Posterior versus lateral surgical approach in reduction of humerus supracondylar fracture in children: a prospective study to compare related complications.

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Abstract

Background: Severely displaced fractures demand great effort and a challenge.
Objective: To compares between postoperative complications related to posterior and lateral surgical approaches in reduction of humerus supracondylar fracture in children.
Patients and Methods: A prospective study conducted at four public and private hospitals in Erbil city between 1st October 2008 and 30th June, 2009. A total of 35 child with a mean age of 7.8 year, suffering from extension supracondylar fracture of humerus (type II or III) were enrolled in the study and followed up for five months. Regardless of type of fracture, 21 cases were treated by posterior surgical approach and 14 cases by lateral surgical approach.
Results: Of the patients treated by posterior approach, one patient (2.9%) developed infection at the site of the pin in the early post-operative period, and seven (20%) developed stiffness 10-20° of elbow with either loss of extension or of flexion. While those treated by lateral approach, only two patients (5.7%) developed cubitus varus 5-10°. Overall, significant difference (P = 0.022) between related complications of the two surgical approaches are observed, were lateral approach shows a lower related complication than posterior approach (14.3% and 38.1% respectively).
Conclusion: Surgical treatment of extension supracondylar fracture of humerus (type II or III) by lateral pinning approach has less related complications than posterior approach.
Key words: Supracondylar Fractures, Open Reduction, Posterior Versus Lateral Approach, Children.
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Introduction

Sixty percent of elbow injuries of children are supracondylar fractures [1][2]. These children fractures represent 15% of all children fractures [1][3]. They affect mostly the non-dominant arm [4]. Boys mainly at age 5-7 years are more commonly affected by this type of fracture than girls [3][5]. They are classified into flexion and extension fractures. Extension fractures being the predominant type of supracondylar fractures [3][6].

According to standard Gartland classification, these fractures are classified into three types: type I, type II, and type III. The fractured part is not displaced in type I, while in type II the fractured part is displaced with intact posterior context, and in type III it is completely displaced [7]. Depending on the type of supracondylar fracture, different

neurovascular bundle injuries are associated. The radial and median nerve and brachial artery are at higher risk of being injured in extension type of fracture, while in flexion type the ulnar nerve being at higher risk [8].

Displaced supracondylar fractures of humerus demand great effort and a challenge to treat as they require accurate anatomical reduction and internal fixation to prevent complications. This study was carried out to compare the posterior and lateral techniques of surgical open reduction and fixation of humerus supracondylar fracture (either by two cross medial and lateral pins or by two or three lateral pins) and comparing their related complications.

Materials and Methods

This is a prospective study conducted at four public and private hospitals in Erbil city including Erbil teaching hospital, Hawler Private Hospital, Shifaa Private Hospital, and Zheen Private Hospital between 1st October 2008 and 30th June, 2009.

Thirty five children with a mean age of 7.8 years (ranging from 1.3 years to 13 years) were enrolled in the study and followed up for five months. Of these 35cases, 27(77%) were males, and 20(57%) were left side fractures. Only two cases (5.7%) have had nerve injury at the time of accident, one was median nerve injury and the other one was ulnar nerve injury.

All cases were treated by open reduction,14 through lateral approach and fixation by two Kirschner wires (k-wires) laterally, and 21 through posterior approach and fixation by two k-wires, one lateral and the other one medial, regardless of type of fracture. Three fractures (8.6 %) have resulted from road traffic accidents (RTAs) and 91.4 % from falling from height (FFH). Twelve (34.3%) cases were type II and 23 (65.7%) were type III supracondylar fractures. Of type II fractures 7 cases were treated through posterior approach and 5 cases through lateral approach, while of type III fractures 14 cases were treated through posterior approach and 9 cases through lateral approach (Table 1).

Table (1): Description of fractures and type of operation.

Variables	No. (%)	Type of fracture	
		Type II No.	Type III No.
Type of fracture			
Type II	12 (34.3)		
Type III	23 (65.7)		
Cause of fracture			
RTA	3 (8.6)		
FFH	32 (91.4)		
Type of operation			
Open reduction through posterior approach	21 (60.0)	7	14
Open reduction through lateral approach	14 (40.0)	5	9
Total	35 (100.0)	12	23

Inclusion and exclusion criteria: Patients suffering from extension supracondylar fracture of humerus (type II or III) under the age of 15 years of both sexes were included in the study. Cases with open or compound supracondylar fractures, comminuted fractures or intra-articular fractures, those treated by POP immobilization, and those

associated with vascular injury were excluded from the study.

Following admission of the child to the hospital first aid and resuscitation were done. Distal pulsation was checked and neurological examination done and recorded. Depending on the role of anterior periosteum in affecting adequate reduction, and site of displacement of distal fragment (Posteromedial or posterolateral), we decide which surgical approach is proper for an open reduction.

Under general anesthesia (GA), surgical reduction by either posterior or lateral approach with internal fixation by K-wire were performed according to the surgical procedure described by Hoppenfeld *et al*[9].

In posterior approach, a longitudinal incision was made 5 cm above the olecranon process, which curved laterally just above the tip of the process to runs on its lateral side, then curved medially to overlie the middle of the subcutaneous surface of the ulna. The deep fascia was incised in the midline. The ulnar nerve was palpated and the fascia overlying was incised to expose it. By distal retraction of the triceps muscle on a stay suture, the fracture was visualized, reduction achieved and fixation done by two crossed k-wires one placed medially and the other one laterally on the medial and lateral epicondyles, respectively. Finally above elbow POP back slab placed on 90° flexed elbow with pronated forearm.

In lateral approach, elbow exposed through Kocher lateral J approach. Separation of the extensor muscle mass will expose the posterior and anterior surfaces of the joint. Two smooth K-wires were inserted across the soft tissue into the medial portion of the metaphysis. Before closing wound, reduction and position of the internal fixation most be checked by radiographs. Then a posterior plaster splint with 90° flexed elbow was placed.

Postoperatively, all the patients remained at hospital for two days; at that time, the drain was removed and the patient discharged to be seen after 10 -12 days for stitch removal. The back slab retained to another 1-2 weeks, and k-wire removal was done 4-6 weeks from the 1st postoperative day as an out-patient without GA. Physiotherapy started after 4 weeks by gradually increasing active movement of affected elbow and follow-up of the patient up to 9-30 weeks. During this period the patient was followed up by clinical examination of elbow in addition to radiological evaluation.

The study was approved by the research ethics committee of the College of Medicine of Hawler Medical University, and a written informed consent was obtained from the mother or father of the child, before being enrolled in the study.

Statistical analysis

Data was analyzed using SPSS, version 20 by calculating Fisher's exact test. P value $\leq$ 0.05 was considered statistically significant.

Result

Out of the total patients operated on by posterior approach, one patient (2.9%) developed infection at the site of the pin in the early post-operative period, and seven (20%) developed stiffness 10-20° of elbow with either loss of extension or of flexion. While those operated on by lateral approach, only two patients (5.7%) developed cubitus varus 5-10°. Overall, significant difference (P = 0.022) between related complications of the two surgical approaches are observed, were lateral approach shows a lower related complication than posterior approach (14.3% and 38.1% respectively). Details are shown in Table 2.

Table (2): Post operative complications by type of operation approach.

Type of approach	No. of cases	Total post-operative complications	Type of post-operative complication		
			Infection	Stiffness 10-20°	Cubitus varus 5-10°
		No. (%)	No. (%)	No. (%)	No. (%)
Posterior approach	21	8 (38.1)	1 (4.8)	7 (33.3)	0 (0.0)
Lateral approach	14	2 (14.3)	0 (0.0)	0 (0.0)	2 (14.3)
Total	35	10 (28.6)	1 (2.9)	7 (20.0)	2 (5.7)
P value:			0.022		

Discussion

In this study all supracondylar fractures of humerus were of extension type. Other studies showed that extension type fractures constitute about 98% while flexion type about 2% [10]. Such fractures are frequently occur in males, and more frequently affected the left side (non-dominant side) than the right side [11]. This is similarly revealed in our study where 77% of fractures affected males and left side are affected in 57% of cases. The most frequent cause of supracondylar fracture of humerus in this study was fall from height which accounts for more than 90% of cases. This finding is in agreement with that of Farnsworth *et al* [12]. The incidence of nerve injury is nearly 6% in our study which is slightly lower than that reported by Cramer *et al*[13]. (7.7%), most commonly involving the median nerve.

In early postoperative period only one patient (2.9%) developed infection at the site of pin. Similarly, other studies reported the occurrence of infection with open reduction of fractures, the incidence of infection was 2.5% [14]. Regarding late postoperative complications in our study, overall complications developed in nine cases out of the 35 (25.7%). Stiffness of elbow with either loss of extension or loss of flexion occurred in 33% of the posterior approach only while the only late complication that occurred in the lateral approach was cubitus varus, accounting for around 14%.

All studies reported good results using open reduction and internal fixation of type II and III supracondylar fractures that could not be reduced by closed method. Therefore, open reduction has been increasingly accepted as it is associated with relatively few complications even in the most severe fractures [15]. Although different complications are rarely associated with surgical reduction [16]. Stiffness remain the most common complication of surgical reduction mainly the posterior approach, while in lateral approach there is minimal dissection of soft tissue, so there is low risk of elbow stiffness [17][18].

Conclusion

In conclusion surgical treatment of extension supracondylar fracture of humerus (type II or III) by lateral pinning approach has less related complications than posterior approach.

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