



Functional and Radiological Outcomes of Surgical Management in Radial Head Fractures: A Prospective Cohort Study”

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Abstract

Background: Radial head fractures impair elbow stability and function when displaced or comminuted. Treatment options—open reduction and internal fixation (ORIF), excision, and radial head arthroplasty—are chosen based on fracture pattern, associated ligament injury and patient demands.

Methods: We reviewed adults with modified Mason II–IV radial head and neck fractures treated surgically at a single centre from 2019–2022. Reconstructible fractures underwent headless screw or low-profile plate fixation; unreconstructible comminuted heads received modular metallic radial head arthroplasty; isolated fragment excision was reserved for low-demand patients. All followed a routine standard rehabilitation protocol and were assessed to at least 12 months. Outcomes included Mayo Elbow Performance Score (MEPS), Disabilities of the Arm, Shoulder and Hand (DASH) score and arcs of motion; radiographs monitored implant position and heterotopic ossification.

Results: Forty patients met inclusion. Arthroplasty showed the most consistent recovery, with lower median DASH scores and reliable restoration of the flexion-extension arc. ORIF produced excellent results when stable anatomic fixation was achieved. Excision yielded more variable outcomes and higher symptom burden.

Conclusion: Preserve the native radial head when stable reconstruction is feasible. If reconstruction cannot restore anatomy and stability, radial head arthroplasty offers predictable functional recovery.

Keywords: Radial head fracture, ORIF, Arthroplasty, Excision, MEPS, DASH.

Introduction

Fractures of the radial head and neck are frequent around the elbow and usually result from a fall onto an outstretched hand. The radial head contributes importantly to elbow stability by resisting valgus and axial loads, and by sharing load transmission through the radiocapitellar joint. When collateral

ligaments or the coronoid are injured, the radial head becomes even more critical as a secondary stabilizer. Early approaches sometimes favored excision for badly comminuted fragments, but biomechanical and clinical studies revealed that removing the radial head can permit proximal radial migration, increase valgus instability, and contribute to late pain or distal radioulnar



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symptoms. For these reasons modern treatment emphasizes preserving the native head when anatomic reduction and stable fixation are achievable, using headless screws or low-profile plates placed within a safe zone to avoid articular impingement. When the radial head is too comminuted to reconstruct or when ligamentous injury cannot be reliably addressed, radial head arthroplasty restores columnar support, maintains radial height and allows early rehabilitation. The decision between fixation and replacement requires careful assessment of fracture pattern, bone quality and associated lesions, as well as patient age and activity expectations. This study reports a single-centre experience comparing outcomes following ORIF, arthroplasty and limited excision for modified Mason II–IV injuries, with the aim of clarifying indications and functional tradeoffs for each strategy. The analysis focuses on MEPS and DASH scores, motion arcs, radiographic findings and complication profiles to provide practical guidance for tailoring treatment to fracture morphology and soft-tissue status [1–4].

Literature review

Mason's original classification and its later modifications remain a practical foundation for treating radial head fractures because they capture displacement, comminution and the presence of associated injuries such as elbow dislocation or coronoid fractures. Non-displaced injuries generally do well with nonoperative care and early motion, whereas displaced two-part and multi-fragment fractures raise questions about fixation versus resection or replacement [5,6].

Biomechanical work underlines the radial head's contribution to valgus and axial stability. Experimental studies demonstrate that loss of radial height or excision increases valgus laxity and shifts load to other elbow articulations, which can accelerate degenerative changes. These findings have moved the field away from routine excision toward preservation or reconstruction of the radial column whenever feasible [4,7].

Fixation techniques have improved with the advent of headless compression screws and low-profile plating. Headless screws used across the articular surface in the safe zone provide interfragmentary compression while minimizing prominence in the radiocapitellar articulation. Numerous series report well to excellent outcomes when anatomic reduction and stable fixation are obtained, particularly for two-part fractures and select three-part patterns in younger patients with good bone quality [8–11]. Technical considerations include accurate fragment reduction, avoiding articular screw prominence, and ensuring the implant does not impinge during forearm rotation. When comminution precludes reliable fixation, radial head arthroplasty is an effective alternative. Modern modular metallic prostheses aim to restore radial length and permit early range of motion. Multicentre and single-centre reports demonstrate that arthroplasty often provides more predictable pain relief and elbow stability than excision for unreconstructible fractures, with acceptable complication rates

when implants are correctly sized and soft tissues repaired [12–15]. Implant-specific risks include oversizing (which may cause capitellar overload and restricted motion), metaphyseal mismatch and radiolucent lines around stems, and heterotopic ossification that can limit motion. Careful intraoperative sizing, assessment of radial height and attention to ligament repair reduce these problems [13,14].

Contemporary practice therefore favors a staged algorithm: attempt fixation when fracture morphology permits interfragmentary compression and secure implant placement; if reconstruction cannot restore radial height and stability, proceed to arthroplasty; reserve excision for isolated, low-demand situations [10,12,16–18].

Outcome measures such as MEPS and DASH alongside objective motion arcs provide a useful, reproducible means of comparing strategies. Across reported series, appropriate matching of treatment to fracture type produces well to excellent outcomes for most patients; conversely, mismatched treatment—especially resection in patients with ligamentous compromise—predicts persistent dysfunction and secondary procedures [15–17].

Materials and methods

This mixed retrospective–prospective study included adult patients (age >18 years) with modified Mason type II–IV radial head and neck fractures treated surgically at a single tertiary centre between January 2019 and December 2022. Exclusion criteria were pathological fractures, active infection, and congenital elbow deformity and isolated non-displaced (Mason I) injuries. Institutional ethics approval and written informed consent were obtained.

Preoperative evaluation used standard anteroposterior and lateral elbow radiographs; CT scans were obtained selectively for complex, multi-fragment injuries to assist surgical planning. Routine preoperative laboratory screening and baseline fitness assessments were completed.

Surgical strategy followed an algorithm: reconstructible fractures with two or three fragments permitting compression were treated with headless compression screws or small plates placed in the safe zone; severely comminuted heads or fractures that could not be restored to stable radial height underwent modular metallic radial head arthroplasty; isolated fragment excision was reserved for rare, low-demand patients. Repair of collateral ligaments or coronoid fractures was performed when indicated. Postoperative rehabilitation emphasized early controlled motion, with passive and active-assisted range of motion beginning within two weeks and progressive strengthening as tolerated.

Patients were followed at 6 weeks, 3 months, 6 months and 12 months. Primary outcomes were MEPS and DASH at final follow-up; secondary outcomes included flexion-extension arc and forearm rotation. Radiographs assessed implant position, fracture union and heterotopic ossification. Complications and

reoperations were recorded. Data were described using medians and ranges; clinical interpretation focused on functional outcome and complication patterns across ORIF, arthroplasty and excision groups [2, 8, 15].

Results

Forty patients met inclusion criteria and completed at least 12 months of follow-up. Treatment distribution was 29 radial head arthroplasties, 9 ORIFs (headless screws or small plates) and 2 isolated excisions. Mechanisms were predominantly falls on an outstretched hand. At final review the arthroplasty group showed the most consistent functional recovery: most patients were graded excellent or good by MEPS and the median DASH score was lowest in this group. Median DASH values were approximately 6 for arthroplasty, 11 for fixation and 22 for excision. Mean flexion-extension arcs were about 130° for arthroplasty and fixation groups and approximately 118° for the excision group. Forearm pronation and supination were better preserved after arthroplasty and ORIF than after excision. Radiographs demonstrated occasional radiolucent lines around stems and limited heterotopic ossification in a subset of patients; there were no prosthetic revisions within the first year. Complications were few: one patient in the arthroplasty group reported persistent pain, two patients in the fixation group had symptomatic hardware or restricted motion, and one excision patient remained symptomatic. No neurovascular deficits were recorded at final follow-up.

Discussion

This series supports a morphology-driven approach to radial head fractures. ORIF remains the preferred option when the fracture pattern allows anatomic reduction and stable fixation: appropriately performed fixation preserves the native joint and often results in excellent motion and low disability, echoing multiple series that report good outcomes with headless screw or low-profile plate techniques [8–11]. However, attempting fixation in extensively comminuted fractures risks loss of fixation, symptomatic hardware and persistent instability if interfragmentary compression cannot be reliably obtained.

Radial head arthroplasty provided predictable restoration of columnar support and allowed early mobilization, with lower median DASH scores in our cohort. This aligns with broader literature indicating that arthroplasty is a dependable strategy for unreconstructible fractures and for cases with associated ligamentous injury that would otherwise leave the elbow unstable [12–15]. Implant-related problems—oversizing, capitellar wear, radiolucencies—were uncommon but present; meticulous intraoperative sizing and robust soft-tissue repair reduce these risks [13, 14].

Excision produced the least favorable functional profile in this group, consistent with biomechanical and clinical work warning that simple resection can permit proximal migration and valgus instability, especially if ligamentous injury is not

addressed [7, 16]. Thus, excision should be restricted to rare, well-selected low-demand patients.

Taken together, our findings support a staged algorithm: attempt ORIF when stable reconstruction can be achieved; if reconstruction cannot restore radial height or elbow stability, proceed to arthroplasty; reserve excision for exceptional situations. Individual patient factors — age, activity level and expectations — must guide final decisions [1, 3, 17–19].

Conclusion

Good management of radial head fractures starts with matching the operation to the fracture pattern and the patient. When the head can be anatomically reduced and fixed securely, ORIF preserves the native joint, allows early movement and most often restores excellent function. For severely comminuted fractures or when ligament injury leaves the elbow unstable, modern radial head prostheses reliably re-establish radial height and stability and permit predictable recovery with early rehabilitation. Simple excision should be reserved for rare, low-demand cases because it can permit proximal radial migration and lead to later instability or pain. Careful intraoperative assessment, correct implant sizing and repair of associated soft-tissue injuries, together with a structured physiotherapy plan, are essential for good results. Shared decision-making with the patient improves satisfaction and adherence postoperatively.

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