

Treatment of Displaced Supracondylar Fracture of Humerus in Children with Percutaneous Pinning in Misurata Central Hospital

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Abstract

Background: Supracondylar fracture of humerus is the most common fracture in the first decade of life. There are various treatment modalities for this fracture; closed reduction and casting adhesive skin traction as described by Dunlop, overhead skeletal traction from the olecranon, closed reduction and percutaneous pin fixation, and lastly open reduction and internal fixation.

Aim: To evaluate the outcome of closed percutaneous pinning of displaced Supracondylar fracture of humerus in children.

Material and Methods: A retrospective study conducted at Orthopaedic surgery department of Misurata central hospital. The Records of 43 children with displaced supracondylar fractures of the humerus (Gartland type II & III) admitted from April 2004 through April 2006 were reviewed. Outcome measures were based on Flynn criteria, namely loss of elbow motion & carrying angle.

Results: The mean age of the 43 patients was 7 years (ranging between 2-12 years). The mean follow-up period was 9 months (ranging between 3 - 18 months). 70 % of the fractures occurred in boys and 30% in girls. The involved side was right elbow in 32 cases (75%) and left in 11 cases (25%). 40 cases (95%) had extension type & 3 cases (5%) had flexion type of fracture. Gartland type II cases were 13 (30%) & type III cases were 30(70%). Our results showed excellent outcome in 28 patients (65%) ,good outcome in 9 patients (21%) and poor outcome in 6 patients (14%).

Conclusion: percutaneous pinning of supracondylar fracture of humerus in children is safe, cost-effective, and time-saving and provides greater skeletal stability with excellent results.

Keywords: Percutaneous pinning, Supracondylar fracture, Humerus, Children.

1. Introduction

Supracondylar fracture of the humerus is the commonest elbow injury and accounts for 60% of elbow injuries in children [1]. It is caused by a fall on the outstretched hand with the elbow slightly flexed and the forearm pronated, the distal fragment is usually displaced upwards and posteriorly (extension type). A fall on the tip of the flexed elbow produces the less common type in which the distal fragment is displaced forward and usually upward (flexion type) [2]. Various methods of treatment were advocated for this fracture.

The main objectives of treatment of displaced supracondylar fracture in children are to maintain an anatomical reduction, restoring joint function and prevention of complications. Ideally, this should be achieved by one definitive procedure. In the orthopedic literature it is reported that the best result is achieved by closed reduction and K-wire fixation [4, 5, 6]

Reduction and percutaneous pinning of these troublesome fractures provide a safe and reliable technique for obtaining and maintaining an excellent reduction, stability, vascular safety, simplified management, less hospital stay and consistently satisfactory appearance and function of the elbow. One of the key advantages of percutaneous pin fixation is that the surgeon can assess the carrying angle by direct examination of the extended elbow at the time of reduction [7]. Open reduction and internal fixation can reduce the fracture anatomically but chances of loss of elbow motion are high [8].

2. Material and Methods

43 cases of closed displaced supracondylar fractures of the humerus in children treated with closed reduction and percutaneous pinning in Misurata central hospital from April 2008 through April 2010. The inclusion criteria were children with closed and displaced supracondylar fracture of humerus, presented within 5 days after fracture. The exclusion criteria were compound fractures and fractures with neurovascular compromise.

Age ranged from 2 to 12 years (mean 7 years, with majority of patients being aged between 6 to 8 years). Boys were 30 (70%) and girls were 13 (30%); male to female ratio was 2.3 : 1. [Figure 1]

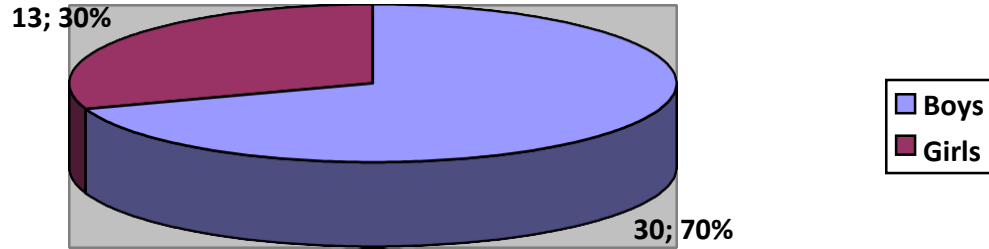


Figure 1 Distribution of injuries between genders

Right elbow was involved in 32 patients (75%), left elbow in 11 patients (25%); right elbow to left elbow ratio was 3 : 1. [Figure 2]

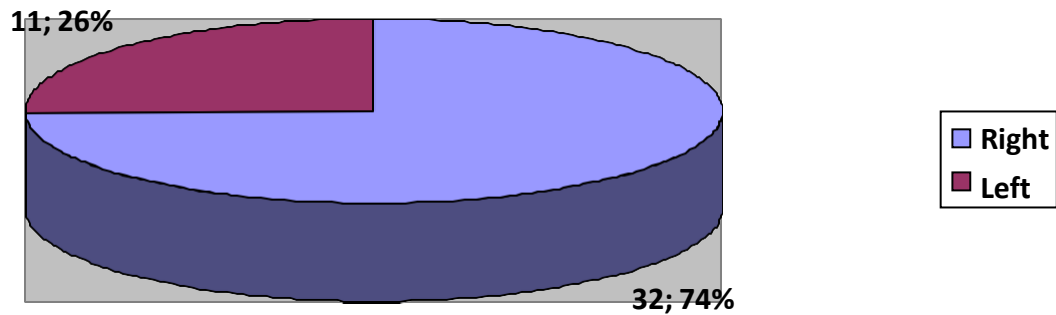


Figure 2 Distribution of injuries between Right& Left elbow

The type of trauma was commonly falling on the ground during jumping, sporting and cycling.

40 patients (96%) presented with extension type while 3 patients (4%) presented with flexion type. [Figure 3].

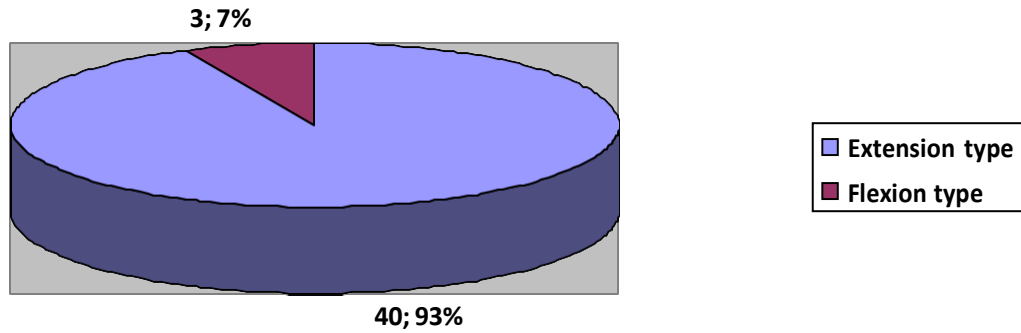


Figure 3 Distribution of injuries between Extension& Flexion types

30 patients (70%) had Gartland type III fracture, 13 patients (30%) had Gartland type II fractures.

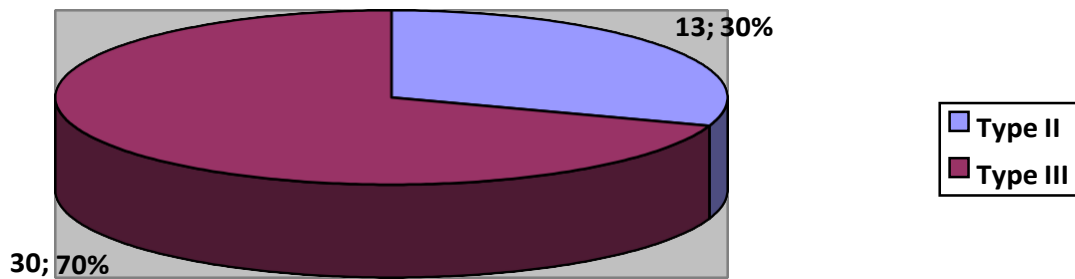


Figure 4 Distribution of injuries according to Gartland classification

Table 1. Gartland classification of supracondylar fracture of humerus in children

TYPE I	UNDISPLACED
TYPE II	DISPLACED WITH THE POSTERIOR CORTEX INTACT
TYPE III	NO CORTICAL CONTACT A – EXTENSION TYPE B – FLEXION TYPE

Most cases(36 patients) presented early within 24 hours, but few cases (7 patients) came late after trauma, within a period of 2 – 5 days.

Careful clinical examination was done to assess the neurovascular state, skin condition and associated fractures. Radiological assessment of both AP and lateral views of the elbow were performed, for detection of the type of fracture and degree of displacement.

3. Operative Technique

Under general anesthesia, and using C-arm monitor closed reduction is performed by applying longitudinal traction, with traction maintained, any medial or lateral displacement was corrected by gentle pressure on the distal fragment. The posterior displacement of the distal fragment is then corrected by applying a force to its posterior aspect while the elbow was gently flexed to approximately 120°, the forearm is pronated for the medially displaced fracture and supinated for the laterally displaced fracture to stabilize the distal fragment, then checking the position by the image intensifier both anteroposterior and lateral views, the fracture is secured by smooth Kirschner wires (1.6 mm in diameter) placed percutaneously. The pins should enter the origin of the collateral ligaments on the epicondyles, the lateral pin was started at the center of the lateral condyle and directed upwards and medially 35-40 degrees to the sagittal plane of the humerus and 10 degrees posterior to the coronal plane while the medial pin was directed upward and laterally 35-40 degrees to the sagittal plane of the humerus and 10 degrees anterior to the coronal plane [8].

Ulnar nerve is protected by milking with thumb posteriorly. In case of swelling a small incision was made through the skin over the medial epicondyle and then medial pin was

inserted, each pin engage the opposite cortex of the proximal fragment. After fracture fixation, clinical and radiological evaluation should be carried out. Stability was assessed by extension of the elbow. With the elbow extended the carrying angle is measured.

If the radiographic appearance, carrying angle, or pin placement is unacceptable, the pins are removed and the reduction and pin fixation was repeated. Once a satisfactory reduction was achieved the pins are bent to prevent migration and cut off outside the skin to allow removal as an outpatient procedure. The elbow is will padded and posterior plaster splint is applied in a position of 90 degree elbow flexion which is the most comfortable for the patient.

4. Follow up

Observation of the distal circulation during the first 24 - 48 hours post operatively was done inside the hospital.

Initially after discharge the follow up was at two weeks interval for one month and then at one monthly interval .The average period of immobilization was three week after which the Kirschner wires and the splint were removed in the outpatient clinic and the patient were left on their own for spontaneous activity and exercise within the range of pain tolerance until full extension and flexion of the elbow are achieved at the end of the follow up period, [9]. The follow up period ranged from 3 to 18 months, with an average of 9 months. In follow up, patients were assessed using Flynn criteria [10] (table-1). During follow up visits, assessment of carrying angle and range of motion of elbow was done clinically which is sufficient to assess outcome of procedure adopted [11]. The limitation of our study was that the follow up for some patient was for only less than six months duration {5 cases (2%)}, because in our city Misurata the patients were not feasible to come for follow up for longer period. Although cubitus virus may take one year to develop but we can have some idea about the development of cubitus virus within six months or less, like in other studies.[12]

Table 2 Flynn criteria for grading results

RESULTS	Rating	Cosmetic factor-loss of carrying angle(degree)	Functional factors-loss of motion(degree)
Satisfactory	Excellent	0 -5	0 – 5
	Good	6 - 10	6 – 10
	Fair	11 – 15	11 - 15
Unsatisfactory	Poor	> 15	> 15

5. Results

Clinical assessment of the results was done taking in consideration two main items, change in the carrying angle and in the joint range of motion. Results obtained were classified as satisfactory or unsatisfactory according to the criteria described by Flynn (table 2). The overall rating of the patients was done on the basis of clinical losses both in the carrying angle and in function (joint range of motion).

According to Flynn criteria, 26 patients (62%) were found to have excellent outcome (i.e. both loss motion and loss of carrying angle = 0-5 degree), 9 patients (20%) turned out with good outcome ((i.e. ,both loss of elbow motion and loss of carrying angle = 6 – 10 degree), 2 patients (4.4%) turned out with fair outcome (i.e., both loss of elbow motion and loss of carrying angle= 11 – 15 degree),6 patients (13.6%) turned out with poor outcome (i.e., either loss of elbow motion or loss of carrying angle = >15 degree). So the satisfactory results in our study were in 37 patients (86%).(table 3). [Figure 5].

Table 3 Results: (According to Flynn criteria)

RESULTS		Number of patients	Percentage
Satisfactory	Excellent	26	62%
	Good	9	20%
	Fair	2	4.4%
Unsatisfactory	Poor	6	13.6%
Total		43	100%

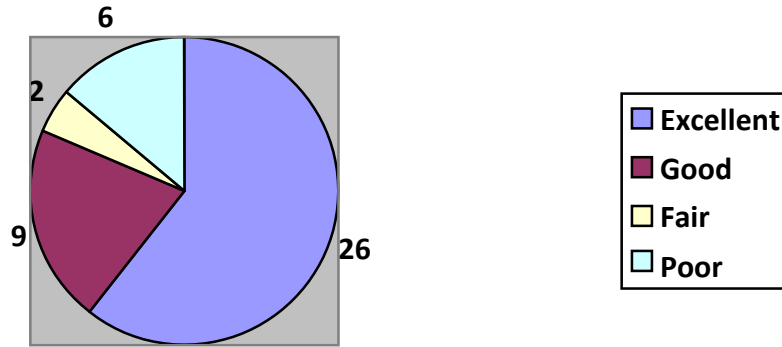


Figure 5 Distribution of results according to Flynn criteria

In the follow up, 4 patients (10%) got cubitus varus, 2 patients (5%) elbow stiffness, 4 patients (10%) pin tract infection, and 2 patients (5%) transient ulnar nerve palsy. Vascular compromise was not reported. [Figure 6]

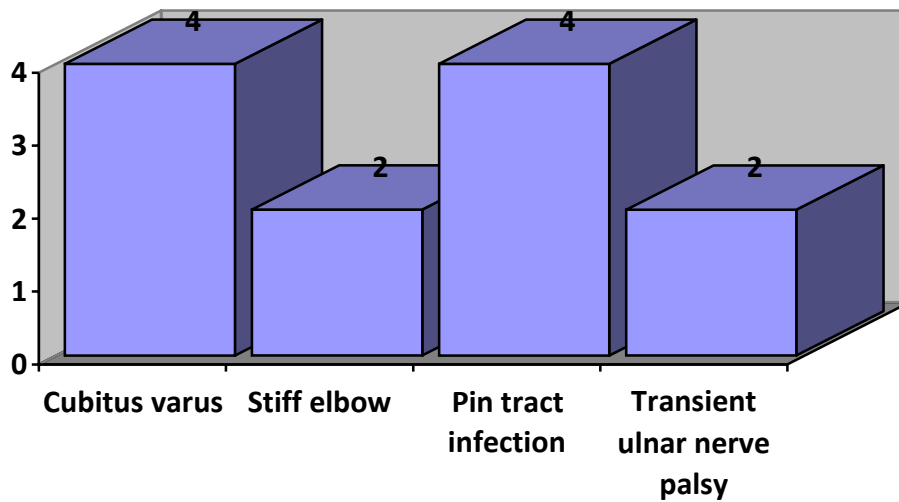


Figure 6 Complications

6. Discussion and Conclusion

Percutaneous pinning has become a standard technique for stabilizing Gartland [13] types II & III fractures, either one lateral and one medial pin or two lateral pins may be used and both should penetrate the opposite cortex. Medial and lateral pins insertion provides better stabilization [14] and assessment of carrying angle is easy with full extension while two lateral pins may not permit full elbow extension, thus preventing full assessment of carrying angle. Percutaneous pinning in unstable or irreducible supracondylar fracture is the treatment of choice with elbow in 90° flexion to reduce chances of vascular compromise[15]. Percutaneous pinning as compared to ORIF has less chances of elbow stiffness [8] and cost-effective in terms of short hospital stay with no use of suture material or prophylactic antibiotic.

As compared to cast immobilization, percutaneous pinning is safe in terms of negligible chances of compartment syndrome and loss of reduction.[16] Utilizing Flynn criteria we had excellent results in 26 patients (62%) and poor results in 6 patients (13.6%) which is compatible with the results of other studies[17] .In a study on 450 patients, the age ranged from 2 – 14 years with male predominance (66%), 16% developed pin tract infection and 18 patients (4%) developed perioperative ulnar nerve injury(which completely recovered). In this study good functional results were obtained in 66% and poor results in 34% at the end of follow up. These results are almost similar to our results. This study reveals extension type of fracture in 40 patients (96%) and flexion type in 3 patients (4%), comparable with study conducted by Cekanaska et al,[20] in which 90 cases (96.7%) were extension type and 3 cases (3.3%) were flexion type. In our study, Gartland type II cases were 13 (30%) and type III cases were 30 (70%) closely resembling the study conducted by Cekanaska et al. [18] Thus, after comparing with international studies, our results are encouraging. We can achieve up to 100% excellent results if we could have practice this procedure in every displaced supracondylar fracture of humerus under C arm monitor in children.

Closed reduction and crossed percutaneous pinning for displaced supracondylar fracture of humerus in children is safe, time and cost effective method and gives stable fixation with excellent results

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