

PERCUTANEOUS CROSSED PIN FIXATION OF SUPRACONDYLAR HUMERAL FRACTURE IN CHILDREN

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ABSTRACT

Objective: Supracondylar humerus fracture is the most common fracture about the elbow in children. Percutaneous crossed pin fixation of supracondylar humeral fracture is the most safe and effective method of maintaining skeletal stability in children.

Material and Methods: Seventy-one patients were treated for Type III (Gartland) supracondylar humerus fracture at Orthopedic Department Hayatabad Medical Complex Post Graduate Medical Institute from January 1999 to December 2001 with follow-up of one year. All fractures were closed fractures.

Results: There were 47 boys (66.2%) and 24 girls (33.8%). The age range was 2 years-12 years. The mean age at the start of treatment was 5.4 years. The side of involvement was left in 49 patients (69.1%) and in 22 patients (30.9%) right side was involved. Sixty-one (86%) patients had completed their follow-up. Results were evaluated by Flynn Criteria, 91.8% excellent/good results were obtained.

Conclusion: This method provides the greatest skeletal stability and prevents neuro-vascular complications in children, hence giving excellent results.

Key words: supracondylar humeral fracture, Percutaneous pinning - Children.

INTRODUCTION

Supracondylar humerus fracture is the most common fracture about the elbow in

children and represents approximately 3% of all fracture in children.¹ These fractures are classified according to mechanism of injury. Extension type supracondylar humerus fractures are caused by fall of out stretched arm.

Whereas flexion type Supracondylar humerus fracture caused by fall on olecranon with the elbow flexed. Extension typed fractures comprises approximately 96% of Supracondylar humerus fracture and are sub classified described by Gartland according to the degree of displacement of the distal fragment.²

In Type I fracture there is minimal, if any, displacement of the distal fragment. In Type II fracture there is posterior displacement of the distal fragment but the posterior humeral cortex appears intact on radiographs. In Type III fractures there is complete displacement of distal fragment. The fracture classification serves as basis for treatment. Patient with Type I fractures usually are treated by immobilization.^{1,2,3,4}

There is a disagreement, however, in the treatment of patients with Type II fractures. Some orthopedic surgeons prefer to treat these patients with closed reduction and immobilization, whereas others prefer closed reduction and percutaneous Kirschner (K) wire fixation.^{1,2,3,5,6,7,8}

Patients with type III fractures usually are treated by closed reduction and percutaneous K-wire fixation, but open reduction and fixation is performed if an adequate reduction cannot be obtained by closed manipulation.^{1,2,5,6,8,9,10,11,12,13} Although closed reduction with two crossed K-wires one medial and one lateral percutaneous fixation under fluoroscopy is generally accepted as the treatment of choice.^{1,5,12,13,14,15}

The purpose of this study was to evaluate the short-term results of all children Gartland with Type III Supracondylar humerus fractures treated by closed reduction and crossed percutaneous pinning under fluoroscopy.

MATERIAL AND METHODS

A prospective/descriptive study was undertaken at Orthopedic Department Hayatabad Medical Complex Post Graduate

Medical Institute from January 1999 to December 2001 with follow-up of one year. Initially, a total of 71 patients were included in this study, all were closed Supracondylar humerus fracture Type III. There were 47 boys (66.2%) and 24 girls (33.8%).

SHOWING NUMBER AND PERCENTAGE OF MALE AND FEMALE PATIENTS

	No. of Patients	Percentage
Male Patients	47	66.2%
Female Patients	34	33.8%

TABLE - I

The range of age was 2 years-12 years. The mean age at the start of treatment was 5.4 years. The side of involvement was left in 49 patients (69%) and in 22 patients (31%) right side was involved.

SHOWING SIDE INVOLVEMENT IN PATIENTS

	No. of Patients	Percentage
Left Side	49	69%
Right Side	22	31%

TABLE - 2

All patients were admitted through emergency. On admission thorough history and examination were performed. The fracture side of all children was placed in posterior splint for temporary stabilization. Capillary refill and distal pulses were monitored closely. In 54 patients (76%) surgery was performed within 24 hours from the time of injury and in 17 patients (24%) surgery was delayed up to 72 hours because of their delayed reporting to the hospital.

SHOWING TIME DURING WHICH SURGERY WAS PERFORMED IN PATIENTS

Time between Injury and Surgery	No. of patients	Percentage
<24hrs	54	76
24hrs-72hrs	17	24

TABLE - 3

Surgical Technique

Under general anesthesia patient is placed in supine position on operating table. C-arm machine is used; the main tube of C-arm machine is draped sterilely so that upper arm and elbow lie on C-arm. Longitudinal traction is first applied to disengage the fracture fragments. An assistant provides counter-traction on the upper arm. While maintaining traction, medial or lateral displacement of corrected. Next the forearm is rotated to correct the rotational deformity. The elbow then is flexed maximally, maintaining traction. While flexing the elbow, the surgeon's thumb is used to push the olecranon forward, which corrects the posterior displacement of the distal fragment. The reduction is assessed with the fluoroscope. Smooth 1.6mm K-wires are used for internal fixation. Bicortical lateral K-wires are inserted first through slab incisions. The lateral pin is placed where the anterior humeral line crosses the center of the lateral condyle. This pin is directed slightly posterior, with the forearm maximally rotated. Whether the forearm is pronated or supinated depends on the direction of displacement of the distal fragment. In the posteromedial type Supracondylar fractures the forearm is maximally pronated whereas in the posteromedial type the forearm is maximally supinated. The ulnar nerve is palpated posterior to the medial epicondyle. If palpable, the nerve is displaced posteriorly with the surgeon's thumb while the medial K-wire is inserted percutaneously. If the ulnar nerve is not palpable because of swelling, a small incision is made over the medial epicondyle and a fine clamp is used to gently retract the ulnar nerve posteriorly while the medial K-wire is inserted through the center of the medial epicondyle. In the sagittal plane, the medial pin is directed from posterior to anterior. In the coronal plane the medial and lateral pins are directed within the columns of the distal humerus such that they

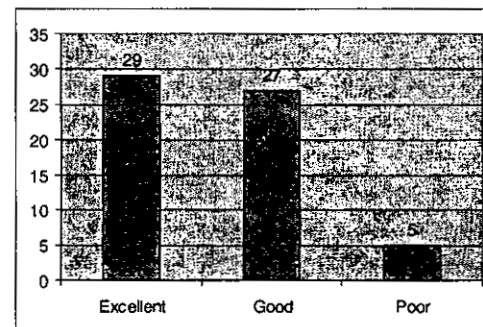
cross well proximal to the fracture site, which produces the most stable fixation construct. After fixation, the elbow is extended and distal pulses are checked. The reduction is checked by fluoroscope. The pins are left protruding through the skin and are bent 90°. The upper extremity is placed in a splint with the elbow in 80° to 90° flexion and neutral rotation.

The follow-up was carried out fortnightly for first month and then monthly for one year.

RESULTS

Sixty-one patients (86%) had follow-up of one year and 10 patients (14%) were dropped out because they did not complete their one year of follow-up. According to criteria of Flynn et al⁽⁶⁾, 29 patients (47.5%) had excellent results, 27 patients (44.3%) had good results, and 5 patients (8.2%) had poor results.

GRAPH 1
SHOWING RESULTS OF 61 PATIENTS AFTER
FOLLOW-UP OF ONE YEAR



Associated injuries in 6 children's (8.5%), radial Pulse was absent on admission but distal pulse returned after reduction and fixation. 5 children (7%) had neurological complications, 3 patients (4%) had median nerve palsy of and 2 patients (3%) had radial nerve palsy, all of which resolved after eight weeks of treatment. No patient in the series suffered from compartment syndrome. None of the patient had Volkmann's ischemic contracture.

DISCUSSION

The displaced Supracondylar fractures of the humerus in Children are common and challenging injuries treated by orthopedic surgeons. The aim of treatment is to gain a functional and cosmetically upper limb with normal range of movement. Ideally, this should be achieved by one definitive procedure. A change in treatment because of loss of reduction maybe psychologically traumatic to the child may give rise parental anxiety and is associated with an increased risk of poor outcome.⁸

In the beginning we started with 71 patients. We tried our best to keep the parents patients in constant contacts during follow-up. Despite these efforts of locating these patients, long-term follow-up was limited to 10 of 71 patients (14%). Other authors report similar difficulties in obtaining long-term follow-up.^{3,6,11,14} Many factors are responsible. At the tertiary center where these patients were treated, patients often are referred for treatment from more than 250 kilometers away. Thus, compliance with follow-up becomes impractical after the cast is removed and the patients begins to use his or her arm again. Furthermore, many of these patients could not be reached because they do not have telephones. Finally, patients sometimes move from province to province, and there is no accessible inter-provincial system that could be used to locate them.

The Percutaneous pinning of Supracondylar Humeral fractures have several advantages. Stable fixation prevents rotational displacements, which may lead to a cubitus varus deformity. Hospitalization time is shortened significantly and patients usually can be discharged on the first or second postoperative day. More importantly, the dilemma of whether to increase the stability of a closed reduction by hyperflexion, which may risk circulatory

compromise, is avoided. Once the fracture is fixed internally, the elbow can be placed in a splint in a safe position, maximizing circulation and minimizing the risk of compartment syndrome. Disadvantages of percutaneous pinning include the risk of neurological injury during pin placement, and pin tract infection. Swenson¹⁵ and others^(4,12,16) reported excellent results using cross-pin method. Our results are comparable with the Boggione et al¹⁷ and Jong-Sup et al¹⁸ as our results show excellent/good 91.8% and 8.2% poor while Boggione et al showed 93.2% excellent/good result. Jong-Sup et al showed 94.4% excellent/good result. Our sample was small as compared to their sample. In our series 8.2% patients show poor results because they develop rotational deformity but painless functional ROM at elbow, which is also described by many authors.^{17,18} Recent studies comparing the relative strength of fixation afforded by different configurations of pin placements have shown crossed medial and lateral K-wires to be the most stable configurations biomechanically. Using a canine model Herzenberg et al¹⁹ concluded that crossed-pin fixation provided the greatest resistance to rotational displacement. Similarly, in a biomechanical study comparing the torsional strength of four different pin configurations, Zionts et al²⁰ showed crossed pin fixation provided the greatest resistance to rotational displacement.

In our study, 11 patients had associated injuries, which were resolved with the passage of time as Davis et al²¹ and Mostafavi and Spero et al²² mentioned in their study. No patient has postoperative ulnar nerve palsy and 2 patients had pin site infection, which healed with antibiotics.

This method provides the greatest Biomechanical Strength to maintain skeletal stability and avoids neuro-vascular complications in children, which gives excellent results.

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