal humeral corrective osteotomy (n=5), medial collateral ligament reconstruction (n=5), delayed coronoid fixation (n=4), coronoid reconstruction (n=4), radial head resection (n=2) and radiocapitellar interposition (n=2). Five patients underwent LCL reconstruction for instability secondary to extensive elbow arthrolysis.

PROMs were available for 45 patients. Median OES was 40/48 (IQR 32–45), indicating generally good functional outcomes. Clinical follow-up data was available for 27 patients. Of those 27 patients, 85% reported symptom improvement, 26% reported complete symptom resolution, 87% returned to work and 89% returned to leisure.

Pre-operatively, mean extension was 16.4° $\pm$ 19.3° (range 0–80°), mean flexion was 124.8° $\pm$ 23.7° (range 20–145°) and mean ROM was 109.0° $\pm$ 35.5° (range 10–145°).

Post-operatively, mean extension was $15.8^{\circ} \pm 14.4^{\circ}$ (range 0–50°), mean flexion was $135.9^{\circ} \pm 9.3^{\circ}$ (range 120–145°) and mean ROM was $122.8^{\circ} \pm 23.7^{\circ}$ (range 30–145°). Forearm rotation shows a mean supination of $80.8^{\circ} \pm 14.4^{\circ}$ (range 30–90°) and pronation of $81.7^{\circ} \pm 19.0^{\circ}$ (range 10–90°).

Complications occurred in 11 patients (13%) including ulnar nerve paraesthesia (n=4), joint crepitus (n=2), stiffness (n=1), weakness (n=1), intermittent swelling (n=1), radial head subluxation (n=1) and deep infection requiring graft removal and debridement (n=1).

Conclusion:

LCL reconstruction for elbow PLRI was associated with good patient-reported function, high perceived stability and high return-to-work rates in this cohort. Further follow-up is required to evaluate longer-term outcomes.



A Machine Learning Algorithm can Identify the Relationship between the Proximal Ulna and the Biceps Tuberosity

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Introduction: Distal biceps tendon rupture is a common injury encountered by Orthopaedic Surgeons. The anatomy of the bicipital tuberosity (BT) is important in the context of surgical repair or reconstruction. Furthermore, variability in BT morphology, particularly tuberosity height, may reduce the space between the BT and the proximal ulna, with potential implications for forearm rotation and the risk of distal biceps tendon rupture

Aim: To validate the use of a machine learning (ML) algorithm in determining the anatomy of the bicipital tuberosity, and to characterize the relationship between the BT and the proximal ulna through forearm rotation

Methodology: CT-derived radius geometries were segmented in 3D Slicer and exported as STL models. To improve correspondence density in the bicipital tuberosity region, full-length radii were cropped to the proximal 50% of the bone. Point2SSM models were trained using an 80/10/10 train/validation/test split. Two fellowship trained upper limb surgeons independently annotated 38 radii, including 20 left and 18 right specimens, in 3D Slicer. For each radius, a two-point longitudinal axis was defined, along with proximal and distal tuberosity endpoints, 12 prominence points representing the maximum tuberosity height across sequential slices, and 40 periphery points defining the tuberosity border. A custom Python script was developed to calculate tuberosity length, width, height, and normalized peak location. Length was measured between proximal and distal tuberosity endpoints, width was calculated from paired left- and right-periphery points at matched axial levels, and height was calculated as the perpendicular distance from each prominence point to the longitudinal axis. Surgeon-specific measurements

were calculated independently and then averaged to create a consensus measurement for each specimen. Consensus landmarks were mapped to Point2SSM correspondence particles using nearest-neighbour matching, and the most frequently matched correspondence point for each anatomical landmark category was selected. Tuberosity measurements were then repeated using the selected Point2SSM correspondence points and the same measurement definitions.

Results: Comparison between surgeon consensus measurements and Point2SSM-derived measurements demonstrated the following values: tuberosity length 27.5 mm (SD 2.7mm) vs 27.9mm (SD 4.9mm), tuberosity width 15.8mm (SD 1.5mm) vs 17.5mm (SD 2.6mm), maximum height 12.8mm (SD 1.4mm) vs 15.4mm (SD 1.5mm). Point 2SSM correspondence points demonstrated an average Euclidean distance error of 2mm

Conclusions: This statistical shape model demonstrates that Point2SSM can accurately identify correspondence points representative of tuberosity morphology.



Elbow Hemiarthroplasty for Non-Reconstructable Distal Humerus Fractures: A Medium-Term Single-Centre Series

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Introduction: Complex, multi-fragmentary distal humeral fractures in patients with poor bone stock often make stable internal fixation unachievable. Although total elbow arthroplasty provides an alternative, its lifelong functional restrictions are undesirable.

Aim: This study evaluated the functional and radiographic outcomes, and patient satisfaction following elbow hemiarthroplasty (EHA) for distal humeral fractures deemed non-reconstructable in physiologically active patients.

Methodology: We retrospectively reviewed all consecutive patients who underwent EHA at our institution between 2018 and 2025. Of 18 identified patients, one died prior to study initiation, leaving 17 available for review. Indications included acute or sub-acute non-reconstructable distal humeral fractures (displaced, intra-articular, multi-fragmentary, osteopenic bone) in 16 patients and a painful distal humeral non-union in one. A 'triceps-on' approach was used in all cases. A Latitude prosthesis (Wright Medical/Tornier, Bloomington, MN, USA) was implanted using high-viscosity bone cement (Simplex HV; Stryker, Mahwah, NJ, USA). Both collateral ligaments were reefed and attached to the implant spool and, whenever possible, to the distal humerus via drill holes. Patients were assessed for pain (VAS 0–10), range of motion (ROM), validated patient-reported outcome measures (QuickDASH, Oxford Elbow Score [OES], Mayo Elbow Performance Score [MEPS]), and a satisfaction questionnaire. Postoperative radiographs were reviewed for component position, periprosthetic loosening, heterotopic ossification, and condylar healing.

Results: Seventeen patients (mean age 73.7 years, range 58–85) were reviewed at a mean follow-up of 48.8 months (range 13.3–93.3). Mean flexion was 143° (range 120–160°) with a mean flexion–extension arc of 132° (range 90–150°). Mean pronation and supination were 89° and 87°, respectively. The mean VAS pain score was 0.3/10. Functional outcomes were satisfactory with mean QuickDASH of 23.1/100, OES of 40.7/48, and MEPS of 89.2/100. Of 13 patients who opted to complete the satisfaction questionnaire, 100% (13/13) would undergo the procedure again and 92% (12/13) would recommend it to a relative. Residual ulnar nerve territory dysesthesia was reported in 2 patients (12%) at the last follow-up visit without motor deficit and did not warrant further management. Radiographically, one patient (6%) demonstrated asymptomatic, non-progressive lucency around the humeral implant (zones 1–7). Medial and lateral condylar union was achieved in 88% and 100% of cases, respectively. No patient required revision surgery to date.

Conclusion: At medium-term follow-up, EHA with an 'off-label' anatomical spool for non-reconstructable distal humeral fractures provided excellent pain relief, preserved functional range of motion, high patient satisfaction, and 100% implant survivorship to date. These data support the continued use of hemiarthroplasty in carefully selected active patients and justify future comparative studies against internal fixation. Limitations include a retrospective design and small patient cohort.

Keywords: Elbow hemiarthroplasty; Distal humerus fractures; Fragility elbow fractures; Triceps-on approach



Headless Compression Screw Versus Locking Plate in 3-Part Radial Head and Neck Fracture Fixation: A Biomechanical Cadaver Study

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Background: Mason type III radial head fractures involve comminution and can be challenging to treat. For repairable 3-part radial head and neck fractures, headless screw compression and locking plate fixation techniques can be used for surgical fixation. To our knowledge, there is no agreement regarding which fixation method is optimal, and additional study on the biomechanical stability of these different fixation types is important.

Aim: To compare the mechanical stability of headless compression screws versus locking plates for treatment of 3-part radial head and neck fractures in cadaveric elbows.

Methods: Using a custom-made cutting jig, a 3-part fracture was created in 9 pair of cadaveric radial heads. Paired specimens were randomized into 2 fixation groups: headless compression screw (tripod technique) or locking plate. An MTS machine administered a cyclic 100-N load to the fixation construct for 1000 cycles. Fragment displacement was captured by a 3D optical metrology system. The specimens were loaded to failure with an axial compression force to determine the force and stiffness at the time of construct failure.

Results: In both the locking plate and headless compression screw groups, fragment displacements after 1000 cycles of cyclic loading were ≤ 0.1 mm. Maximum displacements during cyclic loading were ≤ 0.2 mm. There was no significant difference in the load to failure between the screw (3276 ± 926 N) versus plate (3660 ± 1108 N) groups ($p = 0.314$), though the screw-fixation group exhibited significantly higher stiffness (1206 ± 486 N/mm) versus the plate (788 ± 235 N/mm) ($p = 0.017$).

Conclusion: Both plate and headless compression screw fixation of 3-part radial head and neck fractures provide comparable resistance to displacement under cyclic loading in this cadaveric testing model, with no difference in load to failure. Based on the findings of this study, either technique may be effective for 3-part radial head fracture fixation. Headless compression screw treatment may be preferable when possible due to reportedly high rates of locking plate removal, though additional clinical study is necessary.



The Medial Gutter Portal Provides an Expanded Visible Working Distance for Posteromedial Elbow Arthroscopy: A Cadaveric Study

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Introduction: The purpose of this study was therefore to investigate the efficiency of a straightforward portal named "medial gutter (MG) portal" the senior author (S.O.D.) has developed to work for posteromedial compartment in the medial gutter area. We hypothesized that the MG portal would provide a further anterior working distance than the standard posterolateral portal in the posteromedial compartment.

Methods: Thirteen fresh-frozen cadaveric elbows were secured in the lateral decubitus position, at 90° of flexion. The standard Posterior portal, novel Medial Gutter portal, and posterolateral portal were established in each specimen. Three raters used a 30° arthroscope to quantitatively assess the maximum working distance limit of the Medial Gutter portal (viewed from the Posterior portal) and the Posterior portal (viewed from the Posterolateral portal). Measurements were recorded using a clock-face analogy (to the nearest half-hour). A one-way ANOVA was

used to compare the portals, and the Interclass Correlation Coefficients (ICC) were calculated to assess inter-rater reliability. P-values < 0.05 were considered to be statistically significant.

Results: The anterior working limit of the Posterior portal ranged from 4:00 (range 3:00 to 6:00). In contrast, the Medial Gutter portal increased that working limit ranging from 7:30 (range 4:00 to 10:00; P < .05). Inter-rater reliability was excellent (ICC>0.99) for both the Posterior portal and Medial Gutter portal assessments.

Conclusion: The Medial Gutter working portal significantly increases the limit of how far anteriorly one can work in the medial gutter arthroscopically compared to the standard posterior working portal. This is important for osteocapsular arthroplasty, synovectomy, loose body removal and synovial chondromatosis.



Comparison of the Diamond Pop-Up approach and van Gorder approach for total elbow arthroplasty: A biomechanical study of joint laxity

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Introduction: Postoperative joint stability after total elbow arthroplasty depends on component alignment and the functions of the soft tissues, such as the collateral ligaments and surrounding muscles. However, the role of soft tissues has not been investigated. We aim to evaluate the relationship between the release sites of the soft tissues and joint stability. Our hypothesis is that the Diamond Pop-Up approach, which releases the collateral ligaments from the ulnar and retains the common flexor and extensor muscles' origins, is more stable than the van Gorder approach, which releases the collateral ligaments from the humeral epicondyles and the common flexor and extensor muscles' origins.

Methodology: Ten paired cadaveric elbows were used, with each side randomly assigned to either approach. Metal markers were placed in a consistent location to extra-articular bones for the ultrasound assessment. The joint gaps between two metal markers were measured as varus and valgus laxities during elbow flexion from 0° to 120° at 10° intervals.

Results: As seen in the figure (*p < 0.05), with all soft tissues released ("Surgical Approach"), the Diamond Pop-Up approach shows significantly smaller laxities than the van Gorder (vanG) approach in varus from 60° to 120° and in valgus from 40° to 120°. With the triceps, common flexor, and extensor muscle tendons repaired ("Tendons Repaired"), the Diamond PopUp approach shows smaller varus laxity and significantly smaller valgus laxity than the van Gorder approach. With the collateral ligaments repaired ("Ligaments Repaired"), the Diamond PopUp approach shows significantly smaller laxities than the vanG approach in varus from 50° to 120°

and in valgus from 90° to 120°. Therefore, the Diamond Pop-Up approach yielded significantly smaller varus and valgus laxities than the van Gorder approach, particularly at angles of flexion greater than 50°. In conditions involving the release of all soft tissue, the van Gorder approach indicated 5–31 times greater varus laxity and 3 times greater valgus laxity than the Diamond Pop-Up approach.

Conclusion: The Diamond Pop-Up approach provides minimal loss of joint stability by releasing the collateral ligaments from the ulna and retaining the common flexor and extensor muscle tendon origins.



Clinical Impact of Radiographic Severity and Anatomical Location of Heterotopic Ossification on Elbow Flexion–Extension in Post-Traumatic Elbow Stiffness: A CT-Based Muscle-Guided Classification Study

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Introduction: Post-traumatic heterotopic ossification (HO) is a major contributor to elbow stiffness and often requires surgical excision when associated with significant motion limitation. Although radiographic severity and anatomical location are recognized characteristics of HO, their specific clinical relevance to elbow motion impairment remains incompletely understood.

Aim: To investigate the clinical relevance of radiographic severity and anatomical location of post-traumatic HO on flexion–extension impairment in patients with post-traumatic elbow stiffness using a CT-based muscle-guided classification system.

Methodology: A retrospective study was conducted in 56 patients with significant flexion–extension stiffness (arc <100°) and visible HO on preoperative CT scans. HO location was classified into seven anatomical categories using a previously developed muscle-guided CT classification system. Radiographic severity was graded into three levels according to extent and morphology of ossification. Elbow motion outcomes included flexion contracture (FC), flexion, and flexion–extension (FE) arc. Correlations between HO characteristics and motion loss were analysed.

Results: Grade 3 HO (complete bony bridging) was significantly more common in elbows with severe and very severe stiffness than in those with minimal or moderate stiffness ($p < 0.001$). Grade 3 HO demonstrated significantly greater flexion contracture (median 60°) and reduced FE arc (median 35°), whereas flexion was not significantly affected. Subgroup analysis showed that posterior HO locations, including posterior–olecranon tip–triceps (P–O–T), posteromedial–medial gutter–flexor carpi ulnaris (PM–MG–FCU), and posterolateral–lateral gutter–anconeus (PL–LG–AN), demonstrated significant correlations between radiographic severity and motion loss. HO surrounding the FCU showed the strongest association, affecting both flexion and extension.

Conclusion: Radiographic severity and anatomical location exert a synergistic influence on elbow motion impairment in post-traumatic stiffness. Posterior HO, particularly around the FCU, demonstrated the greatest functional impact. These findings support the clinical value of anatomical HO classification and may assist surgical planning and functional assessment.



A Computed Tomography Based Method for Pre-operative Implant Sizing in Distal Humerus Hemiarthroplasty

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Introduction: Pre-operative planning is a useful adjunct for optimising joint arthroplasty implantation. In distal humeral hemiarthroplasty (DHH), correct sizing is important to minimise contact pressures and wear of the native joint.

Aim: This study aims to develop a standardised and reproducible method for pre-operative anatomic spool sizing for DHH, using the Stryker Latitude system.

Study Design & Methodology: Pre-operative computed tomography (CT) scans of 63 consecutive patients undergoing DHH for acute fracture in a single tertiary centre were included for analysis. CT scans were obtained from multiple centres.

Patients were excluded if they had poor-quality CT reconstructions, pre-existing elbow osteoarthritis, and associated proximal ulna fractures. Intra-operative and post-operative anteroposterior radiographs of the implanted DHH were assessed for correct sizing according to pre-determined criteria. Patients with an inappropriately sized implant according to these criteria were also excluded.

The method used in this study included measuring the distance between the lateral aspect of the radial head and the sublime tubercle on the 3D reconstruction with the humerus subtracted. To ensure standardisation, the measurement line was drawn from the tip of the sublime tubercle and passed through the midpoint of the radial head, thereby dividing it into two equal portions. Measurements were performed independently by two observers and verified by a senior author. Implant size used intra-operatively was recorded and correlated with the CT measurement.

Inter-observer reliability was assessed using intraclass correlation coefficients (ICC). Differences in CT measurements between implant size groups were analysed using the Kruskal–Wallis test.

Results: There were 5 small plus, 27 medium, 23 medium plus, 4 large and 4 large plus anatomic spools used in the 63 patients. No small-sized spools were used.

CT measurements increased progressively with increasing implant size. There was a statistically significant difference in measurements across implant sizes ($p < 0.001$).

Derived CT cut-off values were: ≤ 40.5 mm for Small plus spools, > 40.5 to < 44.5 for Medium spools, ≥ 44.5 to < 48.5 for Medium plus spools, ≥ 48.5 to < 50.0 for Large spools, and ≥ 50.0 for Large plus spools. Thresholds were based on adjacent-group overlap and percentile separation.

Inter-observer reliability shows excellent agreement with a single-measures ICC of 0.946 (95% CI 0.903–0.971).

Conclusion: A simple CT-based linear measurement provides a reliable and reproducible method for pre-operative estimation of humeral component size in Latitude DHH and may serve as a useful adjunct to surgical planning as well as help with stock management and manufacture.



Surgical versus conservative management of lateral humeral condyle fractures in children: a systematic review and meta-analysis

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Introduction: Lateral humeral condyle fractures, when not managed appropriately, are at high risk of non-union, deformity and functional impairment. There is no consensus for the need of surgical intervention, particularly for minimally displaced fractures, and management strategies vary widely between centres.

Aim: To compare surgical versus conservative management in paediatric lateral humeral condyle fractures.

Methodology: Electronic literature searches were conducted using MEDLINE, Embase, PubMed, and Cochrane Library. All comparative studies comparing surgical versus conservative management in children and adolescents aged ≤ 16 years with radiologically confirmed lateral humeral condyle fractures were included. The risk of bias was assessed using the Newcastle-Ottawa scaler. All data was analysed using Review Manager Software 5.4, and meta-analysis was performed using random effect model analysis.

Results: Six comparative retrospective studies involving 574 paediatric patients with lateral humeral condyle fractures were included. Conservative management was associated with a significantly higher risk of secondary displacement requiring surgical fixation compared with primary surgical management (odds ratio 0.07, 95% CI 0.01–0.48; $p = 0.007$). Overall complication rates did not differ significantly between conservative and surgical strategies (risk ratio 1.60, 95% CI 0.77–3.31; $p = 0.20$; $I^2 = 23\%$).

Conclusion: Conservative management of paediatric lateral humeral condyle fractures carries a clinically meaningful risk of secondary displacement, while overall complication rates and

functional outcomes appear comparable to surgical management. Despite this, the substantially higher risk of secondary displacement with conservative management warrants close radiographic surveillance in non-operatively managed minimally displaced fractures.



Trans-Olecranon Exposure for Rare Bipolar Elbow Fractures with Distal Humerus Involvement in Trans-ulnar fracture dislocations: A Case Series of Eight Patients

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Introduction: Bipolar elbow fractures combining proximal ulna fractures with concomitant distal humerus fractures are rare and highly complex injuries. They are frequently associated with high-energy trauma, severe soft tissue damage, and considerable surgical challenges. Due to the low incidence of this injury pattern, evidence regarding optimal treatment strategies and expected clinical outcomes remains limited.

Aim: The aim of this study was to evaluate radiographic and clinical outcomes, complications, and revision rates following surgical treatment of bipolar elbow fractures involving the proximal ulna and distal humerus.

Methodology: A retrospective case series of eight patients treated surgically for bipolar elbow fractures was performed. The median patient age was 52 years (range 16–76 years), with equal distribution between male and female patients. Six injuries occurred in polytrauma settings, while two resulted from low-energy osteoporotic falls. Open fractures were present in five cases. Distal humerus fractures were classified according to the AO/OTA classification as complete intra-articular type C3 fractures in five patients and partial intra-articular fractures involving the lateral condyle in three patients. In all cases, fracture fixation was performed using a trans-olecranon approach to expose the distal humerus, followed by osteosynthesis of the proximal ulna. Clinical and radiographic follow-up data, postoperative complications, and revision procedures were analyzed.

Results: Radiographic follow-up of at least 240 days was available in seven patients. Heterotopic ossification occurred in two patients, including one Hastings and Graham grade I and one grade II ossification. Posttraumatic arthrosis developed in four patients and was graded according to Broberg and Morrey as grade I in two cases, grade II in one case, and grade III in one case. Functional outcomes were generally satisfactory in patients without advanced radiographic degeneration, reflected by favorable Mayo Elbow Performance Score (MEPS) and DASH scores. However, elbow motion remained substantially restricted. After more than one year of follow-up, the median extension deficit was 27.5° (range 20–50°), and no patient achieved a functional flexion-extension arc exceeding 100°. Revision surgery was necessary in five of eight patients, including procedures for infection, avulsion of the olecranon tip, olecranon nonunion, postoperative stiffness, and symptomatic posttraumatic arthrosis.

Conclusion: Bipolar elbow fractures involving the proximal ulna and distal humerus are severe injuries associated with high complication and revision rates. Although the trans-olecranon approach provides reliable exposure and allows stable fracture fixation, postoperative elbow stiffness and degenerative joint changes remain common despite satisfactory radiographic healing in most patients.



Three-Dimensional Planned Distal Humerus Chevron Osteotomy for Post-Traumatic Cubitus Varus: A Retrospective Case Series with One-Year Functional Outcomes

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Introduction: Supracondylar humeral fractures are among the most common pediatric elbow fractures, and post-traumatic cubitus varus is a recognized late complication. A cubitus varus is a triplanar deformity involving coronal varus, sagittal hyperextension, and axial rotation, with potential long-term functional consequences. With conventional osteotomies it is very difficult to correct this triplanar deformity. Three-dimensional (3D) surgical planning with patient-specific instrumentation (PSI) may allow more accurate correction of the full deformity pattern.

Aim: To evaluate one-year functional outcomes after 3D-planned distal humerus chevron osteotomy using PSI for triplanar correction of post-traumatic cubitus varus.

Methods: This retrospective single-centre case series included 12 patients with post-traumatic cubitus varus (8 male, 4 female; median age 16.0 years). The median interval from injury to surgery was 8.0 years. Bilateral CT scans with osseous segmentation were used for preoperative planning to create patient-specific 3D models. The unaffected contralateral humerus was mirrored digitally and used as the anatomical reference for virtual correction planning. Patient-specific cutting and reduction guides were 3D-printed to facilitate intraoperative transfer of the planned correction. Functional outcomes were assessed preoperatively and at one year using the Oxford Elbow Score (OES), QuickDASH, and patient-rated elbow function on a 0-10 numeric scale. Pain was measured using a 100-mm Visual Analogue Scale (VAS) at rest and during activity. Treatment satisfaction was recorded on a 7-point scale.

Results: At one year, median patient-rated elbow function improved from 5.0 to 8.5 ($p = 0.002$), median OES improved from 66.0 to 93.0 ($p = 0.004$), and median QuickDASH decreased from 20.5 to 3.4 ($p = 0.009$). Activity-related VAS pain decreased from 60.0 to 2.5 mm ($p = 0.062$), while pain at rest remained low throughout follow-up (10.0 to 0.0 mm; $p = 0.484$). Treatment satisfaction was high at six weeks (median 6.0/7) and one year (median 6.5/7). Complete osseous union was achieved in all patients, and no major complications occurred.

Conclusion: 3D-planned PSI-assisted chevron osteotomy was associated with significant functional improvement, high patient satisfaction, and no major complications at one year.

These findings support 3D planning and PSI as a promising approach for triplanar correction of post-traumatic cubitus varus, although larger comparative studies are needed to determine whether it offers superior outcomes over a conventional osteotomy technique.



Allograft Reconstruction vs Acute Primary Repair of Distal Biceps Tendon Ruptures: A Matched Cohort Comparison

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Introduction: Allograft reconstruction is the standard salvage for chronic distal biceps tendon ruptures when primary repair is not feasible. Prior matched comparisons (Hendy et al., Albishi et al.) and systematic reviews found no differences in patient-reported outcomes or range of motion (ROM) but lacked objective dynamometric strength outcomes. Although reconstruction is generally assumed to yield less strength than acute repair, the magnitude of this deficit has not been quantified in a matched comparison.

Aim: To compare strength, ROM, patient-reported outcome measures (PROMs), and complications between allograft reconstruction for chronic ruptures and acute primary repair in a 1:2 matched cohort.

Methodology: Single-institution retrospective cohort, four upper-extremity surgeons. Seventeen allograft reconstructions were matched 1:2 to acute repair controls from a pool of 83 within-30-day repairs. Hard match on sex and hand dominance; caliper match on age and contralateral neutral supination strength (z-scored; tight ± 0.5 SD, relaxed ± 1.0 SD); follow-up was carried as a covariate. Primary outcome: supination strength ratio (injured/non-injured) from pronation. Secondary: supination ratio from neutral and elbow flexion ratio, ROM, PROMs (QuickDASH, PREE, SANE), and complications. The three strength outcomes were tested under Holm-Bonferroni correction. Continuous outcomes were analyzed by generalized estimating equations with pair as cluster; categorical by conditional logistic regression with Fisher's exact as sensitivity.

Results: All 17 reconstructions (mean age 49, 100% male, mean follow-up 41 months) matched 1:2 to 34 controls (mean age 47, 100% male, follow-up 20 months); 10 tight, 7 relaxed. Post-match balance was excellent. Supination ratio in pronation was lower after reconstruction (79% $\pm$ 26% vs 95% $\pm$ 33%; mean difference (MD) -21%, 95% CI -32% to -10%; $p < 0.001$). Other strength outcomes also favoured repair: supination in neutral 52% vs 72% (MD -23%, 95% CI -36% to -10%; $p = 0.001$) and flexion 94% vs 105% (MD -15%, 95% CI -25% to -5%; $p = 0.003$). PREE was higher after reconstruction (23.3 vs 18.0; MD +7.1, $p = 0.017$). QuickDASH, SANE, and ROM did not differ. Residual lateral antebrachial cutaneous nerve symptoms were more common after reconstruction (24% vs 3%, $p = 0.037$). No re-ruptures or infections occurred. Heterotopic ossification, re-operation, superficial radial nerve symptoms, and PIN palsy did not differ.

Conclusion: Strength recovery in our reconstruction cohort was at or above the upper end of published dynamometric series (flexion 94% vs 66–90% reported; supination in pronation 79%

vs 69–85%), so the observed deficits reflect genuine limits of reconstruction rather than underperformance. Even so, this first matched dynamometric comparison demonstrates clinically meaningful strength deficits versus acute repair, with worse PREE and more frequent residual LACBN symptoms. This study is limited by the small sample and its retrospective single-institution design. These findings reinforce the clinical priority of timely diagnosis and acute repair when feasible, and inform realistic counselling when reconstruction is unavoidable.



The Impact of Ankylosis Duration on Surgical Outcomes in Intra-articular Bony Ankylosis of the Elbow Treated with Arthroscopic Arthrolysis: An Analysis of 36 Patients

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Introduction: Surgical treatment for intra-articular bony ankylosis of the elbow remains a challenge in orthopedic surgery. The duration of ankylosis is considered to be associated with the severity of periarticular soft-tissue fibrosis, and it can be a debilitating condition for the patient. To date, there has been no consensus regarding the treatment of intra-articular bony ankylosis of the elbow and the effect of the duration of ankylosis on surgical treatment outcomes.

Aim: This study aimed to evaluate the impact of the duration of ankylosis on surgical outcomes in intra-articular bony elbow ankylosis treated with arthroscopic arthrolysis.

Methodology: The retrospective study was conducted at a tertiary referral hospital from July 2021 to November 2025. The study enrolled 36 patients who underwent arthroscopic arthrolysis performed by a single surgeon. Patient demographics, disease duration, number of procedures, clinical outcomes (range of motion (ROM) improvements, Mayo Elbow Performance Scores (MEPS), and subjective outcomes measured using the Satisfaction Outcome Degree (SOD)), radiologic outcomes, duration of perioperative CPM use, and complication rate were documented. A comparative analysis was performed to evaluate pre- and postoperative outcomes.

Results: A total of 36 patients (20 females and 16 males) were enrolled, with a median follow-up of 14.00 months [IQR, 7.25–21.75]. The mean age of the patients was 34.17 ± 11.84 years. The etiology of the disease was prior surgery (21, 58.3%), infection (5, 13.9%), and arthritis (10, 27.8%). The disease duration was subacute (less than 5 years) in 18 patients and chronic (more than 5 years) in 18 patients.

Twenty-three patients underwent a single surgery, while 13 patients underwent multiple surgeries. All patients showed improvement in clinical outcomes (median flexion-extension ROM: 0.00° vs. 105.00° [IQR, 62.50° – 128.75°]; median MEPS: 65.00 [IQR, 60.00–70.00] vs. 100.00 [IQR, 76.25–100.00]; median final SOD score: 9.00 [IQR, 7.25–10.00]; all $P < 0.001$). The median duration of postoperative CPM use was 3.75 months [IQR, 2.55–7.50]. Complications occurred in 4

patients, including transient ulnar nerve palsy ($n = 3$) and joint instability ($n = 1$). Correlation analysis showed no significant association between ankylosis duration and either postoperative ROM improvement ($P = 0.170$), MEPS improvement (Spearman's $\rho = -0.327$, $P = 0.052$), or final SOD scores ($P = 0.912$).

Conclusion: This study showed that arthroscopic arthrolisis yields favorable and comparable clinical outcomes regardless of ankylosis duration in patients with intra-articular bony ankylosis of the elbow, suggesting that chronic bony ankylosis should not be a contraindication for late intervention.



Biomechanical Performance of Cross-Compression Screw Fixation in Transcondylar Distal Humerus Fractures: A Finite Element Study

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Introduction: Low-lying transcondylar distal humerus fractures (TDHF) in elderly osteopenic patients present significant treatment challenges due to fragment size and reduced bone quality.

Aim: This study aimed to compare the biomechanical performance of a variation of crossed compression screws (CCS) versus standard double plating (DP) fixation methods for TDHF by quantifying fracture fragment surface displacements under physiological loading conditions.

Methods: An isolated three-dimensional distal humerus was derived from medical computed tomography (CT) images of an 82-year-old male cadaver. Five structural configurations were developed: four CCS configurations varying in screw number (two and three) and diameter (2.4 mm or 4.5 mm), and one standard DP configuration with twelve 2.4 mm screws. A low-lying type A2 fracture was simulated with 3 mm uniform cortical thickness to represent osteopenic bone. Finite element analysis evaluated each configuration under four loading conditions representing daily activities: axial compression (250 N), internal rotation (7.5 Nm), posterior bending (10 Nm), and varus bending (10 Nm). Actual fracture displacement (AFD) was defined as the difference in maximum displacement between proximal and distal fragment surfaces. For each loading case, AFDs of the two fixation methods were compared using an improvement performance percentage (IPP).

Results: Internal rotation loading produced the largest AFD for all CCS configurations: 0.114 mm (two 2.4 mm diameter screws), 0.102 mm (three 2.4 mm diameter screws), 0.069 mm (two 4.5 mm diameter screws), and 0.058 mm (three 4.5 mm diameter screws). Axial compression resulted in minimal or no displacement for CCS configurations. The DP configuration exhibited the largest AFD (0.170mm) under posterior bending and no displacement under axial compression load. The three 4.5mm diameter CCS configuration demonstrated the best IPP, followed by the two 4.5mm diameter CCS and the three 2.4mm diameter CCS configurations, while the two 2.4mm diameter CCS configuration exhibited the lowest performance.

Conclusion: Both two and three 4.5 mm diameter CCS configurations provide a biomechanically viable alternative to standard double plating for TDHFs in elderly osteopenic patients. Using the current testing conditions, these CCS constructs offer superior stability in bending and rotation compared to DP. Clinically, CCS fixation offers the potential for less invasive surgical procedures allowing for early range of motion in a vulnerable patient population.



Gradual Correction of Severe Congenital Radioulnar Synostosis Using a Hexapod Frame: A Case Report

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Introduction: Congenital radioulnar synostosis is a rare condition that may lead to severe fixed pronation deformity, functional limitations, pain, and compensatory overuse symptoms. Surgical correction remains challenging because acute derotation osteotomy carries a substantial risk of neurovascular compromise, especially in severe deformities or when associated with shortening. We present a case of severe congenital radioulnar synostosis treated with gradual correction using a hexapod frame.

Aim: To describe the use of a hexapod external fixator for gradual derotation and lengthening in a pediatric patient with severe congenital radioulnar synostosis and to evaluate the early functional outcome.

Methodology: An 11-year-old girl presented with functional limitations during typing and sports activities, overuse complaints, and posterior elbow pain of the left arm. Clinical examination demonstrated a fixed pronation deformity of 130° with absent supination. Computed tomography revealed an extensive proximal radioulnar synostosis with intra-articular extension, absence of the radial head, subluxation of the capitellum, and approximately 3 cm shortening compared with the contralateral side. Genetic evaluation was negative. Following multidisciplinary planning, gradual correction using a hexapod frame was proposed to minimize traction on neurovascular structures while allowing continuous monitoring throughout correction. Osteotomy through the synostosis and frame application were performed after 3D preoperative planning. Gradual correction started one week after surgery and was completed after 57 days.

Results: Gradual correction achieved 125° of derotation combined with 1.5 cm of lengthening over an 8-week period, resulting in a functional forearm position with the goal of neutral to slight pronation. The patient tolerated the correction well without neurovascular complications. The frame was removed after 57 days, followed by 4 weeks of cast immobilization. At 3 months follow-up, the patient reported no pain, was satisfied with the outcome, had regained good upper extremity function, and had resumed sports activities cautiously. Radiographs demonstrated progressive regenerate consolidation.

Conclusion: This case illustrates the potential value of gradual correction using a hexapod frame in severe congenital radioulnar synostosis, allowing controlled derotation with continuous neurovascular monitoring and simultaneous lengthening while achieving a satisfactory functional outcome.



Patterns of Elbow Dislocation Treatment: A Descriptive Population-Based Study Using National Health Data

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Introduction: Elbow dislocation is one of the most common joint dislocations across all age groups and is frequently associated with ligamentous and osseous injuries. However, large-scale epidemiological data on incidence patterns and treatment settings remain limited.

Aim: This study aimed to analyze national patterns of elbow dislocation with regard to incidence, demographic distribution, and treatment setting using comprehensive population-based data.

Methodology: A retrospective population-based study was conducted using nationwide German health data from 2016 to 2024. Elbow dislocation cases were identified and stratified by age, sex, and treatment setting. Annual case numbers, administrative prevalence per 100,000 inhabitants, and age-specific incidence rates were calculated. Subgroup analyses were performed for adult and pediatric populations, and associated injuries were evaluated.

Results: Between 2018 and 2024, annual case numbers ranged from 32,471 (2019) to 28,388 (2024), with a declining administrative prevalence from 39.05 to 33.49 per 100,000 inhabitants. The majority of cases were managed in the outpatient setting, accounting for 85.9% in 2018 (27,567/32,094) and 87.4% in 2024 (24,826/28,388), while inpatient cases decreased from 4,527 to 3,562.

Age-specific analyses demonstrated the highest incidence in pediatric patients, particularly in children aged 0–4 years, with consistently higher rates in females (e.g., 8,941 cases in 2024 vs. 5,490 in males). In adults, incidence patterns varied by age and sex. In 2024, males showed higher incidence rates in younger age groups (12.1 per 100,000 in 18–29 years vs. 7.1 in females), whereas females demonstrated a marked increase with age, peaking at 24.0 per 100,000 in patients >70 years compared to 7.5 in males.

Sex-specific incidence rate ratios confirmed a male predominance in younger age groups (IRR <1 in 18–44 years), while females showed higher incidence in older populations, with an IRR of approximately 3.1 in patients >70 years.

Common associated injuries included rupture of the ulnar collateral ligament (23.67%), rupture of the radial collateral ligament (21.04%), radial head fractures (16.08%), and coronoid process fractures (12.22%).

Conclusion: This nationwide analysis demonstrates a decreasing incidence of elbow dislocation with a clear predominance of outpatient management. Distinct age- and sex-specific patterns were identified, with higher rates in young males and elderly females. The high prevalence of associated ligamentous and osseous injuries highlights the need for thorough diagnostic assessment. These findings provide important insights for clinical decision-making and healthcare resource planning.



Development of a Three-Dimensional Modeling Method for Pediatric Elbow Cartilage Based on CT Attenuation Homogeneity

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Introduction: Cartilage is generally difficult to visualize on CT because of its low X-ray attenuation. While MRI is widely used for cartilage assessment, the relatively long scan time limits its use in emergency settings. In addition, high-resolution MRI requires longer scan times, making it difficult to evaluate detailed cartilage morphology. Given that CT can be performed rapidly, CT-based visualization and three-dimensional modeling of articular cartilage may be useful for diagnosing acute cartilage injuries and quantitatively evaluating the extent and severity of cartilage injury.

Aim: This study aimed to develop and validate a CT-based segmentation method for three-dimensional modeling of pediatric elbow cartilage.

Methods: The study included image datasets from two pediatric elbows that underwent both CT and MRI for upper-extremity disorders. The developed method was based on the principle that cartilage is characterized by relatively homogeneous CT attenuation, whereas the surrounding soft tissues are heterogeneous and include focal low-attenuation areas. First, the threshold was defined as the CT attenuation value with the highest voxel count in the soft-tissue histogram, and areas above this threshold were extracted as the initial region. Next, regions through which a 2-mm-diameter sphere could pass continuously from the olecranon fossa were extracted to generate an osteochondral model. This sphere-passage step was designed to retain the homogeneous, continuous cartilage region while excluding heterogeneous, discontinuous surrounding soft tissues.

The accuracy of CT-based osteochondral models was assessed against MRI-based reference models. To minimize the influence of bone-surface agreement, both models were cropped to the smallest volume that contained the entire cartilage region, using planes perpendicular to the humeral axis. The evaluation parameters were the Dice coefficient, recall, precision, and mean surface distance. Recall was defined as the proportion of the MRI-based reference model

reproduced by the CT-based model, and precision was defined as the proportion of the CT-based model that matched the MRI-based reference model.

Results: In the two validation cases, the CT-based models showed Dice coefficients of 0.89 and 0.90, recall values of 92.1% and 90.6%, precision values of 86.3% and 89.6%, and mean surface distances of 0.70 mm and 0.72 mm, respectively.

Discussion: The difference in CT attenuation homogeneity may reflect the contrast in tissue composition: cartilage has a relatively homogeneous composition, whereas the surrounding soft tissues have a heterogeneous composition with interspersed low-attenuation fat. The proposed method represents a novel image-analysis technique that may enable quantitative assessment of cartilage morphology and contribute to improved diagnosis and treatment evaluation in various joint disorders.

Conclusion: We developed a method for generating three-dimensional osteochondral models of pediatric elbow cartilage from CT data. This method enabled highly accurate cartilage modeling.



Considerations for Distal Biceps Tendon Rupture in Anabolic Steroid Users: Incidence, Treatment, and Outcomes

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Introduction: Distal biceps tendon (DBT) rupture is an increasingly recognised musculoskeletal injury, with incidence rates rising sharply over the past two decades. Anabolic-androgenic steroid (AAS) use has emerged as a significant modifiable risk factor, with proposed pathophysiological mechanisms including muscle-tendon unit imbalance and collagen dysplasia. Although surgical repair remains the standard of care for restoring elbow flexion and supination strength, the impact of AAS exposure on postoperative complications and functional outcomes remains poorly defined.

Aim: This systematic review aims to evaluate the evidence regarding AAS use in DBT ruptures, focusing on incidence, perioperative considerations, and surgical outcomes to provide evidence-based guidance for clinical counselling and rehabilitation.

Methodology: This systematic review was conducted in accordance with PRISMA guidelines. PubMed, MEDLINE, and EMBASE were searched for relevant studies published up to October 2025. All studies reporting on incidence, management, or outcomes of distal biceps tendon rupture associated with AAS use were eligible, with no restrictions on language, country, or patient demographics. Data extracted included patient demographics, AAS exposure characteristics, surgical technique, complications, and functional outcomes. Due to significant heterogeneity

across included studies, meta-analysis was not performed and findings are presented descriptively.

Results: Nine studies encompassing a total of 291,937 patients with 858 DBT ruptures met the inclusion criteria. The cohort was predominantly male (77–100%) with a mean age of 40 years (range 23–54). Of the two studies reporting it, there was no age difference between AAS and non-AAS users (43, 42 vs 43, 43). The incidence of distal biceps tendon rupture ranged from 0.22% to 9% in the AAS-using group, compared with 0% to 0.05% in the non-AAS-using group. Prescription testosterone use was associated with a 4.1-fold increased odds of DBT rupture within one year of initiation (95% CI 3.45–4.89), with risk persisting long-term (OR 2.07; 95% CI 1.94–2.38). Bilateral rupture occurred in 4.5–8.3% of AAS users. Among five studies reporting operative outcomes (21 AAS users, 132 non-AAS users), four demonstrated no significant difference in functional outcomes between groups. One study reported superior DASH (3.6 vs 14.6, $p < 0.05$) and MEPS (100 vs 89.6, $p < 0.05$) in AAS users up to 12 months postoperatively. Complication rates, including transient nerve palsy and heterotopic ossification, were comparable between groups.

Conclusion: Current evidence demonstrates a clear association between AAS exposure and increased DBT rupture incidence. Furthermore, the evidence supports operative repair which yields excellent functional outcomes with comparable complication rates regardless of AAS exposure. Standard surgical techniques and rehabilitation protocols appear appropriate for this population. While the nuanced aspects of surgical technique have not been fully elucidated, this remains an area deserving of further investigation.



Feasibility and reliability of ultrasonography for diagnosis of acute elbow soft tissue injuries in children

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Introduction: Several studies have demonstrated that ultrasonography has high sensitivity and specificity for detecting skeletal injuries in children. However, there are no reports describing its use for soft tissue injuries of the elbow in this population.

Aim: The primary aim of this study was to investigate the feasibility and patient experience of ultrasound examination in children following an elbow trauma. A secondary aim was to investigate the inter-rater reliability of soft tissue injury assessment performed by independent orthopedic surgeons.

Methodology: This prospective cohort study included patients under 18 years with acute elbow trauma (fractures, dislocations, or joint effusion). Participants underwent standardized ultrasound examinations within 16 days of injury, performed by 2 independent orthopedic surgeons blinded to each other's findings. Six predefined anatomical structures (extensor muscle origin, lateral collateral ligament, annular ligament, medial muscle origin and the anterior and posterior bundles of the medial collateral ligament) were systematically assessed

and categorized as injured or non-injured. Feasibility was assessed using two patient-reported experience measure (PREM) items, and reliability was evaluated using Cohen's kappa and percentage agreement.

Results: A total of 84 children were enrolled between October 1st, 2022 and April 15th, 2026. The median age was 9 years (range, 2–17 years), 49 (58%) were boys. The ultrasound examinations were performed at a mean of 6 days (range 0–16) post-injury, with 96% of the participants reporting a positive experience. The overall agreement between 2 observers across all variables ranged from 69% to 96%. Cohen's weighted kappa values for each examined structure ranged from 0.50 to 0.73, indicating moderate to substantial agreement.

Conclusion: Ultrasonography is a well-tolerated, reliable method for assessing acute elbow soft tissue injuries in children and adolescents, with high patient satisfaction supporting feasibility in outpatient care.



Reported DAIR Success Versus First-Debridement Success in Elbow Periprosthetic Joint Infection: A Systematic Review and Meta-analysis

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Introduction: Debridement, antibiotics, and implant retention (DAIR) is used for acute periprosthetic joint infection (PJI) after total elbow arthroplasty (TEA), particularly when implant retention is preferred and revision surgery carries substantial morbidity. However, “successful DAIR” is not consistently defined in the elbow literature. In some studies, success reflects a favourable outcome after the index debridement, whereas in others it may include retained-implant status achieved only after several debridement procedures.

Aim: To determine whether reported DAIR success after infected TEA reflects success after the first debridement, while accounting for repeat debridement burden and variation in outcome definitions.

Methodology: A PRISMA-guided systematic review and meta-analysis was performed. Embase, MEDLINE, and Scopus were searched on 18 September 2025, with one additional study identified through manual screening. Studies reporting DAIR outcomes for PJI after TEA were included when DAIR-specific outcome data were extractable. Reported DAIR success was defined as the final successful DAIR outcome reported by each study. First-debridement success was defined as success after the initial DAIR procedure without further debridement or reoperation. Studies were grouped into three categories according to how repeat debridement or reoperation was handled: counted as failure, included within final DAIR success, or not clearly defined. Reported DAIR success was pooled using random-effects meta-analysis; first-debridement success, debridement number, definition group, and timing were analysed descriptively.

Results: Twelve studies comprising 183 DAIR-treated elbows were included. The pooled reported DAIR success proportion was 49% (95% CI, 34%–64%; $I^2=56.1\%$). First-debridement success was derivable in 8 studies comprising 122 elbows. Within these studies, reported DAIR success was 44.3% (54/122), whereas first-debridement success was 19.7% (24/122). The mean number of debridement procedures per case, reported in 4 studies, ranged from 1.3 to 4.0, with individual cases requiring up to 7 debridements. Weighted average reported DAIR success increased across the three definition categories: 28.1% when repeat debridement/reoperation counted as failure, 59.3% when repeat procedures could still occur within final DAIR success, and 60.0% when success definitions were unclear. Earlier DAIR within 2 weeks showed higher raw reported success than later DAIR (76.5% vs 50.0%), but the pooled comparative estimate was imprecise and not statistically significant.

Conclusion: Reported DAIR success in elbow PJI should not be interpreted as equivalent to success after a single operative debridement. Final retained-implant success often included additional debridement procedures and first-debridement success was substantially lower than study reported DAIR success. Future elbow PJI studies should report first-debridement success, repeat debridement burden, and explicit surgical failure definitions so that DAIR outcomes can be interpreted more consistently and applied more clearly to patient counselling and surgical decision-making.



Mechanical Stress-Driven Osteoarthritis in a “Non-Weight-Bearing” Elbow Joint: Three-Dimensional Analysis of Spatial Osteochondral Coupling

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Introduction: Osteoarthritis was once regarded as a disease of articular cartilage wear, but is increasingly recognized as a disorder of the osteochondral unit, involving interrelated changes in cartilage and subchondral bone. Among factors, mechanical stress is important in cartilage degeneration and subchondral bone remodeling. Although the elbow is generally considered a non-weight-bearing, it is exposed to complex joint-specific mechanical stress, including compression, rotation, and shear. However, whether such mechanical stress contributes to the development and localization of elbow osteoarthritis remains unclear.

Aim: To evaluate spatial osteochondral coupling between cartilage and subchondral bone in normal and osteoarthritic elbows, and to determine whether cartilage wear is associated with subchondral bone densification, suggesting a role of joint-specific mechanical stress in lesion localization.

Methodology: Twenty normal and ten osteoarthritic cadaveric elbows were analyzed. For cartilage assessment, each elbow was scanned with a three-dimensional optical scanner before and after cartilage dissolution, and cartilage models were generated by superimposing the cartilage-bone model onto the cartilage-free bone model. For subchondral bone

assessment, three-dimensional bone models were reconstructed from computed tomography data, and subchondral bone density was phantom-calibrated in mg/cm³. Predefined points of interest were distributed over the distal humerus, radial head, and proximal ulna, and assigned to anatomical subregions. Cartilage thickness/wear and subchondral bone density were quantified for each subregion. Spatial osteochondral coupling was assessed overlap ratios between cartilage thick/thinning regions and high-density subchondral bone regions. Subregion-specific values were compared using non-parametric tests.

Results: In normal elbows, cartilage thickness and subchondral bone density showed distinct distribution patterns, indicating limited spatial osteochondral coupling. Thicker cartilage regions (1.10–2.49mm) were concentrated around the center of the elbow joint. In contrast, subchondral high-density regions were distributed in the capitellum (499±75mg/cm³), posterior humeral trochlea (575±67mg/cm³), sagittal ridge of the ulnar trochlear notch (523±80mg/cm³), and ulnar-volar side of the radial head (527±98mg/cm³). The overlap ratio between thick cartilage regions and high-density subchondral bone regions was 32.1%±13.2%.

In osteoarthritic elbows, cartilage wear/thinning was concentrated in regions with high subchondral bone density. The greatest cartilage thinning was observed in the capitellum (0.33±0.31mm VS 1.22±0.18 mm; p<0.001) and ulnar-volar side of the radial head (0.54±0.38mm VS 0.86±0.16 mm; p<0.001). Subchondral bone density was increased in these regions (590±121mg/cm³; p<0.001 and 601±101mg/cm³; p<0.001, respectively). The overlap ratio between cartilage wear/thinning regions and high-density subchondral bone regions was 67.3%±24.5% in osteoarthritic elbows, exceeding that in normal elbows (p<0.001).

Conclusions: Elbow osteoarthritis demonstrated increased spatial osteochondral coupling, with cartilage wear and subchondral bone densification co-localizing in specific articular regions. This finding indicates that elbow osteoarthritic degeneration is organized around regions subjected to joint-specific mechanical stress. Even in a non-weight-bearing joint, these results support mechanical stress as a major driver of cartilage degeneration and subchondral bone remodeling.



Complications and Transfer Pathways in Open Elbow Fractures in a Major Trauma Centre: A Retrospective Cohort Study

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Introduction: Open fractures of elbow are uncommon high-stakes injuries. British Orthopaedic Association Standards for Trauma provide framework for open fracture management of tibia, but upper-limb-specific guidance remains sparse. District general hospitals (DGHs) receiving these injuries decide transferring to tertiary trauma unit with upper-limb and orthoplastic expertise relying on individual clinical judgement rather than upper-limb-specific evidence.

Aim: To determine whether transfer from DGH to tertiary centre following open elbow fractures is associated with worse early outcome after adjustment for injury severity and case-mix. Further aim was to develop and validate risk prediction model for complications using baseline injury characteristics available at first presentation.

Methodology: Retrospective review of consecutive patients with open elbow fractures treated at a single major trauma centre over a 10-year period, including patients presenting directly and those transferred from DGHs with distal humerus, proximal ulna, proximal radius, or combinations of these fractures. Primary outcome was 90-day early complication composite: any of infection, wound breakdown, major metalwork failure or migration, new nerve injury, or an unplanned complication-driven return to theatre within 90 days of index operation.

Logistic regression model was used to identify association between DGH transfer and early complications. Penalised logistic regression model (elastic-net) using six injury features chosen before analysis: wound class (Gustilo 1, 2, 3), fracture location, nerve/vascular injury, injury energy, other orthopaedic injuries, and other non-orthopaedic injuries was used to ascertain complication prediction risk.

Results: Of 206 registry patients, 142 (68.9%) had analysable outcomes with minimum 3 months of follow-up, and 111 (53.9%) had minimum 6 months. In the primary analysis group ($n = 142$) transferred and directly presenting patients were similar in wound class, fracture location, nerve status, and injury energy. Median time to theatre was 20.3 hours; 99.3% had debridement at first theatre. Transferred patients had more non-orthopaedic injuries (58.0% vs. 37.0%, $p = 0.021$).

The 90-day early complication composite occurred in 27/142 patients (19.0%); 18.5% (17/92) in direct presentations vs. 20.0% (10/50) in transfers. Complication rates were similar with infection, wound problems, and nerve issues being the main. Neither upper-limb specialist involvement (adjusted OR 1.21, $p = 0.71$), plastic surgery input (adjusted OR 0.71, $p = 0.72$), nor time to theatre showed significant association with 90-day outcome. Transfers from DGH was not associated with worse early outcomes after adjusting for severity. Baseline injury features could not reliably predict 90-day complications.

Conclusion: In this single-centre cohort, transfer from DGH to tertiary centre was not associated with worse 90-day outcome after severity adjustment, although comparator was directly-presenting tertiary patients rather than DGH-retained patients. Baseline injury features alone did not support a clinically usable early risk prediction model. A multicentre study including DGH-managed patients is needed to define evidence-based referral thresholds for open elbow fractures.



All-Cause Mortality Following Total Elbow Arthroplasty Periprosthetic Joint Infection

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Introduction: Prosthetic joint infection (PJI) is a devastating complication after total elbow arthroplasty (TEA), with pooled rates exceeding those of other joint arthroplasties. While PJI is the most common indication for early revision TEA, it is also a frequent indication for late revision. The effects of PJI on patient mortality are well established in the lower extremity and shoulder literature, with significantly increased 5- and 10-year mortality rates reported. The TEA population is unique, as many patients undergo TEA for inflammatory arthritides, which may carry systemic implications and require chronic immunosuppression.

Aim: The purpose of this study was to determine whether there is an association between total elbow PJI and 5-year all-cause mortality.

Methodology: A single-institution total joint registry was reviewed to identify patients who underwent first-time revision TEA between 2000 and 2026. A total of 128 patients were included (63% female, mean age 64 ± 13 years). Revisions were categorized as septic (25%) or aseptic (75%). Septic revisions were further classified as (1) debridement, antibiotics, irrigation, and implant retention (10%); (2) 2-stage reimplantation for deep infection (84%); or (3) unexpected positive cultures during revision surgery (6%). The most frequently isolated organism was coagulase-negative Staphylococcus (26%), followed by Cutibacterium acnes (14%). All-cause mortality was identified through the institutional registry and confirmed by retrospective review. Mortality rates were compared between groups, and Cox regression analysis was performed to evaluate the association between septic revision and 5-year all-cause mortality after adjustment for age, sex, BMI, and ASA class.

Results: The 1-year crude mortality rate was 3.1% in the aseptic group and 0% in the septic group ($p=0.57$). At 5 years, crude mortality rates were 11.5% and 15.6% in the aseptic and septic groups, respectively ($p=0.55$). Univariable Cox regression demonstrated a statistically similar hazard of 5-year all-cause mortality between septic and aseptic revision groups (HR 1.26, 95% CI 0.44–3.62; $p=0.67$). After adjustment for age, sex, BMI, and ASA class, septic revision remained unassociated with increased 5-year mortality (adjusted HR 0.74, 95% CI 0.23–2.34; $p=0.61$). Increased age (adjusted HR 1.08, 95% CI 1.03–1.13; $p=0.003$) and higher ASA class (adjusted HR 3.49, 95% CI 1.17–10.40; $p=0.025$) were independently associated with increased 5-year mortality.

Conclusion: Elbow PJI was not associated with increased 5-year all-cause mortality compared with aseptic revision. Increased age and higher ASA class were independently associated with increased mortality following revision TEA.



Fragment tilt on CT scan and high fluid signal on Magnetic Resonance Imaging are independent risk factors for Osteochondritis Dissecans lesion instability through rocking horse mechanism

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Introduction: The aim of the study was to describe the "rocking horse effect" of unstable OCD lesion under arthroscopic evaluation and assess if the presence either locking symptoms, a tilted OCD fragment at CT scan, fluid signal on T2 MRI sequences or articular cartilage disruption associated with the said arthroscopic findings.

Methods: This study is a retrospective review of all patients that were referred to the senior author from 1996 to 2023 due to an osteochondral lesion of the capitellum and underwent surgery. Patients were excluded if pre-operative physical examination, second level imaging studies (either CT scan or MRI) and intra-operative report were lacking. The patient population was divided in two groups: 1) cases, characterized by the presence of an osteochondral lesion with a rocking horse effect; 2) controls, characterized by the presence of a stable osteochondral lesion or of osteochondral flaps. Demographic data of the patients, age and sex, together with physical examination of the affected elbow, intra-operative report was collected from patients' charts. The presence of locking symptoms, presence or absence of either a high fluid signal interposed between the native bone and the osteochondral defect and/or the presence of cartilage disruption in T2 MRI sequences and of a tilted bony fragment in respect to the elbow capitellar contour in CT scan were reported. A Fisher exact test was used to assess the association between variables. A multivariable logistic regression model was fitted to look for independent predictors of positive rocking horse effect. with a significance level set at 0.05.

Results: Seventy-one patients, mean age 15 years old (range 11-21 years), were included; of these, 12 patients had a lesion that was considered stable during surgery, while in 59 the lesion was considered unstable. The rocking horse effect was witnessed during surgery in 53 cases (75%). While the presence of locking symptoms during pre-operative examination did not correlate with a positive arthroscopic finding ($p = 0.06$), all the other parameters positively correlated with the presence of a rocking horse effect ($p < 0.01$ for all conditions). In multivariable logistic regression, CT-defined tilted

angulated fragment as well as high fluid signal on MRI were considered independent predictors of a positive rocking-horse effect (likelihood-ratio $\chi^2 = 3.98$, $p = 0.046$, (likelihood-ratio $\chi^2 = 5.44$, $p = 0.020$ respectively).

Conclusions: The rocking horse effect of a capitellar OCD lesion, described as the possibility of the osteochondral fragment to move upon probing during arthroscopy is an indirect sign of lesion instability. Both the presence of a tilted fragment at pre-operative CT scan and high fluid signal presence in pre-operative T2 MRI scans are highly indicative of an unstable OCD lesion.



Early Clinical Outcomes of Patient-Specific 3D-Printed Custom Distal Humeral Implants in Complex Primary and Revision Total Elbow Arthroplasty: A Preliminary Case Series

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Introduction: Total elbow arthroplasty in the setting of substantial humeral bone loss presents a challenging. Standard implant options are frequently inadequate. Additionally, attempts at reconstruction with humeral allograft prosthetic composite or off-the-shelf megaprotheses have been shown to have high complication and humeral-sided failure rates >33%. Patient-specific 3D-printed implants have emerged as a potential solution. Clinical evidence supporting their use remains nascent.

Aim: This study reports early outcomes and complication profiles of a consecutive series of patients treated with a custom 3D-printed distal humeral implant for complex total elbow arthroplasty reconstruction in the primary and revision setting.

Methodology: We retrospectively reviewed 16 consecutive patients who underwent distal humeral reconstruction with a custom patient-specific 3D-printed implant (Restore3D, Durham, NC). Seven elbows met inclusion criteria for this initial analysis: ≥6 months of clinical follow-up or implant failure (humeral component explantation or death). There were 4 females and 3 males with a mean age of 57 years (range 16–71), and a variety of indications (Infection (n=2), fracture (n=2), tumor (n=1), failed primary arthroplasty (n=1), other (n=1)). The mean follow-up was 1.0 ± 0.5 years. Outcomes included implant characteristics, range of motion (ROM), joint stability, patient satisfaction, and patient-reported outcomes (SANE; PROMIS Pain Interference and Upper Extremity). Complications, reoperations, and humeral-sided failure were recorded. Analysis was descriptive given the case-series design.

Results: At short-term follow-up, 1/7 (14%) elbows had a humeral-sided failure with a fracture at the humeral-stem-bone junction. There were 3 reoperations: revision ulnar APC (n=1), revision ulnar APC with an ulnar component explant (n=1), and one humeral explant (n=1) in the patient with the humeral-sided failure. Three of 7 patients (57%) experienced ≥1 complication: nerve palsy (n=1), periprosthetic fracture (n=2), wound dehiscence (n=1), and component loosening (n=1). The mean stem length was 80.3 ± 16.7 mm; with a diameter of 10.3 ± 2.5 mm and one elbow requiring triceps reconstruction. One patient died of stroke at 7 months postoperatively; included as a failure endpoint.

Conclusion: In this preliminary series of complex distal humeral reconstructions using a patient-specific 3D-printed implant, there was only 1 humeral sided failure at short term follow-up. Joint stability and patient-reported pain consistently trended toward improvement. Complication and reoperation rates were substantial, reflecting the high-risk nature of the underlying pathology. These early findings support feasibility and establish a foundation for ongoing prospective study. Continued accrual is required to power survival analysis and comparative outcome assessment.



Outcomes OF Allograft Prosthetic Composite Reconstruction for Revision of Infected Total Elbow Arthroplasties with Massive Bone Loss

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Introduction: Revision surgery for infected total elbow arthroplasty (TEA) is among the most technically demanding procedures in upper extremity surgery. Periprosthetic infection accelerates bone loss, often necessitating allograft prosthetic composite (APC) reconstruction. Published outcomes following APC reconstruction in this setting are sparse, and prior reports may underestimate the true failure burden of this complex population.

Aim: To characterize survivorship free from repeat deep infection, complications, reoperations, and functional outcomes following APC reconstruction for confirmed periprosthetic TEA infection.

Method: Patients undergoing APC reconstruction for periprosthetic TEA infection between 2015 and 2025 at a single tertiary referral center were identified from a prospective total joint registry. Confirmed infection required ≥ 2 culture-positive isolates of the same organism, draining sinus tracts or fistulae, gross purulence, or clinical infection with a positive aspiration. Only the index APC per patient was analyzed; patients were censored at repeat deep infection, death, or construct failure. Outcomes assessed included demographics, APC construct details, Kaplan-Meier survivorship free from repeat deep infection, complications, reoperations, and patient-reported measures (VAS pain, SANE, Mayo Elbow Performance Score [MEPS], PROMIS Pain Interference, and range of motion).

Results: Thirty-four patients were included (55.9% female; mean age 62 ± 11.8 years; BMI median 30.3). Comorbidities included rheumatoid arthritis (44.1%) and diabetes (8.8%); 47.1% were current or former smokers. Patients had undergone a median of 6 prior elbow surgeries; 76.5% were native-bone-to-APC and 20.6% were APC-to-APC revisions. Mean follow-up was 2.7 years.

The most common organisms were *S. epidermidis* (32.4%), *S. aureus* (11.8%), and *Cutibacterium acnes* (11.8%). Constructs were ulna-only (55.9%), combined ulnar and humeral (26.5%), and humerus-only (17.6%); 82.4% required triceps reconstruction. Mean humeral defect was 12.3 ± 6.0 cm and ulnar defect 8.3 ± 4.5 cm.

Complications occurred in 76.5% of patients (35 events): deep re-infection (41.2%), construct or hardware failure (20.6%), periprosthetic fracture (11.8%), and other (14.7%). Reoperations were required in 64.7%: DAIR (34.8%), revision APC or prosthesis (30.4%), and implant removal or spacer placement (17.4%).

Patient-reported outcomes improved significantly: VAS pain 6.6 to 2.9 ($p = 0.011$), SANE 25.9 to 52.5 ($p = 0.004$), and mean postoperative MEPS was 52.7. PROMIS Pain Interference and range of motion trended toward improvement but were not statistically significant; 55.9% reported

postoperative satisfaction. Kaplan–Meier survivorship free from repeat deep infection: 71.5% at 1 year, 61.2% at 2 years, 52.4% at 3 years, and 39.3% at 5 years.

Conclusion: APC reconstruction for periprosthetic TEA infection yields significant improvements in pain and function; however, the complication and reoperation burden is substantial and 5-year survivorship free from repeat deep infection was only 39%—considerably lower than previously reported. These findings highlight the complexity of this reconstruction and should inform preoperative counseling for patients facing infected TEA with massive bone loss.



Increasing Screw Density Reduces Distal Screw Fatigue Failure and Alters Failure Mechanics in Midshaft Humerus Bridge Plating

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Introduction: Mechanical failure following plate fixation of midshaft humerus fractures most commonly occurs through screw loosening, screw breakage, and progressive loss of fixation. Traditional biomechanical testing protocols frequently produce immediate catastrophic shaft fracture and fail to reproduce these clinically relevant hardware-related failure patterns.

Aim: To develop a cyclic torsional loading model capable of reproducing clinically relevant fixation failure and to determine whether increasing screw density reduces physiologic hardware-related failure during bridge plating of midshaft humerus fractures.

Methodology: Nine matched pairs of cadaveric humeri (18 specimens) underwent bridge plate fixation using a standard 11-hole midshaft humerus plate. Constructs were fixed with either three or five screws per fracture fragment and a 5-mm midshaft osteotomy gap was created to simulate a comminuted fracture pattern. Specimens were subjected to cyclic torsional loading using a progressive ramp protocol beginning at 10 Nm with 2 Nm increases every 100,000 cycles until construct failure or runout. Runout was defined as survival through 100,000 cycles at 22 Nm without meeting predefined failure criteria. Primary outcomes included failure torque, cycles to failure, screw loosening, screw breakage, removal torque loss, and mode of failure.

Results: The cyclic ramp protocol consistently reproduced clinically relevant hardware-related failure patterns including screw loosening, screw breakage, screw backout, and progressive construct failure. Three-screw constructs failed at a median torque of 10 Nm (range 10–18 Nm) compared with 16 Nm (range 10–22 Nm) for five-screw constructs. Three five-screw constructs tolerated loading to at least 20 Nm, including two that reached 22 Nm or runout. Five of nine three-screw constructs failed through isolated distal screw breakage without shaft fracture. No five-screw construct failed through isolated distal screw fatigue or screw breakage. Three-screw

constructs consistently demonstrated a distal failure phenotype characterized by progressive loosening and breakage of screws distal to the fracture site. In contrast, five-screw constructs demonstrated a proximal failure phenotype characterized by progressive loosening of proximal screws and subsequent proximal shaft fracture. Removal torque analysis demonstrated that the screw with the lowest residual fixation strength consistently corresponded to the observed site of failure initiation. In five-screw constructs, the most proximal screw (P5) exhibited the lowest residual fixation strength in 6 of 9 specimens, corresponding to the observed location of proximal failure. Initial insertion torque did not predict failure location.

Conclusion: Increasing screw density protected against distal screw fatigue failure, improved torsional tolerance, and shifted failure away from the fracture site during bridge plating of midshaft humerus fractures. The cyclic ramp protocol successfully reproduced clinically relevant hardware-related failure patterns and may provide a more physiologic platform for evaluating fixation strategies. These findings suggest that screw density plays a dominant role in directing torsional load transfer and construct failure behavior.



The clinical and radiological outcomes of arthroscopic treatment of osteochondritis dissecans of the capitellum with 'minced' autologous cartilage transplant

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Introduction: Osteochondritis dissecans (OCD) of the capitellum is an important cause of elbow pain and functional limitation in adolescent athletes participating in repetitive loading sports. Surgical treatment is often required for unstable lesions, however current cartilage restoration techniques may involve donor-site morbidity or staged procedures. Arthroscopic minced autologous cartilage transplantation is a single-stage biological procedure that aims to regenerate hyaline-like cartilage while minimising surgical morbidity. Promising outcomes have been reported in the treatment of chondral lesions of the knee and ankle; however, evidence regarding its use in capitellar OCD remains limited.

Aim: This study aims to describe and evaluate the early clinical and radiological outcomes of arthroscopic minced autologous cartilage transplantation for capitellar OCD in adolescents.

Methods: Adolescents who underwent arthroscopic minced autologous cartilage transplantation were prospectively evaluated. The primary outcome was return to sport at the same level prior to symptom onset. Secondary outcomes included patient satisfaction, complications, and postoperative Magnetic Resonance Imaging (MRI) findings, including bone oedema and graft incorporation. Patient satisfaction was categorised as fully satisfied, partially satisfied, or not satisfied.

The procedure was performed as a single-stage operation. The OCD lesion was debrided, and unstable cartilage was harvested and minced using a shaver connected to a graft collector. The

cartilage fragments were combined with platelet-rich plasma and fibrin to create a biological scaffold, which was then secured into the defect using fibrin glue. Descriptive analyses were performed using Stata version 18 (StataCorp LLC, College Station, Texas, USA).

Results: Ten patients (mean age 14 years; range 13–17) were included. Median follow-up was 12-months (range 12–24). Sports included gymnastics, cheerleading, netball, climbing, basketball, tennis, and cricket. Nine (90%) patients returned to their pre-symptom level of sport; one patient, who had surgery two years after symptom onset, returned to a different sport.

Nine patients (90%) reported full satisfaction, while one patient reported partial satisfaction due to unrelated elbow pain caused by an anterolateral plica and is planned to undergo surgical excision of the plica. MRI demonstrated oedema improvement at 6-months and resolution at 1-year in all patients. Partial graft incorporation was seen in all patients at 1-year, with complete incorporation in the patient with 2-year follow-up. No graft displacement, complications, or revision procedures were observed.

Conclusion: Arthroscopic minced autologous cartilage transplantation is a promising minimally invasive treatment for capitellar OCD in adolescents, avoiding donor-site morbidity and staged procedures. Early clinical and radiological outcomes are encouraging, though larger comparative studies with longer-term follow-up are required.



Translation and Validation of the Dutch Version of the Patient-Reported Outcome of Fracture Healing (PROOF) Questionnaire for Pediatric Upper Extremity Fractures

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Introduction: Patient-reported outcome measures (PROMs) are increasingly used to evaluate treatment outcomes and patient satisfaction after fractures. Although most fractures heal uneventfully, treatment may significantly affect pain, daily functioning, participation in sports and school activities, cosmetic appearance, and overall satisfaction of both children and parents.

Validated fracture-specific PROMs for children are scarce. The Patient-Reported Outcome of Fracture Healing – Upper Extremity (PROOF-UE) questionnaire is a developed and validated English-language PROM designed to assess functional recovery and satisfaction in children after upper extremity fracture treatment. Currently, no validated Dutch fracture-specific PROM exists for the pediatric population.

Aim: The aim of this study was to translate, adapt, and validate the Dutch version of the PROOF-UE questionnaire for children with upper extremity fractures.

Methodology: Translation and adaptation were performed according to international forward-backward translation guidelines. Validation was conducted according to COSMIN recommendations in three Dutch hospitals. Pediatric patients aged 5–17 years treated for upper extremity fractures were included. PROMs were administered digitally between 1–6 weeks (T0) after injury and repeated at 6 months follow-up (T1). A two-week retest interval (T2) after the 6-month assessment was used to determine the test-retest reliability. Construct validity was assessed using established PROMs including PODCI, EQ-5D-Y, QuickDASH, Numeric Rating Scale, and Oucher pain scale. Reliability was evaluated using intraclass correlation coefficients (ICC) and internal consistency using Cronbach's alpha. Responsiveness, floor and ceiling effects, and interpretability were additionally assessed.

Results: A total of 172 pediatric patients have been included. Questionnaire completion rates were 100% at baseline (T0), 61,6% at 6-month follow-up (T1), and 40,7% at 6 months and two weeks (T2). The study population consisted of 49,4% male and 50,6% female patients, with a mean age of 10,4 years (SD 3,0). The most common fracture locations included wrist/hand, forearm, and elbow.

Final psychometric analyses, including internal consistency (Cronbach's alpha) and test-retest reliability (ICC), are currently being completed and will be available at the time of congress presentation.

Conclusion: The Dutch PROOF-UE questionnaire provides the first validated Dutch PROM for pediatric upper extremity patients, with high internal consistency and reliability. Implementation of this instrument may improve standardized evaluation of recovery, functional outcomes, and patient satisfaction after pediatric fracture care and support future multicenter clinical research in pediatric trauma and elbow surgery.



Outcomes of the Treatment of Posterolateral Rotatory Instability Using the Arthroscopic Imbrication Technique

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Introduction: Posterolateral rotatory instability (PLRI) is frequently secondary to traumatic insufficiency of the lateral collateral ligament (LCL) complex. Arthroscopic LCL imbrication is a recently described alternative with encouraging clinical results in the literature when used for grade 1 or 2 PLRI.

The objective of this study is to evaluate the short-term clinical outcomes of an initial series of patients with grade 1 or 2 PLRI treated with this technique.

Methods: A prospective, single-center study was conducted on patients with grade 1–2 PLRI who underwent arthroscopic or nanoscopic imbrication with at least 24 months of follow-up between 2021 and 2023. Range of motion (ROM), the Mayo Clinic Elbow Performance Score (MEPS), and the QuickDASH scale were assessed preoperatively and at 6, 12 and 24 months post-procedure.

Results: Ten patients with grade 1–2 PLRI were evaluated. The initial diagnosis was an elbow fracture-dislocation in 6 patients and a simple dislocation in 4 patients. The average preoperative ROM was 127° of flexion, –17° of extension, 66° of pronation, and 70° of supination. At 6 months post-procedure, average ROM improved to 144° of flexion and –3° of extension, with all patients achieving full pronation and supination. At 24 months, average ROM was 150° of flexion and –1° of extension.

Mean QuickDASH and MEPS scores were 22.5 and 85 at 6 months, and 16.3, 100 at 12 months and 14, 100 at 24 months respectively. Preoperative versus postoperative comparisons demonstrated statistically significant improvements in both QuickDASH and MEPS scores.

Conclusion: Our results suggest that arthroscopic or nanoscopic imbrication is a safe and effective option for the management of grade 1–2 PLRI.



Mechanisms of Mechanical Failure in Total Elbow Arthroplasty: A Systematic Review of Retrieval and Clinical-Radiographic Evidence

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Introduction: Total elbow arthroplasty (TEA) is increasingly used for complex elbow pathology, but long-term durability remains substantially lower than that achieved by total hip (THA) and total knee arthroplasty (TKA). Although the wear-debris-osteolysis paradigm has been thoroughly validated in hip and knee retrieval studies, no systematic review has previously synthesised retrieval-based evidence in TEA.

Aim: To systematically evaluate the mechanisms of mechanical failure in TEA based on combined evidence from physical retrieval analyses and clinical or radiographic investigations, and to position these findings against the established hip and knee retrieval literature.

Methodology: A systematic review was conducted in accordance with the PRISMA 2020 statement. Two independent reviewers selected studies and extracted data. Eligible studies involved physical analysis of retrieved TEA implants or clinical/radiographic assessment of mechanical failure. Risk of bias was appraised using the Methodological Index for Non-Randomised Studies (MINORS) for cohort/case-series and a custom retrieval-quality checklist for explant studies. Thematic synthesis was performed across retrieval-based and clinically-based evidence streams.

Results: Sixteen studies met inclusion criteria (six retrieval/hybrid; ten clinical/radiographic). The Coonrad-Morrey prosthesis dominated the evidence base (14/16 studies). A unifying mechanistic cascade was identified: eccentric polyethylene bushing wear (asymmetric thinning in 96–100% of retrieved bushings) generates polyethylene, titanium, cobalt-chrome and PMMA particulate debris; this debris drives periprosthetic osteolysis; loss of bony support and interface debonding produce the clinically observed end-stage failures of aseptic loosening, component fracture, and hinge mechanism failure. Implant-specific failure signatures were identified for unlinked (Kudo, Souter-Strathclyde) versus linked (Coonrad-Morrey, Nexel) designs. Indication-stratified analysis showed rheumatoid cohorts had longer time-to-failure but identical mechanisms, while posttraumatic cohorts had earlier hinge/locking failures. Risk of bias was moderate to high across studies. Reported 15-year survivorship clustered between 68% and 83%.

Conclusion: Mechanical failure in TEA follows the same wear-debris-osteolysis paradigm established by hip and knee retrieval studies, but with elbow-specific features driven by eccentric varus/valgus loading and small bone envelope. This is the first systematic review to synthesise retrieval evidence in TEA and provides a mechanistic framework that prior clinical-only TEA reviews have lacked.



Current Practice of Elbow Arthroscopy in Latin America: A Cross-Sectional Survey of Orthopedic Surgeons with a Shoulder and Elbow Practice Interest

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Introduction: Elbow arthroscopy has emerged as a minimally invasive alternative with increasingly broad diagnostic and therapeutic applications in orthopaedic surgery. Despite technical advances and the growing body of evidence reported in the international literature, its incorporation into routine clinical practice remains variable, particularly in regions where structural and educational limitations exist. Understanding the factors that influence the adoption of this technique in Latin America is essential to identify barriers, opportunities, and training needs within the regional context.

Aim: To evaluate the current practice patterns, training backgrounds, perceived barriers, and interest in collaborative educational initiatives related to elbow arthroscopy among orthopedic surgeons in Latin America. We hypothesized that despite widespread interest, elbow arthroscopy would be performed at low volumes with significant training gaps and identifiable systemic barriers.

Methodology: A cross-sectional, web-based survey was developed and distributed electronically via SurveyMonkey to orthopedic surgeons with a subspecialty interest in shoulder and elbow surgery across Latin America between October 2025 and February 2026. The 19-item questionnaire, organized into 6 domains, was developed by a panel of shoulder and elbow

surgery specialists, piloted among 10 surgeons, and distributed through professional society networks. Adherence to the Consensus-Based Checklist for Reporting of Survey Studies (CROSS) was followed. Descriptive statistics were used for analysis.

Results: Of 158 consenting surgeons from 19 countries, 148 (93.7%) completed the core survey. The mean age was 48.7 ± 9.5 years with 17.9 ± 9.6 years of experience. Although 75% (111/148) had performed elbow arthroscopy, 56.8% performed only 1–5 cases annually, and 70.4% self-rated as beginner or intermediate. Training was considered partially adequate or insufficient by 70.4% of respondents. The most frequent indications were loose body removal (97.3%), stiff elbow (65.8%), and synovitis (60.4%). Leading systemic barriers were low clinical demand (65.3%) and limited training access (50.7%). Interest in a collaborative network was 86.0%.

Conclusions: Elbow arthroscopy in Latin America is characterized by high interest but low volume, significant training deficits, and interconnected systemic barriers. The overwhelming support for a regional network provides a strong mandate for collaborative educational initiatives and multicenter research.



Long-term Clinical and Radiological Outcomes of Septic Arthritis of the Elbow in Children: Three Cases with up to 13 Years of Follow-up

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Introduction: Acute septic arthritis of the elbow in children is a rare but potentially devastating condition resulting in permanent joint damage and lifelong disability if treated inadequately. Given this destructive potential, it is crucial to monitor treatment effects not only in the short term, but also through long-term follow-up to detect late sequelae. However, long-term outcome data on septic arthritis in children remain scarce and largely outdated. Therefore, long-term sequelae in the context of modern management remain insufficiently studied, making follow-up studies essential, particularly for less commonly affected joints such as the elbow.

Aim: To report the long-term clinical and radiological outcomes for acute septic arthritis of the elbow according to contemporary management principles.

Methodology: Three male patients with confirmed acute septic arthritis of the elbow were identified as part of a larger national multicenter retrospective cohort study conducted across four Dutch hospitals (2008–2018). Diagnosis was confirmed by one or more of the following: pus aspirated from the joint, a positive joint fluid culture, or a joint fluid white blood cell count exceeding $50,000/\text{mm}^3$. All patients underwent prompt drainage and intravenous antibiotic therapy. At long-term follow-up, patients underwent clinical examination, completion of patient-reported outcome measures, including the EQ-5D-Y-3L and the QuickDASH questionnaire, and standardized radiographic assessment. Radiographs were graded using the Kellgren and Lawrence (KL) classification.

Results: The three patients presented at ages 1, 7, and 14 years, with causative organisms being *Kingella Kingae*, *Streptococcus pyogenes* (group A), and *Staphylococcus aureus*, respectively. Initial drainage consisted of arthrocentesis in all cases; two patients required additional drainage procedures, including arthrotomy in both. At follow-up, conducted at ages 14, 15, and 25 years, representing a follow-up duration of 8 to 13 years, no abnormal findings were detected on physical examination in any patient. All three radiographs showed KL grade 0, indicating no radiological osteoarthritis. The EQ-5D-Y-3L index score was 1.0 in all patients, reflecting no problems across all health domains, with VAS scores of 80, 80, and 90. QuickDASH scores for function and symptoms were 0, 0, and 2.3, indicating no or minimal upper-extremity disability.

Conclusion: All three children treated for acute septic arthritis of the elbow according to contemporary management principles demonstrated excellent long-term clinical and radiological outcomes at up to 13 years of follow-up, with no radiological joint degeneration and near-maximal patient-reported functional scores. These findings suggest that, with prompt and adequate treatment, favorable long-term outcomes can be achieved in pediatric elbow septic arthritis. Given the rarity of elbow septic arthritis in children, multicenter collaborative studies are needed to confirm these findings and identify potential prognostic factors.



MRI Analysis of the Development and Ossification of the Coronoid Process in Children

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Introduction: Assessment of paediatric elbow trauma is challenging due to the cartilaginous nature of the immature elbow and the sequential appearance and fusion of ossification centres. Accurate radiographic interpretation depends on knowledge of normal ossification chronology. Although the major elbow ossification centres are well described, the ossification pattern of the coronoid process has not previously been characterised. This is an important diagnostic gap, as paediatric coronoid fractures are uncommon but may be radiographically occult. Missed coronoid injury may contribute to coronoid dysplasia and persistent elbow instability and arthritis, which can be difficult to treat in adulthood. Defining normal ossification may improve diagnostic accuracy and treatment in of paediatric coronoid injuries.

Aim: To characterise normal age and sex related ossification of the paediatric coronoid process using MRI.

Methods: A multicentre retrospective review of paediatric elbow MRI examinations was performed across four hospitals over 15 years. Patients aged 0–17 years were eligible where sagittal T1-weighted reconstructions were available. Exclusion criteria included poor image quality, acute traumatic injury, or pathology likely to alter normal elbow development. A novel angular measurement, the coronoid ossification angle, was developed to quantify progressive

ossification. This angle reflects residual cartilaginous coronoid height and decreases with advancing ossification. Inter- and intra-observer reliability were assessed using intraclass correlation coefficients. Fusion status of the remaining elbow ossification centres was recorded to evaluate correlation with coronoid maturation. Analyses were performed by age and sex.

Results: Of 469 MRI examinations reviewed, 225 met inclusion criteria: 121 female and 104 male patients. The coronoid ossification angle demonstrated excellent inter- and intra-observer reliability, with intraclass correlation coefficients of 0.90 and 0.93, respectively. Increasing age was significantly associated with a reduction in coronoid ossification angle, indicating progressive ossification. The greatest reduction occurred between 10 and 14 years in females and 12 and 16 years in males. Complete ossification was typically observed by 14 years in females and 16 years in males ($r=0.77$, $p<0.001$). Olecranon physal fusion was strongly associated with complete coronoid ossification and demonstrated high diagnostic accuracy, with sensitivity 94.9%, specificity 90.4%, and AUC 0.93. An unfused olecranon physis reliably excluded complete coronoid ossification, with negative predictive value 98% and negative likelihood ratio 0.06.

Conclusion: This study provides the first description of normal age- and sex-related ossification of the paediatric coronoid process. The olecranon physis is a reliable surrogate marker for coronoid maturation; when unfused, complete coronoid ossification is highly unlikely. In females younger than 14 years and males younger than 16 years, radiographs and CT may underestimate true coronoid height because of persistent cartilaginous morphology. T1-weighted MRI should be considered when accurate coronoid assessment is required in this age group. This timeline has implications for diagnosing paediatric coronoid injury and preventing long-term elbow instability.



Isolated Fractures of One Column (Medial or Lateral) of the Distal Humerus: Outcomes After Open Reduction and Internal Fixation

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Introduction: Isolated fractures of the distal humerus medial (AO/OTA 13B2) or lateral (AO/OTA 13B1) column are uncommon and have poorly understood outcomes following open reduction and internal fixation (ORIF).

Aim: This study presents a large series of these fracture patterns and provides insight into both radiographic and clinical outcomes.

Methodology: A retrospective review identified patients treated with ORIF for isolated intra-articular medial or lateral column distal humerus fractures at a single institution between 2005 and 2025, with minimum 6-month follow-up. Patients with other ipsilateral upper extremity fractures, periprosthetic fractures, or comminuted proximal ulna fracture dislocations were excluded. Outcomes included complications (secondary surgeries, hardware failure, infections),

radiographic outcomes (fracture healing, post-traumatic arthritis, heterotopic ossification [HO], avascular necrosis [AVN]), and elbow active range of motion. Patient-reported outcomes (PROs), including pain, QuickDASH, Mayo Elbow Performance Score (MEPS), and Single Assessment Numeric Evaluation (SANE) were collected. Fisher's exact and Wilcoxon rank-sum tests were used for between-group comparisons.

Results: Twenty-two patients were included (mean age 56 years, range 20–85 years), consisting of 10 isolated medial and 12 isolated lateral column fractures with a mean clinical follow-up of 4 years. Medial column patients were older than lateral column patients (69 vs 44 years, $p=0.025$). Distal humerus healing was achieved in 95% of patients; one patient developed nonunion. Overall complication rate was 77%, with post-traumatic arthritis (41%) and HO (18%) being the most common. Reoperation rate was 50% at a mean time of 11 ± 9 months, for symptomatic hardware removal ($n=4$), irrigation and debridement for infection ($n=3$), contracture release ($n=2$), revision ulnar nerve transposition ($n=1$), and revision ORIF of olecranon osteotomy ($n=1$). No patients experienced hardware failure or progressed to elbow arthroplasty. PROs were collected at a mean of 9 years following ORIF, with patients generally reporting low pain (mean 2 ± 1), high satisfaction (9 ± 1), and a mean SANE of $76 \pm 29\%$. The mean MEPS and QuickDASH were 94 ± 9 and 16 ± 15 , respectively. There was no significant difference in PROs between medial and lateral column fractures ($p>0.05$ for all).

Conclusion: ORIF of isolated medial and lateral column distal humerus fractures reliably produces high union rates and favorable long-term PROs. However, these injuries carry a high incidence of post-traumatic arthritis and reoperation, as approximately 50% required additional procedures, although no patients were converted to elbow arthroplasty.



Outcomes of Nonoperative Management for Simple Transcondylar Distal Humerus Fractures with Mean 5-Year Patient Reported Outcomes

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Introduction: Nonoperative management of extra-articular transcondylar fractures of the distal humerus (AO/OTA 13A2.2 and 13A2.3) remains controversial. Most patients are treated with open reduction and internal fixation (ORIF) and outcomes following nonoperative management are poorly defined.

Aim: This study evaluates radiographic and clinical outcomes following nonoperative management of transcondylar distal humerus fractures.

Methodology: A retrospective review was performed of adult patients with isolated extra-articular transcondylar distal humerus fractures treated nonoperatively with minimum 3 months of follow-up at a single institution between 2005 and 2025. Fifty-seven patients met inclusion criteria (65% female; mean age 75 ± 13 years). Outcomes included radiographic healing,

posttraumatic arthritis, complications, and delayed operative management. At presentation, 28% of fractures were nondisplaced, and 72% were displaced. Change in fracture displacement was measured on 2- and 6-week post-injury radiographs. Patient-reported outcomes (PROs) were collected prospectively and included Single Assessment Numeric Evaluation (SANE), Numeric Pain Rating Scale (NPRS), patient elbow satisfaction, Mayo Elbow Performance Score (MEPS), and the QuickDASH score. At the time of PROs collection, 56% of the cohort had passed away or had severe dementia. Of the remaining patients, PROs were collected from 80% (n=20) at mean 5 years after injury (range 1–14 years). Wilcoxon rank-sum, Kruskal-Wallis, and Fisher's exact tests were used for statistical comparisons.

Results: Thirty-eight patients (68%) achieved radiographic healing, while 18 (32%) developed nonunion. One patient had inconclusive healing at final follow-up and was excluded from healing analysis. Interval fracture displacement observed on either 2- or 6-week radiographs was associated with nonunion, with 2-week movement demonstrating 10-fold greater odds of nonunion (OR 10.4, $p=0.009$), and 6-week movement demonstrating an even stronger association with nonunion ($p<0.001$). Of the 18 nonunion patients, 14 (25% of total cohort) underwent delayed operative management (ORIF or TEA) at a mean of 12 months (range 2–29 months), with 71% achieving healing following ORIF. Posttraumatic arthritis developed in three patients (5%), and two patients who healed nonoperatively underwent delayed contracture release. Mean PROs included a SANE of $86\% \pm 24$, pain score of 1 ± 2 , elbow satisfaction of 8 ± 3 , MEPS of 88 ± 21 , and QuickDASH of 25 ± 31 . Patients with nonunion requiring delayed operative management had worse pain and satisfaction than those with successful nonoperative management ($p<0.05$ for both).

Conclusion: Nonoperative treatment of transcondylar distal humerus fractures resulted in a 68% union rate. Fracture movement on subsequent radiographs was associated with development of nonunion and may represent an early marker of failure. Patients requiring delayed operative management for nonunion demonstrated worse outcomes than those who healed successfully with nonoperative management.



Clinical Outcomes and Recurrence After Surgical Treatment of Snapping Triceps Syndrome with Ulnar Nerve Instability: A Multicenter Study

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Objective/Hypothesis: The aim of this multicenter study was to evaluate surgical treatment strategies for the rare snapping triceps syndrome associated with ulnar nerve instability. We

hypothesized that surgical intervention improves clinical outcomes despite invasive soft tissue reconstruction and that specific surgical techniques are associated with lower recurrence rates.

Methods: A total of 33 patients (30 male, 3 female; mean age 38 ± 12 years) were included in a prospective and retrospective study arms. Diagnosis was established clinically and by dynamic ultrasonography, supplemented by EMG, nerve conduction studies, and MRI when indicated. Functional outcomes (DASH, ASES), subjective complaints, and postoperative recurrence were assessed. Different combinations of ulnar nerve transposition and resection or transposition of the medial triceps portion were compared.

Results: Mean symptom duration before diagnosis was 38 ± 46 months, and patients consulted an average of two physicians prior to definitive diagnosis. Ulnar nerve dislocation occurred at a mean flexion angle of $82.7 \pm 15.1^\circ$, followed by snapping of the medial triceps at $108.3 \pm 22.6^\circ$. Postoperatively, subjective elbow value (SEV) improved from 62.5% preoperatively to 81.4% at 6 months. DASH scores improved from 37.9 to 23.2 pts, while ASES scores increased from 49.8 to 80.7 pts by 12 weeks postoperatively significantly. Recurrent instability occurred in 11 of 33 patients (33%), predominantly involving the ulnar nerve. Recurrence rates were lower after combined ulnar nerve and triceps transposition compared with nerve transposition combined with triceps resection. Despite recurrence, most patients would undergo surgery again. Scar- and cosmetic-related complaints were minimal.

Conclusion: Surgical treatment of snapping triceps syndrome results in substantial functional and subjective improvement in most patients. Dynamic ultrasonography is essential for diagnosis. Combined transposition of the ulnar nerve and medial triceps appears to provide the most stable postoperative outcome.



Ligament reconstruction around the elbow with synthetic grafts or autograft: a retrospective observational study

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Background: Chronic elbow instability can be treated with ligament reconstruction. Most are undertaken using tendon grafts taken from the patient's own arm or leg. This can be associated with donor site morbidity or recurrence of symptoms in patients with hypermobility. The use of synthetic grafts could mitigate these problems, but there are no studies comparing the outcome of synthetic graft reconstruction to autograft reconstruction. It has been the senior author's practice to use synthetic graft for ligament reconstruction in patients without a suitable palmaris longus tendon or in those with hypermobility (defined as a Beighton score of 4 or more).

Aims: The aim of this study is to investigate the clinical outcome of elbow ligament reconstruction using autograft and synthetic grafts in adult patients with chronic elbow instability and to explore the complication rate.

Methods: Retrospective observational study of a consecutive series of adult patients (>15 years) undergoing elbow ligament reconstruction using autograft or synthetic graft for the treatment of chronic elbow instability. The primary outcome was the change in Mayo Elbow Performance Score between baseline and 6 months. Secondary outcomes included the rate of adverse events and re-operation.

Results: Sixty-two patients were identified during the study period. Four patients (6%) were excluded for age less than 16 years and 6 patients (10%) were lost to follow-up before 6 months. For the 52 remaining patients the mean age was 35 years (range 16 to 72 years), 20/52 (39%) were female and 38/52 (73%) were treated with synthetic grafts (27 achillocord and 11 infinity lock 5, Xiros, UK). Forty-five patients underwent lateral ligament reconstruction, 5 medial and 2 both). There were no significant differences in age, range of movement, duration of symptoms, proportion of lateral ligaments, or baseline MEPS between those treated with autograft or synthetic graft. The MEPS improved significantly between baseline (mean 51, s.d. 17) and 6 months follow-up on paired analysis (mean difference 40, 95% confidence interval(c.i.) 35 to 45, $p < 0.001$). The difference in change in MEPS between the autograft group and synthetic graft group did not reach significance to reject the null hypothesis (mean difference 5, 95% c.i. -5 to 20, $p = 0.286$). There were no significant differences in the number of re-operations, revisions, or surgical complications within 12 months between the patients receiving autograft or synthetic graft.

Conclusion: Synthetic grafts can be used safely to reconstruct ligaments around the elbow with no evidence of a difference in the clinical outcome or rate of untoward events compared to reconstruction with autograft.



Factors Affecting Patient Reported Outcome Measures and Complication Rates in Plate Fixation for Olecranon Fractures: A Single Trust Study

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Introduction: Olecranon fractures are commonly managed surgically using plate fixation (PF). Whilst complication rates have been reported for this procedure, the factors associated with variability in clinical and functional outcomes are less well described.

Aim: The aim of this single trust cross-sectional study was to determine the outcomes following PF for olecranon fractures. Factors including demographics, fracture type, and other non-patient factors were evaluated in association with complications or poorer patient reported outcomes (PROMS).

Methodology: Patients who underwent PF for olecranon fracture between August 2020 and 2024 were included. Radiographs and clinical letters were examined by trained individuals, and data

pertaining to initial injury pattern, associated injuries, complications, and whether they were listed for plate removal, were extracted into Microsoft Excel. Telephonic interviews were conducted completing Mayo and DASH scores. Interviews covered current level of activity, range of movement and employment type. These data were correlated with patient's initial injury severity, time to surgery, and re-operation rate.

Results: Of the 64 included patients, 17.1% (11) reported a complication, and 17.1% (11) were scheduled a revision surgery. Of these, 4 patients reported plate prominence, 2 reported infection and 2 implants failed. 25 patients consented to interviews regarding PROMS. Their mean MAYO score was 86, and mean DASH 15.36. Patients obtaining a Schatzker E fracture reported the best outcomes (Mayo: 100, DASH: 6.03), whereas Schatzker B fractures had the worst (MAYO: 76.67, DASH: 27). Complication occurrence in patients aged <50 was 22.2% compared to 13.5% in those aged >50 years. Patients aged <50 reported lower MAYO and lower DASH scores of 85 and 8.62 respectively, compared to 100 (Mayo) and 12.01 (DASH) for those aged >50. 57.8% (37) of cases were consultant led, 13.5% of which reported complications, compared to 22.2% of those that were non-consultant led. There was limited difference observed in median PROM scores between lead surgeon type. Among patients obtaining an associated fracture or dislocation of the arm, only 1 patient reported any complication. These patients also reported MAYO and DASH scores that were similar to the medians of the total population: MAYO 92.5–100, DASH: 4.68–9.03. Eight patients were lost to follow up during the study.

Conclusion: This study reports PROMS and complication rates for PF of olecranon fracture. Fracture type and age at injury have been identified as potential variables leading to poorer PROMS, while surgeon grade may impact complication rate. Larger cohort studies are needed to further identify patient factors that may guide management decisions and optimise treatment selection.



Total Elbow Arthroplasty for Severe Primary Elbow Osteoarthritis: Clinical Outcomes of a Modified Alonso-Llames Approach

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Introduction: Severe primary elbow osteoarthritis is characterized by persistent pain, restricted range of motion, and functional impairment. Total elbow arthroplasty (TEA) is an effective surgical option for end-stage disease. However, conventional posterior approaches may compromise the triceps mechanism, potentially resulting in postoperative extension weakness.

Aim: To evaluate the clinical outcomes and safety of TEA performed using a modified Alonso-Llames approach in patients with severe primary elbow osteoarthritis.

Methodology: A retrospective analysis was conducted on 15 consecutive patients with severe primary elbow osteoarthritis who underwent TEA through a modified Alonso-Llames approach between 2020 and 2023. The mean age was 66 ± 6 years, and all patients were followed for at

least 24 months. Based on the classical Alonso-Llames approach, this modification included longitudinal splitting of the anconeus to improve exposure of the proximal ulnoradial structures and routine radial head resection to facilitate thorough removal of anterior and posterior osteophytes. Clinical outcomes were assessed using the Visual Analogue Scale (VAS), Mayo Elbow Performance Score (MEPS), Disabilities of the Arm, Shoulder and Hand (DASH) score, range of motion (ROM), and triceps muscle strength graded by the Medical Research Council (MRC) scale. Radiographic findings and postoperative complications were also recorded.

Results: At final follow-up, the mean VAS score significantly decreased from 6.5 ± 1.2 to 0.9 ± 1.0 ($P < 0.05$). The mean MEPS improved from 49.0 ± 12.7 to 89.0 ± 8.3 ($P < 0.05$), while the DASH score decreased from 56.2 ± 5.9 to 17.8 ± 6.4 ($P < 0.05$). The flexion-extension arc improved by an average of 68° , with significant gains in forearm pronation and supination. Triceps strength recovered to MRC grade 5 in 14 patients and grade 4 in one patient, with no cases of postoperative extension insufficiency. Radiographs demonstrated stable implant positioning without evidence of loosening or heterotopic ossification. Only one patient developed transient ulnar nerve irritation that resolved with conservative treatment.

Conclusion: TEA performed through a modified Alonso-Llames approach can provide adequate joint exposure for osteophyte removal while preserving the triceps mechanism. This technique effectively relieves pain, restores elbow function, and minimizes triceps-related complications, representing a safe and function-preserving surgical strategy for patients with severe primary elbow osteoarthritis.

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