



## Orthopaedics

**TO EVALUATE CLINICO-RADIOLOGICAL AND FUNCTIONAL OUTCOME OF EARLY MOBILIZATION AFTER CLOSE REDUCTION AND PERCUTANEOUS LATERAL K-WIRES FIXATION IN DISPLACED FRACTURE OF SUPRACONDYLAR HUMERUS IN CHILDREN**

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**ABSTRACT** **BACKGROUND:** Supracondylar fracture is one of the commonest fracture in children account for 60% of all fractures around the elbow joint and represent approximately 3% of all fractures in children. **AIM AND OBJECTIVES:** To evaluate clinico-radiological and functional outcome of early mobilization after closed reduction and percutaneous lateral k-wires fixation in displaced fracture of Supracondylar humerus in children by using by Flynn's criteria. **MATERIAL AND METHODS:** The present prospective study was conducted on 34 patients from February 2020 to September 2021 who had displaced supracondylar humerus fracture. **Results:** Mean age of the study population was 6.8 years. A total of 20 were male patients and 14 were female. Majority of patients i.e. 26.4% got injuries due to fall from height. Maximum number of patients had type III Gartland fracture i.e. 20 followed by Type II i.e. 14 patients. Mean duration of trauma – surgery interval was 2.4 days. 50% of patients k-wire was removed at 3 weeks and rest 50% patients at 4 weeks. Final follow up at 6 months showed a total of 28 patients had loss of flexion <5 degree followed by 6 patients who had loss of flexion between 6-10 degree. Similarly, 31 patients had loss of extension <5 degree followed by 3 patients who had loss of extension 6-10 degree. After 6 months, we observed only 30 patients with <5 degree, 4 patients with 6-10 degree and none with >10 degree loss of carrying angle. In 2 patients, we found superficial pin site infection and in none of the patients we found any loss of reduction, delayed union, non-union, malunion and arthofibrosis. A total of 28 patients had excellent results according to Flynn's criteria and 6 patients had good results. **CONCLUSION:** It is concluded that closed reduction and percutaneous lateral pinning is a sound and effective modality for the treatment of displaced supracondylar fractures of humerus.

**KEYWORDS :** Clinico-radiological & Functional Outcome, Early Mobilization, percutaneous K-wires fixation. Displaced Fracture, Supracondylar Humerus

**INTRODUCTION**

Supracondylar fracture is one of the commonest fracture in children account for 60% of all fractures around the elbow joint<sup>1</sup> and represent approximately 3% of all fractures in children.<sup>2</sup> It becomes progressively more uncommon as the child approaches adolescence, the average group of patients being seven and half years. Displaced supracondylar fractures of the humerus in children are common pediatric injuries treated by orthopedic surgeons. They also have a high rate of complications if not reduced and stabilized in optimal position which may lead to serious neurovascular injuries and residual deformity.

Displaced supracondylar fractures of humerus have always presented a challenge in their management.<sup>3</sup> Many methods have been proposed ranging from closed reduction and plaster cast immobilization, Dunlop's skin traction, skeletal traction, closed reduction and percutaneous pinning to open reduction and Kirschner wire fixation.<sup>4</sup>

Closed reduction and percutaneous pin fixation is most widely accepted treatment method for displaced supracondylar humerus fracture but controversy persist regarding optimal pin fixation technique. There is an increased risk of iatrogenic ulnar nerve injury in medial pin fixation compared to lateral pin fixation. Given the potential risk of ulnar nerve injury it is recommended to avoid medial pinning. Displaced supracondylar fracture of the humerus is one of the most difficult work to manage of the many fracture seen in children. These fractures can have serious complication such as compartment syndrome, nerve injury, arterial injury, cubitus varus deformity, Volkmann's ischemic contracture and myositis ossificans. These hazards are less likely associated with early stabilization by percutaneous pinning.<sup>5</sup>

Due to paucity of available data regarding clinico-radiological and functional outcome of "early mobilization" after close reduction and stable percutaneous k-wire fixation in displaced supracondylar humerus fracture in children, the present prospective study was

conducted with an objectives to assess functional outcome of surgeries by Flynn's criteria, union time by serial radiological follow up and clinical outcome & complications by serial physical and radiological followup.

**MATERIAL AND METHODS**

The present prospective study was conducted in Department of Orthopaedics at Maharaja Agrasen Medical College, Agroha (Hisar). A minimum of 34 patients who visited the orthopaedics OPD and the Accident & Emergency Department from February 2020 to September 2021, who had displaced supracondylar humerus fractures. Patients included in the study who had Supracondylar humerus fractures >2 mm displaced (Gartland type II, III), age between 3 years to 12 years. Patients with open fracture, Un-displaced fracture (Gartland type I) <2 mm displaced fracture, Poor skin condition, fracture where closed reduction was failed, other fracture of ipsilateral extremity, Refractures, Metabolic bone disease and any medical condition found to be contraindication for surgery or patients who were not willing for consent were excluded.

**Clinical evaluation:**

In every case a detailed history regarding the mode, duration and nature of injury was taken. Personal history regarding previous history of chronic illness and other relevant medical history was obtained. A thorough examination of the affected upper limb was conducted. Radiological examination was carried out for knowing the type of fracture. Fractures were classified according to the Gartland's classification. Hematological, biochemical and other radiological investigations were carried.

**Operative technique:**

The patient was positioned supine on the operating table and general anesthesia was given to patient by anesthetic. The patient's arm was draped and prepared. First, traction was applied with the elbow flexed at about 20 degrees to avoid the possibility of tethering neurovascular

structures over an anteriorly displaced proximal fragment. For badly displaced fractures significant traction was held for 60 seconds to allow soft tissue realignment, with the surgeon grasping the forearm with both hands, and the assistant providing counter-traction in the axilla. With the elbow almost straight, varus and valgus angular alignment was corrected by movement of the forearm. Medial and lateral fracture translation was realigned with direct movement of the distal fragment by the surgeon with image confirmation. The elbow then slowly flexed and anterior pressure to the olecranon with the surgeon's thumb applied.

Pronation of the forearm was done if the fracture was postero-medially displaced and in postero-lateral displaced fractures the forearm was kept supinated to stabilize the rotation. The reduction was checked by fluoroscopic images in AP, lateral, and oblique planes. Once satisfactory reduction was achieved, the elbow was taped in the reduced position of elbow hyperflexion with elastic tape to prevent loss of reduction while pinning. A 0.6mm to 2mm K-wire was placed against the lateral condyle without piercing skin and checked under AP fluoroscopic guidance to assess the starting point. If the starting point and trajectory found to be correct, the wire pushed through the skin and into the cartilage of the distal lateral condyle. If imaging verifies correct pin placement, then we advanced the pin with a drill. Then second k wire passes parallel, divergent or convergent with minimum gap between 2 wires at 10 mm. Then reduction was checked under fluoroscopy with lateral, oblique, and AP views. Stress was applied in varus and valgus under fluoroscopy to ensure any instability. If we find any instability, then added another lateral-entry pin. Vascular status was assessed. The wires were bent and cut. Antiseptic dressing was done and an above elbow plaster of Paris slab was applied in 80 degrees of flexion.

#### Post-Operative Management:

Postoperatively all patients received broad spectrum intravenous antibiotics for a minimum of 2 days, and then the patient was shifted to oral antibiotics. Elbow was immobilized for 1<sup>st</sup> day for relief of pain in an above elbow slab. Gentle active elbow mobilization exercises were started on 2<sup>nd</sup> post-operative day of surgery in broken slab and then slab was removed on (first post-operative dressing) 3<sup>rd</sup> day and gradual elbow mobilization exercise were continued without any slab till full range of motion achieved. K-wires were removed after radiologically evaluation of union and on bases of individual cases.

#### Follow up:

Post-operative X-Ray Elbow (AP and Lateral views) was taken on 1<sup>st</sup> post-operative day, 2 weeks, 4 weeks and finally at 6 weeks to see position of k-wires and union. Regular follow up was performed at 2 weeks, 4 weeks, 3 months, and finally at 6 months for clinicoradiological evaluation as per annexure II.

#### STATISTICAL ANALYSIS:

At the end of the study, the data was collected and analyzed. Continuous variables presented as mean±SD. Categorical variables expressed as frequencies and percentages. The Pearson's chi-square test or the Chi-square test of association was used to determine relationship between two variables. A p value of 0.05 was considered statistically significant.

#### OBSERVATIONS AND RESULTS

In the present study, maximum number of patients had age between 6-10 years i.e. 20 followed by 11 patients who had age less than 5 years. Mean age of the study population was 6.8 years. A total of 20 were male patients and 14 were female. Majority of patients i.e. 26.47% got injuries due to fall from height followed by 8 patients who were injured while playing. A total of 13 patients got injured in their right side and 21 had their left side injury. Maximum number of patients had type III Gartland fracture classification i.e. 20 followed by Type II i.e. 14 patients. At the time of admission 4 patient had feeble distal pulsation which were regained after closed reduction and k-wire fixation. One patient had median nerve palsy preoperatively which was recovered at the time of k-wire removal.

Trauma to surgery interval in the present study ranged from 0 day to 7 days. Mean duration of trauma – surgery interval was 2.4 days. A total of 2 K-wires used in maximum number of patients i.e. 25 and 3 k-wires were used only in 9 patients. Follow up period ranged from 2 weeks to 6 months.

#### Loss of range of motion (degrees) at 6 months:

In the present study, a total of 28 patients had loss of flexion <5 degree

followed by 6 patients who had loss of flexion between 6-10 degree. Similarly, 31 patients had loss of extension <5 degree followed by 3 patients who had loss of extension 6-10 degree. Mean loss of range of motion was 1.70±3.16 and 1.17±2.11 for Flexion and Extension, respectively.

Table 1

Flexion range	No. of patients	Percentage (%)	Extension range	No. of patients	Percentage (%)
0-5	28	82.35	0-5	31	91.17
6-10	6	17.65	6-10	3	8.83
Mean±SD	1.70±3.16	100%		1.17±2.11	100%

Removal of K-wire which was carried out at time of 3-4 weeks. 50% of patients k-wire was removed at 3 weeks and rest 50% patients at 4 weeks.

At the time of 2 weeks, mean Flexion loss was 41.02±10.05 which decreased to 30.44±8.99 at 4 weeks, further decreased to 14.41±7.25 at 3 months and thereafter at 6 months, it was 1.70±3.16. On statistical analysis, the difference among all these time intervals found to be statistically highly significant.

Further, with regard to Extension, comparison of loss of range of motion among various time intervals shows that at the time of 2 weeks, mean Extension loss was 29.26±6.86 which decreased to 20.29±5.89 at 4 weeks, again decreased to 7.79±4.47 at 3 months and thereafter at 6 months, it was 1.17±2.11. On statistical analysis, the difference among all these time intervals found to be statistically highly significant.

After 6 months, we observed only 30 patients with <5 degree, 4 patients with 5-10 degree and none with >10 degree loss of carrying angle.

In 2 patients, we found superficial pin infection. None of the patient had any other complications like loss of fracture reduction, k wire back migration, deep infection and cubitus varus deformity, delayed union, malunion, arthofibrosis etc. All the patients achieved complete union at the end of 6 months.

In the present study, a total of 22 patients fracture united at 4 weeks and 12 patient's fracture united at 6 weeks. Mean union time of the study population was 4.7 weeks.

Finally, in the present study a total of 28 (82.35%) patients had excellent results according to Flynn's criteria and 6 (17.65%) patients had good results.

#### DISCUSSION

Supracondylar humerus fracture is the most common elbow fracture in children aged 5–7 years, affecting boys more than girls and the majority of fractures are of the extension type. These fractures are usually associated with a number of complications including neurovascular injuries, malunion, and elbow stiffness. To obtain a perfect result after a supracondylar fracture of the humerus, an accurate anatomical reduction is needed. It is essential to minimize additional trauma to the already traumatized joint and periarticular tissues.<sup>6</sup>

The best treatment for supracondylar fracture of the humerus must provide an excellent functional result and an elbow of normal appearance with minimal risk to the patient. From the functional stand point, limitation of flexion of the elbow is considered more disabling than the extension. Next impairment comes the change in carrying angle, which may result in tardy ulnar nerve palsy. Moreover union is never a problem in supracondylar fracture of humerus in paediatric age group, but the problems to be kept in mind are early neurovascular injury and Long term complications like Volkmann's ischemic contracture, Myositis ossificans, Cubitus varus or valgus deformity and Tardy ulnar nerve palsy.<sup>7</sup>

There are no controversies in the management of supracondylar fracture distal end humerus. The major controversy lies in the management of Gartland Type II and III displaced supracondylar fracture of the humerus.

In the present study, maximum number of patients had age between 6-10 years i.e. 20 followed by 11 patients who had age less than 5 years. Mean age of the study population was 6.8 years. Similar findings were

reported by Leonidou et al<sup>8</sup> and Song et al<sup>9</sup> in which they reported mean age of 6.2 and 6.3 years which was found to be comparable with the present study.

A total of 20 were male patients and 14 were female in the present study. Similar sex ratio was reported by other studies. Julfiqar et al<sup>10</sup> reported similar male : female ratio i.e. 1.6:1. In their study, a total of 22 male and 13 female were included which is similar to the present study.

In the present study, majority of patients i.e. 9 (26.4%) got injuries due to fall from height followed by 8 patients who were injured while playing. In a study reported by Pennock et al<sup>11</sup>, 18% patients suffered to injuries i.e. fall from height which is comparable to the present study.

In the present study, a total of 13 patients got injured in their right side and 21 had their left side injury. Shah et al<sup>12</sup> reported 9 males and 12 females with left elbow being the predominant injury side, 12 out of 21 which is comparable to the present study.

In the present study, maximum number of patients had type III Gartland fracture i.e. 20 (58.82%). Julfiqar et al<sup>10</sup> reported majority (60%) of the fractures were Gartland Type III which is comparable to present study.

In 2 patients, we found superficial pin infection which is similar to Kumar et al<sup>6</sup> (3 patients) and Julfiqar et al<sup>10</sup> study (5 patients). In none of the patients, we found any loss of reduction, any malunion, nonunion, any nerve palsy, arthofibrosis etc. one patient had median nerve palsy preoperatively which was recovered at the time of k-wire removal. At the time of admission 4 patients had feeble distal pulsation which were regained after closed reduction and k-wire fixation.

At final follow up, a total of 28 (82.3%) patients had flexion loss <5 degree. Similarly, 31 (91.2%) patients had extension loss <5 degree with only 4 patients had loss of carrying angle of 5-10 degree with none of patients had more than 10 degree loss. Mean loss of range of motion was 1.7±3.1 and 1.2±2.1 for flexion and extension, respectively. Vikram et al<sup>13</sup> (2019) reported satisfactory result for loss of carrying angle and loss of range of motion (ROM) that was 94.4% and 100% respectively. Nacht et al<sup>14</sup> noted loss of range of motion was 7.8° at the final follow up examination in their study whereas, the mean carrying angle loss of 5.8 degree (range 2°-15°) in 20 patients.

In the present study, a total of 22 patients fracture united at 4 weeks and 12 patient's fracture united at 6 weeks. Mean union time of the study population was 4.7 weeks. Union was seen in all patients (100%) after 6 months in the present study.

In none of the patients we found any loss of reduction, delayed union, non-union, malunion and arthofibrosis. All the patients achieved complete union at the end of 6 months. Finally, in the present study a total of 28 (82.35%) patients had excellent results according to Flynn's criteria and 6 (17.65%) patients had good results. Khan et al<sup>15</sup> obtained 88% excellent, 4% good and 4% poor results in his study.

## CONCLUSION

Present study concluded that closed reduction and percutaneous lateral pinning is a sound and effective modality for the treatment of displaced supracondylar fractures of humerus. Lateral pinning reduced the risk of iatrogenic ulnar nerve palsy and early mobilization results in satisfactory functional outcome and cosmesis. If the surgical technique is followed strictly it reduces the incidence of cubitus varus deformity. With this technique, consistently satisfactory results can be obtained both cosmetically and functionally with fewer complications.

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