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Functional Outcomes of Radial Head and Neck Fractures Managed Conservatively and Surgically: A Prospective Comparative Study with Optimized Sample Size

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ABSTRACT

Background: Radial head and neck fractures are common elbow injuries requiring treatment based on fracture severity. Comparative outcome data between conservative and surgical management remain limited in real-world clinical settings.

Methods: This prospective, non-randomized comparative study was conducted in the Department of Orthopaedics, MR Medical College, Kalaburagi, from June 2024 to November 2025. A total of 96 patients were included, with 48 managed conservatively and 48 surgically based on Mason classification. Functional outcomes were assessed using Mayo Elbow Performance Score (MEPS), range of motion, and grip strength over 6 months.

Results: Both groups showed significant improvement. Conservative management demonstrated greater functional gains in patients with less severe fractures (Mason I–II), with MEPS improvement of 57.2 ± 9.6 compared to 47.5 ± 9.1 in the surgical group. Flexion gain (67.1 ± 6.2° vs 54.2 ± 7.9°), extension gain (38.6 ± 4.3° vs 31.4 ± 4.5°), and grip strength (23.8 ± 2.7 kg vs 17.2 ± 2.9 kg) were all significantly higher ($p < 0.001$).

Conclusion: Conservative management provides superior early functional outcomes in less severe fractures, while surgical intervention yields satisfactory outcomes in complex injuries. Treatment should be individualized based on fracture severity.

Keywords*: Radial head fracture, radial neck fracture, conservative management, surgery, MEPS, functional outcome.*

INTRODUCTION

Radial head and neck fractures represent one of the most frequently encountered injuries around the elbow joint in adults and account for nearly one-third of all elbow fractures [1]. These fractures play a crucial role in maintaining elbow stability, forearm rotation, and axial load transmission. The Mason classification system, later modified by Hotchkiss and Broberg-Morrey, remains the standard framework guiding management decisions based on displacement, comminution, and instability [2,3].

Conservative management has been widely recommended for Mason type I and selected type II fractures, emphasizing early mobilization to prevent stiffness and ensure optimal functional recovery [4,5]. Several studies have demonstrated that early supervised mobilization yields excellent outcomes without compromising joint stability [6]. Furthermore, recent randomized trials suggest that nonoperative management may provide outcomes comparable to surgical intervention in carefully selected type II fractures [7].

In contrast, comminuted and unstable fractures (Mason type III and IV) often require surgical intervention, including open reduction and internal fixation (ORIF) or radial head arthroplasty, to restore joint congruity and stability [8,9]. Modern

evidence favors preservation or replacement of the radial head to prevent long-term instability and functional impairment [10].

Despite extensive literature, direct comparisons between conservative and surgical management remain challenging due to inherent differences in fracture severity and treatment allocation [11]. Moreover, real-world prospective data evaluating functional recovery across treatment modalities are limited, particularly in tertiary-care settings [12].

Therefore, the present study was undertaken to evaluate and compare functional outcomes of radial head and neck fractures managed conservatively and surgically, with emphasis on objective measures such as MEPS, range of motion, and grip strength.

MATERIALS AND METHODS

This was a prospective, non-randomized comparative study was conducted in the Department of Orthopaedics at Basaveshwar Teaching and General Hospital, MR Medical College, Kalaburagi, over a period of eighteen months from June 2024 to November 2025.

A total of 96 adult patients aged ≥18 years with radiologically confirmed fractures of the radial head or neck were included. Patients were categorized into two groups: conservative (n = 48) and surgical (n = 48).

Treatment allocation was based on fracture severity using the Mason classification system. Mason type I–II fractures were managed conservatively, while Mason type III–IV fractures were treated surgically.

Exclusion criteria included open fractures, polytrauma, pathological fractures, major comorbid illness, and inability to comply with follow-up.

Conservative management involved short-term immobilization followed by early mobilization. Surgical management included open reduction and internal fixation (ORIF) or radial head replacement.

Patients were followed at 3 weeks, 6 weeks, 12 weeks, and 6 months. Outcomes assessed included MEPS, range of motion, and grip strength.

Statistical analysis was performed using SPSS version 25.0 with $p < 0.05$ considered significant.

RESULTS

Baseline Characteristics

A total of 96 patients were included with equal distribution between conservative (n = 48) and surgical (n = 48) groups. The mean age was 48.9 ± 16.2 years in the conservative group and 44.8 ± 15.1 years in the surgical group, with no statistically significant difference ($p = 0.214$). Gender distribution, side of injury, and mode of injury were comparable between groups. Mason type I–II fractures were predominantly managed conservatively (100%), while Mason type III–IV fractures were mainly managed surgically (75.0%), showing statistically significant distribution ($p < 0.001$).

Table 2: Functional Outcome Comparison at 6 Months

The above table illustrates that both groups showed significant improvement in functional outcomes at 6 months; however, the conservative group demonstrated superior results across all parameters. The mean MEPS improvement was 57.2 ± 9.6 in the conservative group compared to 47.5 ± 9.1 in the surgical group ($p < 0.001$). Flexion gain was higher in the conservative group (67.1 ± 6.2° vs 54.2 ± 7.9°, $p < 0.001$). Extension gain was also greater in the conservative group (38.6 ± 4.3° vs 31.4 ± 4.5°, $p < 0.001$). Grip strength was significantly higher in the conservative group (23.8 ± 2.7 kg vs 17.2 ± 2.9 kg, $p < 0.001$).

Table 3: MEPS Outcome Categories The above table illustrates that the majority of patients in both groups achieved excellent outcomes. In the conservative group, 41 (85.4%) patients had excellent outcomes compared to 35 (72.9%) in the surgical group. Good outcomes were observed in 7 (14.6%) patients in the conservative group and 11 (22.9%) in the surgical group. Fair outcomes were seen only in the surgical group in 2 (4.2%) patients. No poor outcomes were reported in either group.

Recovery Pattern

Both groups demonstrated progressive improvement over time. The conservative group showed faster recovery at early follow-up (6 and 12 weeks), likely due to lower fracture severity and early mobilization. However, by 6 months, outcomes in both groups converged, indicating overall satisfactory recovery in both treatment modalities.

TABLE 1: Baseline Demographic and Clinical Characteristics (N = 96)

Variable	Conservative (n = 48)	Surgical (n = 48)	p-value
Age (years), Mean ± SD	48.9 ± 16.2	44.8 ± 15.1	0.214
Male, n (%)	28 (58.3%)	26 (54.2%)	0.683
Female, n (%)	20 (41.7%)	22 (45.8%)	0.683
Side Involved (Right), n (%)	30 (62.5%)	28 (58.3%)	0.672
Side Involved (Left), n (%)	18 (37.5%)	20 (41.7%)	0.672
Mode of Injury (Fall), n (%)	34 (70.8%)	29 (60.4%)	0.281
Mode of Injury (RTA), n (%)	14 (29.2%)	19 (39.6%)	0.281
Mason Type I–II, n (%)	48 (100%)	12 (25.0%)	<0.001*
Mason Type III–IV, n (%)	0 (0%)	36 (75.0%)	<0.001*

Table 2: Functional Outcome Comparison at 6 Months

Parameter	Conservative (n = 48)	Surgical (n = 48)	p-value
MEPS Improvement	57.2 ± 9.6	47.5 ± 9.1	<0.001*
Flexion Gain (°)	67.1 ± 6.2	54.2 ± 7.9	<0.001*
Extension Gain (°)	38.6 ± 4.3	31.4 ± 4.5	<0.001*
Grip Strength (kg)	23.8 ± 2.7	17.2 ± 2.9	<0.001*

Table 3: MEPS Outcome Categories at 6 Months

Outcome Category	Conservative (n = 48)	Surgical (n = 48)
Excellent	41 (85.4%)	35 (72.9%)
Good	7 (14.6%)	11 (22.9%)
Fair	0 (0%)	2 (4.2%)
Poor	0 (0%)	0 (0%)

DISCUSSION

The present study demonstrated that both conservative and surgical management of radial head and neck fractures resulted in significant functional improvement at 6 months, with the majority of patients achieving good-to-excellent outcomes. The conservative group showed faster and greater improvement in MEPS, range of motion, and grip strength, which is consistent with the inclusion of lower-grade Mason type I–II fractures in this group.

These findings are in agreement with the classical work by Mason [1], who emphasized that fracture morphology is a key determinant of outcome. Studies by Unsworth-White et al. [4] and Liow et al. [6] have shown that early mobilization in minimally displaced fractures leads to excellent recovery and reduced stiffness. Herbertsson et al. [13] further demonstrated that long-term outcomes of nonoperatively treated fractures remain satisfactory despite minor radiographic changes.

Recent randomized controlled trials by Mulders et al. [7] have shown that conservative and operative management yield comparable outcomes in Mason type II fractures without mechanical block, supporting a selective approach to surgery. Similarly, Kaas et al. [11] highlighted the lack of strong evidence favoring routine surgical intervention in these fractures. The surgical cohort in the present study consisted predominantly of Mason type III–IV fractures, representing a more complex injury pattern. Burkhart et al. [2] emphasized the importance of the radial head in elbow stability, while Ikeda et al. [14] demonstrated that outcomes depend on the feasibility of anatomical reconstruction. Nalbantoglu et al. [15] reported favorable outcomes with ORIF in comminuted fractures when stable fixation is achieved.

Meta-analytic evidence by De Mauro et al. [8] suggests that radial head arthroplasty may provide better functional outcomes and fewer complications compared to ORIF in highly comminuted fractures. Similarly, Ly et al. [9] reported comparable long-term outcomes between arthroplasty and fixation but recommended arthroplasty when reconstruction is not feasible.

The observed recovery pattern in the present study, with faster improvement in the conservative group and eventual convergence of outcomes at 6 months, is biologically plausible. Lower-grade fractures allow early mobilization with minimal soft tissue injury, whereas complex fractures require longer rehabilitation due to greater structural damage [3].

Overall, the findings of the present study align with existing literature, reinforcing that treatment outcomes are primarily influenced by fracture severity and that appropriate selection of management strategy is essential for optimal functional recovery.

CONCLUSION

This prospective study involving 96 patients demonstrates that both conservative and surgical management of radial head and neck fractures result in significant functional improvement over a 6-month period. Conservative treatment provides faster recovery and superior early functional gains in less severe fractures (Mason type I–II), while surgical management ensures satisfactory restoration of function in more complex injuries (Mason type III–IV).

The study highlights that apparent superiority of conservative management is influenced by fracture severity rather than treatment effect alone. Therefore, treatment decisions should be individualized based on fracture pattern, stability, and patient characteristics.

Overall, the findings emphasize that a fracture-based, patient-specific approach is essential for achieving optimal functional outcomes, rather than adopting a uniform management strategy.

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