

**MANAGEMENT OF DISPLACED SUPRACONDYLAR FRACTURES OF THE HUMERUS IN CHILDREN BY CLOSED REDUCTION AND PERCUTANEOUS PINNING**P. L. Srinivas<sup>1</sup>, K. Jagadish<sup>2</sup>, B. Mahesh<sup>3</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT: INTRODUCTION:** Supracondylar fracture of the humerus is common injury in children between the ages of 5 to 10 years. With males are affected twice high than females. The average age incidence was 8.3 years. Proper clinical and radiological examination is necessary for type of displacement and type of treatment. Percutaneous pinning of supracondylar fracture is certainly not a new technique (5), but it had excellent results in various series, comparatively with other techniques. Closed reduction and crossed percutaneous pinning is a reliable method of treatment for severely displaced supracondylar fractures of the humerus in children. **MATERIALS:** In our study 25 patients were treated with closed reduction and percutaneous pinning between 2009-2014. All 25 fractures were extension type III and closed variety. Left side was involved in 20 patients and Right side in 5 patients. The commonest mode of injury was by fall while playing and fall from bicycle. The displacement of the fracture was posteromedial in 19 patients and posterolateral in 6 patients. **RESULTS:** In our study we had 84% excellent or good results and 16% fair or poor results. Results were assessed according to the Flynn's criteria. We had following complications after percutaneous pinning. In one patient ulnar neuropraxia developed because of the medial pin. After 1 week medial pin was removed and following that patient recovered completely. In our study one patient had radial and median nerve injury and developed myositis ossificans. Mild degree of Volkmann's ischaemia and restriction of elbow movements. All these were because of the patient had massage and manipulation elsewhere before the treatment. Another patient had mild degree of cubitus varus deformity. **DISCUSSION:** Closed reduction with immobilization in cast and Dunlop's traction, skeletal traction necessitates either longer duration of hospitalization or supervision of the patient constantly. Open reduction and internal fixation always have the chance of infection and risk of myositis ossificans and associated loss of motion. **CONCLUSION:** Closed reduction and percutaneous pinning under image intensifier control offers several advantages such as accurate anatomic reduction, good stabilization, and early mobilization, less chances of joint stiffness and with low rate of malunion. And the hospital stay is shorter (5).

**KEYWORDS:** Supra Condylar Fractures of Humerus, Children, Percutaneous Pinning.

**INTRODUCTION:** The supracondylar fracture of the humerus lies within the metaphysis of the distal humerus and proximal to the transverse physal line.<sup>(1)</sup> This occurs where the humerus is widest and thinnest, at the level of the olecranon fossa.<sup>(2)</sup> Supra condylar fracture of the humerus is most common in children, It accounts for 60% of elbow fractures and is seen most frequently in children between the age of 3 to 10 years.<sup>(1)</sup> The peak incidence is between 5 to 8 years, the incidence in males is twice as frequent as in females and the left arm is involved more commonly than the right arm. The characteristic displacement of the distal humeral segment is posteromedial in 90% of the cases and posterolateral in 10% of extension type injuries. The flexion type supra condylar fracture is a very

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rare injury.<sup>(3)</sup> Management of these elbow fractures is one of the most difficult of all injuries in childhood.<sup>(2)</sup> Much concern has always been expressed over the maintenance of fracture reduction and adequate circulation of the limb. Severe sequelae of this injury are Volkmann's ischaemic contracture, growth deformities, in particular varus angulation and neuropathies.<sup>(2)</sup>

Thus in the management of supracondylar fractures many methods have evolved, but the percutaneous pinning following closed reduction and under image intensifier control had given excellent results in various series. And percutaneous pinning gives good stabilization to the fracture, perfect anatomic restoration and early mobilization.<sup>(4,5)</sup> The concept of doing percutaneous pinning is with the closed reduction alone maintaining the reduction is very difficult,<sup>(6)</sup> because the distal segment is small and very unstable<sup>(6)</sup> and when the patient is having severe oedema, surgical intervention is not advisable because of chances of sepsis.<sup>(4)</sup>

Hence, percutaneous pinning is the superior method than other methods and it can be done on the same day of child's admission (If severe oedema is not present) and acute flexion of the elbow is not necessary to maintain the reduction.<sup>(5)</sup> Finally, we can correct the rotations, angulations, under the image intensifier control and greatly reduce the mal unions, like cubitusvarus or cubitus valgus with Closed reduction and percutaneous pinning technique.<sup>(3)</sup>

Problems with vascular compromise, compartment syndrome and Volkmann's ischaemic contracture, mal union (Cubitusvarus) have been greatly reduced with this technique.

**MATERIALS AND METHODS:** 25 cases of displaced supracondylar fractures of humerus in children were treated by closed reduction and percutaneous pinning during the period 2009 to 2014. There were 17 boys and 8 girls and age group ranging from 3 to 12 years with an average age of 8.3 years. The fracture occurred on the left side in 20 patients and on the right side in 5 patients. All the fractures were closed extension type III (Severely displaced) according to modified Gartland's classification.<sup>(7)</sup>

19 fractures were displaced postero medially and 6 fractures were postero laterally. The time interval between injury and reporting was noted in each case, and the interval ranged between a minimum of 2 hours to a maximum of 48 hours.

### **Complications seen at the time of initial examination are:**

1. Radial pulse was feeble in 2 patients.
2. Skin blisters were seen in 3 patients.
3. Median and radial nerves were injured in 1 case because of massage elsewhere before admission into the hospital.
4. In one patient, because of massage, which caused severe oedema of fore arm and hand and finger movements were absent, compartment syndrome with mild degree volkmann's ischaemia was noticed. Forearm was elevated and anti-inflammatory and anti-oedema medicines were given.
5. In one patient Doppler study was done and it showed spasm of the distal part of the brachial artery. After closed reduction and percutaneous pinning radial pulse was appeared.

Initial treatment was given with posterior plaster slab and elevation of the limbs. Routine investigations were done.

Time interval between admission and closed reduction and percutaneous pinning ranged between 1 to 7 days. The mean duration of anaesthesia was 60 minutes.

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**METHODS** (8,3,9,5,6): The closed reduction was performed with the patient under general anaesthesia. The position of the patient is supine.

To reduce the fracture, traction is applied longitudinally carefully avoiding hyper extension, while traction is maintained any medial or lateral displacement is corrected by gentle pressure on the distal fragment. Then the internal rotation deformity is corrected. Next, to correct the posterior displacement of the distal fragment, with thumb over the olecranon, the distal fragment is pushed forward while the elbow is gently flexed to approximately an angle of 120 degrees. Then the forearm is pronated for the more common posteromedially displaced fracture and supinated for the posterolaterally displaced fracture. After reduction, the position is checked in Antero - Posterior and lateral views on the image intensifier unit. If the reduction appears satisfactory condylar fragment is secured to the shaft by smooth k wires 1.0 or 1.25 mm in diameter.

### INSTRUMENTS:

Power or hand drill,  
1.0 or 1.25mm K-Wires,  
K - Wire cutter,  
K-Wire bender.



**Fig. 1: C Arm unit**



**Fig. 2: Instruments**

**PROCEDURE** (3,9,5,6): The image intensifier provides the surface on which to operate and should be sterilely draped. The distal fragment is usually quite stable in 120 degrees of flexion in pronation, allowing the arm to be moved from neutral to external rotation to allow antero posterior and lateral images/x rays to be taken. An image taken in slight internal and external rotation will confirm that the medial and lateral columns are anatomically reduced.<sup>(3)</sup> Then the extremity is internally rotated, with maintaining the elbow flexion in 120 degrees and the elbow resting on the image intensifier's surface, a 1.0 or 1.25 mm diameter k wire is inserted laterally through the lateral epicondyle crossing just lateral to the olecranon fossa and engaging the medial cortex.<sup>(3,9)</sup>

The position of the first pin is checked in both antero posterior and lateral views. Then the extremity is externally rotated and medial pin is placed directly through the apex of the medial epicondyle, crossing the lateral k wire just proximal to the olecranon fossa and engaging the lateral cortex.<sup>(3)</sup> Each pin should engage the opposite cortex of the proximal fragment<sup>(9)</sup> and pins should

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cross well above the fracture site to provide maximal stability to this fracture.<sup>(3)</sup> Once satisfactory reduction is achieved, these pins are bent to prevent migration and left out through the skin for easy removal. The elbow is padded and posterior plaster splint is applied from axilla to the wrist in 60 to 90 degrees of elbow flexion. Postoperative x-ray is taken, oral antibiotics were advised for 5 days, analgesics (Paracetamol Tablets) were advised for 10 days. The patient is discharged within 2 to 3 days after percutaneous pinning.

Follow up was done weekly and after 3 or 4 weeks, pins were removed and active elbow exercises were advised.

On follow up, neurovascular status, pin tract infection, pin loosening and clinical union were observed. Check x rays were taken after 4 weeks to confirm the radiological union.



**Fig. 3: While traction is applied**



**Fig. 4: While reducing the fracture**



**Fig. 5: After reduction of the fracture**



**Fig. 6: While passing the lateral Pin**



**Fig. 7: While passing the Medial Pin**



**Fig. 8: After passing both the pins, Pins are bent and cut off outside the skin**

**OBSERVATION AND RESULTS:** All 25 patients in our study returned for clinical and radiographic examination. Final assessment was done after 3 months, observations and results were analysed.

As per our study the incidence in males was twice as frequent as in females, male preponderance is due to the fact that the boys are more active than girls and are more prone to injuries at play.<sup>(10)</sup> In our study all the fractures were closed type consisting of 100% and extension type, postero medial in 19 cases (76%) and postero lateral in 6 cases (24%). Right side in 5 cases (20%) and left side 20 cases (80%) Associated injuries were seen in 2 cases (8%), ipsilateral epiphyseal injury of the wrist in 1 case, ipsilateral disruption of acromioclavicular joint was noticed in one case.

In our study 68% were males (17 cases) and 32% were females (8 cases). In our study, all the fractures were closed type III. (100) % posterior displacement. Posteriormedial were 76% (19 cases). Posteriorlateral 24% (6 cases). In our study the mode of injuries were fall while playing 18 patients (72%) and fall from bicycle 7 cases (28%). In our study 2 cases (8%) were in the age group of 0-5 years, 19 cases were in the age group of 6-10 years (76%), 4 cases were in the age group of 10- 15 years (16%). 80% have involved in left side and 20 % on the right side.

The maximum number of cases presented within 6 hours of injury was in 10 cases (40%), between 24-48 hours 10 cases (40%), between 6-12 hours 4 cases (16%) and between 12-24 hours 1 case (4%).

The time interval between the dates of admission to date of surgery was 1 to 7 days.

In 1 case pinning was done on the same day (4%), in 8 cases (32%) pinning was done between 1-3 days and in 16 cases (64%) between 4-7 days. In 21 cases (84%) crossed pinning was done and only 2 lateral pins were passed in 4 cases (16%).

Total incidence of initial problems was 36%. 2 cases (8%) had absence of radial pulse, but following the pinning both the cases were improved. One case 4% developed compartment syndrome, 1 case (4%) had Nerve injury (both medial and radial) following the pinning after 3 months, and the cases were improved. In 3 cases (12%) blisters were noticed and treated with dressings. In 2 cases (8%) associated injuries were noticed. Ipsilateral epiphysial injury of the wrist in one case (4%), Ipsilateral disruption of the acromio-clavicular joint in one case (4%). These were treated at the time of percutaneous pinning of the supra condylar fracture.

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Following the percutaneous pinning we had observed 16% of complications, myositis ossificans noticed in one case (4%) i.e., because of secondary to massage prior to admission in to the hospital.

Ulnar neuropraxia observed in 1 case (4%) because of the medial pin, and after pin removal case was recovered completely. In 1 case (4%) restriction of elbow movement was observed, with physiotherapy satisfactory range of motion was obtained.

In one case (4%) mild degree of cubitus varus was noticed. 21 patients retained satisfactory range of motion just by loss of 0 to 5 degrees. 4 patients had unsatisfactory range of motion by loss of more than 10 degrees.

According to flynn's criteria,<sup>(4)</sup> we had 21 cases (84%) excellent or good results and 4 cases (16%) had fair or poor results. Cause of unsatisfactory and poor results were because of delayed reporting, prior manipulation elsewhere, history of massage, bad follow up, initial surgical technical problem, delayed physiotherapy. Excellent and good results were due to early reporting time, no prior treatment, no massage and manipulation, good follow up, immediate physiotherapy.

Result	Functional factor loss of motion (Degrees)	Cosmotic factor loss of carrying angle (Degrees)
Excellent	0-5 degrees	0-5 degrees
Good	6-10 degrees	6-10 degrees
Fair	11-15 degrees	11-15 degrees
Poor	>15 degrees	>15 degrees

Table 1: Flynn's Criteria<sup>(6,7)</sup>

### RESULTS:

#### CASE NO. 1:



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## CASE NO. 2:





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Full range of extention

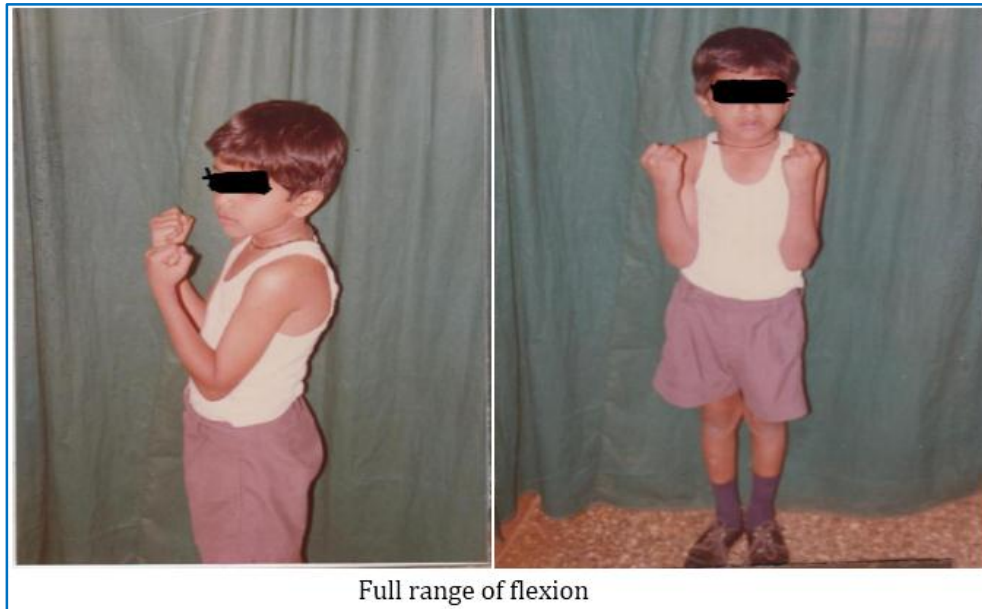
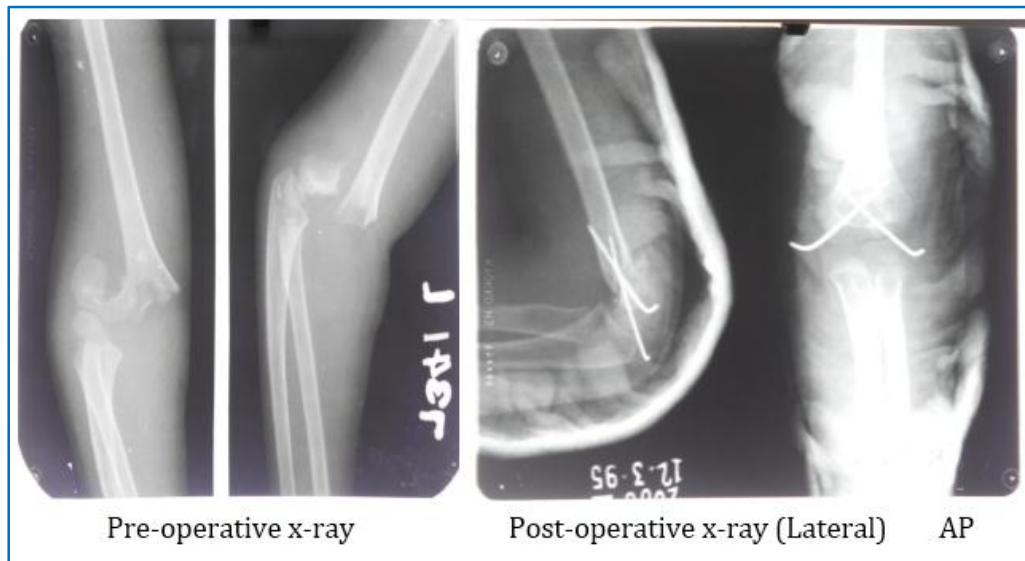


Full range of flexion

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## CASE NO. 3:



**CASE NO. 4:**

**DISCUSSION:** Supracondylar fracture of the humerus is very commonly seen in children.<sup>(1)</sup> In our study the incidence of supra condylar fractures increase during the first decade. Peak incidence between 5-9 years and an average age of 8.3 years with male to female ratio of 2:1. In our study 100% are extension type III.

A displaced extension type supracondylar fracture of the humerus in a child may present problems in management including limb threatening, volkmann's ischaemia, neural palsy, cubitusvarus and stiffness of elbow.<sup>(3,2)</sup> The avoidance of complications and achievement of an excellent functional and cosmetic result are the goals of a treatment.

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To avoid the deformities, neurovascular complications, in 1948 swenson adopted the use of percutaneous pinning as previously described by miller<sup>(9)</sup> (1939). In 1939 miller described blind pinning.<sup>(5)</sup> In 1948 swenson described a method for supracondylar fracture of humerus by k wire trans fixation.<sup>(5)</sup>

In 1965 Jones described a blind pinning in 19 supracondylar fractures with no infection and no neurological damage.<sup>(3)</sup> In 1974 flynn et. al<sup>(7)</sup> reported satisfactory results in 98% of patients in a series of 52 percutaneously pinned fractures followed up from 3 months to 16 years.

In 1977, vincenti. L. Areno et. al<sup>(11)</sup> treated 189 patients with closed percutaneous pinning had satisfactory results of 85%. In 1987 Aronson and prager<sup>(4)</sup> treated 20 patients with closed reduction and percutaneous pinning, all had excellent or good results. In our study we treated 25 patients by closed reduction and percutaneous pinning and obtained 84%of excellent or good results. Use of the image intensifier markedly improved the ability to achieve a satisfactory reduction with stable k wire fixation. Advantages of percutaneous pinning are:

1. Hospitalization period is shorter.<sup>(4)</sup>
2. Stabilises the fracture and minimizes<sup>(4)</sup> the chance of redisplacement and loss of reduction during the postoperative period.
3. Acute flexion of the elbow is not necessary for immobilization.<sup>(4,5)</sup>
4. Decreases the risk of compartment syndrome, vascular insufficiency, volkmann's ischaemic contracture.<sup>(4)</sup>
5. No physeal arrest and low rate of malunion with percutaneous pinning.<sup>(3)</sup>
6. Finally by not operating<sup>(4)</sup> the fracture site, when severe swelling is present the surgeon minimizes the chance of infection and intra operative trauma and risk of myositis ossificans and associated loss of motion of elbow joint. Contra indications<sup>(3)</sup> to percutaneous pinning are massive swelling, extensive comminution and open fractures.

**Disadvantages:** Technical proficiency,<sup>(6)</sup> by medial pin ulnar nerve may be injured,<sup>(3)</sup> pin tract infection, pin loosening.

In our study, excellent and good results were 84% and fair or poor results were 16%. By this method, patients can be started early elbow exercises from 4<sup>th</sup> week onwards. There is no need for traction application and prolonged hospitalization. Hence, closed reduction and percutaneous pinning is economical<sup>(3,5)</sup> and there is less chance of developing deformity as reduction and fixation was done under image intensifier control. The incidence of nerve injuries in supra condylar fractures are 7.7%.<sup>(10)</sup> Where as in our study nerve injury was 4%. In one case, both median and ulnar nerves were injured. Recovery obtained in 3 months There is no need for hyperflexion of the elbow<sup>(4,9)</sup> after percutaneous pinning of the fracture. Injury to ulnar nerve can be avoided by an anatomic reduction and k wire introduction in medial epicondyle anterior to the nerve.<sup>(7)</sup>

**CONCLUSION:** Closed reduction and percutaneous pinning under image intensifier control of displaced supra condylar fractures of humerus in children is a safe and reliable method of treatment. This method has definitely superior than other techniques as it allows accurate assessment of reduction at surgery by direct observation of the elbow, rotational deformities can be recognized and perfect anatomic reduction can be obtained with the fracture stabilized by pins, and an elbow with severe swelling can be extended after reduction of fracture and pinning compression of arteries and veins are avoided. Acute flexion of the elbow is not necessary to maintain the reduction.

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Hospitalization is shorter. Satisfactory results both functional and cosmetic are obtained. Commonest complication of this fracture cubitusvarus is minimized and no physal arrest and no pin tract infection. Early mobilization prevents joint stiffness. After stabilization of the fracture with percutaneous pins directly we can make the assessmment of the carrying angle in the extended elbow. Hence closed reduction and percutaneous pinning of supracondylar fracture of the humerus have many advantages, good stabilization of the fracture and maintenance of reduction, perfect anatomic restoration and early mobilization without surgical intervention to the fracture. And we are correcting the angulations and rotations under image intensification control, greatly reduce the mal unions like cubitus varus or cubitus valgus with this technique. Closed reduction and percutaneous pinning is ideal technique for the management of displaced supracondylar fractures of the humerus in children.

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