

# Evaluation of Displaced Medial Epicondyle Fracture in Children Treated Operatively with K Wire

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## ABSTRACT

**Introduction:** Medial epicondyle fractures of humerus are one of the common pediatric elbow injuries accounting for nearly 11% of the elbow injuries. This avulsion apophyseal fracture can lead to non-union and valgus instability. Thus, open reduction and internal fixation is helpful in maintaining union and a stable functioning elbow joint. **Aims:** To evaluate the outcome of operative management of displaced medial epicondyle fracture of humerus by open reduction and internal fixation with Kirschner wires using MAYO elbow scoring. **Methods:** This prospective observational study was conducted at the Department of Orthopedics of Nepalgunj Medical College and Teaching Hospital, Kohalpur from July 2020 to December 2021 in children between six to 16 years of age. All the patients in study were treated by open reduction and internal fixation with K wires. Mayo elbow performance score was used for evaluating functional outcome. **Results:** Thirty six patients were included with the mean age of 11.5 years (SD  $\pm$  2.5). Twenty five patients were males and 11 were females. Left side was found to be predominantly involved in 23 patients (66.6%). The mean duration of union was found to be 6.6 weeks (SD  $\pm$  0.6). Thirty four patients had excellent result in Mayo elbow performance score while two patients showed good result. The mean Mayo elbow performance score was 96.4 (SD  $\pm$  3.9). **Conclusion:** Open reduction and internal fixation with K wires in this type of fracture had excellent to good results. The complications like nonunion and valgus instability are found to have fewer occurrences in children treated with operative means of treatment.

**Keywords:** Fractures in children, internal fixation, K wire, medial epicondyle fractures, open reduction

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## INTRODUCTION

Medial epicondylar fractures are the avulsion fracture of the distal humerus accounting approximately 14% of the distal humerus and 11% of all fractures in the elbow region.<sup>1</sup> This fracture usually occurs between nine to 14 years of age with peak incidence of 11 to 12 years of age and male to female ratio of 4:1.<sup>2-4</sup> The three etiological theories postulated to describe the mechanism of the injury are: a direct blow, avulsion mechanisms, and associated elbow dislocation.<sup>5</sup> The increasing consensus for operative management of medial epicondyle fracture may be due to better understanding of importance of ulnar collateral ligament and degree of displacement of fracture; improved surgical techniques and never the least availability of better implants for fracture fixation.<sup>6</sup> The non-operative method of treatment using simple immobilization to cast immobilization with early motion remains a common practice for the treatment of undisplaced to minimally displaced fractures less than two millimeters.<sup>7</sup> The indications for operative treatment is broadly divided into absolute and relative indications. The criterion for absolute

indication is incarceration of the fragment into the joint while for relative indication the criteria are the valgus instability, displacement more than five millimeters and ulnar nerve dysfunction.<sup>5</sup> The radiographic nonunion has been found in patients who had undergone conservative form of treatment with good to excellent results. This nonunion later leads to valgus instability.<sup>8</sup> In this study fractures are treated with open reduction and internal fixation with Kirschner wires (K wire) and resultant functional outcome is evaluated.

## METHODS

This study was a prospective study done in children between six to 16 years of age, who were admitted in Nepalgunj Medical College Teaching Hospital, Kohalpur, Banke from July 2020 to December 2021 who had medial epicondyle fracture of humerus. Fractures were classified based on classification by Papavasiliou, which is a four type classification system based on the Watson–Jones classification:

1. Type-I : small degree of avulsion of the epicondylar fragment
2. Type-II : avulsed epicondylar fragment at the level of the joint but not trapped
3. Type-III : avulsed fragment trapped in the joint
4. Type-IV: avulsion of the fragment associated with an elbow dislocation and the fragment in the joint.<sup>9</sup>

**Children meeting the following criteria were included in the study:**

1. Closed and grade 1 and 2 compound fracture
2. Displaced medial epicondyle fracture of humerus > 5mm (Watson Jones Type 2, 3 and 4).
3. Valgus instability over the injured elbow irrespective of the displacement

All other injuries not falling into the above criteria are excluded from the study.

All the surgeries were performed under proper anesthesia. The patient was positioned supine with a tourniquet applied proximal to the affected elbow. A medial incision was made approximately five centimeters in length centered over the medial epicondyle. The ulnar nerve was isolated and protected during the entire procedure. The epicondyle was reduced and fixed with two divergent smooth Kirschner wires under fluoroscopic guidance. K-wires were buried underneath the skin. Wound was closed in layers. In post-operative period, above elbow slab was applied. Post-operative elbow x-rays (anteroposterior and lateral view) were observed on the next day and patients were usually discharged on second or third postoperative day. The slab was continued for two weeks, following which range of motion was allowed within the limits of pain. The patients were requested to attend for serial follow ups were done at two, four, six weeks and 12 weeks as possible for clinico-radiological evaluation and functional outcome. K wires were removed after clinical and radiological union in operating room under proper anesthesia. Elbow range of motion was noted in flexion-extension arc. Clinical evaluations were based on MAYO elbow performance index (MEPI) and MAYO elbow performance score (MEPS). The index scoring ranging from five to 100 points with score ranging from 90 to 100 rated excellent, 70 to 89 rated good, 60 to 69 rated as fair and less than 60 rated as poor.

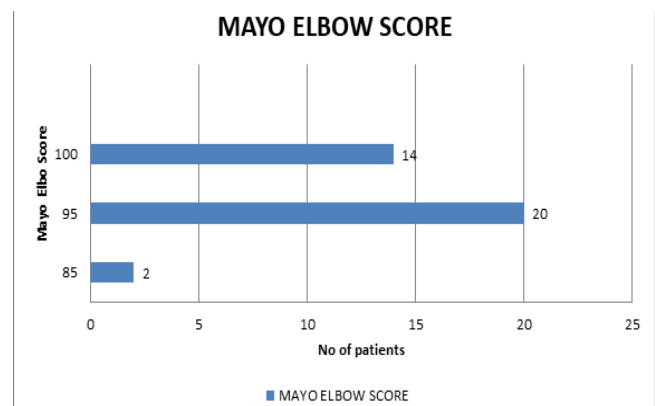
**RESULTS**

All the patients had the union of the fracture with the mean duration for the union of 6.6 ± SD 0.7 weeks. Among 36 patients, based on MEPS value 34 (94.4%) patients had excellent outcome while two (5.6%) patients had good outcome with the mean score of 96.38 ± SD 3.88. (Figure 1) Among 36 patients in the study, there were 25 (69.4%) males and 11 (30.6%) females with M: F ratio of 2.7:1. The study was conducted in children between six to 16 years of age with the mean age of 11.6 ± SD 2.3 years. Out of 36 patients, 23 (63.8%) had fracture in left elbow with non-dominant side accounting for 24 (66.7%) children. In this study, Type 2 on Watson Jones classification was most common type of case presented. The

mean elbow range of motion was 141.5 degrees with the loss of extension by 5.2 degrees when compared to contralateral elbow. After the clinicoradiological union 18 (50%) patients underwent implant removal at six weeks, 14 (38.8%) patients underwent implant removal at seven weeks, three (8.3%) patients underwent implant removal at eight weeks and one (2.7%) patient underwent implant removal at nine weeks with mean duration of implant removal was 6.6 ± 0.7 weeks. Among six patients who had complications, each of two patients developed SSI, hypertrophic scar and hardware prominence.

Classification	Frequency	Percent
Type 2	16	44.4
Type 3	8	22.2
Type 4	12	33.4
Total	36	100

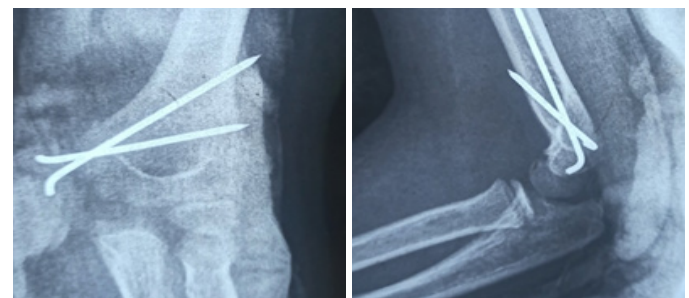
**Table 1: Distribution of patients according to Watson Jones Classification**



**Figure 1: Mayo elbow performance score among total patients**



**Figure 2: Pre-op X-ray AP and lateral view of elbow after injury**



**Figure 3: Immediate post operative x-rays in AP and lateral view**

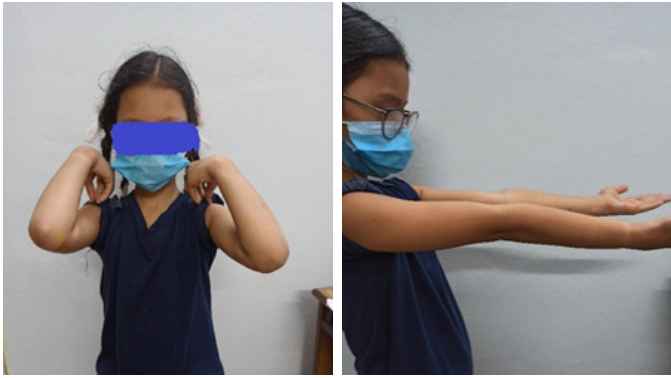


Figure 4: Elbow ROM

## DISCUSSION

Medial epicondyle is the traction apophysis of the distal humerus providing attachment to common flexor muscles of the forearm and ulnar collateral ligament. Injuries in any of the form of direct blow, avulsion injury or associated elbow dislocation results into complete or partial separation of the apophysis. During the elbow dislocation ulnar collateral ligament provides the avulsion force for the fracture.<sup>5</sup> The fall on the outstretched hand with elbow in extension and hand and wrist in hyperextension provides additional tension over medial epicondyle through flexor group of muscles of the forearm which results into avulsion of the medial epicondylar apophysis.<sup>7</sup> The assessment of valgus stability is of paramount importance in medial epicondyle fracture. This instability is assessed using valgus stress test as directed by Woods and Tullos and Schwab et al which was also used in our study after the anesthesia is applied.<sup>10,11</sup>

Apart from absolute indication for the fracture fixation there was always debate for whether or not to fix the fracture. However Mehlman and Howard in their study precisely focused on harm of operative versus non operative form of treatment advocates for surgical form of treatment as superior form of treatment.<sup>12</sup> The two to five mm displacement also remains another point of controversy while selecting the form of the treatment.

In this study all 36 cases showed radiological union at mean duration of  $6.6 \pm SD 0.7$  weeks and ranging from six weeks to nine weeks. This finding was found to be consistent with studies of Case et al and Lee et al.<sup>13,14</sup> Mayo elbow performance index was used to evaluate functional outcome in 36 patients of which 34 patients showed excellent outcome while two patient showed good outcome with mean MEPS score was 96.4 (SD $\pm$  3.9). All the patients in our study have good to excellent result. This finding from our study was consistent with Lee et al, Ip et al and Tarallo et al.<sup>14-16</sup> The mean elbow ROM was 142.5 degrees with mean loss of 4.5 degrees when compared to normal sidewhich was consistent with Pimpalnerker et al.<sup>17</sup> We encountered complications such as hypertrophic scar, hardware prominence and surgical site infection in two patients each. Two patients who had developed SSI improved with regular dressing and further course of oral antibiotics as per

culture and sensitivity. The complaint of hardware prominence got corrected after the implant removal procedure.

## LIMITATIONS

The findings of our study may have been affected by the limited sample size and the shorter duration of this study.

## CONCLUSION

Medial Epicondyle fracture of humerus with fracture fragment incarcerated into the joint or displacement more than five millimeters or with unstable elbow when treated operatively has satisfactory functional results. With the operative treatment of the fracture incidence of nonunion and valgus instability can be reduced significantly.

## REFERENCES

1. Chessare JW, Rogers LF, White H, Tachdjian MO. Injuries of the medial epicondylar ossification center of the humerus. *American Journal of Roentgenology*. 1977 Jul 1;129(1):49-55.
2. Kilfoyle RM. Fractures of the medial condyle and epicondyle of the elbow in children. *Clinical Orthopaedics and Related Research* (1976-2007). 1965 Jul 1;41:43-50.
3. Hines RF, Herndon WA, Evans JP. Operative treatment of Medial epicondyle fractures in children. *Clinical orthopaedics and related research*. 1987 Oct 1(223):170-4.
4. Francis R, Bunch T, Chandler B. Little league elbow: a decade later. *The Physician and Sportsmedicine*. 1978 Apr 1;6(4):88-94.
5. Flynn JMS, David L; Waters, Peter M. *Rockwood and Wilkins' Fractures in Children*. 9th ed. Philadelphia: Wolters Kluwer; 2020; 920-40.
6. Gottschalk HP, Eisner E, Hosalkar HS. Medial epicondyle fractures in the pediatric population. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*. 2012 Apr 1;20(4):223-32.
7. Smith FM. Medial epicondyle injuries. *Journal of the American Medical Association*. 1950 Feb 11;142(6):396-402.
8. Josefsson PO, Danielsson LG. Epicondylar elbow fracture in children: 35-year follow-up of 56 unreduced cases. *ActaOrthopaedicaScandinavica*. 1986 Jan 1;57(4):313-5.
9. Papavasiliou VA. Fracture-separation of the medial epicondylar epiphysis of the elbow joint. *ClinOrthopRelat Res*. 1982;171:172-4.
10. Woods GW, Tullos HS. Elbow instability and medial epicondyle fractures. *The American journal of sports medicine*. 1977 Jan;5(1):23-30.
11. Schwab GH, Bennett JB, Woods GW, Tullos HS. Biomechanics of elbow instability: the role of the medial collateral ligament. *Clinical Orthopaedics and Related Research*. 1980 Jan 1(146):42-52.
12. Mehlman CT, Howard AW. Medial epicondyle fractures in children: clinical decision making in the face of uncertainty. *Journal of Pediatric Orthopaedics*. 2012 Sep 1;32:S135-42.

13. Case SL, Hennrikus WL. Surgical treatment of displaced medial epicondyle fractures in adolescent athletes. *The American Journal of Sports Medicine*. 1997 Sep;25(5):682-6.
14. Lee H-H, Lee C-H, Shen H-C, Chang J-H, Wu S-S. Operative treatment of displaced medial epicondyle fractures in children and adolescents. *J Shoulder Elbow Surg*. 2005;14(2):178-85
15. Ip D, Tsang WL. Medial humeral epicondylar fracture in children and adolescents. *Journal of Orthopaedic Surgery*. 2007 Aug;15(2):170-3.
16. Tarallo L, Mugnai R, Fiacchi F, et al. Pediatric medial epicondyle fractures with intra-articular elbow incarceration. *J OrthopTraumatol*. 2015;16(2):117-23.
17. Pimpalnerkar AL, Balasubramaniam G, Young SK, Read L. Type four fracture of the medial epicondyle: a true indication for surgical intervention. *Injury*. 1998;29(10):751-6.