

CLOSED REDUCTION AND PERCUTANEOUS FIXATION WITH CROSSED K-WIRES IN DISPLACED SUPRACONDYLAR FRACTURES OF HUMERUS

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ABSTRACT

Objective: To evaluate the out-come of closed reduction under image intensifier and percutaneous cross k-wire fixation in Gartland Type II and III supracondylar fractures of humerus in children.

Study Design: Case series

Place and Duration of Study: Combined Military Hospital Rawalpindi and Combined Military Hospital Malir, from Jun 2006 to Jan 2012.

Patients and Methods: Patients 3-10 years of age, of both genders were included in the study by convenience sampling. Patients who had closed Gartland Type II and III fractures and reported within 24 hours of injury were included in the study. Standardized percutaneous cross. K wiring (medial and lateral) was performed in all the patients, followed by casting, by an orthopedic surgeon. K wires were removed after four weeks. Patients were followed for upto 06 months and all the early and late post-operative complications were recorded on the given proforma. Evaluation of the results was done on the basis of Flynn's criteria by measuring loss of elbow motion and carrying angle.

Results: A total of 30 patients completed the study. The mean age was 6.1 years with a gender distribution of 23 males and 7 females. The involved elbow was right in 17(56.6%) patients and 13(43.3%) patients had left sided injury. There were 18(60%) Gartland type II fractures and 12(40%) Gartland III fractures. All of the fractures were extension type. Three patients (10%) had pin tract infections, whereas none had osteomyelitis, neurovascular damage or compartment syndrome. Twenty four patients (80%) had excellent results according to Flynn's criteria whereas four patients (13.3%) had poor results.

Conclusion: Closed reduction under image intensifier and percutaneous K wiring through medial and lateral approach in selected Gartland Type II and III fractures in children is a safe procedure and provides adequate stabilization with satisfactory results.

Keywords: Humerus, Supracondylar fracture, Percutaneous pinning, Cross-wiring.

INTRODUCTION

Supracondylar fracture of humerus is one of the most common fractures amongst children^{1,2,3}. Supracondylar area is the weakest bony region of the upper limb and is most commonly injured by a fall on an outstretched hand⁴. There are two types of supracondylar fractures of humerus in children i.e. extension type (97%) and flexion type (3%). Mechanism of injury commonly is a fall on dorsi-flexed hand with flexed elbow resulting in hyperextension along with abduction or adduction of elbow^{1,4}. Supracondylar fractures of

humerus have been classified by many surgeons but Gartland classification is commonly used⁵. Based on this classification Type II and III fractures usually require operative intervention. There are multiple treatment options comprising closed reduction and POP cast, skeletal traction, closed reduction with percutaneous fixation and open reduction and fixation^{2,3,5}.

Closed reduction and POP casting leads to loss of reduction and varus deformity in some cases. Open reduction and internal fixation can reduce the fracture anatomically but there may be elbow stiffness and chances of loss of range of motion⁶.

The complications associated with operative intervention consist of infection, vascular or neurological injury, myositis ossificans,

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decreased range of motion and cosmetic disfigurement^{5,6,7}.

Keeping in view the common presentation, a detailed and thorough knowledge of surgical anatomy is required followed by the best treatment option which should be tailored according to the type of injury. The inherent constraints of percutaneous k-wire fixation technique require that the procedure be done under optimal conditions. This would include morning theatre lists when trained orthopaedic surgeon, assistant and technician for image intensifier are available^{8,9,10}. It has been shown that over-night delays have not significantly altered the results^{7,9}.

We have studied the post-operative outcome of percutaneous medial and lateral cross K-wire technique in closed Gartland II and III fractures in pediatric population coming to our hospital set-up. The purpose of our study was to highlight the advantages of this technique in reducing the morbidity, hospital stay, elbow stiffness and deformity in children.

PATIENTS AND METHODS

This study was carried out at CMH Rawalpindi from July 2006 to December 2009 and in CMH Malir from January 2010 to January 2012. Patients were selected by non-probability convenience sampling. The inclusion criteria were: patients of both genders from 3 to 10 years of age, presenting in emergency or out-patient dept within 24 hrs of injury without vascular compromise and diagnosed as cases of closed Gartland type II or type III fractures (table-1) . The exclusion criteria were: patients having open fractures, patients with gross swelling and failure to achieve closed reduction, patients who had already undergone closed reduction or any surgical intervention or patients who had any contraindication to general anesthesia. All the patients who fulfilled the criteria were included in the study after taking a written informed consent. After the initial management and investigations these patients underwent standard percutaneous fixation^{1,4} with cross K wiring

under image intensifier by an orthopedic surgeon. Under general anesthesia and supine position closed reduction of the fracture was done by gentle traction, side to side elbow deformity correction, hyper-flexion of elbow and pushing the distal fragment with opposite hand thumb, keeping the forearm in pronation to prevent displacement. This position was maintained by applying sterile roll gauze to wrist and upper arm.

After confirming closed anatomic reduction on Jones and lateral view, the image-intensifier was used as platform. Stainless steel k-wires of 1.5 mm diameter were used. The lateral pin was always inserted first. The insertion site was selected so that the pin would traverse the lateral portion of the ossified capitellum, cross the physis, proceed up the lateral column, and always engaged the opposite medial cortex proximally. Using a Kirschner wire (K-wire) or a radio dense object, the position for inserting the pin was documented on AP and lateral views. A small incision was made in the skin. The pins were angulated superiorly approximately 40° superiorly and 10° posteriorly⁶ ensuring that they continued into the opposite cortex to provide solid fixation. The pin was placed using a power drill and a sharp K-wire. Provisional stability was achieved with the first pin. The elbow was then externally rotated and a lateral image was obtained with fluoroscopy. A second pin was then placed medially. Ulnar nerve was protected by milking with thumb posteriorly⁷. In case of swelling a small incision was made through the skin over the medial epicondyle and then medial pin was inserted. At the end of the procedure the stability and carrying angle was checked by extending the elbow.

POP cast above elbow (20 layers) was applied post-operatively and collar and sling bandage was given to the patients. The patients were discharged the next day and advised to follow up after one week for clinical and radiological evaluation, any wound infection, callus formation and any other complication. Patients were called at 4 weeks after surgery for

removal of k-wires and cast. After clinical and radiological evaluation joint mobilization was allowed. Patients were followed up on monthly basis for upto 06 months and were evaluated clinically and radiologically for healing of fracture, joint deformity and range of motion (i.e. functional and cosmetic) according to Flynn's criteria¹¹ (table-2). The clinical evaluation for pin tract infection, osteomyelitis and damage to ulnar nerve was also done on each visit and all the data were endorsed in the proforma.

RESULTS

A total of 30 patients were included in the study. The mean age was 6.1 ± 1.2 years. There was a higher incidence in boys 23 (76.6%) than girls 7 (23.3%). The right elbow was more frequently fractured 17 (56.6%) as compared to left elbow 13 (43.3%) . According to Gartland's Classification system 18 (60%) patients had Type II fracture whereas 12 (40%) had Type III fractures. Three(10%) patients developed pin tract infections and K wires were removed at 3 weeks after surgery in only one(3.3%) of them. None of the patients had nerve injury, compartment syndrome or osteomyelitis. According to Flynn's criteria¹¹ the range loss of motion and carrying angle was less than 5 in 24 (80%) patients hence their result was excellent (figure). The results were good and fair in 1 (3.3%) patient each. Only 4 (13.3%) patients had poor out-come (loss of range of motion) was more than 150 or carrying angle loss was more than 150. One patient had significant Cubitus Varus deformity.

DISCUSSION

Supracondylar fractures of humerus are the most common fractures in pediatric population accounting for upto 50-70 % of all fractures^{2,12,13}. There have been many treatment options for Gartland Type II and III fractures ranging from closed reduction and plaster, side-arm traction, closed reduction and percutaneous pinning to open reduction^{1,3,10,12}. Percutaneous K wiring can also be done via two different approaches (lateral only, medial and lateral crossed). All these

procedures have their own merits, demerits and complications^{13,14,15,16}. In this study we observed the clinical outcome of percutaneous cross K wiring via medial and lateral approach.

Table-1: Gartland⁴ classification of supracondylar fracture of humerus in children.

Type I - Undisplaced
Type II - Displaced with intact posterior cortex
Type III - Completely displaced with no contact between the fragments

Table-2: Flynn's criteria for assessment of reduction.

Results	Cosmetic factor-loss of carrying angle (degree)	Functional factor loss of motion (degree)
Excellent	0 – 5	0 – 5
Good	6 – 10	6 – 10
Fair	11 – 15	11 – 15
Poor	> 15	> 15

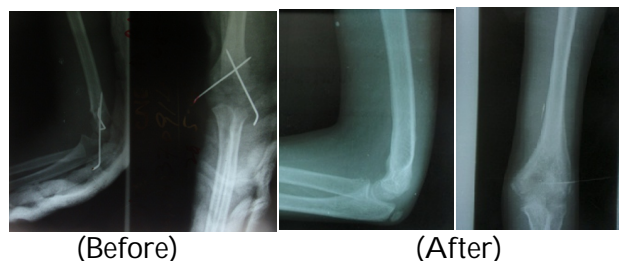


Figure-: Post-operative radiographs before and after removal of k-wires.

In our study the mean age group was 6.1 years which was at par with majority of the studies and hence it was comparable^{15,16,17}. The boys were affected more and this was also observed in other studies^{18,19}. We observed that right elbow was more commonly involved which was also consistent with findings of Soomro et al¹⁸ but contrasting with the study of Shoaib et al²⁰ in which the non dominant limb was more commonly involved.

According to Flynn's criteria we had excellent results in 80% of cases which was quite comparable to other studies^{15,20} but greater than in a study by Ahmad et al¹⁷(63.3%) as they used

side-arm traction. The percentage of cases with poor outcome in our study was 3% which is consistent with studies by Malpuri et al¹⁷ but slightly less than in a study carried out by Shoaib et al who observed poor outcome in 15% cases.

The loss of carrying angle of more than 15° was observed in only one patient who also had decreased range of motion (> 150°). This patient required corrective surgery but the parents refused the treatment and he was lost to follow up.

The most common complication was pin tract infection²¹ which was found in 3 patients, 1 out of these patients had removal of K wires after 3 weeks. This patient had eventually developed cubitus varus²² and restricted movements of elbow. The rest of the patients recovered by conservative management and none developed serious infections and osteomyelitis. None of the patients had ulnar nerve injury or compartment syndrome which was also consistent with many other studies^{6,9} but at variance with Anwar et al² who have quoted 4% occurrence of ulnar nerve injuries in cross K wiring.

All of the patients in our study had extension type fractures. This was at variance with the study of Shoaib et al²⁰ who reported 5% flexion type fractures and Gartland who quoted 3%. The good results, short hospital stay, early recovery, no use of sutures and lesser degree of trauma associated with this modality of treatment is worth-while to be considered by orthopaedic surgeons in selected cases. Comparison of our results with local and international literature strengthens the case for trial of closed pinning in all cases of closed supracondylar fractures (Gartland type II and III).

CONCLUSION

Closed reduction and percutaneous cross K wiring via medial and lateral approach is a safe and effective method of treatment in selected cases of Gartland Type II and III fractures.

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