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CLOSED VERSUS OPEN REDUCTION OF SUPRACONDYLAR FRACTURE OF HUMERUS IN CHILDREN

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ABSTRACT

Background: Supracondylar fractures of Humerus are common in children. Their treatment is controversial when displacement has occurred wither open or closed reduction. ***Objective:*** The aim of this study is to compare the results of closed reduction with percutaneous fixation with open reduction and pinning. in respect to range of movements and deformities. ***Patients and Methods:*** The study is prospective case series study carried out in orthopedic unit in Al-Jumhoori Teaching Hospital from Feb 2018 to Jan 2019**.** The total number of patients were seventy Pediatric patients. Group A 31 patients treated with closed reduction with percutaneous pinning, while group B 39 patients were treated by open reduction with pinning. Both elbows of all patients were examined for range of movements, measurement of the carrying angle with a goniometer and examination of the distal neurological status. The criteria of Flynn et al. were used and loss of movement and changes in carrying angle were recorded in 5° intervals. ***Results:*** In group A (84%) of them had good to excellent results 5 patients (16%) had fair to poor results while in group B (67%) had good to excellent results and 13(33%) had fair to poor results. ***Conclusion*:** Closed reduction with pinning is superior in the treatment of pediatric supracondylar fracture of humerus.

***KEYWORDS*:** Supracondylar fracture, Percutaneous pinning, Closed reduction, Open reduction.

INTRODUCTION

Supracondylar fractures of humerus in children are a common elbow injury accounting for 16.4% of all pediatric fractures and they are the most common elbow fractures in children.[1] One epidemiologic study of elbow fractures in children identified supracondylar fractures in 58%, and 65% of all hospitalizations for pediatric elbow injuries.[2] Although the incidence of these fractures generally has been reported to be higher in boys, more recent reports indicate that the frequencies of supracondylar humeral fractures in girls and boys seem to be equal even are common in girl.[3,4,5] These fractures may be associated with morbidity due to neurovascular complications, compartment syndrome, and malunion.

In the past, a majority of these fractures were treated with long arm casting with the elbow in a position of greater than 110° of flexion. This flexed posture helps to maintain the fracture reduction, but lead to problems with vascular compromise and subsequent Volkmann's contracture.[6,7] Displaced supracondylar fractures may show instability following closed reduction unless the elbow is immobilised in a flexion position. This may compromise circulation and be followed by the development of a varus deformity which has a reported incidence of 9% to 57%.[1,8,9] The dangers and difficulties of closed reduction, with the application of a cast, include the risk of circulatory embarrassment of the forearm and hand, the tendency to recurrence of displacement, and the increased incidence of cubitus varus deformity.[4,6]

At present time the most common used methods of treatment of these fractures are closed reduction with percutaneous wire fixation and Open reduction and wire fixation.

Closed reduction with percutaneous wire fixation has excellent results with negligible complications.[2,5,10] Open reduction and wire fixation has been advised for cases associated with neurovascular injuries and for fractures which are not satisfactorily reduced.[7,11]

Controversies about the treatment of supracondylar humeral fractures in children, however, still exist (how long after injury can operative treatment be done safely and effectively, is a crossed-pin configuration better than a lateral-entry configuration, should type II

supracondylar fractures be treated operatively or nonoperatively, and when does a pulse less hand require emergent treatment).

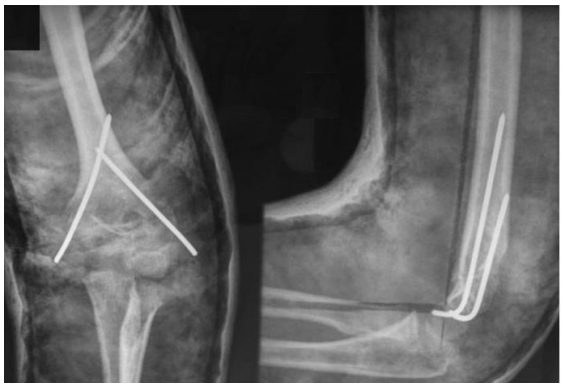

Figure 1: Reduction is held with two crossed K-wires.

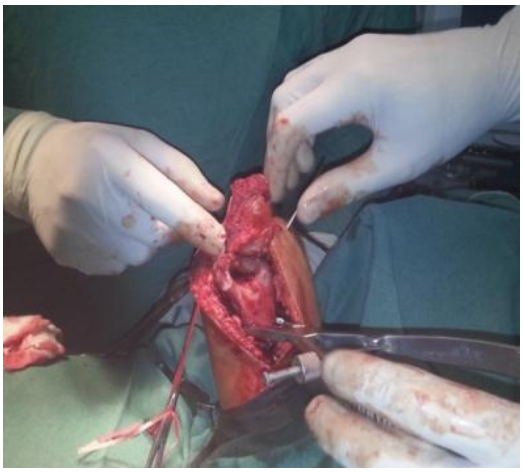

Figure-2: posterior approach in open reduction method.

PATIENTS AND METHODS

A prospective, case control study was carried out at the orthopedic surgical unit, Department of Surgery at Al-Jumhoori Teaching Hospital, Mosul, Iraq. The Study last one year, started from February 2013 to January 2014. This study is approved by the Mosul Ethical Research Committee, and Directorate of Health in Ninawa.

Seventy patients were involved in this study.Pediatric patients with Supracondylar fractures Gartland type II and III undergo closed reduction with percutaneous fixation or open reduction.

We exclude patients having Gartland type I, open fracture, flexion type supracondylar fractures and supracondylar fractures with other associated injuries.

Patients divided into 2 groups (A and B) according to method of reduction (closed or open). Group A was treated by closed method and group B was treated by open method**.**

In group A the patients were treated under GA in supine position, reduction done, checking of reduction by fluoroscopy (2-3 shots), fixation by 2 crossed K-wires and back slap of P.O.P. applied to the limp in 100 ^{o} -110^{o}.

In group B the patients were treated by open method under GA in supine position, through posterior approach reduction done under direct vision and fixation by 2 crossed wires. Closure by layers and back slap of P.O.P. applied to the limp in 100 ^{o} -110^{o}.

Post operative checking radiographs were taken and another checking radiographs after 5 to7 days. Follow up was 20 to 25 days of both groups for removal of K-wires then removal of cast after 30 days with beginning of physiotherapy and to be evaluated with clinical assessment. Both elbows of all patients were examined for range of movement, measurement of the carrying angle with a goniometer and examination of the distal neurological status.

According to the criteria of Flynn[1] (Table 2) the results were categorized to Excellent, Good, Fair and poor. Loss of movement and changes in carrying angle were recorded in 5° intervals. The minimum of two measurements were adopted as the overall rating of the affected elbow. Any child with a varus deformity was rated as poor.

Table 1: Flynn Criteria for Reduction Assessment in Supracondylar fractures.

	Cosmetic factor – loss of carying angle (degree)	Functional factor – loss of motion (degree)
Excellent	**0-5**	**0-5**
Good	6	6
Fair	11	11
Poor	>15	>15

Statistical Analysis

Chi square test was used /P value**.**

RESULTS

The results obtained with the two methods of treatment are shown in Table 2.Closed reduction with percutaneous wire fixation show higher percentage of good to excellent results (84%) than the open reduction method (67%). The circulation was good in patients after open or closed reduction with adequate wire fixation, followed by positioning the elbow in a posterior splint at less than 90° flexion.

Table 3 shows an analysis of the poor results (10%) for closed reduction method and poor results (15%) for open reduction method. Cubitus valgus of an average of 11.3° was found in 4 patients treated by open reduction method. Another 5 patients treated by open reduction method developed cubitus varus of an average of 8.4°. Four patients in this group had an average loss of 23° flexion. The five poor results after closed pinning were due to cubitus varus in 2 patients of an average of 8.5°, cubitus valgus in 1 child by 11° and 2 patients had loss of motion of an average of 20° flexion.

Sixteen (52%) out of 31 patients who undergone closed reduction were grade II and 15 (48%) were grade III type of fracture. While, 21 patients (54%) out of 39 patients who undergo open reduction were grade II and 18(46%) were grade III type of fracture. In group A31 patients (44.3% of the whole group) undergone closed reduction and pinning, 26(84%) of them had good to excellent results 5patients (16%) had fair to poor results (Figure 7) while in group B 39 (55.7%) patients undergone open reduction pinning 26(67%) had good to excellent results and 13(33%) had fair to poor results.

Table 3: Frequency distribution of study subjects according to methods of treatment.

Fracture type	Method of treatment			
	Group A(*n*=31)		Group B (*n*=39)	
	No.	%	No.	%
Grade II	18	58	11	54
Grade III	13	42	28	46
Total Number	31	100	39	100

There was significant statistical association between excellent results and closed reduction method with p value of 0.026 (Table 4). while, higher percentage of poor results were found with open method of reduction (15% out of 39 patients) and statistically was not significant.

Table 4: Frequency distribution of results of reduction with both methods of treatment.

Results	Method of treatment				P-value*
	Group A(*n*=31)		Group B(*n*=39)		
	No.	%	No.	%	
Excellent	21	68	16	41	0.026
Good	5	16	10	26	0.335
Fair	2	6	7	18	0.153
Poor	3	10	6	15	0.479

*chi square test was used

Table 5: Frequency distribution according to analysis of poor results of reduction with both methods of treatment.

Results	Method of treatment			
	Group A(*n*=31)		Group B (*n*=39)	
	No.	%	No.	%
Loss of motion	1	33	2	33
Cubitus varus	2	67	3	50
Cubitus vulgus	1	33	3	50

DISCUSSION

The main objectives of treatment of displaced supracodylar fracture in children are the avoidance of deformities, the prevention of Volkmann's contracture, and restoration of normal function in the least invasive technique and least time and resources consuming measures. In this study the best results were achieved by closed reduction and wire fixation as judged by the high incidence of excellent results and the low incidence of poor results; similar observations have been made by Pirone AM, *etal*.[1,7]

In our study the results of good to excellent outcome in closed reduction were significantly higher than open reduction while, they were insignificant in J.B. Yaokreh et al. In this study: the results of closed reduction had high percentage of good to excellent outcomes(87%) in supracondylar fractures of the humerus Gartland Type II and III. An evidence-based guideline and evidence report of the American Academy of Orthopedic Surgeons in the treatment of supracondylar fractures of the humerus, they suggest closed reduction with pin fixation for patients with displaced (Gartland Type II and III, and displaced flexion) pediatric supracondylar fractures of the humerus in a moderate strength of recommendation.[12] Patients with poor results after open reduction and wire fixation is believed to be due to the high proportion of severely displaced grade III fractures in this group, and to the delay in the reduction treatment

secondarily to the late consultation to hospital for up to 10 days.

The best method of treatment is early closed reduction and percutaneous wire fixation. Open reduction and wire fixation should be reserved for cases with signs of Volkmann's ischaemia, primary vascular or neural disruption, open fractures, and fractures with severe swelling not allowing acceptable reduction.[13]

In our study the percentage of good to excellent results was 67% and the percentage results of fair to poor outcome was 33%. In a study by Shakir Hussain, Malik Faiz Ahmad, Khalid, Waqas[14] of displaced supracondylar fractures of humerus of 50 children treated with open reduction and cross k-wire fixation, In comparison between the two studies we can see that the results are in favor of closed method.

In a study by Lewine E, *etal*[15] it show Postoperative loss of reduction and malunion were more common in the closed fracture group. However, 84% of patients achieved good-to-excellent results by Flynn criteria, with no appreciable difference based upon open versus closed fractures. While in our study Closed reduction and percutaneous fixation was superior with excellent and good results in 84% and had the lowest incidence of Fair to poor results (8%).

CONCLUSION

Closed reduction with pinning is superior in the treatment of pediatric supracondylar fracture of humerus.

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