

Percutaneous pinning of supracondylar fracture humerus with crossed kirschner wires after closed reduction under image intensifier guidance in paediatric age group

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Abstract

Background: The common pediatric injuries around elbow are supracondylar fractures of humerus. Some of them are displaced – Gartland 2 and 3. These fractures may cause complications like deformities and neurovascular problems without reduction and fixation. Percutaneous pinning with crossed k-wires show good results among different methods used for treatment. **Method:** 40 patients between the age groups 2 -10 years were treated with percutaneous pinning with crossed kirschner wires, after closed reduction under guidance of image intensifier (C-ARM). These patients come under Gartland 2 & 3 according to classification and treated between 2012-2015. The fractures are around seven days old. Flynn's criteria used for assessing clinical results. **Results:** The age groups 2 -10 years were treated with mean age- 5 years. The follow-up duration 2-4 years-mean 2 years. The outcomes were assessed with Flynn's criteria and found to be excellent in 28, good in 10, fair in 1, poor in 1. **Conclusion:** Percutaneous pinning with crossed k-wires show good results among different methods used for treatment for Gartland 2 & 3 supracondylar fractures in paediatric age.

Keywords: neurovascular - nerve injuries, arterial, myositis ossificans.

Introduction

One of the commonest fractures around elbow in paediatric age group is supracondylar fracture [1]. These fractures are about 60% around elbow. Out of total fractures in paediatric age group the percentage is around 3-4% [1-2]. These are classified by Gartland in to 3 groups. This fracture may be flexion or extension type. The Gartland type 2 and type 3 are displaced fractures. The possible complications are neurovascular - nerve injuries, arterial, Volkmann's ischemic contracture, myositis ossificans, Varus internal rotation deformity [3-5].

The treatment methods are:

Conservative- Closed reduction and above elbow cast application, skeletal traction, Dunlop traction under c-arm guidance [3-9].

Surgical- Closed reduction under image intensifier guidance - closed reduction & fixation with crossed k-

wires or two lateral k-wires.

Open Method- Opening at fracture site and reduction achieved and fixed with kirschner wires-crossed or lateral only. Swenson first described the percutaneous pinning with two crossed k-wire after closed reduction under guidance of c-arm [10-12]. Flynn and others popularized this technique and this is most stable biomechanically [13]. The purpose of this study is to evaluate results of percutaneous pinning with two crossed k-wires, after closed reduction under c-arm guidance.

Methods and Materials

Place of study: study conducted at Osmania General Hospital, Hyderabad.

Type of study: Prospective randomized control study between 2012-2016.

Sampling methods and collection: The patients under age group 10 years (2-10) were included in study. This

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study was prospective study between 2012-2016 done at Osmania General Hospital, Hyderabad, 40 patients were included with displaced GARTLAND 2 & 3 fracture types, which are less than seven days. They were treated with percutaneous pinning with crossed k-wires after closed reduction under c-arm. 26 were male and 14 were females with 30 right sided and 10 left sided. The mean age-5yrs. All cases with extension type and posteromedial displacement were included.

Procedure

Preoperatively all investigations were done along with pre anesthetic checkups. The surgical procedure was done under general anesthesia. The patient position was supine with the help of assistant longitudinal traction was given with forearm in supination and elbow in extension. Before longitudinal traction, fracture was exaggerated to disimpact. Distal radial pulse monitored during procedure. Under image intensifier guidance lateral or medial forces applied at condyles to correct displacement. The elbow flexion corrected angulations deformity under continuous traction. In reduced position k-wires 2mm were used to fix first through lateral condyle and then medial condyle after stab incisions. Direction of pins kept 100 degrees to coronal plane and 30-45 degrees to sagittal planes of humerus. The crossing of k-wires should be above 2 cms of fracture line. The stability checked under c-arm. The carrying angle and BOWMAN’S angles were measured for assessment. The placements of pins and reduction checked under c-arm in antero-posterior and lateral views.

Above elbow plaster of Paris slab applied in flexed position of elbow (80-100 degrees). The position of forearm was in supination. The patients were discharged after 3-4 days. The patients were followed at weekly intervals first two months and there after monthly follow ups were undertaken. The radiological and clinical assessment was done at 3 and 4 weeks. After evidence of union k-wires were removed and range of motion exercises were started slowly. FLYNN’S CRITERIA was used for assessment with IBM SPSS statistical analysis online software.

Inclusion criteria

- 1) All displaced supracondylar fractures type 2 & 3 of gartland classification
- 2) All pediatric age group patients between 2-10 years.
- 3) Both male and female children were included.

Exclusion criteria

- 1) Open fractures (compound)
- 2) Fractures with vascular injuries
- 3) Fractures with nerve injuries.

Table 1: Flynn’S Criteria.

Results/rating	Cosmetic factor,carrying angle loss(degrees)	Functional factorMovementLoss(degrees)
Excellent	0-5	0-5
Good	5-10	5-10
Fair	10-15	10-15
Poor	>15	>15

Results

Table 2: Results Using Flynn’S Criteria.

Result	Cosmetic	Functional	Overall results
Excellent	28	28	28
Good	10	15	10
Fair	01	02	01
Poor	01		01

After analyzing above, the results were 95% of good to excellent results and 5% of poor to fair results. In one patient, closed reduction not possible due to soft tissue inters position. In this case open reduction done and fixed with crossed k-wires. In two patients including open reduced patients-infection occurred post operatively and due to infection fair to poor outcome occurred.

The patients were followed 2-3 years. The union was assessed radiological and clinically after 3 weeks with weekly intervals. K-wires removed depending on the assessment.

Carrying angle was measured on both sides. The average carrying angle on the fracture side 10 degrees (5-15 range). In the normal side it was 13 degrees (9-18 range).

Bowman's angle was measured radiologically on both fractured and normal side. More than 5 degrees difference was considered fair to poor outcome.

Discussion

Pathophysiology: fall on flexed elbow or rarely on out stretched hands can cause supracondylar fractures. Of which the most common fractures are extension type.

Modified Gartland classification for supracondylar humerus fractures in children.

Type 1	Undisplaced
Type 2	Displaced with intact posterior cortex
Type 3	Completely displaced—either posteromedial 3a or posterolateral 3b
Type 4	Multidirectional instability with circumferential periosteal disruption

Gartland 2 & 3 displaced fractures are common in children below 12 years' age group [1,3,9,12,13]. Good stable anatomical fixation is compulsory along with maintenance for outcome of good function and cosmetic appearance.

Treatment Protocols: Closed reduction and pop plaster application in undisplaced fractures - i.e. type 1 & 2. Different types of treatment had been deployed to treat these cases of type 2 & 3, like closed reduction and plaster cast application, traction, closed percutaneous pinning and open reduction and internal fixation by K wires [14,15]. Out of all the treatment methods, closed reduction and percutaneous K wiring have a promising outcome.

The main problem with open reduction is infection and loss of range of motion [15,16]. Closed reduction and percutaneous k wiring is the choice in displaced supracondylar fractures with least chance of compartment syndrome and reduction in hospital stay [16]. Direct ulnar nerve damage and tardy ulnar nerve palsy is a known complication.

Among various methods of treatment both conservative and surgical percutaneous pinning after closed reduction and fixation with crossed k-wires is efficient.

Advantages: Less time for union, hospital admission. Less possibility of infection and healthy wound healing in short time

Joint stiffness - less possible
Less chance of loss of fracture reduction

Disadvantages & Complications: Possibility of ulnar nerve damage-when swelling is more. Skin infection (surgical site infection) is possible. The crossed k-wires i.e. entered through lateral and medial condyles were biomechanically stable than only lateral 2 k-wires.

Comparative Studies: Overall outcome of percutaneous pinning after closed reduction is excellent according to Swenson and Fennyl [20, 21]

Our study also got good to excellent results as compared to other studies. The results of our study are comparable to the study of R. Mohammed et al [9]

In their study they got 96-97% satisfactory (excellent, good, fair) results as compared to our observation of 95% of excellent to good results.

Our study outcome is also comparable to another Indian study which is conducted by Basantkumarbhuyan et al [1].

Conclusion

The closed reduction and percutaneous pinning with crossed k-wires in the treatment of supracondylar fractures of humerus in pediatric age group is the biomechanically stable and effective

treatment among other options .the mehod is also safe in both experienced and junior residents also.

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