

Radial Head Fracture Mason Type III and IV Treated with K-wire Fixation

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ABSTRACT:

Objective: To assess the functional outcome of radial head fracture Mason type III and IV treated with K-wire fixation.

Materials and Methods: This prospective study was conducted at Department of Orthopaedics, Civil Hospital, Dow University of Health Sciences Karachi from 2013 to 2015. Patients with Radial head fracture type III and IV were included in the study.

Results: A total of 42 patients were included in this study. Out of these 36 were males and 6 were females. Right side was injured in 18 patients and left side in 24 patients. 32 patients were with Mason type III radial head fracture and 10 were Mason type IV fractures. All fractures were fixed with open reduction and internal fixation with K-wire. Lateral approach was used in all fractures. In Type IV elbow was reduced with close technique. Outcome was measured on the basis of Morrey elbow scoring system. 22 patients with type III radial head fracture had excellent results while 10 with type III had good result. All patients with radial head fracture Type IV had good results.

Conclusion: Assessment of functional outcome of radial head fracture Mason type III treated with K-wire fixation showed excellent outcome in majority of patients while Type IV had good outcome. Mason type III radial head fractures should be reduced and fixed with K-wire. It maintains the stability of elbow joint and elbow function.

Keywords: Radial head, Fracture, Mason type III, Mason type IV, K-wire, Reduction, Fixation

INTRODUCTION:

Fractures of the radial head represent a common entity accounting for 33% of all elbow fractures. The typical mechanism involves the application of an axial load to the forearm by a direct fall onto the outstretched hand with the elbow in the extended and the forearm in the supinated position or by subluxation from a posterolateral rotatory movement which lead the radial head to hit against the capitellum of the humerus. The resultant fractures vary from the undisplaced ones to the more comminuted with the possibility of associated elbow instability patterns. The latter are usually caused by high energy trauma which ruptures the distal radioulnar joint and the interosseous membrane, an injury pattern referred to as the Essex-Lopresti lesion.¹

Radial head fractures are challenging injuries to treat.² In adults they are less common.³ Bromberg and Morrey

in 1986, Coleman in 1987 and Esser in 1995 described the non-operative treatment with early mobilization in the management of minimally displaced radial head fractures.^{4,5,6} Mason in 1954, Lindemann-Sperfeldt in 2002, Herbertsson in 2004, King in 2004 have recommended the open reduction and internal fixation with an intra-articular step of 2 mm or more because of early arthritic changes that are more likely to occur.⁷ Mason has classified the radial head fracture that is universally accepted.⁸ Treatment options are radial head excision. "If in doubt, resect" was the old dogma regarding the treatment of fractures of the radial head which were first classified by Mason in 1954.⁹ Several classification schemes have been introduced with the most widely used being that described by Mason. In his original article, Mason proposed a classification system in an attempt to provide a guide for optimal management.

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After evaluating the results of conservative and operative management of every radial fracture pattern in a period of 26 months' follow-up in terms of restoration of radiographic alignment, pain, range of motion, abstention from and return to work, he categorized the fractures into 3 types. Type I included all the undisplaced fractures, type II described the marginal fractures with displacement including impaction, depression and angulation and type III referred to the comminuted fractures involving the entire radial head. Johnston modified the original Mason classification adding a fourth type describing fractures associated with dislocation of the elbow.¹⁰ Fixation can be done with mini low profile plate, K-wire, external fixator, mini screw, absorbable pins and radial head replacement.^{11,12} K wire of 1.5 mm to 2 mm is used for the fixation of fractures.

Mason type III fractures

In the past, following an initial failed attempt of conservative management the preferred option was that of radial head excision. It was not until early 80s that the role of radial head as a secondary stabilizer of the elbow was appreciated. In cases of intact medial and ulnar collateral ligaments and interosseous membrane, the head of the radius acts as a secondary stabilizer to valgus stresses and approximately 60% of the load of the forearm can be transmitted through its surface. However, the situation changes when either of the ligaments or the interosseous membrane is torn, as the radial head then assumes the role of primary stabilizer and therefore is subjected to supraphysiological loads. A second role is attributed to the radial head as it provides stability to the distal radio-ulnar joint in resisting forearm axial forces. The combined injury to the interosseous ligament and the triangular fibrocartilage complex leading to axial instability of the forearm has been well recognized and defined as the Essex-Lopresti lesion.^{13,14} Radial head excision, in case of associated ligamentous injury, can lead to chronic lateral instability of the elbow as the lack of the ulnar bony support normally provided by the radial head will result in long-term overloading of the medial collateral ligament and its subsequent failure as well as in an increase in the carrying angle. A subgroup of patients who presented with posterolateral instability after radial head resection was identified by Hall, further emphasizing the need for accurate recognition of the unstable fracture patterns. Later findings include loss of range of motion of the elbow, radiologic evidence of osteoarthritis, pain and symptoms from ulnar nerve compression. Additionally, the overall risk of subsequent dislocation of the elbow is increased. Further proximal migration of the radius, which was first described by Brockman in 1931, can lead to distal radioulnar joint subluxation with degenerative changes of the wrist joint.¹⁴ A researcher has concluded that open reduction and internal fixation of the Mason type-III fractures have superior outcomes in terms of joint motion, strength and elbow function comparing to those who underwent resection.¹⁵ Furthermore, according to the results of a large meta-analysis with a total of 1264 patients, Zwingmann reported a success rate of 92% in case of open reduction and internal fixation with screws, biodegradable pins or plates.¹⁶

Mason type IV fractures

In the case of the more complicated type III fractures, which are named as type IV fractures in modified classification reduction should be attempted first and then it should be managed as a type III fracture. Due to the unstable pattern of this injury, it should be managed with either open reduction and internal fixation or excision and arthroplasty. Better results have been reported with open reduction and internal fixation.¹⁷ Present study was carried out to assess the functional outcome of radial head fracture Mason type III and IV treated with K-wire fixation. K wire was used because the technique is simple for fixation, requires less surgical time and is easy to remove.

MATERIALS AND METHODS:

This Prospective study was conducted at Department of Orthopaedics, Civil Hospital, Dow University of Health Sciences, Karachi, from 2013 to 2015. Patients with Radial head fracture type III and IV were included in this study while patients with intra-articular fracture, comminuted fracture and open fracture were excluded. All fractures were fixed with open reduction and internal fixation with K-wire. Lateral approach was used in all fractures. In Type IV elbow was reduced with close technique. Outcome was measured on the basis of Morrey elbow scoring system. In the categorical rating, 95-100 points indicates an excellent outcome; 80-94 points, a good outcome; 60-79 points, a fair outcome; 60 points, a poor outcome. (Table 1).

Table: 1
Romberg and Morey scoring system

Variable	Number of point
Motion (total for each plane)	
Flexion (0.2x arc)	27
Pronation (0.1 x arc)	6
Supination (0.1 x arc)	7
Strength	
Normal	20
Mild loss (strength 80% of contralateral side)	13
Moderate loss (strength 50 % of contralateral side)	5
Severe loss (limits everyday task)	0
Stability	
Normal	5
Mild loss (perceived by patient, no limitation)	4
Moderate loss (limits some activity)	2
Severe loss (limits everyday tasks)	0
Pain	
None	35
Mild (with activity , no medication)	28
Moderate (with or after activity)	15
Severe (at rest , constant medication)	0

RESULTS:

42 patients were included in this study. 36 were males and 6 were females. Right side was injured in 18 patients and left side in 24 patients. 32 were Mason type III and 10 were type IV (Figure 1 & 2). Outcome was measured on the basis of Morrey elbow scoring system (Table 2).

Figure: 1

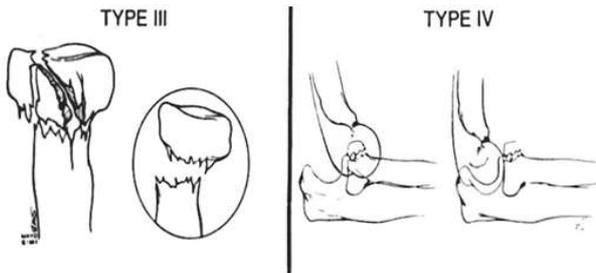
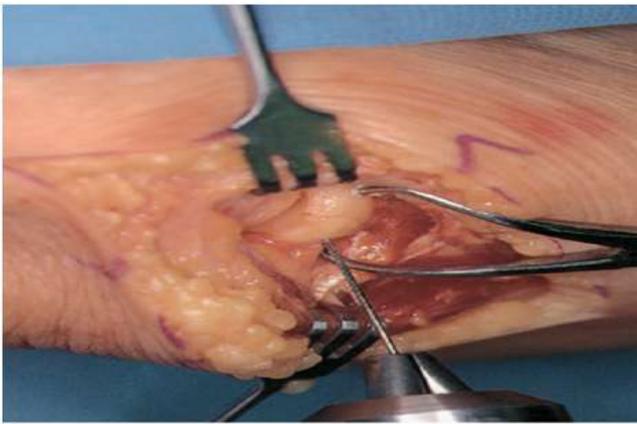


Figure: 2



K-wire is used to secure the fracture

Table: 2

Outcome on the basis of Morrey elbow scoring system

Type III	Result
22	Excellent
10	good
Type IV	Result
10	good

DISCUSSION:

Radial head fractures are the most common fractures occurring around the elbow. Radial head fractures can be treated by non-operative, open reduction and internal fixation, radial head resection, and replacement arthroplasty measures. In our study we have fixed the radial head fractures with K-wires. Outcome was assessed on the basis of Morey scoring system that showed excellent results in 22 with type III while 10 had good results. All Type IV fractures showed good results. Esser has reported twenty-six patients, ranging in age from 14 to 57 years (average 29 years), being evaluated an average of 7 years and 4 months (range 1-14 years) after open reduction and internal fixation of a displaced radial

head fracture. He used the Broberg and Morrey elbow score. He had good and excellent results in all type II and III fractures respectively and patients with type IV fracture were good or excellent. Fair results were obtained in two patients who had an associated dislocation of the elbow.⁶ A study compared open reduction and internal fixation (ORIF) with bipolar radial head prosthesis replacement in treatment of radial head fractures of Mason type III. As a control group, another eight cases of radial head type III fractures were treated with ORIF with cannulated screws and Kirschner (K) wires. The 14 patients who received radial head prosthesis replacement were followed-up for 15.9 months (range 10-27 months). Results found excellent recovery in nine cases, good in four, and fair in one.¹⁸ Our results coincides with these findings.

Another study showed that radial head excision is contraindicated, though the open reduction and internal fixation or the radial head replacement should be the better option.¹⁹ Paolo has documented in his study that 6 patients with radial head fracture were treated arthroscopically with cannulated screw and showed satisfactory functional outcome.²⁰ Thirteen complex intra-articular (pilon) fractures of the distal radius were treated. Only three patients had any residual functional problems. Follow-up motion showed wrist dorsiflexion/palmar flexion to be 74% of the opposite side, and grip strength was 76% of the opposite side. Twelve of the 13 patients showed no radiographic evidence of posttraumatic arthritis at an average follow-up period of 2.5 years.²¹ 19 cases with mason type III fractures treated with open reduction and internal fixation with the Herbert screw, all patients achieved good to excellent results.²² Another multicentric, prospective, randomized study compared the use of biodegradable polylactide pins with standard metal mini-fragment implants for the treatment of displaced radial head fractures. At 2 years, 135 (82%) of 164 patients were available for evaluation. Functional status was Good or excellent in 92% (56/61) of the control patients and 96% (71/74) of the polylactide patients. Biodegradable polylactide pins have at least comparable outcomes as standard metal implants for the internal fixation of reconstructable displaced radial head fractures.²³ Anneluuk noticed flexion arc motion postoperatively. At the 1-year follow-up evaluation there were no significant differences in the flexion or rotation arc. The average Disabilities of the Arm, Shoulder, and Hand (DASH) score was 5 points in the ORIF cohort and 15 points in the excision cohort. Eight patients in the excision cohort had arthrosis (5 mild, 2 moderate, 1 severe) compared with 2 patients in the ORIF cohort (1 mild, 1 moderate).²⁴ Masayushi studied patients in whom the comminuted radial head fracture was treated with open reduction and internal fixation and had satisfactory joint motion, with greater strength and better function than the patients who had undergone radial head resection. These results support a recommendation for open reduction and internal fixation in the treatment of this fracture.²⁵

Ward and William have reported seven cases of

coexisting capitellum and radial head fractures. The best results were obtained when early open reduction and internal fixation (ORIF) of the larger, more suitable fracture was combined with excision of the smaller fracture fragments and the early initiation of motion. Our results are in line with the findings of researchers who obtained good results. Poor results were obtained when there was incomplete removal of intra-articular fragments, associated medial collateral ligament injuries, or when ORIF was attempted on small capitellum fracture fragments.²⁶ David have documented unsatisfactory results for four of the fifteen patients with a comminuted Mason Type-IV fracture of the radial head. Thirteen of the fourteen patients with a Mason type-3 comminuted fracture with more than three articular fragments had an unsatisfactory result.²⁷

Ufuk and other researchers have found mean range of motion at the elbow joint, calculated as 5° extension to 136° flexion for Mason type III and 7° extension to 133° flexion for Mason type III with elbow dislocation. The mean pronation and supination for all patients were 74° and 67°, respectively.^{28,29,30} Our results are in line with these findings.

CONCLUSION:

Type III and IV fractures of radial head were reduced and fixed with K-wire. It maintains the stability of elbow joint and elbow function. Further research in the form of prospective randomized trials comparing the results of conservative, open reduction and internal fixation and radial head replacement therapy is needed in order to identify the best management of individual fracture patterns.

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