A Prospective Study of Functional Outcomes of Radial Head Plating in Radial Head Fractures

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ABSTRACT:

Background: Radial head fractures are common elbow injuries and are important because the radial head contributes to elbow stability and longitudinal forearm mechanics. Open reduction and internal fixation using anatomically contoured plates has become a preferred option for reconstructable displaced fractures.

Objective: To evaluate the functional and radiological outcomes of radial head plating in adult patients with Mason type II and III radial head fractures.

Materials and Methods: This prospective observational study was conducted over 12 months in the Department of Orthopaedics, Tertiary care hospital, Chennai. Thirty adults with Mason type II and III radial head fractures underwent open reduction and internal fixation using a low-profile radial head plate through the Kocher posterolateral approach. Functional outcome was assessed using the Mayo Elbow Performance Score (MEPS), and radiological outcome was evaluated using the Broberg and Morrey criteria over 1 year of follow-up.

Results: Of the 30 patients, 22 (73.3%) had Mason type II fractures and 8 (26.7%) had Mason type III fractures. At final follow-up, 16 patients (53.3%) had excellent, 9 (30.0%) had good, 4 (13.3%) had fair, and 1 (3.4%) had poor MEPS outcomes. Radiological union was achieved in all patients, with a mean union time of 14 weeks. Excellent or good radiological outcome was observed in 29 patients (96.7%). Younger patients had significantly better functional outcomes than older patients ($p = 0.047$). Return to activities of daily living was significantly delayed in Mason type III fractures ($p = 0.012$), and time to union was significantly longer in type III fractures ($p = 0.018$). Complications were minimal, with one case of postoperative elbow stiffness.

Conclusion: Radial head plating is an effective treatment option for Mason type II and selected type III radial head fractures. It provides stable fixation, reliable union, Excellent functional recovery, and a low complication rate when combined with early mobilization and careful surgical technique..

Keywords- radial head fracture; radial head plating; ORIF; Mayo Elbow Performance Score; Mason classification

Introduction

Radial head fractures are one of the most prevalent types of elbow fractures and make up a large part of all adult elbow injuries.1 Most often, a fall onto an extended hand causes the radio-capitellar articulation to undergo axial stress, which in turn causes displacement or comminution of varied degrees, leading to these fractures.2 The radial head is not only an articular surface, but it also helps keep the forearm stable in the long direction and is a supplementary stabiliser against valgus stress.3,4 If it is not properly restored, it might result in discomfort, stiffness, instability, proximal radial migration, and reduced function of the upper limbs.3,4

In radial head fractures, the Mason classification is considered the gold standard. It categorises wounds as either having displacement or comminution.5 Surgical intervention is often required to restore congruity and preserve elbow function in instances involving displaced Mason type II fractures and some reconstructable type III fractures, even if conservative therapy is usually adequate for fractures with modest displacement.6 Surgical options include arthroplasty, radial head excision, fragment excision, and open reduction with internal fixation.6,7

In recent years, open reduction and internal fixation using anatomically contoured low-profile plates has gained increasing acceptance for reconstructable fractures. These implants permit stable fixation, restore articular alignment, and facilitate early mobilisation, which is critical for preventing postoperative stiffness.6,8 Preservation of the native radial head also avoids some of the long-term biomechanical disadvantages associated with excision and may be preferable to arthroplasty in suitable patients.9,10

It remains limited whether radial head plating improves outcomes, particularly in more complex fractures, despite these benefits. With that background, the present study set out to assess the radiographic and functional outcomes of radial head plating in adults with Mason type II and III fractures. The purpose for this study was to compare the results of Mason type II and type III fractures, as well as to evaluate postoperative complications, compare radiographic union and healing quality, and evaluate postoperative recovery using the Mayo Elbow Performance Score.

Methodology

This prospective longitudinal study was conducted in the Orthopaedics Department of a tertiary care hospital in Chennai and lasted for 12 months. Thirty adults with radial head fractures were included in the study after written informed consent was obtained. Institutional Ethics Committee permission was obtained before the study could begin.

Participants ranged in age from 18 to 70 years and had radial head fractures of type II or type III verified by radiographs. Exclusion criteria included a history of neurovascular damage, pathological fractures, elbow dislocation, paediatric fractures, preexisting osteoarthritis of the elbow, and open fractures.

Neurovascular condition, range of motion, local examination, and cause of injury were all included of the comprehensive clinical evaluation that all patients experienced. In every patient, we obtained standard elbow radiographs (anteroposterior and lateral) and, where necessary, computed tomography to further define fracture morphology and plan surgery.

An internal fixation technique using a low-profile pre-contoured radial head plate was used to repair all fractures after open reduction. The patient was placed on a radiolucent arm table to support the afflicted limb while the surgeon operated under regional or general anaesthesia with the patient reclined. A standard Kocher posterolateral approach was used in all cases. After exposure, hematoma and debris were removed, fracture fragments were identified, and anatomical reduction was achieved under direct visualisation. When needed, Kirschner wires were used for temporary fixation, and a radial head plate and screws were employed for final fixation. Joint congruity, implant placement, and fracture reduction were all verified using intraoperative fluoroscopy.

For a few times after surgery, the elbow was immobilised in a splint that went behind the elbow. The duration of early active mobilisation ranged from 48 hours to 5 days, depending upon

the severity of discomfort and the state of the wound. The patients were evaluated at 2, 4, 6 weeks, and at 3, 6, and 12 months into their rehabilitation program, after which they continued to follow a systematic procedure.

The Mayo Elbow Performance Scale (MEPS) was used to evaluate the functional outcome. Using the Broberg and Morrey criteria, the radiological result was scored based on serial radiographs. Radiographic evidence of bridging trabeculae across the fracture site without accompanying pain or local tenderness was used to identify fracture union.

Statistical Analysis

Analyses were done using statistical tools after data input in Microsoft Excel. The data was presented as frequencies and percentages for categorical variables and mean ± standard deviation for continuous variables. To compare the groups, we used a chi-square test for categorical variables and an independent t-test for continuous variables. All p-values below 0.05 were considered statistically significant.

Results

Thirty adult patients with Mason type II and III radial head fractures participated in the study. Patients' ages varied from 21 to 60 years, with the predominant demographic being those aged 31 to 40 years. Male patients constituted 66.7% of the group. Road traffic accidents were the predominant mechanism of injury, followed by sports injuries and falls. The right upper limb was affected in 60.0% of cases, with the majority of patients exhibiting right-hand dominance (Table 1).

Table 1: Baseline demographic and injury characteristics of the study population

Variable	Category	Frequency (n=30)	Percentage (%)
Age group (years)	21–30	6	20.0
	31–40	11	36.7
	41–50	7	23.3
	51–60	6	20.0
Sex	Male	20	66.7
	Female	10	33.3
Occupation	Manual labourer	12	40.0
	Office worker	6	20.0
	Homemaker	5	16.7
	Student	4	13.3
	Retired	3	10.0
Side involved	Right	18	60.0
	Left	12	40.0
Hand dominance	Right	26	86.7
	Left	4	13.3
Mode of injury	Road traffic accident	12	40.0
	Sports injury	8	26.7
	Self fall	5	16.7

	Assault	3	10.0
	Fall from height	2	6.6

The Mason classification found that type II fractures were observed in 22 patients (73.3%) and type III fractures in 8 individuals (26.7%). On average, it took 4.6 ± 1.3 days from the time of injury until the procedure. The Kocher posterolateral method was used to handle all patients. According to Table 2, the typical operating time was 70 ± 12 minutes, the typical blood loss was 85 ± 20 mL, the typical time spent applying a tourniquet was 58 ± 10 minutes, and the typical length of hospital stay was 5.2 ± 1.4 days.

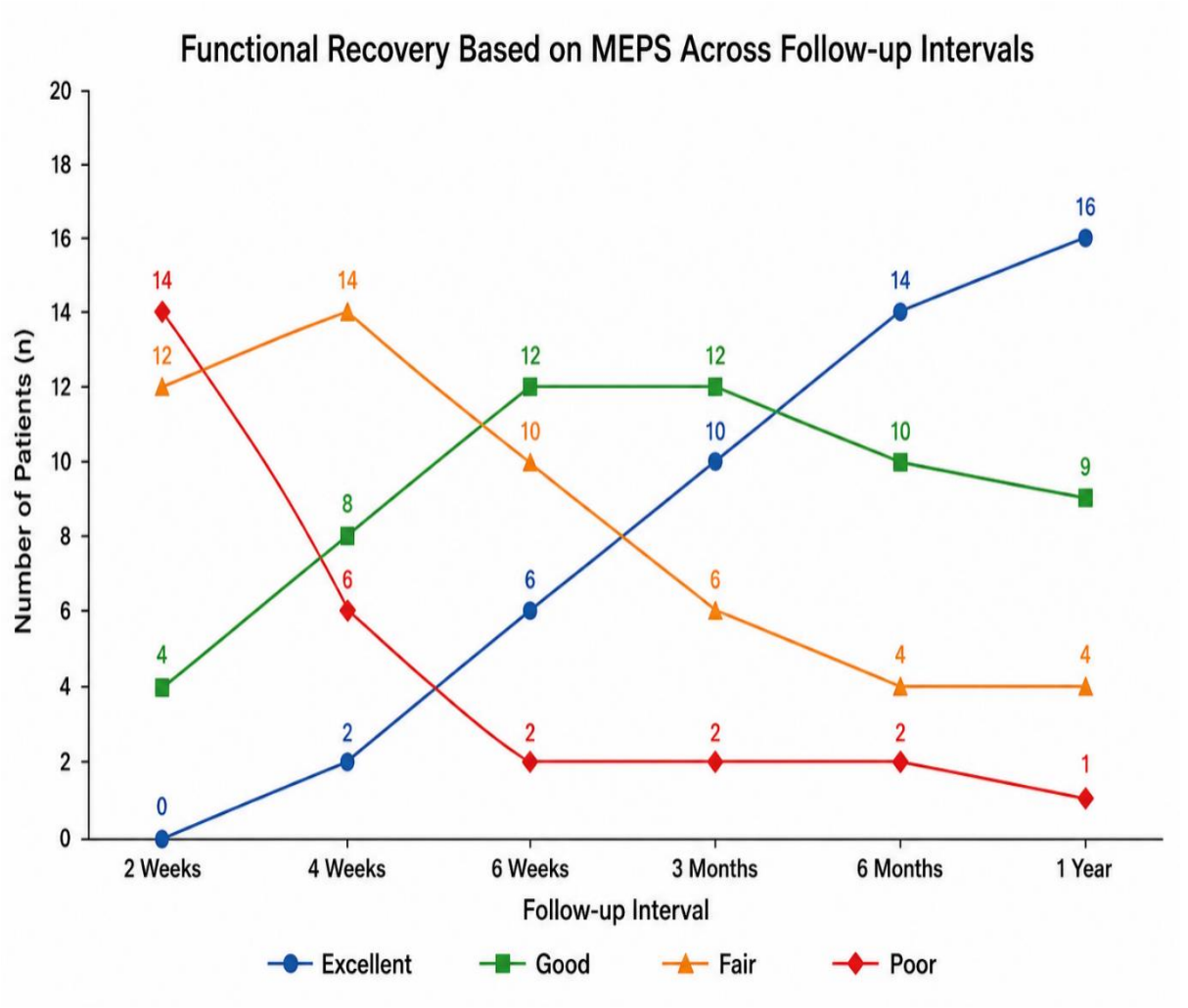
Table 2: Fracture and perioperative characteristics

Variable	**Category / Value**	**Frequency (n=30) / Mean ± SD**	**Percentage (%) / Range**
Mason classification	Type II	22	73.3
	Type III	8	26.7
Duration between injury and surgery (days)		4.6 ± 1.3	3 - 7
Surgical approach	Kocher posterolateral approach	30	100
Duration of surgery (minutes)		70 ± 12	55 - 90
Duration of hospital stay (days)		5.2 ± 1.4	3 - 8
Intraoperative blood loss (mL)		85 ± 20	60 - 120
Tourniquet time (minutes)		58 ± 10	45 - 75

Functional outcome was assessed using MEPS. At final follow-up, 16 patients (53.3%) had excellent, 9 (30.0%) had good, 4 (13.3%) had fair, and 1 (3.4%) had poor outcomes. Functional recovery improved progressively with follow-up. By the sixth postoperative week, 60.0% of patients had already achieved good or excellent results, and by 1 year, 83.3% had good to excellent outcomes (Table 3).

Table 3: Functional recovery based on Mayo Elbow Performance Score across follow-up intervals

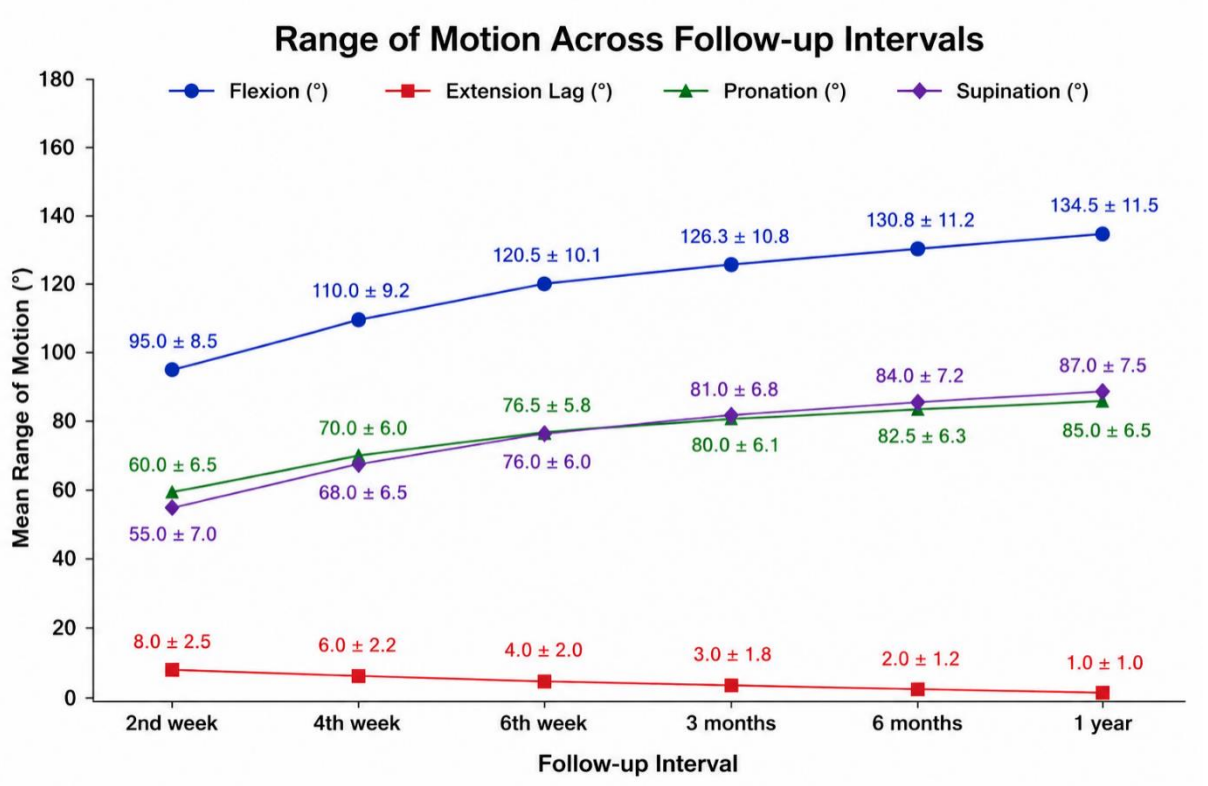
Follow-up interval	**Excellent, n (%)**	**Good, n (%)**	**Fair, n (%)**	**Poor, n (%)**
2nd week	0 (0.0)	4 (13.3)	12 (40.0)	14 (46.7)
4th week	2 (6.7)	8 (26.7)	14 (46.7)	6 (20.0)
6th week	6 (20.0)	12 (40.0)	10 (33.3)	2 (6.7)
3 months	10 (33.3)	12 (40.0)	6 (20.0)	2 (6.7)
6 months	14 (46.7)	10 (33.3)	4 (13.3)	2 (6.7)
1 year	16 (53.3)	9 (30.0)	4 (13.3)	1 (3.4)



Range of motion also improved steadily during follow-up. Mean flexion increased from 95.0 ± 8.5° at 2 weeks to 134.5 ± 11.5° at 1 year. Mean extension lag improved from 8.0 ± 2.5° to 1.0 ± 1.0°. Mean pronation increased from 60.0 ± 6.5° to 85.0 ± 6.5°, and mean supination increased from 55.0 ± 7.0° to 87.0 ± 7.5° (Table 4). With respect to return to activities of daily living, 20.0% of patients resumed routine activities within 6 weeks, 60.0% between 7 and 12 weeks, and 20.0% after 12 weeks.

Table 4: Range of motion across follow-up intervals

Follow-up interval	Flexion (°), Mean ± SD	Extension lag (°), Mean ± SD	Pronation (°), Mean ± SD	Supination (°), Mean ± SD
2nd week	95.0 ± 8.5	8.0 ± 2.5	60.0 ± 6.5	55.0 ± 7.0
4th week	110.0 ± 9.2	6.0 ± 2.2	70.0 ± 6.0	68.0 ± 6.5
6th week	120.5 ± 10.1	4.0 ± 2.0	76.5 ± 5.8	76.0 ± 6.0
3 months	126.3 ± 10.8	3.0 ± 1.8	80.0 ± 6.1	81.0 ± 6.8
6 months	130.8 ± 11.2	2.0 ± 1.2	82.5 ± 6.3	84.0 ± 7.2
1 year	134.5 ± 11.5	1.0 ± 1.0	85.0 ± 6.5	87.0 ± 7.5



Radiological union was attained in every patient; the average union duration was at 14 weeks, with a range of 12 to 18 weeks. As per the Broberg and Morrey criteria, 23.4% of patients had radiological results that were excellent, 23.3% had results that were good, and 3.3% had results that were fair. Better radiological healing was significantly associated with better functional outcome (p = 0.04) (Table 5).

Complications were minimal. One patient developed postoperative elbow stiffness, which improved with supervised physiotherapy. No cases of wound infection, implant loosening, heterotopic ossification, posterior interosseous nerve palsy, valgus instability, or non-union were observed.

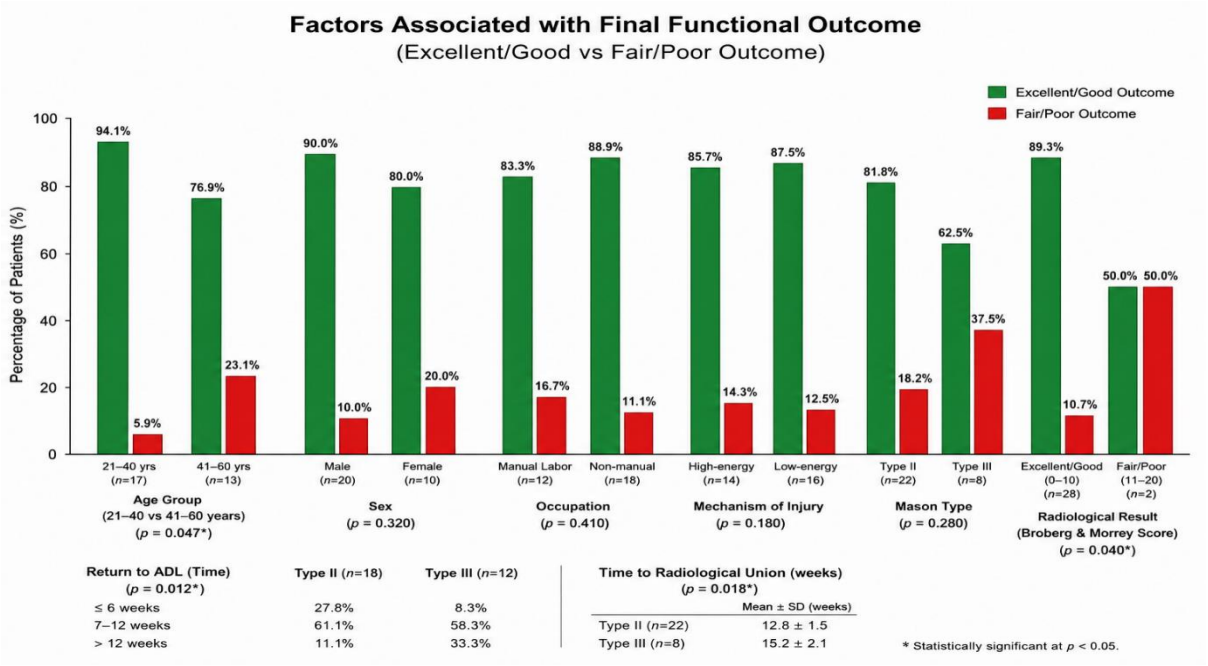
Patients aged 21 to 40 years had substantially superior functional results compared to those aged 41 to 60 years (p = 0.047). Gender, employment, and method of injury had no statistically significant correlation with the ultimate result. Mason type II fractures had a more advantageous healing pattern compared to type III fractures. An excellent or good functional result was attained in 81.8% of type II fractures and 62.5% of type III fractures; however, this difference was not statistically significant (p = 0.28). However, the resumption of daily activities was markedly postponed in type III fractures (p = 0.012), and the average union duration was considerably extended in type III fractures compared to type II fractures (15.2 ± 2.1 weeks vs 12.8 ± 1.5 weeks; p = 0.018).

Table 5: Factors associated with final functional outcome and comparative outcome analysis

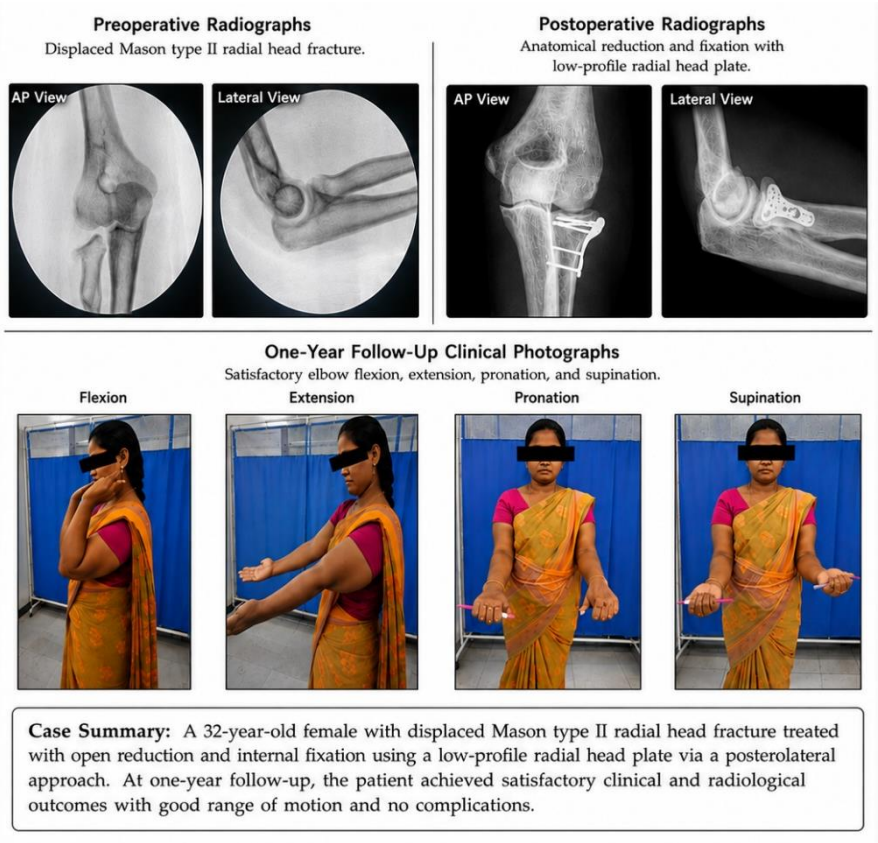
Factor	Category	Excellent/Good outcome, n (%)	Fair/Poor outcome, n (%)	p-value
Age group	21–40 years (n=17)	16 (94.1)	1 (5.9)	0.047*
	41–60 years (n=13)	10 (76.9)	3 (23.1)	

Sex	Male (n=20)	18 (90.0)	2 (10.0)	0.320
	Female (n=10)	8 (80.0)	2 (20.0)	
Occupation	Manual labor (n=12)	10 (83.3)	2 (16.7)	0.410
	Non-manual (n=18)	16 (88.9)	2 (11.1)	
Mechanism of injury	High-energy (RTA, fall from height) (n=14)	12 (85.7)	2 (14.3)	0.180
	Low-energy (self fall, assault, sports) (n=16)	14 (87.5)	2 (12.5)	
Mason type	Type II (n=22)	18 (81.8)	4 (18.2)	0.28
	Type III (n=8)	5 (62.5)	3 (37.5)	
Radiological result (Broberg and Morrey)	Excellent/Good (0–10) (n=28)	25 (89.3)	3 (10.7)	0.04*
	Fair/Poor (11–20) (n=2)	1 (50.0)	1 (50.0)	
Return to ADL	Type II: ≤6 weeks	5 (27.8)	—	0.012*
	Type II: 7–12 weeks	11 (61.1)	—	
	Type II: >12 weeks	2 (11.1)	—	
	Type III: ≤6 weeks	1 (8.3)	—	
	Type III: 7–12 weeks	7 (58.3)	—	
	Type III: >12 weeks	4 (33.3)	—	
Time to radiological union (weeks)	Type II	12.8 ± 1.5	—	0.018*
	Type III	15.2 ± 2.1	—	

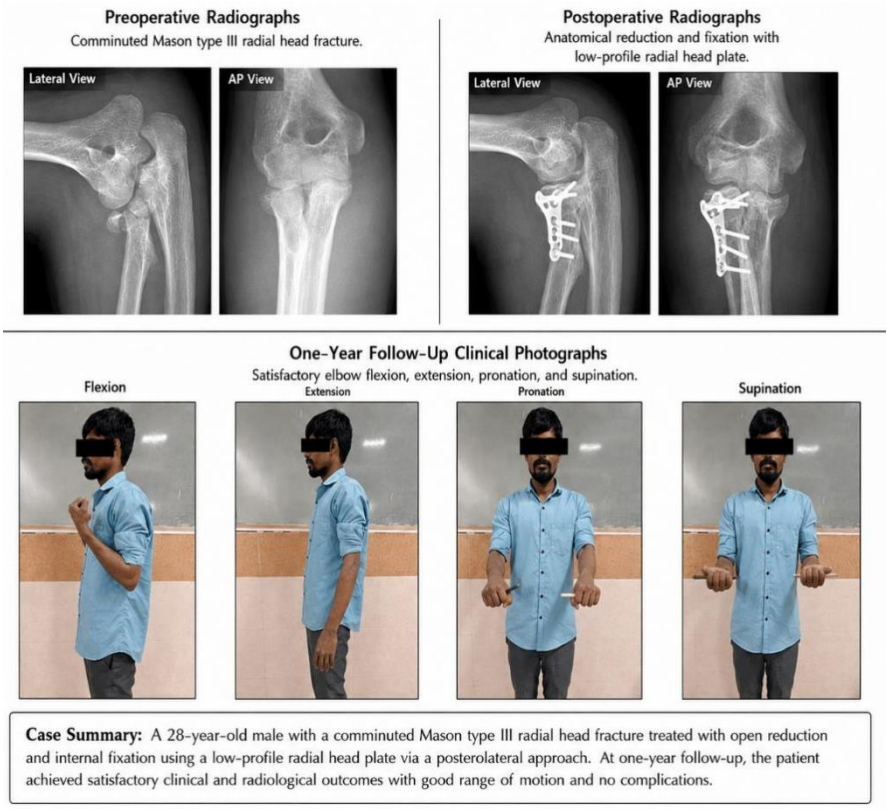
*Statistically significant at $p < 0.05$.



Case illustrations 1



Case illustrations 2



Case illustrations 3

Discussion

This study shows that radial head plating yields good functional recovery, dependable fracture union, and a low complication rate in adult patients with Mason type II and select type III radial head fractures. These results corroborate the prevailing approach of conserving the original radial head if anatomical restoration is feasible.6,11,12

The demographic pattern observed in this study is consistent with the known epidemiology of radial head fractures. Most patients were young or middle-aged adults, and males predominated, reflecting the greater exposure of active and working-age individuals to trauma.1,11 Right-sided and dominant-limb involvement were also common, which is in agreement with prior reports describing instinctive use of the upper limb during falls.8,13

Mason type II fractures constituted the majority of cases in the present series. This is clinically relevant because type II and selected type III fractures are generally the most suitable patterns for reconstruction.6,12 Early fixation was achieved in most patients, with a mean injury-to-surgery interval of 4.6 days. Timely intervention probably contributed to the favourable outcomes observed, as delayed surgery is known to increase the risk of soft-tissue scarring and postoperative stiffness.6,12 All fractures were managed through the Kocher posterolateral approach, which provided satisfactory exposure and safe implant placement.

At the final follow-up, most patients attained excellent or good MEPS scores, and subsequent evaluations indicated a gradual improvement in elbow mobility. The findings align with other data indicating that secure fixation coupled with early mobility yields advantageous elbow function in reconstructable radial head fractures.6,12,13

Similarly, the radiological findings were favourable. Union was accomplished in all instances, with an average union duration of 14 weeks. The majority of patients had excellent or good radiographic outcomes, and adequate radiological healing was substantially correlated with improved functional recovery. This underscores the significance of precise reduction and secure fixation in the restoration of both anatomy and function.12,14,15 The shorter union time observed in Mason type II fractures compared with type III fractures is also expected because less comminuted fractures provide better cortical contact and greater intrinsic stability.12

Comparison between Mason type II and type III fractures showed that both groups benefited from plating, but type II fractures showed a more favourable pattern of recovery, earlier return to activities of daily living, and shorter time to union. Although the difference in final MEPS outcome was not statistically significant, the delayed recovery in type III fractures highlights the greater technical challenge posed by comminution. Nevertheless, the overall outcome in selected reconstructable type III fractures remained acceptable, indicating that plating remains a valid option in carefully chosen cases.6,12,13

Complications were minimal in the present study. Only one patient developed postoperative elbow stiffness, which improved with physiotherapy. No implant-related failure, nerve palsy, heterotopic ossification, valgus instability, or non-union was encountered. This low complication rate compares favourably with published series in which stiffness and implant irritation are among the most frequently reported concerns after ORIF of radial head fractures.13,14

Age showed a significant association with final functional outcome, with younger patients demonstrating better recovery than older patients. This may be related to better bone quality, faster healing, and more effective rehabilitation participation. In contrast, gender, occupation, and mechanism of injury were not significantly associated with outcome in the present study. These findings suggest that fracture configuration and biological healing potential may influence postoperative recovery more strongly than demographic variables alone.1,13

The findings of this study indicate that radial head plating is a reliable treatment alternative for Mason type II and certain type III fractures. It maintains the native radial head, reinstates joint congruity, promotes early mobilization, and produces favourable functional and radiological results. Nonetheless, the current study is

constrained by its restricted sample size, single-center design, and one-year follow-up period. Comprehensive comparative studies with extended follow-up are necessary to elucidate the function of plating in relation to screw fixation and arthroplasty for more intricate radial head fractures.6,10,14

Conclusion

Mason type II and type III radial head fractures are reliably and effectively treated with open reduction and internal fixation using radial head plating. This intervention provides stable fixation, dependable union, and favourable functional recovery. The majority of patients achieve excellent or good outcomes at final assessment. Timely surgical intervention, precise anatomical realignment, and systematic rehabilitation seem to play a crucial role in these outcomes. Patients with Mason type II fractures had superior functional recovery, an earlier resumption of daily activities, and expedited radiological union compared to those with type III fractures, while some reconstructable type III fractures also shown favourable outcome. The little complication rate further substantiates the safety and dependability of this operation when executed meticulously and accompanied by prompt mobilization. In summary, radial head plating aids in preservation.

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