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Symptomatic medial humeral epicondylar fracture non-union- rare presentation of a relatively common injury

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KEYWORDS

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Incarceration of medial epicpondyle
Fracture dislocation
Ulnar nerve injury

ABSTRACT

Background: Symptomatic non-union of medial humeral epicondylar fractures is a limited entity. Some studies recommend surgical excision of the fragment, but the results are controversial. The purpose of this study is to evaluate the outcome of open reduction and internal fixation of a medial epicondyle non-union fragment.

Materials and methods: A retrospective study was conducted in all the patients, who were operated in our hospital between the year 2010 and 2015 for symptomatic medial humeral epicondyle non-union. Inclusion criteria were open reduction and internal fixation of symptomatic medial epicondyle non-union and minimum one year of follow-up from time of surgery. Exclusion criteria included other associated musculoskeletal disorders of the affected limb. Open reduction and internal fixation of the fragment was done in all patients and the ulnar nerve was decompressed and anteriorly transposed in cases where symptomatology was present. Outcome was assessed with radiograph, range/arc of motion, Visual analogue pain scoring and two functional outcome tools.

Results: Study sample consisted of 14 patients, with mean age at presentation of 14.9 years (range 6 to 50 years) with mean time since injury of 7.7 months (range 3 to 24 months). Patients presented with medial elbow pain and prominence, limited range of motion, valgus instability, and ulnar nerve compression. After open reduction and internal fixation, at a mean of three years after surgery (range 1.5 to 5 years), patients reported an improvement in visual analogue pain score from a mean of 7.29±1.3 to 0.21±0.4, and the difference was statistically significant (p=0.001). Mean postoperative Quick DASH (Disability of Arm, Shoulder, and Hand) score was 5.21±7.2. Mean Mayo Elbow Performance Score was 96.7±6.1. Improvement in arc of motion was statistically significant (p=0.001). Radiographic union was achieved in all patients except one who had fibrous union. Functional elbow range of motion was achieved in 13 out of 14 cases (92.8%) and ulnar nerve recovered in five patients and one patient required tendon transfer.

Conclusion: Open reduction and internal fixation of symptomatic medial humeral epicondyle non-union gives excellent clinical and functional outcome in the majority of cases.

Introduction

Fractures of the medial humeral epicondyle are relatively common in children [1]. With conservative treatment non-union rates of displaced medial humeral epicondyle fractures are reported as high as 90%, however most of them remain asymptomatic without any functional deficit [1–4]. Symptomatic non-union of medial humeral epicondylar fracture is a relatively rare entity and complications can sometimes be devastating. The medial epicondyle of the humerus does not usually begin to ossify before the age of four or five years and, hence is not seen on radiograph of young children. In cases where apophysis is not ossified, a diagnosis of these fractures is difficult to make and often missed [5,6] as is the case of a TRASH lesion [7]. Although rare, these fractures can sometimes be disabling for patients with a painful unstable medial collateral ligament (MCL) deficient elbow [3]. Moreover missed incarceration of the medial epicondyle with ulnar nerve entrapment in the joint can lead to chronic painful stiff elbow with ulnar nerve neuropathy [8]. Satisfactory results were obtained with surgical excision of the epicondylar fragment and suture attachment of the tendons and MCL [3,4], however excision is not a solution for instability [3]. Surgical excision of the medial epicondylar fragment should be avoided and not recommended in many studies [1,9,10].

The aim of this study is to evaluate the clinical and functional outcome of open reduction and internal fixation of symptomatic un-united epicondylar fragments.

Material and methods

A retrospective cohort study was conducted after obtaining approval from our institutional ethics committee. Informed consent was obtained from all the patients.

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Inclusion criteria: (1) diagnosis of medial epicondyle non-union; (2) open reduction and internal fixation of symptomatic medial epicondyle non-union; and (3) minimum 1 year of follow-up from the time of surgery. Exclusion criteria: other associated musculoskeletal disorders of the affected limb, multiple medical comorbidities, that would prevent operative intervention.

Data was collected for all the patients who had symptomatic medial epicondyle non-union, operated in our institute between the year 2010 and 2015. There were 14 patients, nine males and five females with a mean age of 14.9±10.6 years (range 6 to 50 years). The mean time since injury was 7.96 months (range 3 to 24 months). Six patients had preoperative ulnar nerve injury, five had incarceration of the epicondylar fragment, three had elbow dislocation, two had elbow joint contracture and one had heterotopic ossification

All patients had some amount of valgus instability, determined by examination under anaesthesia. All patients were operated with open reduction and internal fixation using a posteromedial approach [11]. A single incision was made anterior to the medial epicondyle. This incision allows exposure to the fracture site as well as the ulnar nerve. The fracture site was visualized and the medial epicondylar fragment located, this was usually displaced anteriorly and distally [11]. If there was an incarceration of the epicondyle into the elbow joint then through gentle extension of the elbow, wrist and fingers with the forearm fully supinated, whilst at the same time abducting the forearm at the elbow, will bring the fragment out [12,13]. The base of the fractured humerus was exposed, and soft-tissue obstructions were carefully dissected away from the fracture bed to allow for an anatomic reduction. The base of the fracture bed was curetted carefully for growth plate remnants to expose cancellous bone. The reciprocal surface on the medial epicondylar fragment was carefully exposed, as well, and any soft tissue that blocked the reduction, was removed [11].

Once the fracture was reduced anatomically by supinating the forearm and flexing the elbow, internal fixation is achieved with the help of either a 4.0 mm cancellous screw for a larger fragment, or by two k wires and a tension band wiring construct, or two k wires and 1'0 vicryl construct, or a 1'0 vicryl alone for a smaller fragment (Figure 1). Augmentation of the flexor origin was done by drilling into humerus and suturing with 1'0 vicryl. The ulnar nerve was decompressed and anteriorly transposed in six patients with preoperative ulnar nerve injury. Medial collateral ligament reconstruction was done in all patients. Securing attachment of the medial complex including anterior band of medial collateral ligament allowing early mobilization and improved outcome. Two of them required Palmaris longus tendon graft as it was difficult to oppose the two ends of MCL. Triceps lengthening was required in seven patients. One patients required capsular release and flexor pronator musculotendinous lengthening. In one patient heterotopic mass excision was done for joint contracture. Intraoperatively before closure the elbow was examined for stability and range of motion.

Post operatively the elbow was immobilized in a posterior above elbow splint for two weeks, then gradual mobilization was started with hinged elbow brace in consultation with a physiotherapist.

Patients were followed up regularly every week in the first month, then monthly for next three month, progressively increasing the range of motion at every visit, then every three monthly for the next one year. Protection of the elbow with avoidance of weight lifting was advised for first three months and strengthening exercise were started thereafter.

Outcome was assessed radiologically by post-operative radiograph, clinically by range of motion, arc of motion and 10-point visual analogue pain scale (VAS). Functionally patients were evaluated with two outcome tools at minimum one year follow up or the latest follow up, one was the patient completed Quick-DASH (Disability of Arm, Shoulder, and Hand) score [14,15] (Q-DASH), and the other was the clinician completed Mayo Elbow Performance Score (MEPS) [14]. Quick-DASH scores range from 0 to 100 with higher scores representing greater disability. The Mayo Elbow Performance Score is an upper extremity functional assessment in which an overall score of 0 to 100 is calculated, with 90 to 100 points graded as excellent, 75 to 89 as good, 60 to 74 as fair, and less than 60 as poor [10].

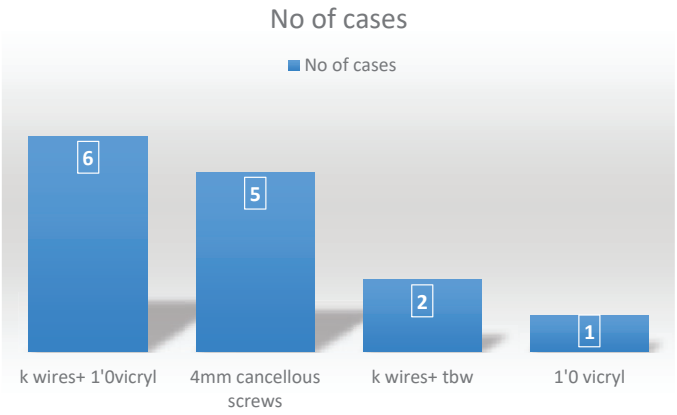

Fig. 1. Different modes of internal fixation used in the procedure with number of patients in each group shown in the box.

Statistical analysis

Statistical analysis was performed using paired t test to compare the difference between pre-operative and post-operative values of all variables considered.

Results

Patients presented with medial elbow pain, prominence, fixed flexion deformity, limited range/arc of motion, stiffness, valgus instability, ulnar nerve compression, joint contracture, elbow dislocation, incarceration of the fragment and heterotopic ossification. At a mean follow up of three years after the surgery (range 1.5 to 5 years), patients reported an improvement in visual analogue pain score from a mean of 7.29±1.3, preoperatively to 0.21±0.4, post-operatively, and the difference was statistically significant ($p<0.001$).

The mean preoperative fixed flexion deformity was 46.78±23 degrees (range 10–90 degrees) which improved to mean of 11.4±8.6 (range 0–20 degrees) postoperatively and the difference was statistically significant ($p<0.001$). Post operatively, four out of 14 patients did not have any fixed flexion deformity. Maximum fixed flexion deformity was 20 degrees and maximum flexion achieved was 140 degrees post operatively. Only one patient had flexion less than 130 degrees (120 degrees). The mean preoperative arc of motion was 41±20 degrees which improved to a mean of 120.7±19.38 degrees and the difference in the result was statistically significant ($p<0.001$)

Radiographic union was achieved in all but one patient who had fibrous union; this patient was followed up for a year and had mild pain, mild weakness on lifting heavy weights and medial prominence. This patient did not have any complaints on performing his activities of daily living. On examination moderate amount of instability was present. Three other patients had slight enlargement or irregularity of the medial epicondyle. Visual analogue pain score was zero in rest of the cases. One patient had superficial infection, it was debrided, antibiotic beads were inserted and the infection subsided.

Ulnar nerve recovery was achieved in five patients and one patient required second stage tendon transfer. None of the other patients had any other post-operative complications. All patients

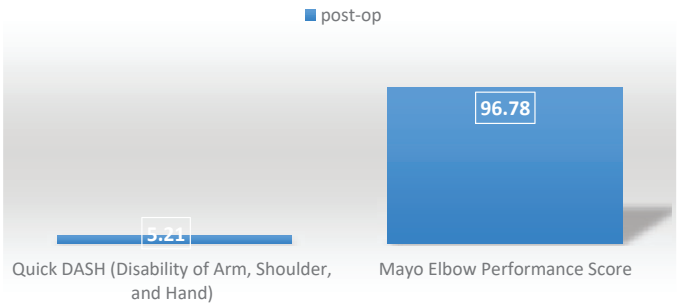

Fig. 2. Post-operative Quick-Dash Score and Mayo elbow performance score. Quick-DASH (Q-DASH) scores range from 0 to 100 and higher scores represent greater disability. Mayo Elbow Performance Score (MEPS) range from 0 to 100 with lower scores representing greater disability.

were able to perform their activities of daily living and were satisfied with their surgery.

Three patients have already had implant removal and five more wish to have their implant also removed due to implant prominence, but no other complaints were noted.

Mean postoperative Quick DASH (Disability of Arm, Shoulder, and Hand) score was 5.21±7.2 (Figure 2).

Mean Mayo Elbow Performance Score was 96.7±6.1. According to mayo elbow performance score 12 out of 14 patients (85.7%) had excellent results and two out of 14 patients (14.3%) patients had good results, none had fair or poor results (Figure 3).

Discussion

Conservative management often serve well in case of acute injuries, non-displaced or minimally displaced fractures (according to Wilkins classification) [16] or Papavasiliou [17] type 1 fracture, i.e., small degree of avulsion of the epicondylar fragment. Although the frequency of non-union or fibrous union in these conservatively treated patients is fairly high [1,2,18,19], most patients remain asymptomatic. Although rare, only a small percentage of these patients remain symptomatic, according to an established non-union [1,3], probably because of greater impact of injuries leading to severe soft tissue injuries and dislocations. This category of patients poses a great challenge in the management of these fractures.

There have been controversies in the surgical management of these fractures. Fowles et al [20] reported good results in three patients who had had excision of the epicondyle for the treatment of an old fracture with entrapment of the fragment in the elbow joint, which was almost ankylosed at the time of surgery. After surgery, the range of motion of the elbow improved a great deal in all three patients, but the maximum duration of follow-up was only 20 months.

Gilchrist et al [4], on the basis of his experience with five patients, reported that excision of the non-union fragment and repair of the medial collateral ligament to the distal humerus can provide satisfactory outcomes in these patients.

The major limitation to these studies was that sample size was too small to come to a conclusion. Farssetti et al [1] in his comparative study of 42 patients reported that none of the patients undergoing surgical excision had good results. This group of patients have decreased grip strength, marked elbow instability, and hypoplasia of the medial aspect of the distal humeral epiphysis which was evident radiographically. Osteoarthritis of the elbow, probably caused by marked elbow instability, was also present in two patients. Excision of the fragment is not recommended, because the displaced epicondyle is still important in maintaining the contour of the inner side of the elbow [9]. Many studies [21–23] have postulated that fibrous union of the epicondyle can lead to laxity of the medial collateral ligament.

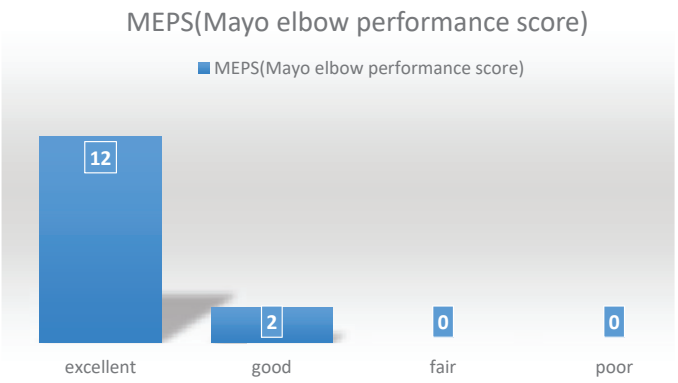

Fig. 3. Grading of Mayo elbow performance. Excellent outcome in 12 patients and good outcome in two patients.

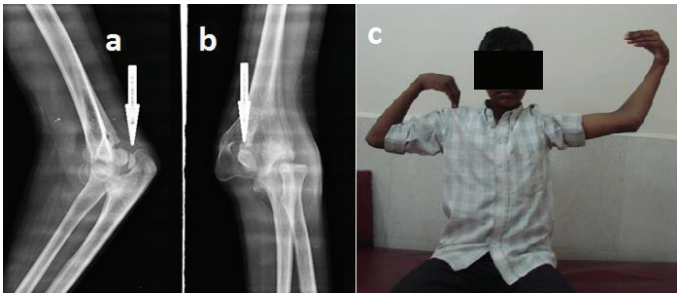

Fig. 4. X-ray of a 10-year-old male showing lateral and anterior-posterior view of elbow (a and b, respectively) with arrows showing the 4-month-old neglected fracture dislocation with incarcerated medial epicondylar fragment into the elbow joint. (c) Clinical picture of a same 10-year-old child with stiff elbow fixed in 60 degrees of flexion.

The present study deals with open reduction and internal fixation of epicondylar fragment with multiple methods describes in the literature [1,3,9,24,25]. Bony union was achieved in 13 patients and one patient had a fibrous union.

Sardelli et al [26] in his article on functional elbow range of motion for contemporary task mentioned that a minimum flexion of 27±7° with further flexion up to 130±7° was required for different functional tasks. The present study had maximum post-operative fixed flexion deformity of 20 degrees while maximum flexion achieved was 140 degrees. Thirteen out of 14 patients (92.8%) had maximum flexion of more than 130 degrees, which is a functional requirement and only one patient had maximum flexion less than 130 degrees.

The overall mayo elbow performance score was excellent in 12 patients and good in two patients. This can be attributed to a case, who had achieved 120 degrees of flexion, thus limiting his activities of daily living and a case of fibrous non-union who complained of mild pain and weakness on heavy weight lifting which can probably be explained by the laxity of medial collateral ligament.

Smith [24] in his article postulated that it takes a real dislocation at the elbow joint with its lateral displacement, ligamentous tear and muscular contraction to draw the avulsed epicondyle into the joint. Contrary to this, Patrick [12] states that epiphyseal fragment can be sucked into the joint by a temporary vacuum produced through the rupture of medial collateral ligament and hyper-abduction of ulna on the humerus, not necessarily associated with dislocation of elbow joint.

The present study had five cases of incarceration of fragment, and only three cases of elbow dislocation (Figures 4–6). On careful questioning from the patients, it was clear that these two patients too had had some deformity in the elbow joint at the time of injury, probably a dislocation and was treated somewhere with traction and without any anaesthesia.

Fig. 5. Intraoperative figures showing that posteromedial incision (a) was taken anterior to medial epicondyle. Fragment was found incarcerated into the joint (b) and was fixed with 1'0 vicryl. Immediate post-operative x-ray (c, d) of the same patient showing the reduced elbow with the fragment in place fixed with 1'0 vicryl.

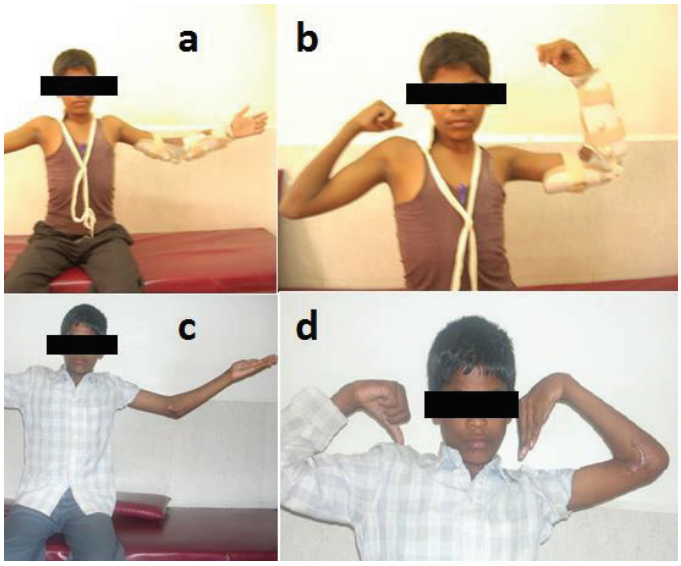

Fig. 6. Immediate clinical picture of the same patient at two weeks with hinged elbow brace showing the improved range of motion (a, b). Clinical picture (c, d) at 18 months follow-up with functional range of motion achieved with flexion deformity of 20 degree with further flexion up to 130 degrees.

The limitation of the present study include lack of preoperative self-reported functional outcome score [10], small sample size due to a relative rarity of this condition and that a comparison between different modalities of treatment was not possible.

Conclusion

In conclusion our results clearly indicate that open reduction and internal fixation gives excellent clinical and functional outcome in majority of the cases. Excellency of the outcome is dependent on careful dissection medially, to find out incarcerated medial epicondyle without crushing it, secure anatomic reduction of the fragment, proper release of the contracture in long standing cases and early mobilization. The preferred method of internal fixation demands further comparative studies with larger sample size.

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Conflict of interest

None declared.

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