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## Displaced supracondylar fractures of the humerus treated by closed reduction with percutaneous pin fixation

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### Abstract

**Background:** Displaced variety of supracondylar fractures of the humerus are common in the pediatric age group. These fractures when left untreated or mistreated are associated with a higher rate of complications like neurovascular injury and residual deformity and disability. Although various treatment methods are available, the method of closed reduction with percutaneous pin fixation has been widely employed by many as a satisfactory one.

**Materials and Methods:** Between July 2017 and January 2018, 15 patients with supracondylar fracture of the humerus of Gartland type III in the age group less than 10 years were included in our study. These patients were managed by closed reduction and pin fixation with crossed Kirschner wires under C-arm guidance and their outcome was assessed clinically using Flynn's criteria.

**Results:** The average age at surgery was around 5.5 years (range 2 to 9 years). As per Flynn's criteria, the outcome was excellent in 5 patients, good in 8 patients, fair in 2 and poor in nil patient.

**Conclusion:** Closed reduction with percutaneous pin fixation seems to prove an effective treatment for supracondylar fractures of the humerus in the pediatric age group.

**Keywords:** Closed reduction, percutaneous pin fixation, displaced supracondylar fracture

### Introduction

Supra condylar fractures of the humerus account for roughly 60 to 65% of the fractures around the elbow joint especially in the age group of 4 to 7 years<sup>[1]</sup>. These are also responsible for 3% of the overall fractures in children<sup>[2]</sup>. These being associated with a list of complications like malunion, injury to major nerve and vessels and Volkmann's ischemic contracture, myositis ossificans, cubitus varus deformity<sup>[3, 4]</sup>. Various modalities of treatment are available like closed reduction followed by POP immobilization, skeletal traction, Dunlop's method of skin traction, closed/ open reduction with Kirschner wire fixation<sup>[5, 6]</sup>. But closed reduction with percutaneous pin fixation has been reported as the most preferred, simple and stable compared to other pin models<sup>[7, 8]</sup>. The present study has been carried out to evaluate the clinical outcome of this treatment method for displaced supracondylar humerus fractures in children

### Materials and Methods

During our study period from July 2017 to January 2018, 15 patients were admitted in our department at Sree Balaji Medical College and Hospital, Chennai with Gartland type III supracondylar fracture of the humerus. The common cause was fall on a outstretched hand. We had 9 males and 6 females. The mean age was 5.5 years (range 2 to 9 years). Left side was involved in 8 cases and right in 7.

Under general anaesthesia, elbow was held in extension, forearm was supinated and traction applied longitudinally with adequate counter traction. The impaction was thus released and medial/lateral displacement was corrected by appropriate varus/valgus force. Elbow was flexed with continued traction and the angulations were corrected. Radial pulse was kept in check throughout the procedure to avoid vascular injury.

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Reduction was confirmed by C-arm Women with fracture following a road traffic accident and with tumor, primary hyperparathyroidism or secondary causes of osteo and assessed by calculating Baumann's angle. After satisfactory reduction was obtained, 1.5 to 2mm Kirschner wires were inserted through the lateral epicondyle percutaneously. The pin was in an upward and medial direction at an angle of 35 to 40 degree to the long axis of the humerus. The pin entered through the distal fractured fragment to the cortex of the proximal humerus fragment, extending upto 3cm above the fracture line. Similarly, medial pin fixation was done through the medial epicondyle, such that both the pins crossed each other 1.5 to 2 cm above the line of fracture. Injury to the ulnar nerve in its groove was carefully avoided. Under C-arm guidance, the fracture reduction and pin fixation was rechecked and the pins were cut subcutaneously. Clinically the reduction was assessed by the degree of flexion possible and measuring the carrying angle.

The patients were put on third generation cephalosporin coverage started preoperatively and continued postop. Plaster slab was applied above elbow with the limb in 90 degree flexion and full supination. Radiologically patient was assessed by comparing the preoperative and postoperative pictures. Any neurovascular deficit was carefully watched regularly. Patients got discharged by 72 to 96 hrs and were followed up at one week postop and thereafter at weekly intervals. K-wire was removed on adequate union assessed clinically and radiologically. Active exercised were taught and started thereafter. The patients were then followed up weekly for 6 weeks, and monthly for 6 months. Clinico-radiological assessment was done using Flynn's criteria [9] (Table1).



Fig 1(A)



Fig 1(B)

Anteroposterior and lateral radiographs of a child showing Gartland type III supracondylar fracture of the humerus



Fig 2(A)



Fig 2(B)

Anteroposterior and lateral views of the same patients taken postoperatively showing successful reduction of the fracture and fixation with Kirschner wire and plaster cast in situ



Fig 4(A): Preoperative radiograph showing displaced supracondylar fracture of the humerus-extension type



Fig 4(B): Postoperative radiograph of the same patient showing lateral pin fixation after fracture reduction

**Table1:** Flynn's criteria

Results	Rating	Cosmetic Factor:	Functional
		Loss of Carrying Angle (Degrees)	Factor: Loss of Motion (Degrees)
Satisfactory	Excellent	0-5	0-5
	Good	6-10	6-10
	Fair	11-15	11-15
Unsatisfactory	Poor	>15	>15

### Observation

The results were good to excellent in 86.6% and fair in 13.3%. Two patients had fair results due to technical errors in the initial treatment. The average inpatient hospital stay was 2.5 days. No remarkable postoperative complications were noted. The mean time to union both clinically and radiologically was 4 weeks with a range of 2 to 6 weeks. During follow up, the carrying angle was measured in both the limbs. It was in the range of 4% to 15% in the affected limb and 8% to 18% in the normal limb. No neurovascular deficit was noted. The patients recovered well by 3 to 6 weeks after K wire removal.

**Table 2:** Results

Results	Rating	Cosmetic Factor:	Functional
		Loss of Carrying Angle	Factor: Loss of Motion
Satisfactory	Excellent	6	4
	Good	1	0
	Fair	0	1
Unsatisfactory	Poor	0	2

### Discussion

Treatment of supracondylar fractures of the humerus, common in the pediatric age group, is quite challenging. Proper reduction and its maintenance is essential for the recovery. Various treatments like reduction and immobilisation in plaster cast, skin traction, skeletal traction, closed reduction with percutaneous pinning, open reduction and fixation with K-wire [5, 6]. Treatment by traction has a disadvantage of longer inpatient stay and also being less reliable in the pediatric population. The drawback of open reduction and fixation is more infection and joint stiffness. Hence, closed reduction with percutaneous pin fixation is preferred for Gartland type III supracondylar humerus fractures. This has many advantages like reduction in the duration of hospitalisation, no fear of loss of reduction, lower risk of compartment syndrome, better blood circulation [9]. In order to avoid iatrogenic ulnar nerve injury some have suggested pinning through the lateral epicondyle of the humerus, either in a parallel or crossed fashion [10]. Excellent results by crossed pin fixation has been reported by Swenson. Iatrogenic ulnar nerve injury is a problem of concern in pinning through the medial epicondyle, more so when there is associated swelling at the fracture site [5]. This iatrogenic

injury can be either due to direct causation or due to delayed neuropathy attributed to stretching. Recent studies prove that crossed medial and lateral pin fixation are found to be most stable in this setting [11, 12].

In our current study, we conclude that closed reduction with percutaneous pin fixation is an effective and reliable approach for the management of displaced supracondylar fractures of the humerus in children, even in cases associated with swelling. The advantages include shorter hospital stay, earlier mobilisation, stability of the fixation and thus a better functional outcome.

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