

SUPRACONDYLAR HUMERUS FRACTURES

OUTCOME OF OPEN REDUCTION AND PERCUTANEOUS CROSSED PIN FIXATION

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ABSTRACT... Displaced supracondylar fractures of the humerus in children are common injuries treated by orthopaedic surgeons. **Objectives:** To evaluate the role of open reduction and percutaneous crossed pin fixation in displayed supracondylar fractures and to design a simple and effective protocol for the treatment of these fractures. **Design:** Prospective. **Setting:** Independent Medical College Independent University Hospital Faisalabad. **Period:** From January 2009 to June 2010. **Method:** Fifty six cases with grade II and grade III Gartland supracondylar humeral fractures were treated with open reduction through postero-medial approach and percutaneous crossed pin fixation with Kirschner wire and followed up for a minimum period of 1 year. **Results:** Patients were assessed on the basis of Flynn's criteria there were 41 Excellent and 12 good results. **Conclusions:** It is concluded that open reduction and percutaneous crossed pin fixation is a sound and effective treatment for displayed supracondylar fractures with several advantages but requires careful judgment on the part of surgeon to avoid complications.

Key words: Displaced supracondylar fractures open reduction, crossed pin fixation.

INTRODUCTION

Supracondylar fracture of humerus accounts for 60% of all fractures about the elbow in children^{1,7} and represents approximately 3% of all fractures in children^{4,7,18}.

Many methods have been proposed for the treatment of supracondylar fracture of humerus in children^{17,18,22} manipulative reduction immobilization in a plaster cast with elbow flexed^{16,19}. Dunlop's skin traction,²² closed reduction and percutaneous pinning^{4,5,11,12,20} and open reduction and internal fixation^{18,21,25,26,30}.

Treatment of displaced fracture is fraught with many complications including nerve injury,² arterial injury,^{2,23} skin slough²³, cubitus varus⁹ and Volkmann's Ischemic contracture²³.

Closed reduction and percutaneous cross Kirschner wire fixation was initially described by Swenson¹⁰. Iatrogenic ulnar nerve injury is possible⁶. Two lateral parallel pins popularized by Flynn¹¹ to avoid ulnar nerve injury is less stable.

However modified Swenson's technique of open

reduction through postero medial approach and percutaneous crossed pin fixation continues to be used today with excellent results and low morbidity^{18,21,25,30}. It is biomechanically most stable as compared to other pin configurations^{5,29}.

The purpose of this study was to evaluate the role of open reduction and percutaneous crossed pin fixation in displayed supracondylar fractures and to design a simple and effective protocol for the treatment of these fractures.

MATERIALS AND METHODS

From January 2009 to June 2010 a total fifty six cases with supracondylar fractures were studied prospectively. All the fractures were unilateral and opposite elbow was taken as control for comparison. The type of fracture was determined according to the Modified Gartland's classification^{8,12,16}.

The indication was Gartland grade II and grade III displaced fractures.

Out of total 29 of fractures were grade II and 27 were grade III. Fractures up to 1 month old were included.

Patients with established cubitus varus deformity excluded.

There were 35 male and 21 female the age of patient range form 3 to 13 (mean age 8 years). Left elbow was involved in 36 cases and right side in 20 cases 39 had posteromedial displacement and 17 had posterolateral displacement.

Neurovascular complications, associated fractures and delay before surgical treatment were also recorded.

Associated injuries and complications were both bones fractures forearm in 8 cases, radial nerve injury in 3 cases absent/feeble pulses in 5 cases and impeding compartment syndrome in 2 cases.

PROCEDURE

With the patient under general Anaesthesia and in supine position, high up tourniquet applied.

Table. Gartland’s classification for extension type supracondylar humerus fracture

Fracture type	Description
I	Non-displaced
II	Minimal to moderately displaced: partially intact posterior cortex
III	Severely displaced: no cortical contact

A poster-omedial incision was given longitudinally in hockey stick shape anterior to the medial epicondyle keeping the forearm at 30 flexion. Skin flaps raised – the ulnar nerve exposed above the medial epicondyle and saved. Medial supracondylar ridge identified.

Two spikes near the fracture site in proximal fragment, the distal segment aligned by rotating, manipulating the elbow, keeping medial side in reduced position the medial pin was inserted percutaneously through the

Fig. Gartland type II a-preoperative x-rays b-postoperative x-rays anteroposterior view c- postoperative x-rays lateral view

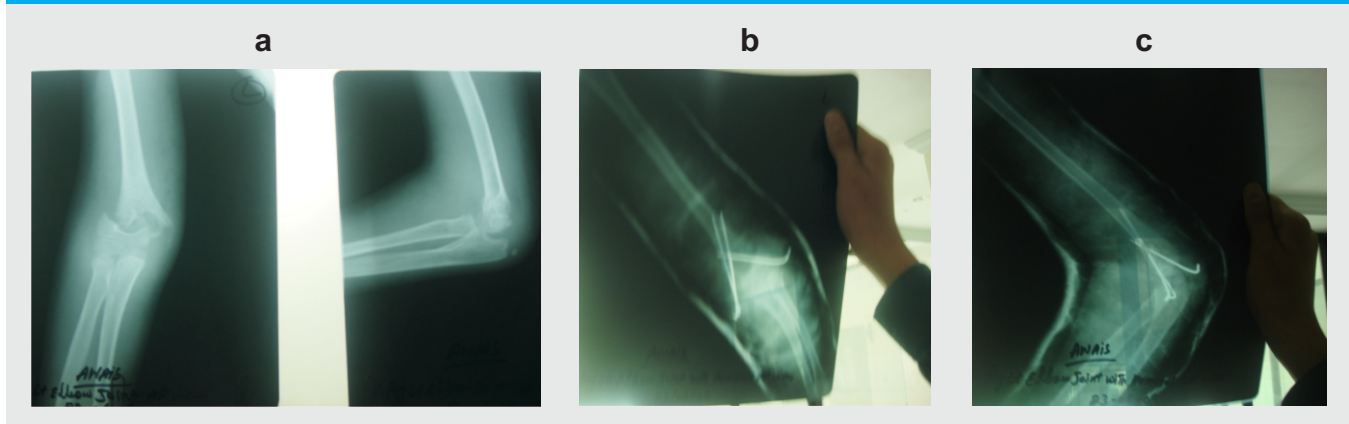


Fig. Gartland type III supracondylar fracture (a-b) preoperative (c-d) postoperative



center of the medial epicondyle directed upward and laterally at an angle 35 to 40 to the sagittal plan of the humerus and 10 posterior to the coronal plane of the humerus. The pin was thus passed through the distal fragment and medullary cavity of the proximal fragment to engage the cortex of the proximal fragment about 3 cm above the fracture line. The ulnar nerve was saved under vision. Reduction was rechecked, the rotational element corrected, keeping the elbow in flexion and fracture in reduced position, lateral epicondyle palpated and lateral pin was inserted through the lateral epicondyle, the pin was directed upward and medially in a similar manner as medial pin. Pins should cross each other 1.5 to 2cm above the fracture line. Pins were cut off beyond the skin and ends were bended with plas or wire bender.

The stability of the fracture fixation was checked clinically through movements of the elbow joint and carrying angle of the forearm, tourniquet removed. Haemostasis secured, drain put in and wound closed in layers, keeping the elbow in 90 degree flexion and in full supination. An above elbow plaster applied, window made for wound care dressing bandage applied over the window. In case of massive swelling back slab applied.

The drain was removed after 24 hours. X –rays taken, patients discharged after 72 hours and 1st follow up was

done after 7 days. The patients were reviewed at weekly intervals; pop changed after 3 weeks and subcutical stiches removed. Skin condition was assessed. Follow up evaluation was done at weekly intervals for 6 weeks, fortnightly for further 6 weeks and monthly for next 9 months.

Kirschner wires were removed when clinico-radiological union was found satisfactory and active exercises²⁷ were started. At each review patients were assessed clinically and radio logically with standardized anteroposterior and true lateral x-rays of the elbow at 6weeks, 3 months, and 6 months and after 1 year.

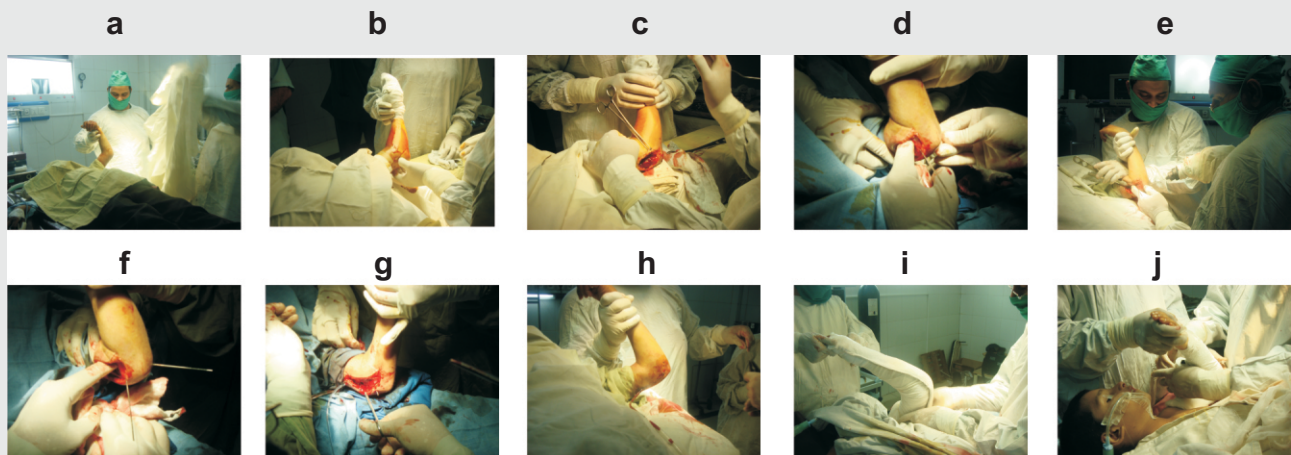
The results were evaluated on the basis of Flynn's criteria¹¹.

There were 94.64% good to excellent and 5.36% fair to poor results. In these patients fair to poor results were due to technical error.

In 1 patient, anatomical reduction was not obtained because of persistent rotation between the fragments.

In 1 patient, the wires were crossing too close to fracture site leading to secondary displacement.

Fig. Surgical technique (a) under general anesthesia, high up tourniquet (b)ready for incision (c)posteroemial incision(d)ulnar nerve saved ,reduction and medial pin insertion (e)percutaneous lateral pin insertion correcting rotation and carrying angle(f)both pins in crossed configuration(g)bending pins beyond skin (h)wound closure (i)back slab if swelling(j)pop in routine cases



Flynn's criteria		
Ratings	Cosmetic factor carrying angle loss (degrees)	Functional factor movements loss (degrees)
Excellent	0 to 5	0 to 5
Good	6 to 10	6 to 10
Fair	11 to 15	11 to 15
Poor	>15	>15

The lower of the two values in above grading and an elbow with varus deformity was automatically graded as poor

Table	Results		
Results	Cosmetic	Functional	Overall results
Excellent	41	42	41
Good	12	14	12
Fair	01	–	01
Poor	02	–	02

In 1 patient, one of the wires was put unicortical leading to secondary displacement due to inadequate fixation.

Radiological evaluation was done to assess union and measure Baumann's angle^{15,32}. The difference of more than 5° in Baumann's angle between the two sides correlated with fair to poor results. Time required for clinico-radiological union ranged from 2 to 6 weeks means 3 weeks.

The average carrying angle was 10.2 degree (ranged from 5 to 16) on the affected side and 12.8 (ranged from 7 to 18 degree) on normal side.

Pin tract infection of very mild nature was detected in 14 patients but usually it did not lead to any complications.

Because in most of cases Kirschner wires were removed in 4–6 weeks and infection healed without any active intervention. No nerve injury or palsy in 53 patients. 3 cases of radial nerve palsy due to posterolateral displacement which was recovered spontaneously without any neurological deficit within 12 weeks.

Fig. Excellent clinical functional and cosmetic result.



DISCUSSION

Displaced supracondylar fractures of the humerus are one of the commonest childhood injuries and good cosmetic results and functional recovery are the goal of the treatment.

Although good results have been reported using various methods of treatment. In the developing countries many patients presents with history of manipulation and massage and tight bandages. These cases have massive swelling, more chances of compartment syndrome¹, Volkmann's ischemic contracture²³ and latter on with massive massage to treat stiff elbow causes myositis ossificans³. In such massive swelling stability of closed reduction in hyperflexion may increase circulatory compromise. With closed reduction and cost immobilization the reported incidence of cubitus varus deformity⁹ is as high as 24 %. Studies show poorest functional² and cosmetic outcome with this modality of treatment. The results of skeletal traction^{17,19,22,24,28} treatments for these fractures have been varied.

The incidence of cubitus varus deformity with this modality of treatment varies from 0 to 57 %. Other disadvantages of skeletal traction include prolong hospital stay, pin tract infection ulnar nerve injury during insertion of traction pin and elbow stiffness. The compliance for Dunlop's traction²² is very poor.

In massive swelling and delayed cases closed reduction and percutaneous pinning is difficult to achieve anatomical reduction and stable fixation^{17,18,25,26}. This situation poses a dilemma for the surgeons. In case of close reduction and crossed pin fixation the injury to the

ulnar nerve^{2,6} from the medial pin is a major concern its incidence is estimated to be 2 % to 3 % further close reduction is difficult if the time between injury and surgery is more than 7 days^{18,21,23,25}.

The pins placed from the lateral epicondyle^{5,14,31} in a parallel or crossed configurations to minimize the risk of iatrogenic ulnar nerve injury but it is not the stable configuration biomechanically^{5,11}.

The open reduction and percutaneous crossed k- wire fixation^{18,21,25,26,30} has several advantages. Initial fixation of these fractures reduces the duration of hospital stay stable fixation which prevents cubitus varus⁹ deformity. If the fracture is treated with open reduction, anatomical reduction, stable fixation with crossed k- wires. It can be splinted in a safe position without any fear of loss of reduction. This decreases mechanical disturbance to the soft tissues and neurovascular structure. This minimizes the risk of complications like compartment syndrome¹ and maximizes circulation.

Our views and results were in concordance with several other studies. Swenson¹⁰ reported excellent results using crossed pin fixation.

However Kirschner wire fixation has its own disadvantages, wire extrusion, pin tract infection^{4,8} and heterotropic ossification^{4,8,23} have been reported. These complications can be prevented by strictly following the surgical technique and proper follow up. The chances of cubitus varus^{4,9,23} and ulnar nerve injury^{4,6} is minimum in open reduction and doing surgery under vision.

CONCLUSIONS

From the present study it could be concluded that open reduction and crossed pin fixation is a sound and effective modality for the treatment of displaced supracondylar fractures with the advantages of decreased duration of hospital stay, anatomical reduction, stable fixation and early mobilization. It also reduces the incidence of cubitus varus and ulnar nerve damage if the surgical technique is followed strictly. This can be done without causing any additional morbidity.

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Article received on: 30/12/2010

Accepted for Publication: 08/01/2011

Received after proof reading: 00/00/0000

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Article Citation:

Sial NA, Rashid A. outcome of open reduction and percutaneous crossed pin fixation in displaced supracondylar humerus fracture in children. Professional Med J Mar 2011;18(1):147-153.

CORRECTION

Correction Prof-1667.wpd

The amendment of the Professional Vol:17, No.04 (Prof-1667) titled: "Mullerian duct anomalies; presentation and reproductive outcome" on page 678 is as under;

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