

# Outcome of Close Reduction and Percutaneous Pinning In Displaced Pediatric Supracondylar Fracture of Humerus Assessed By Flynn's Criteria

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## ABSTRACT

**Objective** To evaluate the adequacy of closed reduction and percutaneous Kirschner (K)-wire fixation technique in treatment of unstable type II and III supracondylar humeral fractures in children by Flynn's Criteria.

**Study design** A descriptive study.

**Place & Duration of study** Combined Military Hospital / Military Hospital Rawalpindi, from August 2008 to September 2012

**Methodology** Children with displaced type II and III supracondylar fractures of the humerus who were managed with closed reduction and percutaneous K-wire fixation were included. All patients were operated upon within three days after trauma. Patients were followed up for a mean period of  $4 \pm 1$  months and assessed radiologically for union. Functionally and cosmetically they were assessed according to Flynn's criteria.

**Results** Eighty nine children with displaced type II and III supracondylar fractures of the humerus were managed with closed reduction and percutaneous K-wire fixation. There were 67 boys and 22 girls with a mean age of  $7.2 \pm 2.07$  year. All patients achieved solid union. Functionally, 94.4% patients achieved excellent and good while 4.5% had satisfactory results. Cosmetically 86.5% of patients had excellent and good results, 5.6% satisfactory and 7.9% had unsatisfactory results. The most frequent complication was minor pin tract infection in seven patients. Two patients had neurapraxia of ulnar nerve after pinning.

**Conclusion** The obtained results and few complications noted suggest that the technique is a suitable treatment option for displaced type II and III supracondylar fractures in children, if referred early.

**Key words** Humeral supracondylar fracture, Percutaneous pinning, Closed reduction, Flynn's criteria.

## INTRODUCTION:

Children frequently sustain fractures of upper limb. Of all the fractures of the upper limb supracondylar fracture of the humerus is the most common injury.<sup>1</sup> It can result in serious complications if not treated appropriately. Management of supracondylar fractures of humerus

has evolved from a purely conservative approach to a more aggressive one in recent years. In the case of partially displaced fractures the majority can be treated by closed reduction followed by immobilization for 3 weeks. The incidence of displaced grade III fractures is low (16.7%) and their treatment is challenging and controversial.<sup>2</sup>

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Displaced fractures can be associated with various complications and can be as high as 60%.<sup>3</sup> The management of completely displaced fractures is more controversial. Recommended treatment modalities vary from no reduction and immobilization to open reduction

and internal fixation. Because of the difficulty in maintaining adequate reduction with cast immobilization, stabilization of the reduced fractures with pins placed percutaneously has become a widely accepted method of treatment.<sup>4</sup> All of these methods have their advantages and disadvantages, and the treatment option has to be tailored according to the configuration of the fracture and the expertise as well as facilities available. The aim of present study was to evaluate the results of closed reduction and percutaneous K-wire fixation technique in treatment of unstable type II and III supracondylar humeral fractures in children.

**METHODOLOGY:**

This descriptive study was conducted at Combined Military Hospital/Military Hospital Rawalpindi Orthopaedic unit. Between August 2008 to September 2012, 438 children with supracondylar fracture humerus reported to the Orthopaedic Department. Out of these 127 were unstable displaced type II and III supracondylar humeral fractures. Inclusion criteria was children below 10 year of age with displaced Gartland's type II and III supracondylar humeral fractures reporting within three days of injury.<sup>5</sup> Exclusion criteria was open fractures, fracture associated with vascular, neurological, or compartment problems, and failure of close reduction. Only 89 patients met the inclusion criteria.

All patients were assessed clinically. Closed reduction of the fractures was done by traction and manipulation under general anesthesia. Medial or lateral displacement of the distal part was corrected with respect to the shaft of the humerus under fluoroscopic control. Reduction was achieved by the thumb pressure over the olecranon when the elbow was at 120° flexion and the forearm in pronation. The new moon image at the lateral view and antero-posterior position of the distal part at the Jones' position were evaluated. After stable anatomic reduction K-wires were placed depending upon the fracture configuration. The position of the K wires was controlled by anteroposterior and lateral view flouroscopy. Two lateral K wires were preferred in stable fractures after reduction. Medial and lateral K wires were used in comparatively unstable fractures after reduction.

Postoperative neurological assessment for median, ulnar, and radial nerves was performed after recovery from anesthesia on evening ward round. Period of hospitalization was 1–2 days. Patients were followed up at one week for radiological confirmation of maintenance of reduction. At 4 weeks

the K wires were removed and elbow physiotherapy was started. Patients were followed up monthly for a mean period of 4±1 month. At the last follow-up, patients were assessed radiologically for union and functionally according to Flynn's criteria (table I).<sup>6</sup> Internal rotation deformity was measured by the method described by Yamamoto et al.<sup>7</sup>

**Table-I: Flynn's Criteria For Cosmetic and Functional Assessment of Results**

Result rating	Cosmetic factor Carrying angle loss	Functional factor Loss of motion
Excellent	0–5	0–5
Good	6–10	6–10
Fair	11–15	11–15
Poor	>15	>15

The results were tabulated as frequency distribution for different qualitative values. Using the standard version of the SPSS program (release 12). The arithmetic mean and standard deviation were calculated for quantitative variables. Comparison between those with satisfactory outcome and those with unsatisfactory outcome was done using  $\chi^2$  (Chi square) test of significance.

**RESULTS:**

There were 67 boys (75.3%) and 22 girls (24.7%). Their ages ranged from 2 to 10 year with a mean of 7.2±2.07 year. Thirty-three patients (37%) were below the age of 7 year. Right side was affected in 64% and left in 36% patients. Majority of the injuries (78%) occurred due to fall while playing. Functional and cosmetic results are shown in table II.

There was no statistical significant difference in the functional results between boys and girls. All patients in both the groups had satisfactory outcome. Boys had better cosmetic results than girls, but the difference was statistically insignificant. There was also no statistical significant difference in the results between patients below 7 year of age and those above 7 year.

There were 68 patients with Gartland type II fractures and 21 patients with type III fractures. All patients with Gartland type II fracture and 14 patients with Gartland type III fractures had satisfactory results, 7 (7.9%) patients with Gartland type III fracture had unsatisfactory result. The difference was statistically not significant ( $\chi^2=0.349/P>0.05$ ).

Seven patients (7.8%) who had minor pin-site infection that resolved after K-wire removal and use

of oral antibiotics. Cubitus varus deformity was noted in 7 (7.9%) patients whose reduction was unsatisfactory. All of these 7 patients had Gartland type III fractures. In these 3 patients corrective osteotomy was planned later. There was neuroaprexia of ulnar nerve in two patients which recovered after removal of K wires. None of the patients developed joint stiffness.

**DISCUSSION:**

Supracondylar fractures of the humerus are most frequently seen in children between the age of 3 and 10 years.<sup>1</sup> There is no uniformity of opinion concerning the ideal method of treatment of displaced supracondylar fractures. Closed reduction and cast immobilization is the least invasive method provided the reduction is maintained. However quite often redisplacement occurs once edema subsides and hematoma are absorbed. Subsequent attempts at reduction are usually not as fruitful.

Open reduction and internal fixation produce scarring and may lead to restriction of movements. Our study has demonstrated that percutaneous fixation technique offers a viable compromise between conservative treatment and open surgery. An early decision to manipulate and reduce these fractures with 'percutaneous pinning and POP cast results in early discharge from hospital. Less supervision is required for these patients. Percutaneous pinning compared to ORIF has less chance of elbow stiffness and is cost effective.<sup>8</sup> Percutaneous pinning as compared to cast immobilization is safe in terms of negligible chances of compartment syndrome and loss of reduction. In our study functionally 98.8% patients had satisfactory results. This is because of good initial reduction. It is comparable to other international studies.<sup>9,10</sup>

Cubitus varus deformity is the most common problem seen after the treatment of supracondylar fractures. The cause of the deformity is coronal rotation, or tilting of the distal fragment. Some investigators believe that varus deformity is due to epiphyseal growth disturbance or rotation of the distal fragment.

Smith suggested that residual medial tilt after reduction is the most important factor in varus angulations, with isolated rotational deformities being corrected by compensatory rotation at the shoulder.<sup>11</sup> Cubitus varus occurred in 7 (7.9%) cases. This was related to unsatisfactory reduction of the fracture before pinning. Two patients had posteromedially displaced type III fracture. No revision surgeries were done.

In the present study 7 patients (7.9%) had minor pin-site infection that resolved after K-wire removal and use of oral antibiotics. No deep infection or septic arthritis was encountered. Our pin tract infection rate is in comparison with other studies.<sup>10,12-14</sup> There was neuraprexia of ulnar nerve in two patients, which recovered after K wire removal. Similar results were found in other studies.<sup>10,15</sup>

Iatrogenic neurological injury was reported in certain studies.<sup>9,12,13</sup> None of the studies has reported iatrogenic vascular injury. Several methods have been tested in order to eliminate the risk for nerve injury.<sup>16-18</sup> Wind et al suggested to stimulate the nerve either by a small needle before placing the medial K-wire or by the K-wire itself before being placed to determine the location of the ulnar nerve; and they proposed that this method can minimize nerve injury.<sup>19</sup> Locating the ulnar nerve with a nerve stimulator has been suggested.<sup>20</sup> We used two lateral wires for fixation if the fracture was stable after closed reduction. For unstable fractures, medial and lateral pins were used. If medial pin was used a small incision was made over the medial epicondyle and a drill guide was placed on the bone. The wire was then inserted. Also, placing the lateral pin first with the elbow hyperflexed and then placing the medial pin with the elbow in only 70 degrees of flexion lessens this risk. We routinely palpate the ulnar nerve at the time of pinning.

**CONCLUSIONS:**

Treatment by close reduction and percutaneous pinning was an adequate option in children with supracondylar fracture humerus, Gartland's type II

Table II: Cosmetic and Functional Results		
Result Rating	Cosmetic Factor Carrying Angle Correction	Functional Factor Restoration of Movement
Excellent	68 (76.4%)	77(87.5%)
Good	9 (10.1%)	7 (7.9%)
Fair	5 (5.6%)	4 (4.5%)
Poor	7 (7.9%)	1 (1.1%)

and III, provided patients report early. This method provided good union rate, sufficient stability with acceptable rate of complications, and minimal risk of iatrogenic nerve injuries.

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