

## Original Research Article

# Is radial head resection a menace for the clinical outcomes of the elbow for comminuted radial head fractures?

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## ABSTRACT

**Background:** Radial head fractures are about 20% of all the elbow fractures. Comminuted radial head fractures can cause great impairment on upper extremity functional status. In older times, radial head resection was the treatment of choice for comminuted radial head fractures. Recently, radial head implant arthroplasty has become popular for fractures that could not be fixed. In this study, we assess the clinical outcomes in patients who underwent Radial head resection in Indian population of the productive age group.

**Methods:** Prospective study of 15 patients of age more than 18 and less than 50 years of age, who have undergone radial head resection for Mason type III radial head fractures. Outcomes were evaluated according to the Mayo Elbow Performance Score at 3 months, 6 months and at 1 year follow up.

**Results:** We observed that 80% of our patients were pain free at the end of 1 year and 20% had minimal to moderate pain. About 80% of our patients regained their “functional range” of movements. 12 of our patients had a stable elbow joint and only 3 patients complained of minimal to moderate instability after the procedure. 87% of our patients had a good to excellent functional outcome at the end. The mean Mayo elbow performance score was 92.3 which is graded as excellent and did not have any significant complications to hinder the clinical outcome.

**Conclusions:** Radial head resection yields a good to excellent clinical results in young Indian population with isolated comminuted radial head fractures.

**Keywords:** Comminuted radial head fracture, Mason type III fractures, Radial head resection, Indian population

## INTRODUCTION

The human elbow has been evolved from a weight bearing joint to a complex non-weight bearing joint since the era of homo-sapiens. The elbow joint is a ginglymoarthroidal or hinge joint and is formed by the humerus, radius and ulna.

Radial head fractures were first described by the Paul of Aegina (625-690 A.D.): “The ulna and radius are sometimes fractured together and sometimes one of them only, either in the middle or at one end as at the elbow or

the wrist”. Failure to recognize radial head fractures earlier might be probably because of “thick muscle covering”.<sup>1</sup> However, Helferich was the first person to recommend resection of the radial head to prevent late deformity in 1899.<sup>2</sup>

The incidence of radial head fractures is between 1.7% to 5.4% of all fractures.<sup>3,4</sup> Radial head fractures are about 20% of all the elbow fractures becomes one of the common elbow injuries.<sup>4</sup> A relatively simple radial head fracture can cause great impairment and disability. Reduced elbow range of motion following a radial head

fracture can have a substantial impact on upper extremity functional status.<sup>5</sup> With increased emphasis in healthcare on the quality of life, there has been an increased interest in development of treatments for radial head fractures.

Immobilization of three to four weeks, passive motion and avoidance of “operative treatment”, surgical fixation, removal of the fracture fragment and resection of the entire head for severe comminution, radial head replacement are all recommended treatments for radial head fractures.<sup>6-9</sup>

Many studies do not advocate radial head resection because of its high rate of complication, including pain, varus-valgus and posterolateral rotatory instability, heterotopic ossification, proximal radial migration, cubitus valgus and associated ulnar nerve symptoms, and elbow and wrist arthritis; instead, these studies suggest radial head preservation if possible or replacement when necessary.<sup>10-12</sup>

Yet numerous other authors have reported excellent functional outcome following the procedure inspite of the complications.<sup>13-18</sup>

In this study of ours we aim at assessing the clinical outcome of the elbow following resection of a comminuted radial head fracture in Indian population less than 50 years old.

## METHODS

### Materials

This was a prospective study of 15 patients with radial head fracture who underwent surgical fixation at Sri Ramachandra Institute of Higher Education, a tertiary care centre in South India from January 2015 to November 2017.

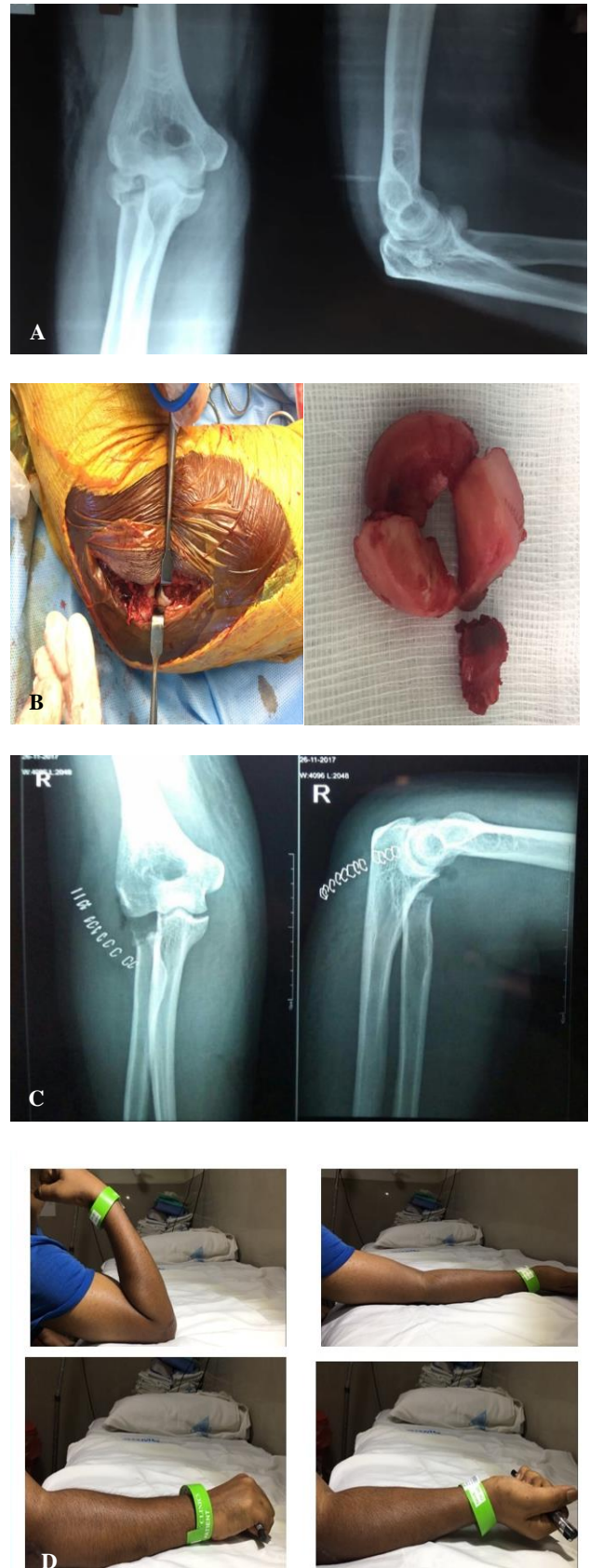
All patients with comminuted radial head fractures i.e, Mason classification type III, who consented for the studies were included. We included cases of radial head fractures after failed insitu fixation / replacement too.

We excluded cases with presence of destabilizing injuries of the elbow, MCL deficiency or if the patient is less than 18 years and more than 50 years of age. We also excluded patients with Essex–Lopresseti fracture.

### Patients and methods

15 patients with mean age of 37 years (25 to 50 years), who sustained a comminuted radial head fracture were treated by radial head resection. There were 10 men and 5 women with fracture on the right side in 8 of them.

All the patients sustained the fracture following a fall on outstretched hand. Fracture study was done by Antero - Posterior, lateral x-ray for all (Figure 1A) and CT scan with 3D reconstruction view for few cases.



**Figure 1: Case illustration: 30 year old male with right sided radial head fracture. (A) Preop X-rays; (B) intra operative pics; (C) postoperative X-rays; (D) movements at 1 year follow up.**

The fracture type was classified according to the Mason classification, as modified by Hotchkiss and Green (1991) and identified as type III.

All the patients were initially stabilized using an above elbow slab. After anesthetic fitness, patient underwent Radial head resection through Kocher's approach (Figure 1B), with ligament reconstruction if required. Post operatively, X-rays done (Figure 1C) patient elbow immobilised with above elbow POP slab for 2 weeks. Dressings were done on POD 3, 6, 9 and suture removal done on POD 12.

Post operatively elbow mobilisation started after 7 days. Active assisted movements till 15 days. Following which active movements were started till 6 weeks without weight resistance. Thereafter resisted movements with weights started.

We conducted the study on these patients who were treated by radial head resection and consented, using Mayo elbow performance scoring system and assessing various parameters like pain, range of movements, stability and functions at 3 months, 6 months and 1 year (Figure 1D). Statistical analysis was done by student's t-test.

## RESULTS

### Subjective outcomes

At the end of 1 year follow up, 12 (80%) of our patients were pain free and only 3 patients had moderate pain (Figure 2) while carrying out activities alone and not during rest. None of them experienced wrist pain or ulnar nerve irritation symptoms. Only 3 of our patients had minimal to moderate instability while lifting objects (Figure 3).

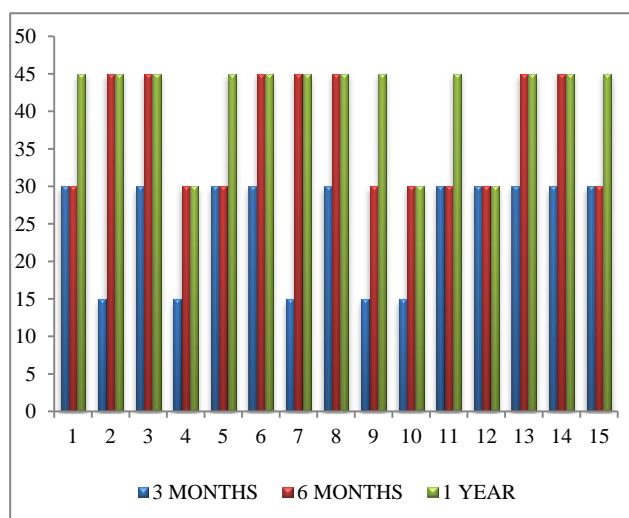


Figure 2: Graphical representation of the pain distribution.

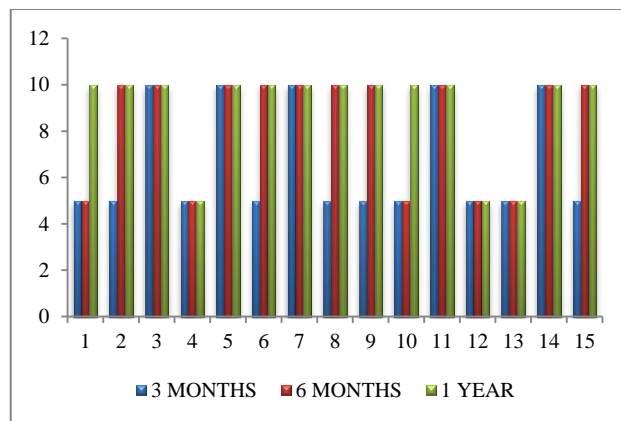


Figure 3: Graphical representation of the range of movements.

### Objective outcomes

We observed a mean sagittal arc of 125, mean supination of 80 degrees and pronation of 76 degrees. 12 patients (80%) had a total functional arc of more than 100 degrees and 3 patients (20%) had a range between 50 to 100 degrees (Figure 4).

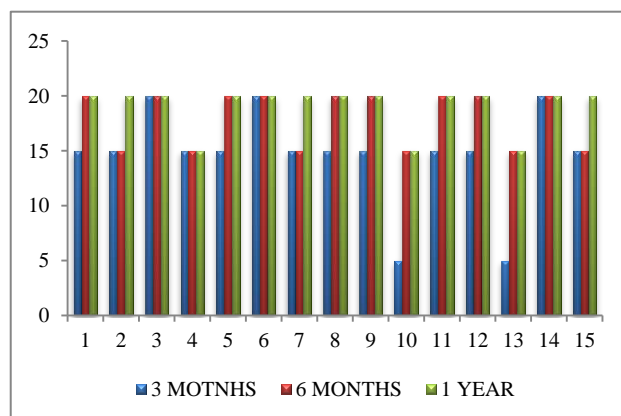


Figure 4: Graphical representation of the stability of the elbow.

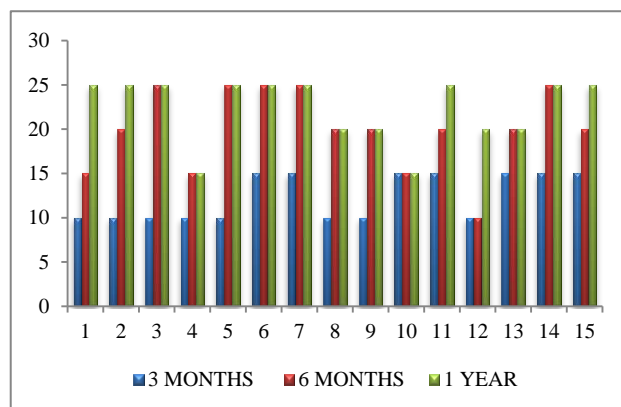


Figure 5: Graphical representation of the function.

Two patients had increase valgus laxity compared to the normal side and that did not cause any functional limitation. None of the patients had posterolateral rotator instability or DRUJ instability.

All but one of the patients returned to their daily work activities with good to excellent functional outcomes (Figure 5). Only one patient has to change his occupation from driver to security since he had only 50 degrees of supination, 45 degrees of pronation and fixed flexion contracture of 30 degrees since he did not follow post op mobilization protocol

## DISCUSSION

Radial head fractures are one of the commonest fractures around elbow (33%) and account for approximately 1.5% to 4% of all fractures.<sup>19,20</sup>

Initially, radial head resection was the treatment of choice for mason type 3 fractures. Maintaining the radial head by attempting reconstruction using open reduction and internal fixation has been associated with a high number of complications as well.<sup>14,21-23</sup> In recent times, radial head replacement has gained popularity for the treatment of isolated radial head fractures. The purpose of this study is to analyze the functional results of patients who have undergone radial head resection for comminuted radial head fractures in the most productive age group in Indian population.

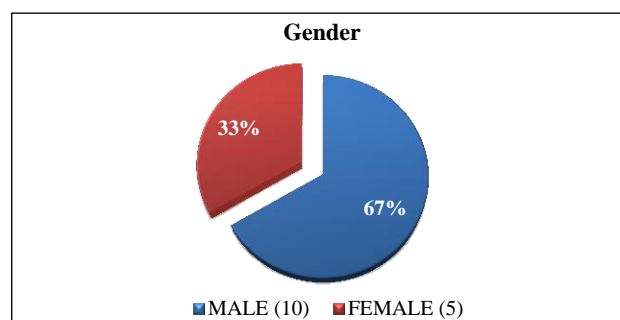
Studies related to radial head resection have been dated back to 1899.

According to the literature, incidence of radial head fractures was between 3rd and 6th decade and the male: female ratio was 2:3. The mechanism of trauma is usually indirect, being transmitted from the wrist to the elbow along the radius and causing the fracture of the radial head during a fall on outstretched hand.<sup>24,25</sup>

In this study, we had 15 patients between 25 to 50 years of age with mean age of 37.6 years and the male: female ratio was 2:1 (Figure 6). The mechanism of injury was by fall on an outstretched hand as mentioned in the literature. The right: left side ratio was 8:7 with no bilateral cases.

In 2010, Autuna et al published a retrospective study of long term outcome of 26 patients, less than 40 years of age who had underwent radial head resection. According to this study, twenty-one patients (81%) had no elbow pain, three had mild pain, and two had moderate pain.<sup>26</sup> The mean arc of motion was from 9 to 139 degrees of flexion. All but one patient had a functional arc of motion.

The mean mayo elbow performance score was 95 points; the score was classified as excellent for 53.8% of the patients, good for 38% and as fair for 8%.



**Figure 6: Comparing the sexes of the patients involved in the study.**

Only three patients complained of wrist pain due to proximal migration of radius. The pain was mild in two patients and moderate in one. In four patients, some degree of elbow instability could be detected on physical examination. Out of the 26 patients, three patients complained of ulnar nerve irritation but none of them underwent any treatment for the same. The mean carrying angle of the involved elbow was significantly greater than that of the uninjured elbow (21 degrees). Radiographic changes of arthritis were considered mild in seventeen elbows and moderate in nine. But none of those complications were associated with functional impairment.

In our present study, we observed that 80% of our patients were pain free at the end of 1 year and 20% had minimal to moderate pain. About 80% of our patients had regained their “functional range” of movements of an arc >100 degrees with only 3 patients (20%) had an arc of 50 to 100 degrees. All of our patients had a minimal flexion deficit ranging from 5 to 20 degrees.

In regards with the elbow stability, 80% of our patients had a stable elbow joint and only 3 patients complained of minimal to moderate instability after undergoing radial head resection. 87% of our patients had a good to excellent functional outcome at the end of 1 year with only 2 patients having a fair outcome. All but one of our patients returned to their daily work activities without any difficulty at a mean of 117 days. Only one patient has to change his occupation from driver to security.

Our results were comparable with few other studies that advocated radial head resection such as the study conducted by Goldberg et al, Fuchs et al, Iftimie et al and Yalcinkaya et al.<sup>14,18,27,28</sup> All these studies also suggest that despite the radiological complications, clinical outcomes were satisfactory without pronounced functional impairment.

At the end of this study we had 74% of our patients having an excellent outcome, 13% had a good outcome and 13% had fair outcomes (Table 1) and our results were comparable (Figure 7) to that of the available literature with a mean score of 92.3 which according to MEPS is termed as excellent outcome (Table 2).

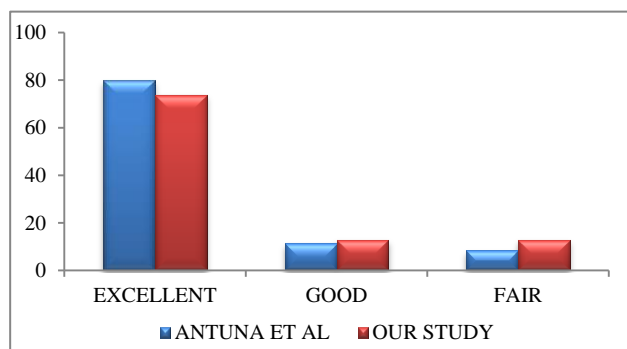


**Table 1: Final results.**

Performance	3 months (%)	6 months (%)	1 year (%)
<b>Excellent</b>	0	6 (40)	11 (74)
<b>Good</b>	0	5 (33.3)	2 (13.3)
<b>Fair</b>	9 (60)	4 (26.6)	2 (13.3)
<b>Poor</b>	6 (40)	0	0

**Table 2: Mean score.**

	Maximum	3 months	6 months	1 year (%)
<b>Pain</b>	45	25	37	42 (93.33)
<b>Arc of movements</b>	20	14.66	16	19 (95)
<b>Stability</b>	10	6.66	8.33	9 (90)
<b>Function</b>	25	11.33	20	22.33 (90)
<b>Total</b>	100	57.59	81.33	92.33
<b>Interpretation</b>		Poor	Good	Excellent

**Figure 7: Comparison of our study with the Antuna et al study.**

Prolonged immobilization of elbow is attributable to elbow stiffness as mentioned by King et al and early mobilization has been advised to prevent this complication.<sup>29-31</sup> Likewise we started early mobilization of the patients from POD 7 onwards, hence none of the patients had stiffness.

Literature suggests use of indomethacin to prevent periarticular ossifications but we did not use and we did not have any of our patients developing the complication.<sup>14,32</sup>

As mentioned by Morrey et al that valgus stability is provided by an intact medial collateral ligament, and prosthesis is not necessary after resection with an intact MCL, the presence of intact MCL in our patients reduced the incidence of instability in our study.

Many authors have reported regarding the proximal migration of radius following radial head resection and DRUJ disruption and treated it as the cause of wrist pain.<sup>33-35</sup> But controversies exist with this ideologies as many authors suggest there is no correlation between the two.<sup>25,36,37</sup> Many reports tells if proximal translation of the radius within 2-3 mm then wrist may be

asymptomatic.<sup>19</sup> None of our patients had postoperative wrist pain.

Though there are various studies advocating radial head arthroplasty for comminuted radial head fractures, there are numerous complications associated with metal prosthesis which are not seen in patients who have undergone radial head excision.

Such common complications after radial head arthroplasty for comminuted radial head fractures, there are numerous complications associated with metal prosthesis such as loosening, stress shielding, foreign body reactions secondary to wear and Osteoarthritis seen in almost all patients in follow up as reported by Riet et al.<sup>38</sup> Also, there are various technical complications attributable to radial head replacement such as pain and stiffness due to over lengthening, Inadequate stem design and insufficient cement technique as discussed by Stephanie et al.<sup>39</sup> A few cases of heterotopic ossification causing proximal radioulnar synostosis after insertion of a radial head prosthesis has also been reported in a study by Bimmel et al.<sup>40</sup>

The current study has several limitations. The study lacks a control group. The number of patients is limited, which reduces the power of the statistics and with a short period of follow up. However, it is the only study series on radial head resection arthroplasty with a homogeneous patient group in terms of fracture pattern in our centre. The study revealed that the procedure yields satisfactory clinical outcomes and the possible complications must be taken into account.

## CONCLUSION

The clinical scores in the current study are satisfying and compatible with those reported in studies advocating radial head resection. Radial head resection in young patients in the productive age group with isolated

fractures with intact collateral ligament yields satisfactory clinical results. Though complications exist post resection of radial head as discussed in the literature, the results of clinical outcomes are not hindered. Considering the complications with radial head metal prosthesis replacement as discussed above, resection is not technically demanding and we suggest radial head resection as a better modality of treatment for type III fractures.

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*Ethical approval: The study was approved by the institutional ethics committee*

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