

## Original Research Article

# Medial epicondyle fractures in children: a study of functional outcome of surgical fixation

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## ABSTRACT

**Background:** Medial epicondyle fracture is a common elbow injury in children. It is associated with elbow dislocation in many cases. Treatment of displaced medial epicondyle fracture with and without elbow dislocation is a debated topic. Surgical and non surgical methods are practiced with variable results.

**Methods:** Our study was a prospective study of medial epicondyle fractures treated by surgical fixation with k wires. We studied total of 24 cases out of which 15 had elbow dislocation. The study period was from 2012 to 2015 and indications for surgery were displacement more than 5 mm, elbow instability, incarceration of fragment, ulnar nerve irritation. Open reduction and internal fixation with K wire done. We used joystick method while reducing the fragment with k wire which was a great help. We assessed the cases using mayo elbow performance score.

**Results:** Our study yielded excellent results in 92% of patients (mayo elbow performance score >90). There was no major difference in clinical outcome between two groups of patients. Complications like instability and non-union not seen following surgical fixation with K wires. The mean loss of flexion, extension, supination, and pronation was 4, 5, 3 and 2 degrees respectively with elbow dislocation group and 2, 3, 1, 1 in without dislocation group. Pre op instability seen in 54% patients was absent in follow up period. Stiffness was more in elbow dislocation group but overall performance was almost equal.

**Conclusions:** Surgical fixation of medial epicondyle fractures yields excellent results and may be advisable when indicated.

**Keywords:** Medial epicondyle, Elbow dislocation, K wire fixation, Mayo elbow performance score

## INTRODUCTION

Medial epicondyle fracture in children is one of the common fractures associated with elbow dislocation. The undisplaced fracture may be treated conservatively with immobilization whereas displaced one needs surgical fixation. The indications for surgical fixation are Incarcerated medial epicondyle fracture with elbow dislocation, ulnar nerve dysfunction, marked instability, open fractures.<sup>1</sup> The classification of medial epicondyle fracture is into four types. Type 1 is with small amount of avulsion, type 2 is non entrapped fragment at the level of

joint, type 3 a fragment incarcerated in the joint and type 4 is with elbow dislocation.<sup>2</sup>

In the pediatric age group, medial humeral epicondyle fractures account for 12% of all elbow fractures, with a major proportion associated with elbow dislocations.<sup>3,4</sup> Various studies show that males are involved in nearly three-fourths of the cases, with a peak incidence at age of 11–12 years.<sup>3</sup>

The various options of surgical treatment are with K wire fixation, cancellous screw fixation, and fixation with

sutures. Elbow dislocations are associated with severe soft tissue injury. There are very few articles comparing the outcome of surgical fixation following elbow dislocation as compared to isolated displaced fractures of medial epicondyle. Many articles have reported relatively good results with conservative management but still doubt exists about few complications like instability, nerve injury and return to sports activity. There needs to be a proper study to decide the treatment plans in a fracture associated dislocation. Our aim was to study clinical outcome of surgically treated medial epicondyle fractures with and without elbow dislocation. We studied operated patients using Mayo elbow performance score. Surgical fixation was done using K wires with joystick method.

## METHODS

The study was prospective in nature and was conducted in Pariyaram Medical College from 2012 to 2015. Ethical committee approval was obtained. All patients' parents gave their written consent. We included all children with displaced medial epicondyle fractures who underwent surgical fixation with K wires. Patients with associated elbow dislocation were also included in our study. We did not include two patients around 16 years old where cancellous screws were used to fix the fracture. Patients with severe head injury where proper follow-up could not be done were excluded from study. We followed up patients for a minimum duration of 2 years. Data was entered into Microsoft Excel (Windows 7; Version 2007) and analyses were done using the Statistical Package for Social Sciences (SPSS) for Windows software (version 24.0; SPSS Inc, Chicago). Descriptive statistics such as frequencies and percentages were calculated for categorical variables and Mean and standard deviation (SD) for continuous variables and were determined.

We collected total of 24 patients out of which 15 were males and 9 were females. The injury was due to fall from height in 8 patients, 9 were due to fall while playing and running. We studied all patients prospectively considering history, type of injury, instability associated nerve symptoms. We compared the clinical results of surgical fixation of the isolated medial epicondyle fracture with those associated elbow dislocation. Elbow dislocations were reduced immediately in emergency room under sedation.

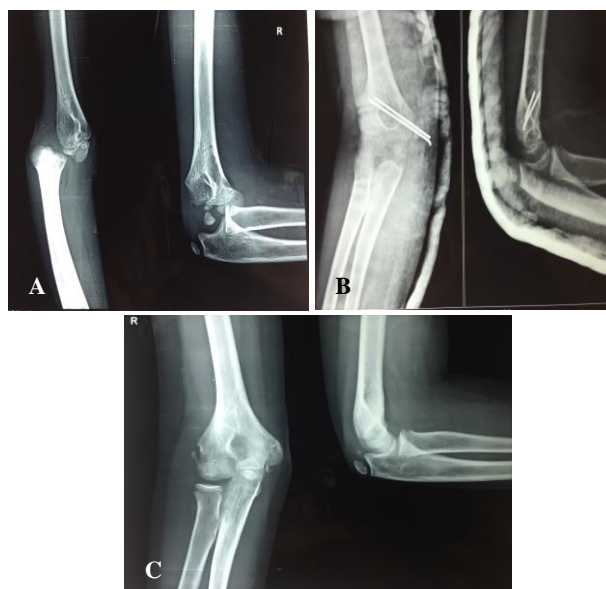
Patients were divided into two groups. Group 1 included patients with isolated displaced medial epicondyle fractures and 2 with those having associated elbow dislocation. Fracture was surgically treated by open reduction and internal fixation with k wires in both groups of patients.

The surgery was conducted by experienced orthopaedic surgeons in an elective surgical day. Patients under general anaesthesia were put in supine position. Tourniquet was used. Incision was put over medial epicondyle and fracture was exposed. Elbow was flexed and pronated to pull the displaced fracture fragment. We

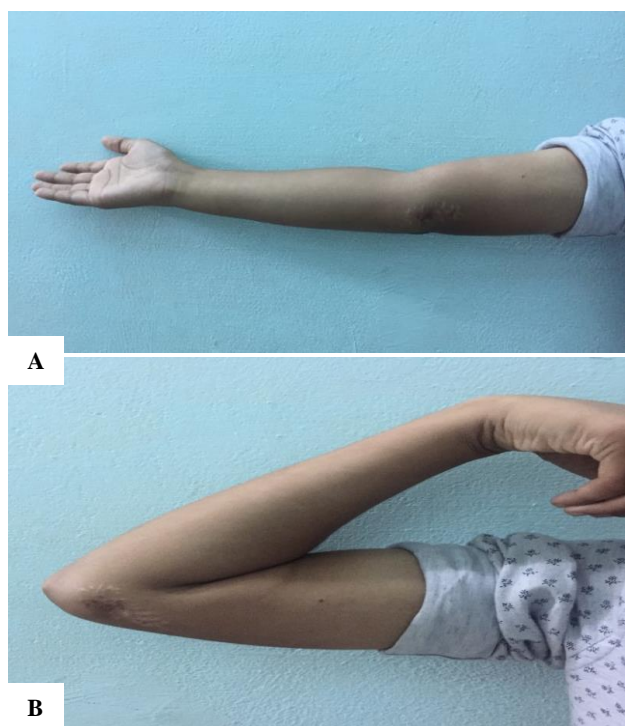
used k wire as a joystick. The fracture fragment was held with a small towel clip and k wire was inserted. We used the k wire as a joystick to manipulate the fragment. It was kept pressed at fracture site maintaining reduction using k wire. Another K wire was inserted through the bone and passed to opposite cortex. Once the fracture was stable initial k wire was pushed further inside. We used this technique in all of our cases and found very useful. The k wires were kept inside the skin (Figure 1). We removed implants after 6 months of original procedure unless it created skin irritation. The limb was immobilized for 4 weeks. Mobilization was started after plaster removal, regular physiotherapy was advised. We followed up all patients regularly taking x-rays (Figure 2a-2c) and range of movements were noted down (Figure 3, 4). Evaluation was done using Mayo elbow performance score.<sup>5</sup> It has got four components like pain intensity, motion stability and function. A score of more than 90 was excellent, 75 to 89 was good and below 60 was poor.



**Figure 1: Intra operative picture showing fracture fixed with two k wires and kept inside skin.**



**Figure 2: (A) X-ray showing posterior elbow dislocation with displaced medial epicondyle fracture. (B) X ray showing medial epicondyle fracture fixed with two parallel k wires; (C) X-ray showing united medial epicondyle fracture after k wire removal.**



**Figure 3: (A) Photograph showing elbow extension during follow up period; (B) Photograph (b) Photograph showing elbow flexion during follow up period.**

**RESULTS**

This study was conducted in Pariyaram Medical College hospital from 2012 to 2015. We evaluated age and sex, mechanism of injury, type of dislocation, duration of

immobilization, and Mayo elbow score. The average follow up period was 26 months. Male patients were 15 and females 9. Among elbow dislocations 11 were poster lateral and 4 poster medial (73% and 27% respectively). 3 cases of elbow dislocation were reduced from different hospitals and referred to our hospital for further management. The timing of surgery is shown in Table 1.

**Table 1: Timing of surgery and number of cases.**

No. of cases	Time of surgery
3	Day 1
8	Day 2
9	Day 5
3	Day 8
1	Day 14

We had 15 patients having elbow dislocation amounting 63%. Right side was involved in 14 children. Preoperative instability was found in 54% of patients making the joint unstable as shown in Table 2 which was absent in all patients during follow up period following surgery. Ulnar nerve symptoms observed in 5 patients preoperatively while 4 of these were seen in children with elbow dislocation. These symptoms disappeared after surgical fixation of medial epicondyle fracture.

We found 87% had excellent results with Mayo elbow performance score. 13 children had scored 95 while only two children got score of 85 as depicted in Table 3. The score achieved by groups with and without elbow dislocation revealed in Table 4. The range of movements of elbow was assessed and analysed for loss of motion which is shown in Table 5 and 6.

**Table 2: Total number of patients having preop instability and elbow dislocation.**

				No	Yes		
<b>Pre op instability</b>	No			4	7	11	
		% within pre op instability		36.4	63.6	100.0	
			% within elbow dislocation		44.4	46.7	45.8
	Yes	Count		5	8	13	
<b>Total</b>	Count			9	15	24	

**Table 3: Mayo elbow performance score of patients with frequency.**

Score	Frequency	Percentage (%)
85	2	8.3
90	1	4.2
95	13	54.2
100	8	33.3
Total	24	100.0

**Table 4: Mayo elbow performance score of patients with and without elbow dislocation.**

		Elbow dislocation	N	Mean
<b>Mayo elbow per score</b>	No		9	97.22
	Yes		15	94.67

**Table 5: Loss of flexion and extension movements of elbow post surgically.**

Loss in degrees	Flexion		Extension	
	Frequency	Percentage (%)	Frequency	Percentage (%)
0	5	20.8	4	16.7
2	2	8.3	3	12.5
3	5	20.8	7	29.2
4	7	29.2	2	8.3
5	2	8.3	2	8.3
6	1	4.2	3	12.5
7	1	4.2	1	4.2
8	1	4.2	2	8.3
<b>Total</b>	24	100.0	24	100.0

**Table 6: Loss of supination and pronation movements post surgically.**

Loss in degrees	Supination		Pronation	
	Frequency	Percentage (%)	Frequency	Percentage (%)
0	7	29.2	8	33.3
2	10	41.7	3	12.5
3	4	16.7	10	41.7
4	2	8.3	1	4.2
5	1	4.2	2	8.3
<b>Total</b>	24	100.0	24	100.0

## DISCUSSION

Fracture of medial epicondyle and associated elbow dislocations are one of the common elbow injuries in paediatric population. There are different opinions and dilemmas regarding standard treatment options in case of isolated as well as dislocated elbows. There are few studies which observed good results with conservative management in isolated medial epicondyle fractures.<sup>6</sup> Elbow dislocations itself is a contributing factor for elbow stiffness. The general apprehension is about surgical procedure around dislocated elbow which may be an added factor for causing the joint more stiffness. Good functional, radiological and clinical outcome obtained by surgical fixation of all type of medial epicondyle fractures unless there is delay in management. Undetected incarcerated fragment leads to poor results.<sup>7</sup> Aim of the study was to find out the results of surgical fixation of medial epicondyle fracture with and without elbow dislocation. The Mayo elbow performance index showed excellent results in majority of our patients. Both group of patients showed functionally satisfying results. Patients with ulnar nerve symptoms preoperatively improved following surgical fixation. There were more cases of elbow dislocation that required operative management. There was no elbow instability postoperatively which allowed athletic activities. Pin tract infection observed in three patients healed with regular dressings. A review article showed good results with surgical fixation yielding stability, functional range of movements and return to previous activity level substantiating our findings.<sup>8</sup> Bulut et al found poor Mayo elbow score in patients with delayed surgery and

concluded that surgery is better option if displacement is more than 5 mm.<sup>9</sup>

We got majority of patients from our district. Our study time spanned around 5 years which gave us time to collect and study relatively good number of patients. There were 32 patients who satisfied our inclusion criteria but we lost the follow up of 8 patients and so not included in this study. We used k wires and didn't face problem as our group of patients were below 15 years unlike study by Pace et al where they used screws and washers in adolescent group.<sup>10</sup> A review article by Kapok et al titled as outcomes of non-operative treatment of medial epicondyle fractures in children with and without associated elbow dislocation opined that increased rates of non-union, stiffness and elbow laxity may be associated with nonsurgical treatment of fractures with dislocation and needed further validated studies.<sup>11</sup> Our study indirectly proves the point raised by this study. We showed that clinical results are excellent when medial epicondyle fractures are surgically fixed even in cases of associated dislocation. A study by Park et al showed good radiological and surgical outcome following surgical fixation with K wires or screws without elbow dislocation.<sup>12</sup>

We relied on x-ray pictures and did not use CT scan or MRI which would have changed the study group. Few of the cases came from distances of around 80kms might have got reduced spontaneously. Most of our cases presented early which helped us in getting better results. Three of our patients who had elbow dislocation with fracture had terminal restriction of elbow extension by



around 15 degrees. Mayo elbow performance score did not reflect this as it gives full score for movements above 100 degrees. One patient had nerve irritation symptoms which improved after k wire removal. In a study of elbow dislocation with elbow injuries where various associated fractures were studied, Mayo elbow score was excellent in majority (83.3%) of their patients with medial epicondyle fractures as compared to other associated injuries after surgical fixation. They studied various fractures like medial condyle, lateral condyle, medial epicondyle and olecranon fractures, and radial head fractures.<sup>13</sup> In this study the cohort of medial epicondyle fracture was small (n=10). We exclusively studied only medial epicondyle fractures with and without elbow dislocation and our assessment showed excellent results in 92% of patients.

Louahem et al in their article studied surgical outcome of 139 patients with medial epicondyle fracture.<sup>4</sup> They concluded that elbow stability, anatomical union was excellent in 130 cases. This is similar to our study and they emphasized much on stability which was disrupted in most cases of medial epicondyle fracture. In our study we compared the results of surgical management with and without dislocation which proved excellent results in both groups.

A study by Stepanovich et al revealed good functional results after surgical fixation of displaced medial epicondylar fractures as compared to conservative treatment.<sup>14</sup> Skak et al in their study Deformity after internal fixation of fracture separation of the medial epicondyle of the humerus described different deformities after treatment of displaced medial epicondyle fractures by different methods. Pseudoarthrosis was seen after conservative method or open reduction and suturing. Hypoplasia and cubitus varus deformity following nailing. They hardly found any deformity following treatment with K wires.<sup>15</sup> In our study we did not find any gross deformity where we fixed all fractures with kwire.

A study by Fowles et al raised concerns about surgical fixation when medial epicondyle fractures associated with elbow dislocation. In their observation among 9 patients 6 had lost 35 degrees of flexion while remaining 3 had normal range of motion. They advocated surgery only when fragment was trapped in joint or severely displaced.<sup>16</sup> The mean loss of flexion, extension, supination, and pronation was 4, 5, 3 and 2 degrees respectively with elbow dislocation group and 2, 3, 1, 1 in without dislocation group. We got relatively good functional results as compared to this study. Majority of our patients presented early except one which reduced our complication rates.

## CONCLUSION

Our study focused on surgical management of medial epicondyle fractures both isolated and with elbow

dislocations. It showed excellent results in both groups of patients. Elbow stiffness was relatively higher in elbow dislocated patients, but it did not affect the job and other activities of patient. We would recommend surgical fixation in all indicated patients of medial epicondyle fracture. There is need of further studies with longer duration of follow up.

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## REFERENCES

1. Patel NM, Ganley TJ. Medial epicondyle fractures of the humerus: how to evaluate and when to operate. *J Pediatr Orthop.* 2012;32:10–3.
2. Papavasiliou VA, Crawford AH. Fracture-separation of the medial epicondyle epiphysis of the elbow joint. *Clin Orthop Relat Res.* 1982;171:172–4.
3. Herring JA. Tachdjian's pediatric orthopaedics. 4th ed. Philadelphia (PA): Saunders; 2008: 2496-2504.
4. Louahem DM, Bouelle 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;130:649-55.
5. Cusic MC, Bonnaig MS, Azar FM, Mauck BM, Smith RA, Throckmorton TW. Accuracy and reliability of the Mayo Elbow Performance Score. *J Hand Surg Am.* 2014;39:1146–50.
6. 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(9):1299-305.
7. Canavese F, Marengo L, Tiris A, Mansour M, Rousset M, Samba A. Radiological, clinical and functional evaluation using the Quick Disabilities of the Arm, Shoulder and Hand questionnaire of children with medial epicondyle fractures treated surgically. *Int Orthop.* 2017;41(7):1447-52.
8. Pathy R, Dodwell ER. Medial epicondyle fractures in children. *Curr Opin Pediatr.* 2015;27(1):58-66.
9. Bulut G, Erken HY, Tan E, Ofluoglu O, Yildiz M. Treatment of medial epicondyle fractures accompanying elbow dislocations in children. *Acta Orthop Traumatol Turc.* 2005;39(4):334-40.
10. Pace GI, Hennrikus WL. Fixation of Displaced Medial Epicondyle Fractures in Adolescents. *J Pediatr Orthop.* 2017;37(2):80-2.
11. Knapik DM, Fausett CL, Gilmore A, Liu RW. Outcomes of Nonoperative paediatric Medial Humeral Epicondyle Fractures With and Without

- Associated Elbow Dislocation J Pediatr Orthop. 2017;37(4):224-8.
12. Park KB, Kwak YH. Treatment of Medial Epicondyle Fracture without Associated Elbow Dislocation in Older Children and Adolescents. Yonsei Med J. 2012;53(6):1190-6.
  13. Lu X, Yan G, Lu M, Guo Y. Epidemiologic features and management of elbow dislocation with associated fracture in paediatric population. Medicine (Baltimore). 2017;96(48):e8595.
  14. Stepanovich M, Bastrom TP, Munch J III, Roocroft JH, Edmonds EW, Pennock AT. Does operative fixation affect outcomes of displaced medial epicondyle fractures? J Child Orthop. 2016;10:413–9.
  15. 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(2):297-302.
  16. Fowles JV, Slimane N, Kassab MT. Elbow dislocation with avulsion of the medial humeral epicondyle J Bone Joint Surg Br. 1990;72(1):102-4.

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