

## CLOSE REDUCTION AND PER CUTANEOUS PINNING OF SUPRACONDYLAR FRACTURES OF HUMERUS IN CHILDREN

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### ABSTRACT

**Objective:** The purpose of this study was to assess outcome and complications associated with closed reduction and internal fixation of supracondylar fractures type III of humerus in children.

**Study Design:** Quasi - experimental.

**Place and Duration of Study:** Department of Orthopedics, Fauji Foundation Hospital Rawalpindi and Railway General Hospital (RGH), Rawalpindi, from June 2011 to August 2012.

**Material and Method:** The study group included 16 boys and 8 girls aged 4-12 years with supracondyle Type III fractures of humerus, having no neurovascular injury and no appreciable edema. Relevant history and clinical details were taken. All those cases having any neurovascular injury or moderate to severe edema at elbow and presenting late more than two weeks were excluded. These cases were treated with closed reduction and internal fixation. Follow up was done for 6 months to assess the level of cosmetic and function according to the system described by Flynn's et al as excellent, good, fair and poor.

**Results:** Study was completed on 24 patients (16 males and 8 females). All fractures were united in acceptable alignment. At final assessment there were 16 excellent, 5 good, 3 fair. No one was poor. The fair clinical outcome was higher in children above 10 years of age.

**Conclusion:** Closed reduction and internal fixation with cast stabilization can provide precise and good fracture reduction, maintains stabilization for fracture healing, results in good cosmetic outcome, cost effective and facilitates easy removal of implants after treatment.

**Keywords:** Supracondylar humeral fractures, Close reduction and internal fixation

### INTRODUCTION

Supracondylar fractures of the humerus are the most common fractures in children around the elbow. It usually occurs during a fall onto an outstretched hand and is associated with considerable morbidity, including neurovascular complications, mal-union, myositis ossificans, and compartment syndrome<sup>1-3</sup>. About 96% of supracondylar fractures are extension type and are further classified by Gartland according to the degree of displacement of the distal fragment<sup>4,5</sup>. Type I is undisplaced fracture, type II is displaced with intact posterior cortex and type III is completely displaced with no contact between the fragments<sup>6</sup>. Table-1.

It is only the Gartland type III variant<sup>6</sup> that is associated with acute complications such as brachial artery injury, nerve injury and compartment syndrome which receive immediate attention. Cubitus varus is an often neglected but nevertheless important long-term problem. Closed reduction and percutaneous pinning is the accepted primary treatment modality. But open reduction and fixation is performed if an adequate reduction cannot be obtained by closed manipulation<sup>7-10</sup>.

Closed reduction and fixation with percutaneous Kirschner (K) wire was first described by Swenson<sup>11</sup>. He pointed out the advantage as 1) stable fixation of fracture fragment, 2) decreased risk of circulatory compromise in the form of restoration of radial pulse in nearly 90% of cases of brachial artery injury and 3) a simple and cost-effective procedure. The purpose of this study was to

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assess the ability of closed reduction and percutaneous K-wire fixation, to obtain and maintain an adequate fixation, and to evaluate the recovery of elbow range of motion (ROM) and carrying angle.

### MATERIAL AND METHODS

This quasi-experimental study done in Fauji Foundation Hospital and in Railway Hospital Rawalpindi during June 2011 to August 2012, study included 24 patients (16 male and 8 female) aged 6 to 12 (mean: 8 years) having no neurovascular injury and no appreciable edema.

**Table-2: Flynn's system**

Result	Rating	Cosmetic factor loss of carrying angle in degrees	Functional factor loss in degrees
Satisfactory	Excellent	0-5	0-5
	Good	6-10	6-10
	Fair	11-15	11-15
Unsatisfactory	Poor	>15	>15

**Table-3: Quantitative variables of the patients.**

Variables	Age of patients in years (mean +sd)	Operating time in minutes	Bone union time in weeks	POP cast time in weeks	Implant removal time in weeks
No of patients	24	24	24	24	24
Mean	7.87	45.12	7.95	8.25	8.00
Standard deviation	1.91	3.04	1.33	1.45	1.25

Patients with moderate to severe edema at elbow and presenting later than one week and having neurovascular injury were excluded. Surgery was carried out only by senior specialists. These selected patients underwent closed reduction and internal fixation by K wires using image intensifier with above elbow cast immobilization.

With the patient under general anesthesia, traction was given with the elbow in extension and forearm in supination, longitudinal traction was given with an assistant applying counter traction. The fracture was thus disimpacted and then the medial or lateral displacement was corrected by applying a varus or valgus force. The angulations were corrected by flexing the

elbow with continued traction. During the entire procedure, the radial pulse was observed at

**Table-1: Gartland's classification for extension type supracondylar humerus fracture.**

Fracture type	Description
I	Non-displaced
II	Minimal to moderately displaced : partially intact posterior cortex
III	Severely displaced: no cortical contact

regular intervals, images were then taken in antero-posterior and lateral view under image intensifier and the reduction was assessed. While taking the lateral views, special attention was given to rotate the image intensifier rather than rotating the arm. The assessment of reduction was done clinically by assessing the extent of flexion and by assessing the carrying angle prior to flexion of the elbow.

If the reduction was clinicoradiologically acceptable the assistant held the elbow in the same position and the Kirschner wires (1.5-2.0 mm) were passed from the lateral epicondyle to avoid damage to the ulnar nerve. A minimum of two and a maximum of three wires were used.

The direction of the Kirschner wires were 40° from the long axis of the humerus medially and 10° posteriorly. Care was taken to see that they engaged in the far cortex, which ensured stable fixation. In selected cases the Kirschner wires were passed in varying configurations like crossed, parallel, divergent or crossed parallel. In parallel fixation the Kirschner wires were separated by a distance of at least 10 mm so that they acted as separate Kirschner wires. The fixation was again assessed radiologically and once acceptable, the Kirschner wires were cut flush with the skin and bent outside the skin. Limb was protected and kept in above elbow slab with 80-100° flexion with arm to chest strapping. An above-elbow plaster cast was applied until

**Table-4: Results of final, cosmetic and functional outcome of patients.**

Final outcome of patients	Excellent	Good	Fair	Total
Cosmetic outcome of patients	15	6	3	24
Functional outcome of patients	16	5	3	24

sufficient bone healing ensued.

The patients were followed up every 2 weeks for the first 2 months and then monthly thereafter for 06 months. At the final follow-up, clinical outcomes were graded according to the system described by Flynn's et al table-2 to evaluate the final cosmetic and functional results. Data was collected on proforma and analyzed on SPSS version 16. Mean and standard deviation were calculated for quantitative variables (table-3). Frequencies were calculated for qualitative variables.

## RESULTS

After a mean follow-up of 24 weeks (range: 12-30), results were excellent in 16 patients, good in 5, and fair in 3. None was poor. There were 87.5% good to excellent and 12.5% were fair. The

mean operating time was 45 minutes. The mean time to bone union was 8 weeks (range, 6-10). The mean time in the cast was 8 weeks (range, 5-11). The mean time to implant removal was 8 weeks (range: 6-10).

Complications were evaluated in particular. All patients regained a full range of elbow movement. There was no intra-operative complication e.g: neurovascular injury, refracture, non-union, delayed union or deep infection. Four patients had pain owing to wire protrusion. Two patients had a superficial infection, which resolved after oral antibiotics and dressings.

Results of final, cosmetic and functional clinical outcome of patients are shown in table-4.

## DISCUSSION

A supracondylar fracture of the humerus is the most common fracture of the elbow in children. Unfortunately, it can also be one of the most difficult fractures to treat. While some authors have relied on a child's remodelling capability to compensate for inadequate reduction, most authors agree that accurate reduction with minimum joint and soft-tissue trauma is required to achieve the best possible functional result<sup>10,12,13</sup>.

It can be difficult to obtain and maintain reduction in supracondylar fractures of the humerus with severe displacement in children. Although some investigators have reported a satisfactory outcome with closed reduction and casting,<sup>6,14,15</sup> the fracture may still be unstable, and excessive elbow flexion may cause a Volkmann's ischaemic contracture<sup>14-16</sup>. In the past, treatment with closed reduction or traction has been recommended,<sup>2,14,17-18</sup> but complications such as joint stiffness, long hospital stays and cubitus varus deformities have been reported<sup>20-22</sup>. At present closed reduction and K-wire fixation<sup>10,13,23-25</sup> is widely used. However, in patients with severe oedema and those who are in danger of developing a compartment syndrome, closed reduction can be difficult, and

open reduction using a minimal incision has been suggested<sup>26,27</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<sup>28</sup>. Some investigators believed that varus deformity is due to epiphyseal growth disturbance or rotation of the distal fragment<sup>29</sup>. 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>30</sup>. This concept has become popular in understanding the sequel of alteration in carrying angle<sup>31</sup>.

Open reduction and internal fixation has its own demerits like more soft tissue trauma, increase the surgery time, increase the hospital stay and increase the elbow stiffness post operatively<sup>32</sup>.

Closed reduction and percutaneous pinning is the solution. It gives skeletal stability with no loss of reduction and with minimal soft tissue damage. Its demerits are radiation exposure (cannot be performed without image intensifier), pin tract infection, ulnar nerve damage and sometimes secondary procedure for K-wire removal<sup>4,32</sup>.

The results of our study were comparable to both local and international studies. In our study the excellent and good results were 87.5% comparable to Zions<sup>33</sup>, Swenson<sup>34</sup>, Boggione<sup>35</sup> et al, Jong Sup<sup>36</sup> et al.

Overall patient satisfaction with regards to functional and cosmetic outcome was excellent.

## CONCLUSION

Closed reduction and percutaneous K-wire pinning in the management of supracondylar fractures of the humerus in children is safe as regards avoidance of vascular complications, effective in obtaining good results, and relatively economical regarding hospitalization. It gives excellent stabilization of the fracture site.

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