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Original Research Paper

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# FUNCTIONAL OUTCOME OF CLOSED DISPLACED SUPRACONDYLAR FRACTURE OF HUMERUS IN CHILDREN TREATED WITH CLOSED REDUCTION AND PERCUTANEOUS PINNING – A PROSPECTIVE OBSERVATIONAL STUDY

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**ABSTRACT** **Background:** Supracondylar humeral fractures are the most common fractures around elbow in children. The incidence is equal in both sexes with left or non-dominant side being most frequently injured. 96 to 98% are extension type and the flexion type is far less common. Displaced supracondylar fractures are notorious for difficulty in reduction, maintenance of reduction and frequent involvement of neurovascular structures. **Material and methods:** A prospective observational study was conducted on sixty children with closed displaced supracondylar fracture of humerus treated with closed reduction and k wire fixation, between May 2016 and June 2018. Children aged between 3 and 15 years, radiological finding confirming displaced supracondylar fracture of humerus were included in this study. Children with less than 3 years of age, physeal injury or intraarticular extension, open fractures, polytrauma of the same limb, previous fracture of the same elbow, fracture requiring open reduction and inability to give written informed consent were excluded in this study. All patients underwent closed reduction and percutaneous pinning within 24 hours of admission. The functional outcome was measured by the range of motion and carrying angle by using Flynn et al criteria. **Results:** Of 60 patients, 73.3% had excellent results, 18.3% had good, 5% had fair and 3.3% patients had poor results. **Conclusion:** Closed reduction and percutaneous pinning under C arm guidance is a simple and effective method of treatment of displaced supracondylar fractures of humerus in children with relatively fewer short term complications.

**KEYWORDS :** supracondylar fracture, elbow fracture in children, percutaneous pinning

## INTRODUCTION

Supracondylar humeral fractures are the most common fractures around elbow in children[1]. The peak age of this fracture in children is between 5 to 6 years [2]. The incidence is equal in both sexes with left or non-dominant side being most frequently injured [3,4]. 96 to 98%[5] are extension type and are usually caused by a fall onto the outstretched hand with elbow in full extension. The flexion type is far less common and results from a fall onto the point of the olecranon with flexed elbow. Displaced supracondylar fractures are notorious for difficulty in reduction, maintenance of reduction and frequent involvement of neurovascular structures. Various modalities of treatment have been advocated for these fractures which include closed reduction and posterior slab support, closed reduction and cast application, closed reduction and percutaneous pining under fluoroscopic guidance and open reduction and k wire fixation.

### Pre-operative evaluations:

A thorough history, clinical examination, radiographic assessment of the elbow both antero-posterior and lateral views were taken preoperatively. All patients were temporarily put on above elbow slab and the fractures were classified based on the displacement of the distal fragment. All patients underwent closed reduction and percutaneous pinning within 24 hours of admission after receiving the written informed consent, and getting anaesthesia clearance.

### Operative procedure

All patients were positioned in supine after giving either GA or brachial block. Under all aseptic precautions, closed manipulative reduction under C- arm done. First, traction was applied with the elbow in extension and supination. "Milking maneuver" was performed for patients with puckering sign. Under C arm guidance, varus and valgus angular alignment on antero posterior view was corrected by direct movement of the distal fragment. The elbow was then slowly flexed while applying anterior pressure to the olecranon with the thumb. After confirming the reduction, elbow kept flexed over folded sheet and lateral condyle was palpated. The lateral pin was inserted first, just lateral to the olecranon through the capitellum aiming at about 45° toward the medial metaphyseal cortex. For medial pin placement, the ulnar nerve was palpated with thumb and pushed posteriorly. Then elbow was extended and pin inserted anterior to thumb aiming at about 45° toward the lateral metaphyseal cortex.

**Figure 1: Intra-operative picture of inserting k wire**

The pins were bent close to the skin and cut distal to the bend, sometimes pins were buried under the skin. The medial epicondyle and nerve were inspected and confirmed that there was no injury, impingement, or kinking of the nerve throughout flexion–extension arc of motion. Dressing done with gauze piece over and under the pins. Above elbow slab applied with elbow in less than $90^0$ of flexion.

### Post-operative evaluations

All patients were received appropriate antibiotics and analgesics . On second day all patients were discharged with oral antibiotics for five days, if swelling is settled.

At each follow the functional outcome was measured by the range of motion and carrying angle. The grading of the results was assessed using the criteria by Flynn et al, which was used to compare the motion and carrying angle of the affected and unaffected elbow.

**TABLE 1: FOLLOW-UP SCHEDULE AND ASSESSMENT**

| FOLLOW-UP | ASSESSMENT | |
|---|---|---|
| 1st week | check X-ray for assessing maintenance of reduction and neurovascular status | |
| 3rd week | 1)Check X-ray after removal of plaster for assessing union. 2)Assessing for pin loosening, pin tract infection and k wire irritation | Mobilization if satisfactory union presents |
| 5 to 6 weeks | K wire removal and check X-ray | Active elbow movements after 1 week of k wire removal |
| 9th week, 12th week and at 6 months | check X-ray | |

**TABLE 2: FLYNN CRITERIA**

| RESULTS | RATING | COSMETIC FACTOR: LOSS OF CARRYING LOSS OF CARRYING ANGLE (DEGREES) | FUNCTIONAL 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 |

### Statistical method

The information collected regarding all the selected cases were recorded in a Master Chart. The collected data was analysed with **"IBM.SPSS statistics software 23.0 Version"**. To describe the data, descriptive statistics, frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. To find the significance in categorical data, Chi-Square test was used. In the above statistical tool, the probability value .05 is considered as significant level.

### Ethical concerns

The study conformed to the guidelines of Declaration of Helsinki 1964 (revised in 1975). Study protocol was subjected to the Institutional Ethics Committee clearance obtained. Patients right to opt out of the study without prior notice was explained and written consent was obtained from the patient, and first degree relatives for his/her inclusion in the study. Only necessary investigations that form part of the evaluation were done. No undue financial burden was given to the patient as a part of study.

## RESULTS

The final results were evaluated according to the Flynn criteria based on the cosmetic factor (loss of carrying angle) and functional factor (loss of motion). Two patients (3.3 %) had a comparable varus deformity at final follow up. Of 60 patients, 44 (73.3%) had excellent results, 11 (18.3%) had good, 3 (5%) had fair and 2 (3.3%) patients had poor results.

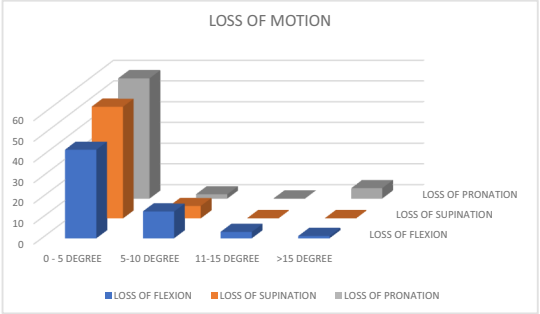


**FIGURE 2: LOSS OF MOTION**

## DISCUSSION

Supracondylar fracture of humerus is one of the commonly encountered fractures in children. The treatment goal for supracondylar humerus fracture is to avoid neurologic and vascular complications and to prevent long term angular and extension deformities.

In this study, the incidence of fracture was more in boys 44 (73.3%) than girls 16 (26.7%) which was similar to the study conducted by Cheng JC et al[2].

In this study, 43 (71.6%) patients had left sided involvement and 17 (28.3%) had right sided involvement. The most common mechanism was fall while playing (81.7%) followed by fall from bicycle 6 (10%). These results were similar to the study done by Kumar Prashant et al[6] where involvement of the left side was 77.4 % and the right side was 22.6 % and the commonest cause of injury was fall while playing (64.51 %), followed by fall from tree (27.41 %) and fall from bicycle (8.06 %).

In this study, based on Gartland's classification, 44 (73.3%) patients had type III injury and 16 (26.7%) had type II injury which correlates to the study done by Anmol Sharma et al[7]

In this study, 54 patients (90%) underwent crossed pinning, while 6 patients(10%) underwent lateral pinning. In patients with crossed pinning technique, we achieved 40 (74.1%) excellent, 10 (18.5%) good, 3 (5.6%) fair and 1 (1.9%) poor results. Thus 53 (98.2%) had satisfactory results and 1 (1.9%) had unsatisfactory results according to criteria described by Flynn et al, which were similar to the studies conducted by Basant Kumar Bhuyan[8] and Irena Krusche-Mandl et al[9] . 6 (100%) patients had satisfactory results with lateral pinning technique. Pin fixation from lateral side has the advantage of avoiding ulnar nerve injury but this construct has been thought to be biomechanically less stable.

In this study, 56 (93.3%) patients had limitation of flexion between 0-10°, 3 (5%) patients had limitation of flexion between 11-15° and 1(1.7%) patient had >15° limitation of flexion.

52 patients (86.7%) had change in carrying angle less than 5°, 7 patients (11.7%) had change between 6-10°, 1 patient(1.7%) had change >10°. The average carrying angle was 9.3°.

In this study, two patients (3.3 %) had a comparable varus deformity at final follow up. The study conducted by Lee et al[10] and Wael et al[11] also observed cubitus varus as 6% and 8.6% respectively.

Concerning vascular complications in this study, three (5%) patients had absent radial pulse at the time of presentation which was immediately palpable following closed reduction and pinning. All patients were handled as emergencies and because of the prompt treatment, long-term vascular complications were avoided.

With respect to neurologic complications in this study, 9 (15%) patients had injury related neurological complications. 2 (3.3%) had median nerve injury, 3 (5%) had primary median nerve injury with pink pulseless hand, 1 (1.7%) had primary radial nerve injury and 2 (3.3%) patients had ulnar nerve injury. Expectant therapy was provided and all neurologic injuries resolved with complete recovery. Iatrogenic ulnar nerve injury was reported in one patient (1.7%) after crossed pinning but the injury resolved after 14 weeks with complete recovery. This study correlates with the study done by Irena Krusche-Mandl et al[9] where 5 (6.4%) patients had median nerve injury, 2 (2.6%) had radial nerve injury and 1 (1.3%) patient had ulnar nerve injury.

We did not find any case of late complications like compartment syndrome, myositis ossificans and non union in this study.

## LIMITATIONS OF THE STUDY

The main drawback of this study is short duration of follow up. Thus, the results of this study reflect only the early outcome and may vary slightly from the results of other studies with a long follow up.

## CONCLUSION

Closed reduction and percutaneous pinning under C arm guidance is a simple and effective method of treatment of displaced supracondylar fractures of humerus in children with relatively fewer short term complications.

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