

# Comparison of Kirschner wires and Cannulated screw internal fixation for displaced lateral humeral condyle fracture in children



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## ABSTRACT

**Background:** Lateral condyle fracture of the distal humerus is the second most common injury around the elbow. **Aims and Objective:** The purpose of the study was to compare Kirschner wires (K-wire) and Cannulated cancellous (CC) screw for internal fixation of displaced lateral humeral condyle fracture in children. **Materials and Methods:** Forty-six patients with a displaced lateral condyle fracture of humerus were included in the study. Patients were treated with open reduction and internal fixation either with two 1.8mm K-wires or one 4mm CC screw. Fractures were classified according to Milch classification and clinical outcomes were evaluated according to criteria of Hardacre et al. **Results:** There were 23 patients in each group with the mean age of 6.57 years (range 2 to 12 years). Milch type II was common (n = 34) than Milch type I (n = 12). Fracture union was observed at mean 4.13 weeks in the CC screw and 4.61 weeks in K-wire group. (p value = 0.026). On an average the CC screws were removed at 13.57 weeks and K-wires were at 4.57 weeks. The mean follow-up was 13.83 months in CC screw and 12.52 months K-wire group. Three patients (6.5%) had superficial pin site infection and 2 patient (4.3%) had lateral condyle prominence in the K-wire group and only one lateral condyle prominence (2.2%) was observed in the CC screw group. According to the Hardacre et.al criteria CC screw group were excellent in 20 (87%) and good in 3 (13%) patients whereas 13 (56.5%) excellent and 10 (43.5%) good results were found in the K-wire group. (p value = 0.022). **Conclusion:** Open reduction and internal fixation with either K-wires or cannulated cancellous screw for displaced lateral condyle fracture of humerus are both effective treatment methods but screw fixation provides absolute stability at the fracture site enhancing the fracture healing, reduces the probability of lateral prominence and allows early range of motion and activity in the affected elbow.

**Key words:** Lateral condyle; Humerus; Children; K-wires; Cannulated screw fixation

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## INTRODUCTION

Lateral condyle fracture of the distal humerus is the second most common injury around the elbow and accounts for 20% of all the elbow fractures in children.<sup>1-3</sup> The average age for the fracture involving the lateral condyle is around six years.<sup>4-6</sup>

Various classification systems are available to describe the lateral condyle fracture of humerus. Milch classified them into Milch type I injury in which the fracture line extends

through the ossification center of the lateral condyle and exits at the radio-capitellar groove and Milch type II fracture line exits medial to the capitello-trochlear groove. Both angulation and lateral translation of the olecranon and upper segment of radius are present in type II fractures.<sup>2,7</sup>

Different treatment options of the lateral condyle fractures include non-operative management with plaster cast immobilization for undisplaced or minimally displaced fractures. Whereas the fractures displaced >2 mm need operative management. The objective of treatment

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in the displaced fracture is to obtain and maintain the articular congruity.<sup>8,9</sup>

In the operative management, the reduction technique includes open, closed or even arthroscopic assisted method. But it has been generally accepted that the displaced fractures should be treated with open reduction so as to achieve the near anatomical alignment.<sup>10-13</sup>

Smooth Kirschner wires (K-wire) are the most commonly used metallic implants for fixation of the fracture.<sup>8,14</sup> But this fixation requires an additional immobilization with a plaster splint or a cast for four to six weeks. Few recently published reports suggest the use of cannulated cancellous (CC) screws for fracture fixation as it provides compression at the fracture site and is a more stable construct. It also allows early range of motion, shortens time to union and without any significant complication.<sup>10,15-17</sup>

However, there have been very few publications comparing cannulated cancellous screws to K-wire fixation in a displaced lateral condyle fracture of humerus in children. Thus we aimed to evaluate the clinical outcome of a displaced lateral condyle fracture of humerus in children treated with cannulated cancellous screws compared to K-wire fixation.

## MATERIAL AND METHODS

A prospective study was conducted from Dec 2015 to Dec 2018 for displaced lateral condyle fractures of humerus in children admitted in the Department of Orthopaedics, Manipal Teaching Hospital. Patient were divided into two groups using a table of random numbers for either CC screw or K-wire fixation by opaque sealed envelope system. Patients were treated with open reduction and internal fixation either with 4 mm cannulated cancellous (CC) screw or 2 K-wires of 1.8 mm size. Children up to 14 years having closed fracture with displacement more than 2mm and fracture < 2 weeks of injury were included. Patients with open fracture, other associated injury in the same elbow and elbow with anatomical deformity were excluded. Pre-operative X-rays were used to classify fracture on the basis of Milch classification. Informed consent from all patients and patients' parents or guardians was obtained. Operation was done under general anesthesia and a lateral approach to the elbow was used. Soft tissue and periosteum handling was done with utmost care. After open reduction, the fracture fixation was done either with K-wire or cannulated cancellous screw. The K-wires were inserted through the skin and the wire ends were left exposed under sterile dressing. An above elbow plaster splint was applied to further immobilize the fracture fixed with K-wires for 4 weeks and 2 weeks for those fixed with screw. At

2 weeks sutures were removed. After fracture union was apparent in the follow up radiographs, the K-wires and the posterior splint was removed as an out-patient procedure without anesthesia and the patient was put on elbow range of motion exercises. For the patient with screw fixation, splint was removed in 2 weeks and elbow range of motion exercises were started. Screws were removed once the fracture union was seen on radiographs after 12 weeks under general anesthesia in the operating room.

The patients were followed up at 2, 4, 8, 12 weeks, 6 months and 1 year. Post-operative X-rays were evaluated for fracture union, nonunion, malunion, lateral prominence and clinical examination was done to see neurological status, deformity, the range of motion and any other complications. Outcome of the treatment was evaluated using the criteria suggested by Hardacre et al.<sup>18</sup> (Table 1).

### Statistical analysis

Statistical analysis was done using the Pearson chi-square test and the Fischer's exact test.  $p < 0.05$  was considered statistically significant.

**Table 1: Hardacre et al criteria**

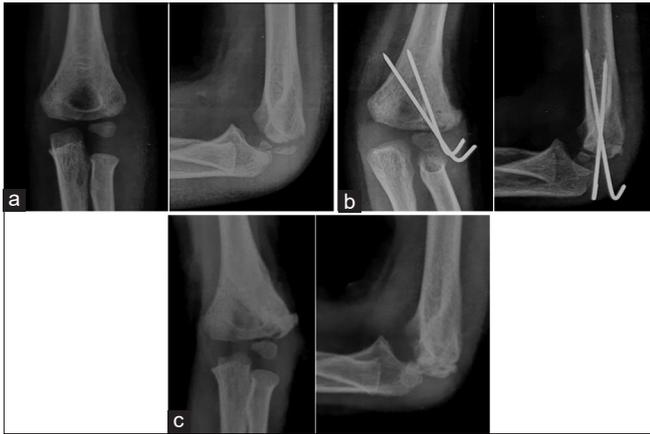
Excellent Result	No loss of motion, no alteration in the carrying angle, no symptoms
Good Result	Functional range of motion, lacking no more than 15° of complete extension, inconspicuous alteration in the carrying angle, no arthritic or neurological symptoms
Poor Result	Disabling loss of motion, conspicuous alteration of carrying angle, arthritic symptoms, ulnar neuritis or radiological findings of non-union or avascular necrosis

**Table 2: Demography of the patients**

Parameters	Fracture Fixation with CC screw	Fracture Fixation with K-wire
No. of Patients	23	23
Male	15	19
Female	8	4
Mean Age (years)	6.26	6.87
Right Side	15	9
Left Side	8	14
Milch I	7	5
Milch II	16	18

**Table 3: Outcome of treatment**

Parameters	Fracture Fixation with CC screw	Fracture Fixation with K-wire
Union (weeks)	4.13	4.61
Implant	13.57	4.57
Removal (weeks)		
Average Follow up (months)	13.83	12.52



**Figure 1:** Fracture Fixation with K-wire. (a) Pre-op X-ray, (b) Follow up at 4 weeks of K-wire fixation, (c) After K-wire removal



**Figure 2:** Fracture Fixation with CC screw. (a) Pre-op X-ray, (b) Follow-up X-ray at 3months of CC screw fixation, (c) X-ray after CC screw removal

## RESULTS

A total of 50 patients with displaced lateral condyle fracture of humerus were enrolled in the study. There were 24 cases in the CC screw group and 26 in the K-wire group. One patient from the CC screw group and 3 from the K-wire group were lost until the final follow up and were excluded from the study. Twenty-three patients in each group were treated with open reduction and fixation with either one cannulated cancellous screw or two K-wires was done.

There were total 34 males and 12 females in the study with the mean age of 6.57 years and range from 2 to 12 years. We had total of 24 right sided and 22 left sided fractures. According to Milch classification Milch II was common (n= 34) than Milch I (n=12) (Table 2).

Fracture union was observed at a mean of 4.13 weeks in the CC screw and 4.61 weeks in K-wire group. Statistically significant difference was found between the two groups

(p value = 0.026). On an average the CC screws were removed at 13.37 weeks (range 12-14 weeks) and K-wires were at 4.57 weeks (range 4-6 weeks) (Figures 1 and 2). The mean follow-up was 13.83 months (range 11-16 months) and 12.52 months (range 10-15 months) in CC screw and K-wire group respectively (Table 3).

Except one lateral condyle prominence (2.2%), no other complications were observed in the CC screw group. In the K-wire group, 3 patients (6.5%) had superficial pin site infection which was managed with oral antibiotics and local wound care and 2 patients(4.3%) had lateral condyle prominence.

According to the Hardacre et.al criteria at the final follow up clinical outcome in the CC screw group were excellent in 20 (87%) and good in 3 (13%) patients whereas 13 (56.5%) had excellent and 10 (43.5%) good results in the K-wire group which showed a statistically significant difference between the two groups (p value = 0.022).

## DISCUSSION

Displaced lateral condyle humeral fractures in children are most commonly treated by open reduction and internal fixation although some study shows some promising results by close reduction and percutaneous fixation for minimally displaced fractures.<sup>7,12,15,19</sup> K-wires are the commonest implants used for the internal fixation but in the recent times cannulated cancellous screws are also being used to stabilize the fracture.<sup>9,10</sup> Several studies have suggested that immobilization of the elbow for a period of 6-8 weeks following open reduction and K-wire fixation.<sup>2,7,8</sup> In our study also we immobilized the elbow with above elbow posterior plaster slab till the fracture union was confirmed radiologically at an average of 4.61 weeks in the group fixed with K-wire whereas the slab was kept only for two weeks in the CC screw group and the fracture union was observed at 4.13 weeks. A single partially threaded cancellous screw even provides an absolute stability, promotes early fracture healing and allows early range of motion of the elbow.<sup>1,9,10,13</sup>

Usually the K-wires are left protruding outside the skin for easy removal and the CC screws are buried underneath the skin. So the possibility of skin infection is more with the K-wires. The optimal time for implant removal is also very critical. Usually the implants are removed only after the fracture is radiologically united. Thus the K-wire is removed around 3-8 weeks and the CC screw around 3-4 months after union.<sup>2,7,9,10,20</sup> Our results showed the K-wire was removed on an average of 4.57 weeks and CC screw in 13.37 weeks. K-wires were removed on an out-patient basis even without local anesthesia whereas the CC screw had to

be removed under anesthesia in the operating room which increased the cost of treatment.

Out of the many complications of the operative treatment of the lateral condyle of humerus fixed with K-wires, superficial skin infection is one of most common complication which was also observed in 3 (6.5%) of our cases treated with K-wire fixation. All the cases weremanaged with oral antibiotics and local wound care. Various studies also reported similar complication and were also managed accordingly.<sup>8,12,19,21</sup>

One of the other notable complication of open reduction and internal fixation of lateral condyle fracture is the lateral prominence or the lateral spur which is a distinct radiological finding and is rarely symptomatic. The development of the lateral spur depends upon the degree of initial fracture displacement, the amount of periosteal dissection done and the stability of fracture fixation.<sup>2,8-10</sup> Wen et al<sup>10</sup> noted that 36.7% with K-wire and 12.5% with CC screw fixed patient developed lateral prominence. In our study, 1 patient (2.2%) fixed with CC screw and 2 patients (4.4%) fixed with K-wires had lateral prominence which were asymptomatic.

The final assessment was done using the Hardacre et al criteria. We had 20 (87%) excellent and 3 (13%) good results in CC screw group and 13 (56.5%) excellent and 10 (43.5%) good result in K-wire group which is comparable to other studies.<sup>2,7,10,11</sup>

## CONCLUSION

Displaced lateral condyle fracture of humerus in children can be treated by open reduction and internal fixation with either K-wires or a single partially threaded cannulated cancellous screw. The K-wires are relatively cheap, easy and cost effective. There is a potential risk of skin infection and it needs prolonged immobilization. Although the screw fixation requires a second operation for screw removal, it provides absolute stability at the fracture site which enhances the fracture healing, reduces the probability of lateral prominence and also allows early range of motion and activities in the affected elbow.

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