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Management of comminuted fracture of radial head by radial head excision and anconeus arthroplasty

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Abstract

Background: Fracture and dislocation of radial head commonly occur secondary to trauma, usually from fall on the outstretched hand. These fractures are notorious for development of complications which include stiffness, arthritis, radial nerve injury and deformities. The patient usually presents with the history of fall on outstretched hand followed by pain and swelling around wrist. The types of fractures which may occur include non-displaced isolated radial head fracture, single fragment displaced and comminuted fractures. For comminuted fractures the treatment options include screw fixation of individual fragments or radial head excision in irreparable cases. Excision of radial head is associated with altered elbow kinematics and increased laxity. Management of comminuted radial head fracture by radial head resection along with anconeus interposition arthroplasty had been described by few authors. We conducted this study to know the outcome of patients who were treated by radial head resection along with anconeus interposition arthroplasty following irreparable comminuted radial head fracture.

Aims and Objectives: The purpose of this study was to know the outcome of radial head resection with anconeus interposition arthroplasty and complications associated with this procedure in patients of irreparable comminuted fracture of radial head.

Materials and Methods: After obtaining approval from institutional ethical committee we conducted a prospective study of 30 patients who had been admitted to our institute with the diagnosis of comminuted fracture of radial head. Patients were enrolled on the basis of pre-defined inclusion criteria and any patient having any exclusion criteria was excluded from the study. X-Ray, 3 D CT and MRI (if required) were done. Detailed history, thorough clinical examination and baseline investigations were done. All patients underwent radial head resection with anconeus interposition arthroplasty. The outcome of procedure and associated complications were studied. The data was tabulated and analyzed using SPSS 16.0 version software.

Results: Out of 30 studied cases 18 (60%) were males and 12 (40%) were females with M:F ratio of 1: 0.66. Predominantly fractures were seen on right side (66.66 %). All patients underwent radial head resection with anconeus interposition arthroplasty. Majority of the patients (90%) were found to have either excellent or good outcome. the Mayo Elbow Performance Score (MEPS) was found to have improved statistically significantly. Quick Disabilities of Arm, Shoulder and Hand (Quick DASH) score was also found to have improved in all the patients and majority of the patients had either no or mild difficulty with a mean Quick Dash Score of 22. The complications in the studied cases included wound infection (6.66%), hematoma (6.66%) and nerve injury (3.33% patients). On long term follow up 5 (16.66%) patients were found to have developed arthritis of elbow joint, repeat surgeries were required in 3 (10%) patients and 1 (3.33%) patient developed valgus deformity of the elbow joint.

Conclusion: Radial head excision with anconeus interposition arthroplasty is found to have good to excellent results in patients with type III radial head fractures. The complications following this procedure can be managed conservatively in almost all the patients.

Keywords: Irreparable comminuted fracture of radial head, Anconeus transposition arthroplasty, Outcome

Introduction

Fractures of radial head constitutes almost 2-4% of all the fractures [1]. It usually occurs following a trauma or fall on the outstretched hand where the force of impact is transmitted to radial head through forearm consequent upon which radial head is forced into the humeral capitellum. Radial head fractures ranges from non-displaced or minimally displaced (Type I),

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displaced or angulated (Type II), comminuted and displaced (Type III) and radial head fracture with elbow dislocation (Type IV). The symptoms of radial head fracture depends upon the type of fracture and associated injuries. Most common injuries seen in association with these fractures include collateral ligament injuries (Medial, lateral or both), introsseous membrane disruption, distal radioulnar joint dislocation, coronoid or scaphoid fractures [2]. The patient most commonly present with pain, tenderness and limited elbow or forearm motion which is present in almost all cases. The diagnosis is usually done by Plain X-rays. 3D CT may also be done for better evaluation and further delineation of fragment in comminuted fractures. It can also identify associated injuries in cases of complex fractures involving multiple bones. Complications associated with these fractures may include compartment syndrome, wound infection, persistent pain due to intraarticular injuries and arthritis and restricted movements [3].

The management of fractures of radial head depends upon the factors like age of the patient, type of fracture and associated complications if any. The undisplaced fractures (type I) are usually treated by arm sling or immobilization in plaster cast followed by mobilization and physiotherapy [4]. The management of displaced or angulated (type II) fractures is controversial and there is no consensus as to which treatment protocol is best. Many researchers have come up with the studies reporting good results following surgical as well as conservative management of isolated, displaced but stable radial head fractures [5]. No conclusion could be drawn yet from the studies about whether open reduction and internal fixation is better than conservative management in these patients. For management of comminuted fractures of radial head (Type III) the treatment options available include screw fixation of individual fragments or excision of radial head in cases where repair is not possible [6]. Once popular isolated radial head excision was later found to be associated with elbow instability and hence it was initially treated by excision followed by silicone implants but these implants were associated with several implant related complication due to which researchers were again more inclined towards open reduction and internal fixation of comminuted fracture of radial head. Open reduction and internal fixation though was satisfactory for 2 or 3 simple fragments it gave very unsatisfactory results in cases of comminuted fractures of radial head where there were more than 3 fragments [7] [ring *et al*]. Many researchers came up with the options of silicone, polyethylene and various metal implants but all these implants though gave satisfactory results in short time they were associated with the complications like loosening and wear requiring a revision surgery in long term follow up [8].

Excision of radial head and anconeus interposition arthroplasty for the management of comminuted fracture of radial head has been reported to give satisfactory results by many authors [9]. The purpose of this study was to study the outcome of patients who were treated by radial head excision along with anconeus interposition arthroplasty following irreparable comminuted fractures of radial head.

Materials and Methods

This was a prospective study was conducted the department of orthopedics of a teaching institute located in an urban area. The study consisted of 30 patients who were admitted to our institute with the diagnosis of comminuted fracture of radial head. The study was approved by institutional ethical committee. The information like demographic profile (age sex

and address), history, clinical examination with a special emphasis on presence of swelling, pain and restricted movements of affected elbow were all noted in a proforma. Investigations like Complete blood count, biochemical tests and Imaging studies (X-Ray in all patients and 3 D Computed Tomography in selected patients) were done. Whenever available, additional clinical and diagnostic results were also compiled. After appropriate preoperative evaluation all patients underwent radial head excision and anconeus arthroplasty.

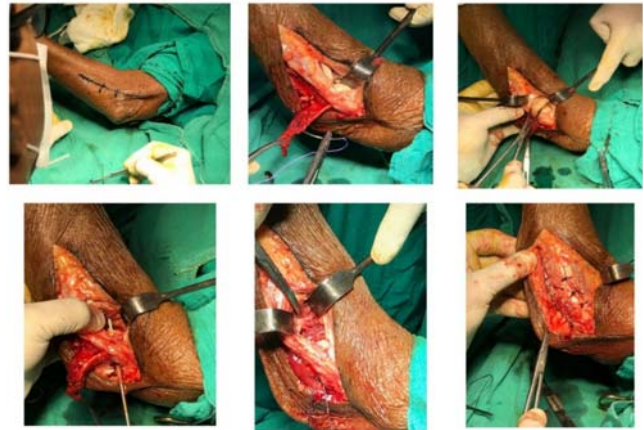


Fig 1: Figure showing (Clockwise from left upper corner) Incision, exposure of anconeus, radial head excision, anteroposterior tunnel formation in the lateral condyle, pulling up of anconeus in the gap created by radial head excision followed by tying it posteriorly on lateral condyle and finally suturing of anconeus fascia and lateral capsular incision.

Appropriate post-operative examination was done in all cases. The outcome was determined on the basis of quick-Disabilities of Arm, Shoulder and Hand (quick -DASH) and Mayo Elbow Performance Score (MEPS). Patients were followed up at least for 1 year and preferably up to 2 years. Those patients who didn't come for follow up at least for 1 year were excluded from the study. Whenever needed and whenever it was possible a telephonic communication was made with patients. The results were studied using appropriate statistical methods. Data analysis was carried out using SPSS16.0 version software. Microsoft word and excel were used for generating charts and graphs

Inclusion Criteria

1. All cases of comminuted fracture of radial head (Type III) confirmed on Imaging.
2. Age of the patient should be 18 years or more.
3. Patients who attended follow up OPDs at least for 1 year.

Exclusion Criteria

1. Age less than 18 years.
2. Patients having dysplastic elbow joints.
3. Patients who refused consent to be part of the study.
4. Patients who didn't come for follow up visits at least for 1 year.
5. Patients having inflammatory or autoimmune conditions like rheumatoid arthritis.

Results

Out of the 30 patients diagnosed with comminuted fracture of radial head 18 (60 %) were Males and 12 (40 %) were females with a M: F ratio of 1: 0.66.

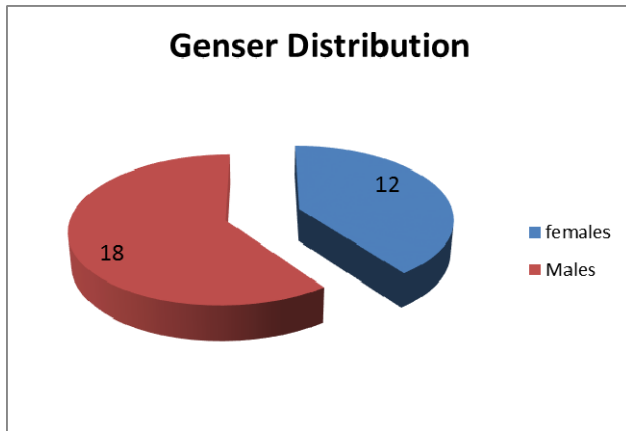


Fig 2: Gender Distribution of the studied cases

The analysis of the age groups of the patients revealed there were 12 (40 %) patients in age group between 18 – 40 years, 10 (33.33%) patients in age group between 41 – 60 years and 8 (26.66%) patients in age group between 61 – 80 years. Mean age of the study group was 43.96 ± 18.12.

Table 1: Age distribution of the studied cases

Age groups	No. of Patients	Percentage
18 - 40 years	12	40 %
41 - 60 years	10	33.33%
61 – 80 years	8	26.66 %
Grand Total	30	100 %
Mean Age ± SD = 43.96 ± 18.12 years		

The analysis of body mass index revealed that there were 5 patients with BMI < 18.5, 7 patients with BMI of 18.50 - 24.99, 9 patients with BMI 25.00 - 29.99, 7 patients with BMI 30.00 - 34.99 and 2 patients with BMI ≥40.00.

Table 2: Body Mass Index of the studied cases

Age groups	No. of Patients	Percentage
< 18.5	5	16.66 %
18.50 - 24.99	7	23.33 %
25.00 - 29.99	9	30.00 %
30.00 - 34.99	7	23.33 %
≥40.00	2	6.66 %
Grand Total	30	100.00%

Mechanism of injury in majority of the patients with comminuted fracture of head of radius was found to be fall on outstretched hand (60%) followed by motor vehicular accidents (30) and sports injury (10%).

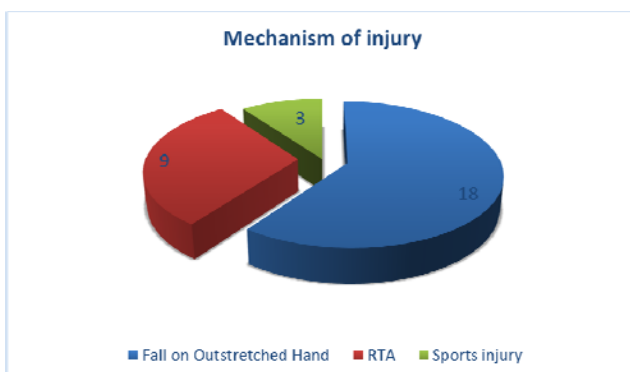


Fig 3: Mechanism of Injury in the studied cases

In 20 (66.66 %) comminuted fracture of radial head was seen on right side and in 33.33% this fracture was seen on left side.

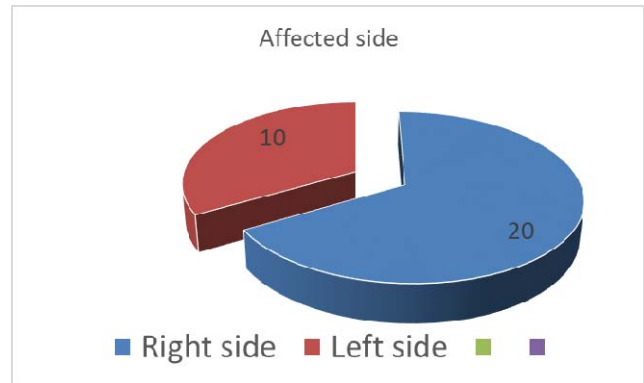


Fig 4: Affected side in the studied cases

All patients underwent anconeus muscle interposition arthroplasty. These were performed according to the surgeon’s experience. The same procedure was performed in all the cases unless there was any specific indication for performing additional procedure while performing anconeus transposition.

The analysis of the results obtained from this in patients with comminuted fractures of radial head showed that there was a significant difference in preoperative and postoperative Mayo Elbow Performance Score (MEPS). While in preoperative patients it was found to be 58 +/- 16 after anconeus interposition arthroplasty the mean MEPS score was found to be 86 +/- 18. The difference in mean preoperative and postoperative MEPS score was statistically significant.

Table 3: Mean Pre and post-operative Mayo Elbow Performance Scores

Mean Preoperative MEPS score	58 +/- 16	P< 0.001. Statistically Significant
Mean Postoperative MEPS score	86 +/- 18.	

Based on the outcome of patients on the basis of MEPS scores it was found that 18 patients had excellent results (MEPS score more than 90) while 9 patients had good results (MEPS score between 75-89). Fair (MEPS score between 60-74) and poor (MEPS score less than 60) results were found in 2 and 1 patients respectively.

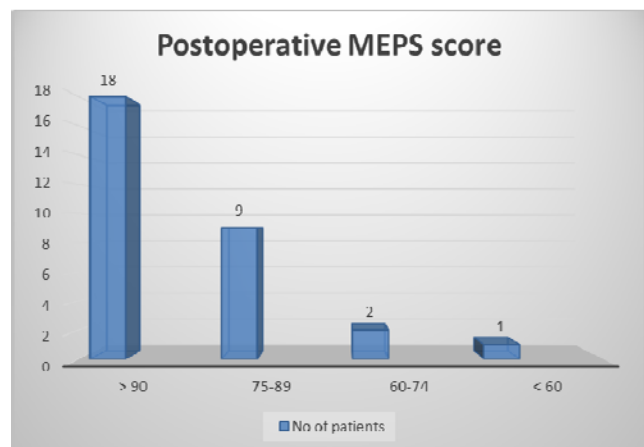


Fig 5: Post-operative Mayo Elbow Performance Scores

The analysis of Quick-DASH which takes into account the factors like opening a jar, intensity of pain, tingling intensity, sleep quality, level of socialization, ability to wash back, forceful recreation, heavy chores, carrying a bag, using a knife and extent of limitation in routine work. The analysis of mean Quick DASH in operated cases was found to be 22 +/- 11.

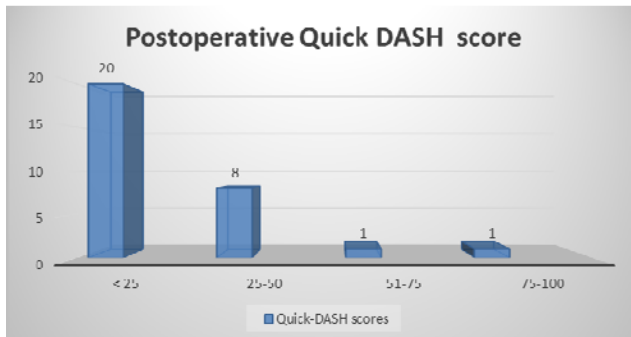


Fig 6: Mean post-operative Quick DASH scores

Analysis of the complications in the studied cases revealed that out of 30 operated cases there were 5 cases with postoperative complications. These complications included wound infection (6.66%), hematoma (6.66%) and nerve injury (3.33% patients). On long term follow up 5 (16.66%) patients were found to have developed arthritis of elbow joint, repeat surgeries were required in 3 (10%) patients and 1 (3.33%) patient developed valgus deformity of the elbow joint.

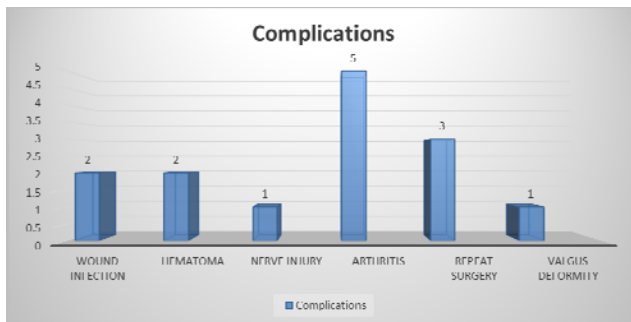


Fig 7: Complications in the studied cases

Discussion

Our study comprised of 30 patients with comminuted fracture of radial head. Males were found to be affected predominantly with a M:F ratio of 1:0.66. The Male to female ratio in affected cases is interesting. Many studies have reported that the males are more commonly affected in cases of comminuted radial head fracture this may be because of common involvement of males in motor vehicular accidents and sporting activities but as the age advances the proportion of females increases. The fact that with advancing age men are less likely to engage in sporting activities and women starts getting osteoporosis making them vulnerable for fractures following relatively less severe trauma may be one of the reasons why in older age groups women more commonly affected than men. Kaas L *et al.* in their retrospective study of 322 patients found that the M: F ratio in the studied cases was 2:3. The authors moreover found that as the age advances there was a gradual increase in the numbers of affected females in comparison to males and above 50 years, the number of affected female patients was statistically

significantly higher than the number of male patients [10].

The obesity is found to be one of the risk factors for occurrence of complex elbow and ankle fractures. The studies have established the relationship between increased BMI and risk of fractures. Bistman OM *et al.* in their study of 4012 adult patients with acute extremity fractures requiring surgical treatment found that the fracture patients had a higher mean BMI than the general population. The authors concluded that an increased body mass index was associated with increased chances of displaced fractures at the elbow and the ankle and that overweight and obesity can be regarded as predisposing factors to these injuries [11].

The common mechanism of injuries causing radial head fractures include fall on outstretched hand, direct trauma as seen in road traffic accidents and sports injuries. Izzak F Kodde in their overview of current concepts of the management of radial head fractures showed that fall on outstretched hand was found to be one the common mechanism of injury resulting in fractures of radial head. With increased motorization radial head fractures due to direct impact as a result of road traffic accidents is also becoming one of the common causes of these fractures [12].

In our study majority of the patients (66.66%) had a fracture on dominant side (18 right handed and 2 left handed patients had fractures on their respective dominant side) while 10 (33.33%) patients had fractures on their non-dominant side. Similar findings were reported by many authors and fractures on dominant side was uniformly reported to be more common than on non-dominant side. Gonzalez Roldan CA *et al.* in their study of 44 patients with radial fractures found that out of these patients 30 (68.18%) patients had fractures on dominant side and 14 (31.82 %) patients had fractures on non-dominant side [13].

Anconeus interposition arthroplasty for comminuted fractures of radial head was first used and described by Morrey BF *et al.* in 2002 who reported that Interposition of the vascularized anconeus muscle provides a viable soft tissue cushion to mitigate bone impingement and hence prevent later occurrence of complications such as osteoarthritis. They moreover reported that rerouting of the anconeus underneath the lateral collateral ligament is responsible for improved overall elbow stability [14]. In our study of patients with comminuted fractures of radial head all patients underwent radial head excision and anconeus interposition arthroplasty. Majority of the patients had excellent results with significantly improved Mayo Elbow Performance Scores (MEPS). The quick DASH scores revealed significantly reduced difficulty in functioning of elbow in operated patients. Similar results were reported by Baghdadi YMK *et al.* who in their study of mid and long term outcomes of 39 patients who have undergone anconeus interposition arthroplasty found that anconeus arthroplasty provides a reasonable surgical alternative in management of irreparable fractures involving radial head. The authors concluded that this procedure is especially useful when other alternatives such as radial head replacement may be problematic due to capitellar erosion or marked proximal radius bone loss [15].

Conclusion

Management of comminuted radial head fracture by radial head resection with anconeus interposition arthroplasty is found to have good to excellent results in majority of the patients with minor complications which could be successfully managed conservatively except in 3 patients who required some or the form of repeat surgery.

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