International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2017; 3(3): 287-291

www.orthopaper.com
Received: 08-05-2017
Accepted: 10-06-2017

Sahu RL
M.S. Orthopaedics, Professor, Department of Orthopedics, SMS & R, Sharda University. Greater Noida U.P. India

Dr. Nadeem Ahmad
Department of Orthopedics, SMS & R, Sharda University. Greater Noida U.P. India

Correspondence
Sahu RL
M.S. Orthopaedics, Professor, Department of Orthopedics, SMS & R, Sharda University. Greater Noida U.P. India

Outcome of surgically treated displaced medial epicondyle fracture of humerus in children: A prospective study

Sahu RL and Dr. Nadeem Ahmad

DOI: http://dx.doi.org/10.22271/ortho.2017.v3.i3e.53

Abstract
Background: The aim of this study was to evaluate the functional outcome of surgically treated displaced medial epicondyle fracture of humerus in children using kirschner wire.
Methods: A prospective longitudinal study was undertaken in our hospital during the period of December 2010-December 2014. A total number of 34 patients with the diagnosis of displaced medial epicondyle fracture were included in the study. Ten children had elbow dislocation and three children had ulnar nerve injury. All the cases were treated by two parallel or divergent K-wires. All patients were operated under general anaesthesia. The mean follow-up period was 14 months (range 12 to 16 months). Results were analyzed using the Mayo elbow performance score.
Results: All children achieved union in a mean time of 3 weeks (range from 2.5 - 6 weeks). The mean Mayo elbow performance score was 93.5. Late surgery was associated with a score of 80 in two patients and 75 in one patient; the remaining patients had an excellent result (100 points). Full range of elbow motion was achieved in all the patients however, following late surgery; two patients had extension and flexion losses of 5° and 10°, respectively. None of the patients had instability postoperatively. Full ulnar nerve recovery seen at final follow-up.
Conclusion: Anatomical reduction either close or open and percutaneous kirschner wires fixation affords a significantly higher union rate, a significantly higher functional outcome score and a significantly better range of movement of the elbow joint.

Keywords: Close reduction; Humerus; Kirschner wires; Medial epicondylar fracture

Introduction
Fractures of the medial epicondyle are common than dislocations and account for about10% of elbow fractures in children. Nearly 50% of medial epicondyle fractures are associated with dislocation of the elbow, and often the displaced fragment becomes trapped in the joint [1-3]. The undisplaced or minimally displaced fractures are generally treated with simple immobilization. The operative treatments are considered when the fracture fragment is displaced into the elbow joint, when ulnar nerve entrapment is suspected, when valgus instability is suspected, or when the fracture fragment is displaced >5 mm [1, 4-6].
Surgical excision is avoided whenever possible, because some reports demonstrated decreased grip strength, and hypoplasia of the medial aspect of the distal humeral epiphysis [7]. Open reduction and fixation are found to reduce the frequency of nonunion and prevent valgus instability [3, 7, 8]. Although the clinical results are satisfactory, elbow stiffness, ulnar nerve symptoms and radiologic abnormality such as hyperplasia, hypoplasia or pseudarthrosis have been reported after open reduction and fixation [3, 9, 10].
The aim of this study was to evaluate the functional outcome of surgically treated displaced medial epicondyle fracture of humerus in children using kirschner wire at the same time to see the possibilities of complication of iatrogenic ulner nerve palsy.

Material and methods
This prospective study was carried out at Orthopaedics department from December 2010 to December 2013. It was approved by institutional medical ethics committee. A written informed consent was obtained from all the patients (by their parents).

A total of 34 children (14 girls and 20 boys) with fractures medial epicondyle of humerus that was followed-up for 12 to 16 months were included in this study. The patients were aged between two to 13 years with the mean age of 7.76 years.

Inclusion Criteria

1. Age between 2 to 13 years.
2. The mean follow-up period was 14 months (range 12 to 16 months).
3. All cases unilateral and close fracture.
4. Displaced > 5 mm, unstable with or without rotation.
5. Failure of conservative treatment.

Exclusion Criteria

1. Age more than 13 years.
2. Open fractures
3. Cases with polytrauma.
4. Fractures manageable by immobilization alone which were stable.
5. Multiple bones fracture involving the same elbow.

The final clinical and radiographic examinations of cases were performed after 14 months in average. All injuries were associated with low-energy traumas, resulting from falls. Preoperatively, three children out of ten had ulnar nerve contusion, two requiring anterior transposition of the nerve. Left elbow was involved in 15 patients and right elbow in nineteen patients. Other injuries were present in addition to the medial humeral epicondyle in six patients. The fractures with dislocations were due to fall from high (wall or stairs) in three patients, and simply fall while playing in seven patients. All of them were closed fractures; three patients had posteromedial dislocation while seven patients had posterolateral dislocations. Nine patients underwent closed reduction immediately after the clinical and radiographic diagnosis in the emergency department.14 children were treated by close reduction and internal fixation with two K-wires and 20 children were treated by open reduction and internal fixation with two K-wires. In all cases with instability, there was a displacement over 5 mm in the medial epicondyle. For all patients who underwent surgical treatment, posteromedial incision was used, and ulnar nerve exploration was performed. Anterior transposition of ulnar nerve was done in two children. The medial epicondyle fixation was achieved by cross Kirschner wires in 14 cases, and by parallel Kirschner wires in 20 cases. All patients used a long arm cast for a period of 3 weeks after the operation. Thereafter range of motion exercises was started. Final outcome measures included pain assessment, range of motion and Mayo elbow performance score (MEPS) [11]. Results were considered excellent if the MEPS were 90 or above, good if it was between 75 and 89, fair between 60 and 74 and poor less than 60. The mean follow-up period was 14 months (range 12 to 16 months). Radiographically, full lateral and full anteroposterior images of both elbows were obtained for all patients. (Figure 1a, 1b, 2a, 2b, and 3a, 3b) Healing of fracture and potential complications were evaluated. Radiographic indication of healing is the visualization of the callus tissue around the fracture on the anteroposterior and lateral views of the elbow. Avascular necrosis, presence of non-union and misunion, and status of the medial epicondyle growth plate were also taken into consideration during the evaluation of functional results. Radiographs of the elbow were also evaluated in terms of rotational or angular deformities, and heterotopic ossification. Based on these observations, deformities of elbow were classified as normal, relatively cubitus varus, cubitus varus, pseudo cubitus varus and cubitus valgus. The carrying angle of the injured elbow is reduced in the relatively cubitus varus compared to the other elbow; but still above 0 degrees while in cubitus varus, the carrying angle is below 0 degrees.

Results

There were 34 children in this study. Out of 100% (34/34), 58.82% (20/34) children were male and 41.17% (14/34) children were females.The children were aged 2 years to 13 years. There were 44.11% (15/34) left sided and 55.88% (19/34) right-sided fractures. 50% (17/34) children had injury during playing, 41.17% (14/34) children had met with a road traffic accident and 8.82% (3/34) had a fall from a height. 100% (34/34) were closed fractures. All the cases were treated by two parallel or divergent K-wires. 58.82% (20/34) children were treated by 2 parallel k-wires and 41.17% (14/34) children were treated by two cross k-wires. In 58.82% (20/34) cases we were unable to reduce the fracture by close means due to displacement and rotation of the fragment. For 58.82% (20/34) patients who underwent surgical treatment, posteromedial incision was used, and ulnar nerve exploration was performed. Preoperatively, 8.82% (3/34) children had ulnar nerve contusion, two requiring anterior transposition of the nerve. Postoperatively ulnar nerve paralysis recovered fully. Intraoperative ulnar nerve injuries were not seen in this study. Close reduction and internal fixation with K-wire were performed on the day of trauma in 8.82% (3/34) patients, one day later in 11.76% (4/34) patients, within 2 to 7 days in 11.76% (4/34) patients and after one week in 8.82% (3/34) patients. Open reduction and internal fixation with K-wire were performed on the day of trauma in 14.70% (5/34) patients, one day later in 17.64% (6/34) patients, within 2 to 7 days in 17.64% (6/34) patients and after one week in 8.82% (3/34) patients. Cases treated within 2 to 7 days were late referrals to our institute. Two K-wires were used for medial humeral approach and fixation in all cases; placed percutaneously, and the fixation time was limited to three weeks. Percutaneous K-wires were removed without any need for clinical anesthesia at the end of the specified period. No complication was observed during early period. The mean carrying angle in the fractured elbow was 8° (range from 0 to 15°), and 7.8° (range from 5 to11°) in the other elbow during the late monitoring period. These values had no significant difference. The carrying angles of both elbows were equal in 30 (88.23%) patients (Figure 1a, 1b and 1c), with a mean difference of 5° in 4 patients (11.76%). The intraoperative views showed that the reductions were anatomically performed and maintained. Following the removal of K-wires, no malunion or any arrest of growth in the medial humeral growth plate was observed. According to the Mayo elbow scores, all patients had satisfactory (75 points and over, mean 95.5) results. The Mayo elbow score was 80 in two of the patients, who underwent surgery after seven days; and 75 in the patient who underwent surgery at week 10; and 100 points in all of the remaining cases. A full range of motion was achieved in all patients who underwent early surgical treatment. One of the patients who underwent late surgical treatment had a 5° extension loss while the other had a 10° flexion loss. The patient who was treated with a ten weeks delay had a full range of pronation-supination during the examination at post-operative week 14; the range of flexion-extension was 30°-120°. There was no instability and pain in the elbow. No instability was found during the final examinations of the four cases, which underwent surgery for

instability. During follow-up, we did not found secondary displacement of wires and loss of reduction. Post-operatively, 5.88% (5/34) patients got pin tract infection, which was superficial and healed after removing pins and oral antibiotic administration. Callus formation was seen in all patients at the three week post-operatively before removing the K-wires. The fracture united in all cases at the three week post-operatively. All patients were followed at eighth weeks, 16 weeks 24 weeks and12 months postoperatively. 73.52% (25/34) had excellent, 17.64% (6/34) good, 5.88 % (2/34) fair and 2.94% (1/34) poor results at eight weeks which was improved to 88.23% (30/34) excellent, 8.82% (3/34) good, 2.94% (1/34) fair and no poor result at the final follow-up. In my study, there was an inappropriate fixation in one case where two pins, which is too close and work as one pin, though reduction was maintained and union had occurred without deformity. Child was kept in close follow-up. During this study, complications like vascular injury, compartment syndrome, myositis ossifications, significant mal-union and non-union were not seen.

Discussion

The diagnosis and evaluation of the displacement in medial humeral epicondyle fracture is difficult, because the epicondyle is small, the displacement is overlapped by the distal humeral metaphysis or it is often confused with the other trochlear ossification center [4, 12]. Delayed diagnosis and stiffness due to the displaced intraarticular fragment have been reported [5, 12] However, except for the displaced intraarticular fragments, good long-term results of nonsurgical treatment of medial humeral epicondyle fracture have usually been obtained even in the cases with nonunion [7]. Others reported non-satisfactory results and a slightly restricted extension in athletes [7, 10, 13]. Smith, *et al.* [5] reported the preoperative functional limitations including pain with activities of daily living and instability with lifting weight or throwing a ball. But, the previous studies did not differentiate between the medial humeral epicondyle fracture with associated elbow dislocation and without associated elbow dislocation. Furthermore, the results were not compared according to the fixation method used. Previous reports suggested that damage to the medial stabilizing structure of the elbow is more important than the extent of medial epicondyle displacement in elbow instability [3, 14].

Moreover, several studies showed that fibrous union of the medial epicondyle may result in laxity of the medial collateral ligament of the elbow [14, 15, 16]. On the other hand, Farsetti, *et al.* [7] reported that none of the patients who had been treated nonoperatively had elbow instability at the long-term follow-up. We included cases of medial humeral epicondyle fracture with associated elbow dislocation and also displaced intraarticular medial epicondylar fragment, because they indicate damage to the medial structure of the elbow joint. We did not find any cases of rupture of the medial collateral ligament during the operation, and we did not find any cases of elbow instability at the final functional evaluation. We also observed that the fracture fragment was usually found to be displaced anterior to its origin on the humeral condyle, because of the pull of the flexor-pronator muscle mass, and was located extraarticularly, the finding being similar with that of the previous study [4]. The varus instability is supposed to be due to the injury to the medial collateral ligament, because of elbow dislocation or rupture of the medial stabilizing structure of the elbow joint. Several studies reported on elbow stiffness after operative fixation [7, 9]. However, Louahem, *et al.* [3] showed that stiffness was rare even with postoperative immobilization of the elbow (mean of 4 weeks) in medial epicondyle avulsion fracture with associated elbow dislocation. In our series, only two patients had limited elbow motion: both the children had posterior dislocation of elbow. All other patients had a full range of motion. If there is no intraarticular injury or damage to the medial structure of the elbow joint, the epicondylar fragment is united or the immobilization period is less than 4 weeks, a full elbow range of motion recovery can be expected. Some studies showed varus or valgus deformity of the elbow after medial humeral epicondyle fracture [10, 17]. However, the medial epicondyle is a traction apophysis, and others the fracture cannot have any direct influence on the growth of the distal humerus [7, 18]. In this study, we had 14 cases of displaced medial epicondyle fracture associated with 10 cases of elbow dislocation; at final follow-up we did not find any varus or valgus deformity of the elbow. In very young children, varus tilt of the joint surface has been reported after nailing and hypoplasia [10]. Cannulated screws can also cause damage to the growth plate, because these screws probably lock the epiphysis to the metaphysis, like nailing [10]. However, the effect of cannulated screws on traction apophysis of the medial epicondyle is not clear. In this study, we did not use cannulated screws. All the children were treated with k-wires. We did not find any varus tilt of the joint surface at the final follow-up. Callus formation was seen in all patients at the three week post-operatively before removing the K-wires. The fracture united in all cases at the three week post-operatively. All patients were followed at eighth weeks, 16 weeks 24 weeks and12 months postoperatively. 73.52% (25/34) had excellent, 17.64% (6/34) good, 5.88 % (2/34) fair and 2.94% (1/34) poor results at eight weeks which was improved to 88.23% (30/34) excellent, 8.82% (3/34) good, 2.94% (1/34) fair and no poor result at the final follow-up. Park stated that on the immediate postoperative radiographs, the distal humeral width in Group II was larger than that in Group I. On the final follow-up radiographs, the epicondylar position in Group I was lower than that in Group II. There was no significant difference in the distal humeral width, epicondylar position and joint space tilt between the immediate postoperative, final follow-up radiographs and the normal side within each group. There was no significant difference in the final JOA score between groups [19]. Over the last several decades, our understanding of the complexities of elbow anatomy and medial epicondyle injuries/fractures has changed dramatically. Medial epicondyle injuries were traditionally considered as benign and insignificant extra/peri-articular fractures of the distal humerus. As we have furthered our understanding about elbow stability and the importance of full range of motion in elbow biomechanics, perspectives towards the treatment and management of these injuries are changing and will continue to change. Functional demand and athletic performance, which is increasingly the norm of today, were not clearly considered in many of the earlier studies. The intensity and duration of modern day sporting activities that push the functional demand of the elbow and shoulder to its maximum necessitate stable mechanics for optimal performance. The goals with operative fixation certainly are to maximize the possibility of early return to full function and high-level activity, and to minimize late deformity and the likelihood of stiffness (as with prolonged cast immobilization). Preoperatively, three children out of ten had ulnar nerve contusion, two requiring anterior transposition of the nerve. Postoperatively there was complete ulnar nerve

anesthesia and paralysis. Eventually there was full motor recovery and partial sensory recovery. One patient with postoperative ulnar nerve paralysis recovered fully. Intraoperative ulnar nerve injuries were not seen in this study. A potential limitation of our study was the absence of a control group treated by a different modality and limited number of cases. Thus we cannot actually determine if any other method of treatment would have led to different results. Nevertheless our results are better than those of the previous studies in which other screws or tension band wirings have been used.

Acknowledge: None

Compliance with ethical standards

Conflict of interest: None

Patient consent: All patients gave the informed consent prior being included into the study.

Ethical approval: All procedures involving human participants were in accordance with the
1964 Helsinki declaration and its later amendments".
The study was approved by the Research Ethics Committee (or Institutional Review Board)".

Funding: There was no source of funding

Fig 1a: Pre-operative anteroposterior and lateral view of displaced fracture medial epicondyle of humerus in 5 years of old boy.

Fig 1b: Post-operative A-P and lateral view of fracture medial epicondyle of humerus showing fracture fixation with two K wires.

Fig 2a: Pre-operative anteroposterior and lateral view of displaced fracture medial epicondyle of humerus in 7 years of old girl.

Fig 2b: Post-operative A-P and lateral view of fracture medial epicondyle of humerus showing fracture fixation with two K wires.

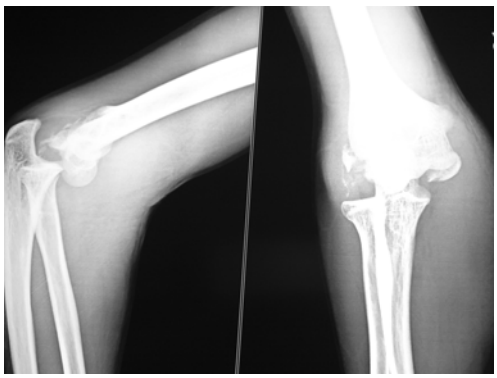

Fig 3a: Pre-operative anteroposterior and lateral view of displaced fracture medial epicondyle of humerus with elbow dislocation in 12 years of old girl.

Fig 3b: Post-operative A-P and lateral view of fracture medial epicondyle of humerus showing fracture fixation with two K wires.

References

1. Herring JA. Tachdjian's pediatric orthopaedics. 4th ed. Philadelphia (PA): Saunders, 2008, 2496-2504.
2. Scherl SA. Surgical management of pediatric long-bone fractures. 1st ed. Rosemont (IL): American Academy of Orthopaedic Surgeons. 2009, 28-29.
3. Louahem DM, Bourelle S, Buscayret F, Mazeau P, Kelly P, Dimeglio A *et al*. Displaced medial epicondyle fractures of the humerus: surgical treatment and results. A report of 139 cases. Arch Orthop Trauma Surg. 2010; 130:649-655. [PubMed]
4. Edmonds EW. How displaced are "nondisplaced" fractures of the medial humeral epicondyle in children? Results of a three-dimensional computed tomography analysis. J Bone Joint Surg Am. 2010; 92:2785-2791. [PubMed]
5. Smith JT, McFeely ED, Bae DS, Waters PM, Micheli LJ, Kocher MS. Operative fixation of medial humeral epicondyle fracture nonunion in children. J Pediatr Orthop. 2010; 30:644-648. [PubMed]
6. Fowles JV, Slimane N, Kassab MT. Elbow dislocation with avulsion of the medial humeral epicondyle. J Bone Joint Surg Br. 1990; 72:102-104. [PubMed]
7. Farsetti P, Potenza V, Caterini R, Ippolito E. Long-term results of treatment of fractures of the medial humeral epicondyle in children. J Bone Joint Surg Am. 2001; 83-A:1299-1305. [PubMed]
8. Pimpalnerkar AL, Balasubramaniam G, Young SK, Read L. Type four fracture of the medial epicondyle: a true indication for surgical intervention. Injury. 1998; 29:751-756. [PubMed]
9. Duun PS, Ravn P, Hansen LB, Buron B. Osteosynthesis of medial humeral epicondyle fractures in children. 8-year follow-up of 33 cases. Acta Orthop Scand. 1994; 65:439-441. [PubMed]
10. Skak SV, Grossmann E, Wagn P. Deformity after internal fixation of fracture separation of the medial epicondyle of the humerus. J Bone Joint Surg Br. 1994; 76:297-302. [PubMed]
11. Morrey BF, An KN, Chao EY. Functional evaluation of elbow. In: Lampert R, ed. The elbow and its disorders. 3rd ed. Philadelphia: WB Saunders, 2000, 74-83.
12. Fowles JV, Kassab MT, Moula T. Untreated intra-articular entrapment of the medial humeral epicondyle. J Bone Joint Surg Br. 1984; 66:562-565. [PubMed]
13. Josefsson PO, Danielsson LG. Epicondylar elbow fracture in children. 35-year follow-up of 56 unreduced cases. Acta Orthop Scand. 1986; 57:313-315. [PubMed]
14. Woods GW, Tullos HS. Elbow instability and medial epicondyle fractures. Am J Sports Med. 1977; 5:23-30. [PubMed]
15. Schwab GH, Bennett JB, Woods GW, Tullos HS. Biomechanics of elbow instability: the role of the medial collateral ligament. Clin Orthop Relat Res. 1980, 42-52. [PubMed]
16. Case SL, Hennrikus WL. Surgical treatment of displaced medial epicondyle fractures in adolescent athletes. Am J Sports Med. 1997; 25:682-686. [PubMed]
17. Hines RF, Herndon WA, Evans JP. Operative treatment of Medial epicondyle fractures in children.Clin Orthop Relat Res. 1987, 170-174. [PubMed]
18. Van Niekerk JL, Severijnen RS. Medial epicondyle fractures of the humerus. Neth J Surg. 1985; 37:141-144. [PubMed]
19. Park KB, Kwak YH. Treatment of Medial Epicondyle Fracture without Associated Elbow Dislocation in Older Children and Adolescents. Yonsei Med J. 2012; 53(6):1190-1196.