RESEARCH PAPER

Functional Outcomes of Radial Head Excision Versus Osteosynthesis in Mason Type II and III Fractures: A Comparative Study

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Introduction

Radial head fractures account for approximately one-third of all elbow fractures and are critical injuries affecting joint stability, load transmission, and forearm rotation. The Mason classification remains the most widely adopted system for categorising these fractures, with Type II and III injuries representing displaced or comminuted intra-articular patterns, frequently requiring surgical intervention to restore function. While undisplaced (Type I) fractures are generally managed conservatively with predictable outcomes, the optimal treatment for displaced fractures continues to be debated.

Historically, **radial head excision** was a popular option for comminuted fractures, offering pain relief and restoration of motion, but long-term studies have documented complications such as valgus instability, proximal migration of the radius, distal radioulnar joint dysfunction, and degenerative changes in the wrist and elbow. Conversely, **open reduction and internal fixation (ORIF)** preserves native anatomy and joint biomechanics, and thereby, avoiding the sequelae of excision, but is technically demanding, and outcomes may be compromised in cases with severe comminution or poor bone quality.

Recent biomechanical and clinical studies have shifted preference towards fixation whenever feasible, especially in the presence of associated ligamentous injury, yet there is **no universal consensus** on whether fixation consistently yields superior functional outcomes compared with excision in isolated Mason Type II and III fractures. Moreover, most comparative studies have been retrospective, with heterogeneous fracture patterns, variable surgical techniques, and inconsistent rehabilitation protocols, limiting the generalisability of their findings.

Given the paucity of **prospective, randomised comparative data** in this domain—particularly from low- and middle-income settings where implant availability, cost, and surgeon experience may influence treatment choice—there is a need for robust evidence to guide decision-making. This study was

therefore undertaken to prospectively compare the functional outcomes and complication profiles of radial head excision versus osteosynthesis for Mason Type II and III fractures, using validated scoring systems to provide clinically meaningful, reproducible results.

Aim

To compare the functional outcomes of radial head excision versus open reduction and internal fixation (osteosynthesis) in Mason Type II and Type III radial head fractures.

Objectives

1. **Primary Objective** – To compare postoperative elbow function between the two treatment groups using the **Broberg and Morrey Elbow Score** and the **Disabilities of the Arm, Shoulder and Hand (DASH) score** at defined follow-up intervals.
2. **Secondary Objectives** –
   - To assess differences in range of motion, fracture healing, and elbow stability between the two techniques.
   - To document and compare the incidence and nature of postoperative complications in each group.

Materials and Methods Study Design and Setting

This was a hospital-based, prospective, randomised interventional study conducted in the Department of Orthopaedics, SMS Medical College and Attached Hospitals, Jaipur, Rajasthan, India, between March 2020 and April 2021.

Participants

Adult patients aged 18–60 years presenting with **Mason Type II or III radial head fractures** were eligible. Exclusion criteria were: Skeletal immaturity, pathological fractures, associated ipsilateral upper limb fractures or head injury and those who were medically unfit for surgery.

Sample Size and Randomisation

A total of 40 patients were enrolled. Based on an anticipated clinically meaningful difference in functional scores, the sample size was calculated to provide 80% power at a 5% significance level. Patients were allocated equally to radial head excision or osteosynthesis using a computer-generated random sequence.

Preoperative Evaluation

All patients underwent clinical assessment and standard radiographs (anteroposterior, lateral, and radiocapitellar views). CT with 3D reconstruction was performed when fracture configuration was unclear or surgical planning required further delineation. Preoperative medical and anaesthetic clearance was obtained in all cases.

Surgical Technique

All procedures were performed under regional (supraclavicular block) or general anaesthesia using the Kocher lateral approach.

- **Osteosynthesis group:** Fracture fragments were anatomically reduced and fixed using Kirschner wires, Herbert screws, T-plates, locking proximal radius plates, or small-fragment screws. Fluoroscopic guidance confirmed reduction and extra-articular implant placement.
- **Excision group:** Comminuted radial head fragments were excised in their entirety. The proximal radial stump was contoured flush with the annular ligament using a burr, and the capsule was plicated to enhance stability.

Postoperative Protocol

Immobilisation was maintained for 15 days after excision and 21 days after osteosynthesis. Rehabilitation progressed in three phases:

1. **Phase I (0–2 weeks post-immobilisation):** Pain and oedema control, active-assisted range of motion within comfort, and maintenance of shoulder, wrist, and finger mobility.
2. **Phase II (3–5 weeks):** Progressive active motion, isometric strengthening for elbow flexion/extension and forearm pronation/supination.
3. **Phase III (≥6 weeks):** Progressive resistive strengthening, proprioceptive training, and return to functional activities.

Outcome Measures

Patients were reviewed at 6 weeks, 3 months, and 6 months postoperatively.

- **Primary outcomes:**
  - Broberg and Morrey Elbow Score
  - Disabilities of the Arm, Shoulder and Hand (DASH) Score
- **Secondary outcomes:**
  - Range of motion (flexion–extension arc, pronation–supination arc)
  - Radiographic union
  - Complications (stiffness, instability, implant failure, nerve injury)

Statistical Analysis

Continuous data are presented as mean ± standard deviation and compared using the independent *t*-test or Mann–Whitney *U* test, as appropriate. Categorical variables were analysed using the Chi-square or Fisher's exact test. Statistical significance was defined as $p < 0.05$.

Ethical Considerations

The study was approved by the Institutional Ethics Committee of SMS Medical College, Jaipur .Written informed consent was obtained from all participants.

Results

Demographics and Baseline Characteristics

Forty patients with Mason type II and III radial head fractures were randomized equally into osteosynthesis (n = 20) and excision (n = 20). The mean age was significantly higher in the excision group (39.5 ± 9.2 vs. 32.7 ± 10.3 years, p = 0.034). Male predominance was observed overall (72.5%), with similar distribution across groups (p = 0.723). Road traffic accidents were the commonest cause of injury (60%). Fracture type differed significantly between groups: osteosynthesis was more common in Mason type II, while excision predominated in type III (p = 0.004). The median delay to surgery was shorter for osteosynthesis (3 vs. 7.5 days, p = 0.001).

Primary Outcomes

The mean Broberg–Morrey score at final follow-up was comparable between groups (87.3 ± 8.2 vs. 85.5 ± 12.5, p = 0.968), with 80% of patients in both arms achieving good or excellent grades. In contrast, DASH scores were consistently lower in the osteosynthesis group, indicating superior functional recovery. At 3, 12, and 24 weeks, osteosynthesis patients had significantly better DASH scores than excision patients (13.6 vs. 31.1; 10.3 vs. 25.3; 5.5 vs. 14.5, all p < 0.001). Both groups showed significant within-group improvement over time (p < 0.001).

Secondary Outcomes

No significant differences were observed in elbow flexion (94.0° vs. 96.0°, p = 0.732), extension lag (13.8° vs. 17.0°, p = 0.158), or grip strength (17.9 vs. 17.5 kg, p = 0.932). Stability scores, however, significantly favored osteosynthesis: all patients achieved the highest grade compared to 65% in the excision group (p = 0.008).

Complications

Complications occurred in 45% of excision cases versus 5% of osteosynthesis (p = 0.003). The most common events after excision were periarticular ossification (25%) and arthritis (10%); additional complications included infection (5%) and proximal migration of the radius (5%). Osteosynthesis was associated with a single

superficial infection.

Discussion

Radial head fractures account for nearly one-third of elbow fractures and remain a subject of debate regarding optimal management, particularly for Mason type II and III injuries. Historically, excision was widely practiced, with early advocates recommending resection when in doubt. However, advances in implant design, understanding of elbow biomechanics, and recognition of the radial head as a secondary stabilizer of the elbow have shifted preference toward osteosynthesis whenever feasible.

In this study, osteosynthesis demonstrated clear advantages in patient-reported outcomes and joint stability. DASH scores were consistently and significantly better in the osteosynthesis group across all follow-up intervals, echoing the results of Zarattini et al., who reported superior DASH outcomes in fixation compared to excision for Mason type II fractures.

Similarly, Ikeda et al. and Khalfayan et al. documented improved function, strength, and motion after fixation, reinforcing our findings that anatomical reconstruction, when achievable, yields better recovery.

Although Broberg–Morrey scores were comparable between groups, the osteosynthesis group exhibited significantly greater elbow stability. This finding aligns with biomechanical studies emphasizing the stabilizing role of the radial head and the increased risk of valgus instability and proximal radial migration following excision. In our cohort, one excision patient developed proximal migration with poor outcome, consistent with earlier reports by Morrey and Sanchez-Sotelo
et al.

Mason type II fractures in particular benefitted from osteosynthesis, with stable fixation achievable in the majority of cases. Our data support the current consensus that open reduction and internal fixation should be the first-line option for type II fractures, as also recommended by Ring et al. For type III fractures, outcomes were less favorable; fixation was associated with reduced motion compared to excision, reflecting the greater comminution and soft tissue injury. In line with Geel et al. and King et al., our results suggest that excision remains a reasonable salvage option for severely comminuted, non-reconstructable type III fractures, though with higher complication rates.

The complication profile in our series further underscores the trade-offs between the two approaches. Excision was associated with a markedly higher complication rate (45% vs. 5%), most commonly periarticular ossification and arthritis.

These findings are consistent with long-term studies reporting radiographic degenerative changes after excision. In contrast, fixation was associated with only one superficial infection, suggesting a safer profile in the short-term when stable reconstruction is possible.

Our study also highlights contextual differences in patient demographics and mechanisms of injury. Road traffic accidents accounted for the majority of fractures, reflecting the high-energy trauma patterns prevalent in developing countries, which may contribute to the severity of associated injuries compared to Western series. Despite this, 80% of patients in both groups were able to return to their previous occupations, underscoring the functional relevance of both treatment options.

Limitations include the relatively small sample size, short follow-up (six months), and heterogeneity in implants used for fixation. Longer-term studies are needed to evaluate degenerative changes, late instability, and prosthetic options for irreparable fractures.

Conclusion

Osteosynthesis provided superior functional outcomes, greater stability, and fewer complications compared to excision in Mason type II and many type III fractures. Excision should be reserved for highly comminuted fractures where stable reconstruction cannot be achieved. These findings align with the evolving paradigm favoring radial head preservation whenever feasible.

Limitations and Future Directions

Some limitations include the relatively small sample size, short follow-up duration, and variability in fixation implants. Future studies should aim for longer-term follow-up and larger sample sizes, focusing on degenerative changes, late instability, and the role of prosthetic options for irreparable fractures.

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