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Original Research Article

Study of Functional Outcome of Radial Head Fractures Treated with Primary Replacement

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Abstract

Introduction: Radial head fractures are common in adults and the elderly, with 85% occurring between 30-60. Falling forcefully on an outstretched hand during trauma is the usual mode of injury but osteopenia and osteoporosis can make even a little fall dangerous.

Aim: This study aims to assess the functional outcome of fractures of the radial head treated with a primary replacement.

Methods: This prospective, single-arm, observational study was conducted at the Department of Orthopaedics, SRM Medical College Hospital and Research Centre, between November 2020 to August 2022. In this study, 21 patients with radial head fractures fulfilling the inclusion criteria were treated using Kocher's approach with a radial head prosthesis and evaluated functionally. In addition, functional outcome was assessed with Mayo and Oxford elbow scores.

Results: Of the 21 patients included in the study, 13 were male (61.9%), and eight were female (38.1%). 61.9% had Mason Type 3 fractures, 38.1% had Mason Type 4 fractures, and 47.6% had mild chronic pain as a complication of radial head replacement. We had excellent results in 14 (66. 7%) patients, and 7 (33.33%) had good results. It was observed that postoperative pain was the major complication. There was a significant improvement in the functional outcome scores within six months of the postoperative period.

Conclusion: Radial head replacement with radial head prosthesis has given excellent results and can be the implant of choice for complex radial head fractures.

Keywords: Radial head fractures, Kocher's approach, Oxford elbow, MAYO scores, Elbow joint

Introduction

Elbow fractures are one of the frequent and troublesome injuries. Surgery is necessary for some of the complicated fractures. However, many of these fractures are merely isolated, easily treatable injuries that will most likely have favourable

outcomes for the patient. There is sadly a state of in consensus in the treatment of complicated isolated fractures of the radial head. Radial head fractures make up 2 to 5% of all adult fractures. [1] One-third of all elbow injuries are radial head fractures. Approximately 90% of these injuries are stable and are not linked with forearm instability, an elbow dislocation, or other fractures. Falling on an outstretched hand with a pronated and partially flexed elbow is the leading cause of radial head fractures. Injury to the collateral ligaments of the elbow, as seen in some cases of radial head fracture, results in significant instability of the elbow joint. [2,3]

The radial head significantly maintains the stability of the elbow. The three primary static stabilisers of the elbow are the medial collateral ligament, the ulnohumeral articulation, and the lateral collateral ligament. The origins of the common extensor and flexor, the joint capsule and the radial head are secondary stabilisers. The radial head becomes a crucial stabiliser if the medial collateral ligaments (MCL) or coronoid processes are injured. [4] The radial head is crucial for preserving elbow joint stability and initiating early mobilisation. Treatment for radial head fractures depends on the type of injury; for instance, Mason I injuries are typically managed conservatively, whereas Mason II injuries are treated cautiously by conservative methods, although displaced injuries should be treated with open reduction and internal fixation. [5,6] Excision of the radial head in a comminuted radial head fracture may result in loss of elbow strength, valgus instability and radius proximal migration, which causes wrist discomfort, decrease in hand grip strength. The normal architecture and functionality of the elbow, radioulnar and wrist joints are restored by radial head replacement. [7]

In 1935 Jones stated that a displaced fracture of the radial head or neck is a hazardous injury. Though a displaced fracture is likely to heal, it is not often associated with normal elbow movements. [8] As with all intraarticular fractures, radial head fractures necessitate absolute anatomical reconstruction but comminuted fractures make the task difficult. As for the treatment, un-displaced fractures are treated conservatively and have good results. Therefore, using a prosthesis to replace the radial head becomes a novel approach towards restoring the intraarticular surface and maintaining joint congruity. This study aims to assess the functional outcome and results of the displaced radial head and neck fractures treated by replacing with a radial head metal prosthesis using the Mayo and Oxford elbow performance scoring system.

Materials and Methods

This prospective, single-arm, observational study was conducted on 21 patients with radial head fractures treated with Primary radial head replacement in the Department of Orthopaedics, SRM Medical College Hospital and Research Centre, between November 2020 to August 2022. All patients and their families were explained about the treatment strategy and gave their informed consent and the data was recorded using standard methods. After being discharged, patients continued to be monitored for a minimum of six months in the outpatient clinic.

Inclusion criteria:

Patients with Mason type III and type IV radial head fractures, patients with associated fractures and dislocation of the elbow, patients aged above 18 and below 65 years of age, patients who are medically fit to undergo surgery.

Exclusion criteria:

Patients with Mason type I and type II radial head fractures, patients with associated upper limb fractures of the ipsilateral side (involving other than the elbow), patients with age less than 18 and

above 65 and patients medically unfit for surgery were excluded.

Patients underwent the following pre-op investigations: X-ray Elbow with forearm AP and lateral views, CT elbow if needed, complete hemogram, blood grouping & typing, HIV ELISA test, HbsAg test, Anti HCV RBS, RFT, LFT, ECG, Chest X-ray, RBS and coagulation profile.

Patients were taken for elective surgery after all investigations and obtaining anaesthesia fitness. The Mayo elbow performance and oxford scoring systems were used to evaluate the functional outcome. Follow-up at intervals of 2 weeks, 12 weeks, and six months postoperatively were done for clinicoradiological assessment.

The procedure was performed with the patient in supine position with an arm board, and Kocher postero-lateral approach was used. All radial head and neck fragments are resected with the annular ligament spared. Trimming the radial neck was done to fit the prosthesis with a small rongeur. The medullary canal was opened with an awl to fit the prosthesis stem. The excised radial head was reconstructed to check the size of the prosthesis, and a trial prosthesis was used. A radial head prosthesis of appropriate size was inserted and the articular surface of the radial head prosthesis was checked to be at the lateral edge of the coronoid articular surface. Ligamentous repair is done, especially if the lateral ulnar collateral ligament is ruptured. The wound is closed, and the sterile dressing is applied. Standard post operative wound care given. Mobilisation of elbow and forearm started once the patient tolerates postoperative pain.

MS Excel was used for data entry, while SPSS V22 was used for analysis. Mean, and standard deviation were used to illustrate descriptive statistics. Statistical significance was determined using analysis of variance, t-tests, and paired t-tests. A significance level of 0.05 was used for the statistical analysis.

Results

Of 21 patients included in the study, 13 were male (61.9%), and eight were female (38.1%). 42.9% of patients were from the age group less than 40 years (n=9), 23.8% of patients from the age group 41-50 years and 51-60 years and 9.5% of patients in the age group more than 61 years (Table 1).

28.6% (n=6) patients had fractures involving the right elbow and 71.4% (n=15) had fractures on the left elbow. 85.7% showed Road traffic accidents as the mode of injury (n=18), while only 14.3% of patients showed falling on an outstretched hand as a mode of injury (n=3).

Table 1: Demographic data of the study

		Frequency	Percentage
Gender	Male	13	61.9%
	Female	8	38.1%
Age group	<40	9	42.9%
	41-50	5	23.8%
	51-60	5	23.8%
	>61	2	9.5%
Side	Left	15	71.4%
	Right	6	28.6%
Mode of injury	Fall on outstretch hand	3	14.3%
	Road Traffic Accident	18	85.7%
Fracture type	3	13	61.9%
	4	8	38.1%
Complications	Valgus laxity	2	9.5%

	Skin infection	0	0.0%
	Implant loosening	1	4.8%
	Elbow stiffness	3	14.3%
	Iatrogenic fracture	0	0%
Outcomes	Good	7	33.3%
	Excellent	14	66.7%

All the patients in our study had either Mason Type 3 or Type 4 fractures. 61.9% were shown Type 3 fractures (n=13), while 38.1% were shown Type 4 fractures (n=8).

Only 47.6% of patients (n=10) had mild chronic pain (Mean VAS Score-2.2) as a complication of radial head replacement. Valgus laxity was found in two patients in postop follow-up (9.5%). Implant loosening and elbow stiffness were found in 1(4.8%) and 3(14.3%) patients, respectively.

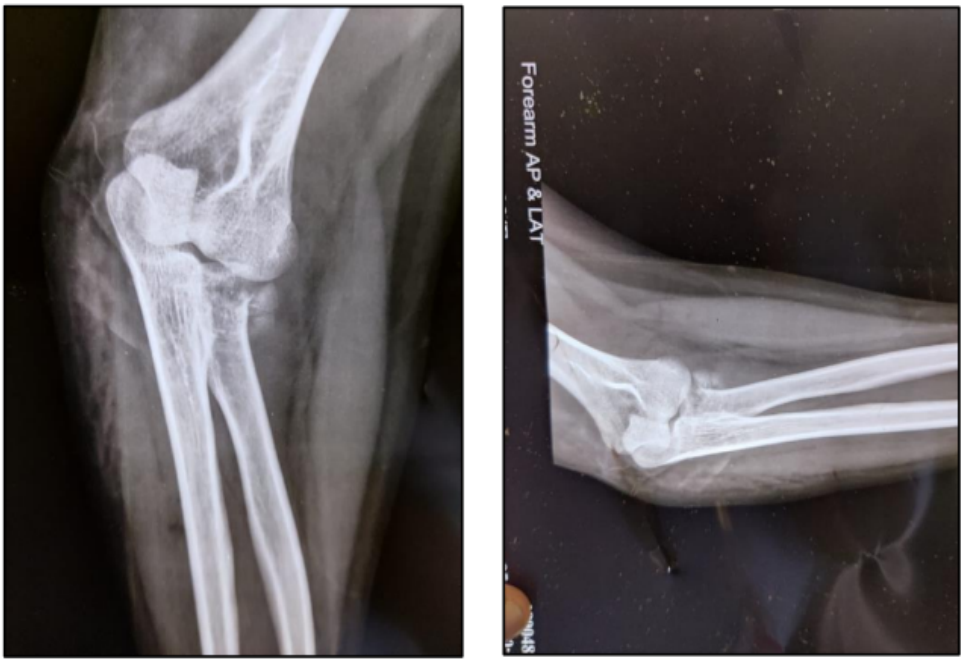

Figure 1: Pre operative Xray of Elbow showing Mason Type 3 Radial Head fracture

66.7% of patients showed excellent overall outcomes (n=14), while 33.3% (n=7) showed good outcomes of radial head replacement (Table 1).

Table 2: The mean size of implant, range of movement, Oxford score and Mayo score

		Minimum	Maximum	Mean	Std. Deviation
Size of implant		18.00	21.00	20.05	0.89
Range of movement	Flexion	100.00	140.00	127.86	12.31
	Extension	0.00	0.00	0.00	0.00
	Pronation	70.00	90.00	83.81	6.69
	Supination	60.00	90.00	83.33	7.96
Oxford score		40.00	45.00	42.86	2.54
MAYO score	2 Weeks	60.00	90.00	81.19	9.47
	12 Weeks	60.00	95.00	86.90	8.87
	6 Months	80.00	100.00	93.57	5.73

The implants' minimum size was 18 mm in diameter and the maximum was 21 mm. The mean size of the implant was 20.05 ± 0.89. When the range of movement was considered, mean flexion was 127.86 ± 12.31, mean pronation was 83.81 ± 6.69 and mean supination was 88.33 ± 7.96.

Figure 2: Postoperative Xray after Radial Head Replacement

The mean Oxford score of the 21 patients was 42.86 ± 2.54, the minimum Oxford score was 40 and the maximum was 45. The mean Mayo score of the patients at two weeks was 81.19 ± 9.47. At 12 weeks was 86.90 ± 8.87 and at six months was 93.57 ± 5.73 (Table 2).

Discussion

Comminuted Radial head fractures are usually difficult to treat but in the recent past, radial head excision and replacement has been identified as a way to treat them. [9] The radial head is inside the joint capsule and supplied by intra-osseous and intra-articular vessels. It is disturbed by radial head fractures, which require a technically challenging open reduction and internal fixation. These fractures are not amenable sometimes, for ORIF as osteonecrosis and non-union of fracture fragments are difficult to treat. [10]

In this study, we compared different parameters like age, side of injury, gender, mode of injury, fracture type, complications of radial head replacement, size of implants used, range of movement and functional outcomes using Oxford score and Mayo score. In contrast to its former disposable status, the radial head is now understood to play a crucial role in maintaining joint stability in the elbow and forearm. The majority of the patients in our study were from an age group of fewer than 41 years. However, the mean age of the patients in a study conducted by Nalbantoglu et al. [11] and Ikeda et al. [12] was 34 years and 42 years, respectively.

The male-to-female ratio was 13:8 in our study. However, in a study conducted by Nalbantoglu et al. [11] and Ikeda et al. [12], it was 20:5 and 6:4, respectively. This shows there is a male preponderance in the present study.

The present study showed road traffic accidents as the most common cause of injury, similar to the Nalbantoglu et al. [11] study which has 60 percent of cases due to accidents whereas 40 percent of the cases are due to fall from height. Raven et al. [13]

quoted an equal incidence of cases due to trauma by direct trauma to the elbow and injury due to fall on an outstretched hand. Based on the inclusion and exclusion criteria, Mason type 3 fractures are more common in the present study, followed Mason by type 4 fractures. The present study is comparable to Ozturk et al. [14] survey of radial head fractures, including type 2, 3, and 4 fractures of the radial head.

In the present study, only 47% of patients showed chronic pain due to radial head replacement. The mean VAS score among them was 2.2. Valgus laxity was found in two patients in follow-up (9.5%). Implant loosening and elbow stiffness were found in 1(4.8%) and 3(14.3%) patients, respectively. Nalbantoglu et al.11 and Raven et al. [13] found no complications in the fixation of type 2 radial head fractures treated by Open reduction and internal fixation with Herbert screw fixation. Still, in type 3 fractures treated by plating, they encountered 1 case of posterior interosseous nerve injury and 1 case of implant failure leading to the removal of the plate. Ozturk et al.14 showed a complication of painful crepitation after plating leading to implant removal in one out of 9 cases of Open reduction and internal fixation with plating.

The mean size of implants was 20.05±0.89 in the present study. Outcome scores of excellent and good are generally considered satisfactory. The overall outcome in the present study was 66.7% excellent and 33. 3% good at the end. Raven et al.13 showed a good functional outcome of 84.9 at the end of the follow-up period with 3 cases showing excellent results, 14 cases showing good results and 5 cases showing fair results with a satisfactory result in 70 percent of cases. Ring et al. [15] study showed a good outcome of 89.21 at the end of the follow-up period.

In our study, when the range of movement is compared, the mean flexion range was 127.86± 12.31, with a range of 100.00 to 140.00. The studies by Nalbantoglu et al. [11] and Raven et al. [13] showed similar results. In these studies, the mean flexion was 135 and 122.3, respectively. Also, the study by Ozturk et al. [14] showed flexion of 135, comparable to the present study results. When the loss of extension is studied among the patients, none showed loss of extension after radial head replacement. In the studies conducted by Nalbantoglu et al. [11] and Raven et al. [13], loss of extension was found to be 6 and 14. 5, respectively. Similarly, in a study by Ikeda et al. [12] and Ozturk et al. [14], the loss of extension was 7 and 5, respectively. Loss of extension was 11 in a study by Ring et al. [15]

Figure 3: Postoperative Range of movement after 6 weeks

In the present study, the mean pronation and supination were 83.81±6.69 and 83.33± 7.96, respectively. These results were comparable to the studies by Ozturk et al. [14] and Ikeda et al. [12], where they found pronation 76 and 73 while supination 86 and 85, respectively. The pronation of 74 and 74.8 and supination of 67 and 61.4 was found in studies conducted by Nalbantoglu et al. [11] and Raven et al. [13], respectively. Therefore, the results of the present study were found to be satisfactory. When the Oxford score of radial head fractures was recorded in the present study, it showed the mean oxford score of 42.86±2.54. Also, the Mayo score was recorded at two weeks, 12 weeks and after six months. The mean Mayo score was 81.19±9.47, 86.90±8 .87 and 93. 57±5.73 at two weeks, 12 weeks and six months, respectively. [16] The findings of the current study were better with those of the previous literature with Open reduction and internal fixation for comminuted fractures. This data implies that the patients treated with primary replacement could resume their previous routines as soon as possible.

Conclusion

Radial head fracture is one of the most frequent fractures around the elbow joint. The radial head plays a crucial role in establishing stability of the elbow joint. Therefore, re-establishing joint congruity is of utmost priority. Our study showed excellent results for a radial head replacement for comminuted radial head fractures with minimal complications. However, a proper surgical approach, implant selection, and early postoperative mobilisation are crucial for a successful functional outcome. A larger trial with a longer follow-up period is required to determine the effectiveness of radial head replacement in isolated radial head fractures.

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