ORIGINAL RESEARCH PAPER

Orthopaedics

EVALUATION OF FUNCTIONAL OUTCOME OF SUPRACONDYLAR FRACTURES TREATED WITH CRISSCROSS VS LATERAL PINNING

KEY WORDS:

Ashok Kumar Patnala* Professor and Head of the Department, Department of Orthopaedics, Andhra Medical College, Visakhapatnam, A.P. India. *Corresponding Author

Ramya Krishna Pahana Junior Resident, Department of Orthopaedics, Andhra Medical College, Visakhapatnam, A.P. India.

Kanugula Saibharath Junior Resident, Department of Orthopaedics, Andhra Medical College, Visakhapatnam, A.P. India.

ABSTRACT

Introduction : Supracondylar humerus fractures are the most common elbow fractures seen in children. The peak age is 5 to 6 years .Gartland classified these fractures in to extension and flexion type with former being most common. Extension injuries are further divided in to un displaced (type 1),partially displaced with intact posterior cortex(type 2),completely displaced (type 3).Type 2 and type 3 fractures requires intervention (closed reduction and pinning). In this scenario, our study is designed to know the functional outcome of Criss cross pinning versus lateral pinning in supracondylar humerus fractures

Aim :

1. To restore the anatomy of the distal end of the humerus with percutaneous Kirschner's wire fixation.
2. To evaluate the functional and cosmetic outcome of displaced supracondylar fractures of the humerus in children treated with cross pinning and lateral pinning.

Materials And Methods : A prospective study with 30 cases of Gartland type 2 and type 3 supracondylar fracture humerus, treated by lateral (n=16) and criss cross (n=14) pinning, was conducted between October 2018 to october 2020. The results were expressed as mean and standard deviation and $p<0.05$ was considered as statistically significant.

Results : In this study, among thirty patients, cross pinning was done in fourteen patients (46.67%), and lateral pinning was done in sixteen patients (53.33%). All patients had satisfactory results according to Flynn's criteria. **Conclusion :** There was no significant difference in cosmetic outcome, i.e. loss of carrying angle, and in functional outcome i.e.; loss of flexion in degrees between crisscross Kirschner wire fixation and lateral Kirschner wire fixation in supracondylar fractures of the humerus in children.

INTRODUCTION :

Fracture of the supracondylar humerus is one of the most common fractures sustained by children. Supracondylar fracture of the humerus is the commonest around the elbow in children accounting for 50% to 70% of fractures in this region.Supracondylar fracture of humerus in children is the commonest fracture and one of the most difficult fractures to treat because of rather frequently occurring complications like nerve injury, vascular injury, Volkmann's ischemic contraction, stiffness of elbow, and malunion.

Among all treatment modalities described, e.g., side-arm skin traction, overhead skeletal traction, closed reduction and casting, closed reduction with percutaneous pinning, and open reduction with internal fixation, not a single modality has proved supreme.

Closed reduction and percutaneous pinning for supracondylar fracture humerus promises to be the best method at present but closed reduction is not always achievable because of intense soft tissue swelling and intrinsically unstable nature of the supracondylar fracture of the humerus. In these cases, the open reduction becomes mandatory.

The goal in treating these fractures is to reestablish the anatomy of the distal humerus perfectly with the least complications and with enough stability to permit early painless, functional elbow motion.

AIMS AND OBJECTIVES :

1. To restore the anatomy of the distal end of the humerus with percutaneous Kirschner's wire fixation.

2. To evaluate the cosmetic and functional outcome of displaced supracondylar fractures of the humerus in children treated with cross pinning and lateral pinning.

MATERIALS AND METHODS :

The clinical material for the study, consists of 30 cases (n=30) of fresh supracondylar fractures of the humerus in children of traumatic etiology meeting inclusionand exclusion criteria, admitted in King George Hospital attached to Andhra Medical College, between October 2018 and October 2020.

Inclusion Criteria:

1. Gartland type 2 and type 3 supracondylar humerus fractures.
2. Age less than or equal to 10 years.
3. Supracondylar fractures humerus with or without neurovascular complications.

Exclusion Criteria:

1. Gartland type 1 supracondylar humerus fractures.
2. Open injuries.
3. Age more than 10 years.
4. Fractures more than 2 weeks old.
5. Flexion type injuries.

As soon as the child was admitted, a detailed history was taken, and a meticulous examination of the patient was done. The required information regarding the fracture was recorded in the proforma prepared. The patient's radiographs were taken in AP and lateral views. The diagnosis was finalized by clinical and radiological examination.

In this study, supracondylar humerus fracture was classified according to Gartland's classification.

Type 1: undisplaced supracondylar fracture of humerus

Type 2: displaced supracondylar fracture with intact posterior cortex

Type 3: displaced supracondylar fracture with no cortical

contact
a) Posteromedial
b) Posterolateral

Temporarily closed reduction of fracture was done on admission, and above elbow posterior slab was applied in 90 degrees of flexion at the elbow. The limb was elevated to reduce swelling of the elbow keeping in view of the vascular status.

All patients were taken for elective surgery as soon as possible after necessary blood investigations and radiographic pre-operative work-up.

Patient attenders were explained the nature of the injury and its possible complications. Patient attenders were also explained about the need for the surgery and complications of surgery.

Written and informed consent was obtained from the parents of the children before surgery.

All patients were started on prophylactic antibiotic therapy. Intravenous cephalosporins were used. It was administered according to the bodyweight of the children prior to the induction of anesthesia and continued at 12 hourly intervals postoperatively for 5 days, and then oral antibiotics were given till suture removal.

OPERATIVE TECHNIQUE :

A child with supracondylar fracture humerus Gartland type 2 and type 3 was taken up for surgery under general anesthesia. The patient was placed supine with the ipsilateral shoulder at the edge of the table. The surgical site was scrubbed, painted, and draped, leaving the elbow, the lower third of the arm, and the upper third of the forearm exposed. Longitudinal traction with the elbow in extension and supination was given. At the same time, countertraction was given by an assistant by holding the proximal portion of the arm. Continuing traction and countertraction, medial and lateral displacement was corrected by valgus or varus force, respectively at the fracture site. After that, posterior displacement and angulation were corrected by flexing the elbow and simultaneously applying posteriorly directed force from the anterior aspect of the proximal fragment and anteriorly directed force from the posterior aspect of the distal fragment.

If an adequate reduction is obtained, the elbow should be capable of smooth and almost full flexion. Confirm the adequacy of the reduction under the image intensifier in two views. After getting satisfactory alignment, the reduction was maintained by percutaneous k-wire fixation.

Stainless steel Kirschner's wire of about 1.2 mm to 2.0 mm were used. In this study, crisscross pinning technique for 14 cases, one from the medial epicondyle and one from lateral condyle and lateral pinning technique for remaining 16 cases, two or 3 pins from lateral condyle were done after randomization.

After achieving satisfactory reduction, k-wires were introduced with the help of a power drill under image intensifier control.

Medial pin entry from the tip of the medial epicondyle avoiding ulnar nerve injury by palpating the nerve and make entry point, and lateral pin was entered at the center of the lateral condyle. K-wire placement was checked in an image intensifier in AP and lateral views. K-wires were bent and kept at least 1 cm outside the skin. Sterile dressing was applied. Above elbow posterior pop slab in 90 degrees elbow flexion and mid prone position of forearm applied.

Postoperatively, the operated limb was elevated on a drip-stand, and the patient was encouraged to move fingers.

On the 2nd postoperative day, check dressing was done, and the condition of the operative wound or pin site was noted. Following dressing, a check x-ray in AP and lateral views were done.

Patients were discharged on the 4th or 5th postoperative day with oral antibiotics.

K-wires were removed at 3 weeks postoperatively with x-ray confirmation of satisfactory callus formation. Pop slab was discarded at the same time and patient was advised to do active elbow flexion-extension and supination-pronation exercises.

Patients were advised not to do heavy weight lifting till 12 weeks postoperatively. Follow up was done on an O.P.D basis at 3rd week, 6th week, and 3rd month postoperatively.

SCORING SYSTEM USED IN THE STUDY:

Table 1: FLYNN'S CRITERIA

Results / Rating	Cosmetic factor Carrying angle loss (degrees)	Functional factor Total range of elbow motion loss (degrees)
Excellent	O - 5	0 – 5
Good	5 - 10	5 – 10
Fair	10 – 15	10 – 15
Poor	>15	>15

RESULTS :

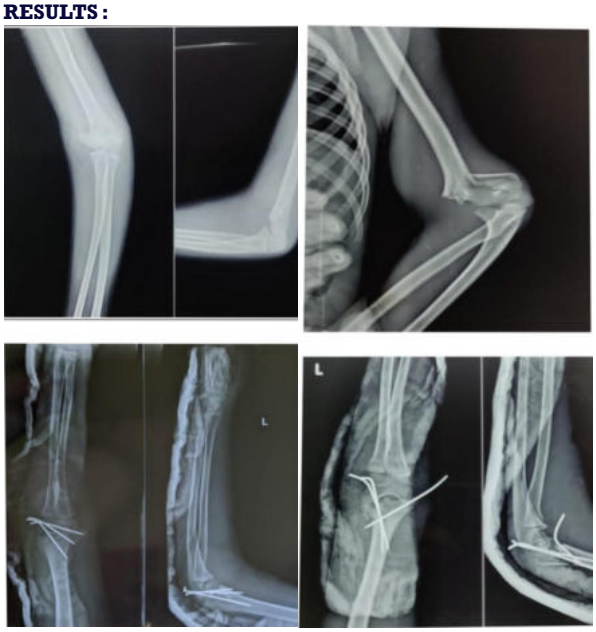

Figure 1: pre-op and post-op radiograph of lateral pinning VS crisscrossed k wire technique

In the present study, 30 cases (n=30) of supracondylar fracture of the humerus were treated with percutaneous Kirschner's wire fixation between October 2018 and October 2020 at King George Hospital attached to Andhra Medical College, Visakhapatnam was included.

The following observations were made in the present study.

Age :

The age of the patient in the study ranged from 2 years to 10 years average being 6.77 years.

Sex :

In the study, out of 30 patients, twenty-one were males, and 9 were females.

Side Of Injury:
In the study of the 30 patients, eleven had an injury of the right humerus, and nineteen had an injury of the left humerus.

Gartland Types:
In thirty cases in this study, twenty-six patients had Gartland type 3, and four patients had type 2 injuries.

Displacement:
In thirty cases in this study, twenty patients had posteromedial displacement, and ten patients had posterolateral displacement.

Associated Injuries:
Among thirty patients, one patient had median nerve injury, which recovered spontaneously by the time fracture healed, and one patient had brachial artery injury in the form of absent radial artery pulsation, which improved after emergency closed reduction and percutaneous fixation.

Table 2: Associated Injuries

Associated injury	Number of patients	Percentage (%)
Radial nerve injury	0	-
Median nerve injury	1	3.33
Ulnar nerve injury	0	-
Brachial artery injury	1	3.33

Postoperative Complications:
Among thirty patients, one patient had ulnar nerve injury, which recovered spontaneously within 12 weeks. Two patients had pin tract infection, which was controlled by antibiotics and following removal of the pin after the satisfactory union of the fracture.

Loss Of Terminal Flexion:
Among thirty cases, loss of terminal flexion was observed in 20 patients.???

Loss Of Carrying Angle:
Among these thirty cases on follow-up, change in carrying angle ranged from zero degrees to five degrees.

Table 4: Loss Of Carrying Angle

Change In Carrying Angle (in degrees)	Number Of Patients	Percentage (%)
No loss	25	83.33
0 – 5	5	16.67
5 - 10	0	0
10-15	0	0
>15	0	0

RESULTS:
In the present study, thirty cases of supracondylar fracture of the humerus were treated by k- wire fixation, and results were evaluated according to Flynn's criteria. Among thirty patients, eleven patients had an excellent result, and eighteen patients had good results while one patient had fair results.

Table 5: Results

Result	Number Of Patients	Percentage (%)
Excellent	11	36.37
Good	18	60
Fair	1	3.33
Poor	0	-

DISCUSSION :
Fractures of the supracondylar humerus are one of the most common injuries in children. But it is one of the more difficult fractures to treat. Difficulty in treating these fractures arises because the fracture gets complicated frequently.

Initial treatment of the fracture, as well as definitive treatment, is of utmost importance. The main goal of the treatment is the anatomical reduction and stable fixation of the fracture.

Thorough clinical examination with proper assessment is very crucial during the initial assessment of every patient. Two crisscross percutaneous k - wire fixation or two or three lateral percutaneous k - wire fixation for supracondylar fracture of humerus in children offer a simple, safe, and affordable treatment option, and it has reduced hospitalization stay.

Thirty cases of supracondylar humerus fractures in children were treated in the King George Hospital attached to Andhra Medical College, Visakhapatnam, by either closed percutaneous criss-cross or lateral k - wire fixation in this study. The purpose of the current study is to evaluate the outcome of management of supracondylar fracture of humerus in children by closed percutaneous criss-cross versus lateral k - wire fixation.

In Fowles et al. (1974) study, 87.5% had satisfactory results, and 12.5% had unsatisfactory results. In Nacht et al. (1983) study, 76% had satisfactory results, and 24% had unsatisfactory results. In Aronson & Prager et al. (1987) study, 100% had satisfactory results. In Pirone et al. (1988) study, 80% had satisfactory results, and 20% hadunsatisfactory results. In Davis et al. (2000) study, 80% had satisfactory results, and 20% had unsatisfactory results.

In this study, among thirty patients, cross pinning was done in fourteen patients (46.67%), and lateral pinning was done in sixteen patients (53.33%). All patients had satisfactory results according to Flynn's criteria. Out of 14 cross pinned patients, 4 had excellent, and 9 had good, and 1 had fair results. Out of 16 lateral pinned patients, 7 had excellent, and 9 had good results.

CONCLUSION:
In the present study, thirty patients with fracture of supracondylar humerus in children were managed surgically with percutaneous criss-cross Kirschner wire fixation or lateral Kirschner wire fixation.

The data was assessed, analyzed, evaluated, and the following conclusions were made:
Fractures of supracondylar humerus are common in children due to anatomical characteristics of the distal end of the humerus and elbow in this age group. These are more common in boys than girls due to more activity in boys. The mode of injury for supracondylar fractures of the humerus is a fall on an outstretched hand, which results in frequent extension type of fractures.

Cross pinning is the most stable configuration in maintaining the reduction of supracondylar fractures of the humerus in children. It has a definitive risk of iatrogenic ulnar nerve injury.Lateral pinning is an equally stable configuration in maintaining the reduction of supracondylar fractures of the humerus in children. It is a safer procedure to avoid iatrogenic ulnar nerve injury in supracondylar fractures of the humerus in children.

There was no significant difference in cosmetic outcome, i.e. loss of carrying angle, and in functional outcome i.e.; loss of flexion in degrees between criss-cross Kirschner wire fixation and lateral Kirschner wire fixation in supracondylar fractures of the humerus in children.

Hence, we conclude that both the cross pinning and lateral pinning configurations are stable constructs if we reduce the fracture anatomically. Cross pinning appears beneficial in more unstable / grossly comminuted fracture patterns. Lateral pinning K- wires should be more divergent at the fracture site and should not cross each other at the fracture site. Cross pinning had a risk of iatrogenic ulnar nerve injury which can

be reduced by taking necessary precautions.

REFERENCES:

1. Gartland JJ. Management of supracondylar fracture of humerus in children. Surg. Gyneco. Obstet 1949; 109; 145 – 54.
2. Basant Kumar Bhutan. Closed reduction and percutaneous pinning in displaced supracondylar fracture in children . J Clin Orthop Trauma. 2012;89-93.
3. Ramji Lal Sahu. Percutaneous kirschner wire fixation in paediatric supracondylar fracture humerus : a retrospective study. Niger Med J. 2013;54(5):329-334.
4. Anmol Sharma. Early results of displaced supracondylar fracture humerus in childrentreated by closed reduction & percutaneous pinning. Indian J Orthop. 2015:529-535.
5. Lokesh Gudda Naik. Cross pinning versus lateral pinning in the management of type III supracondylar fracture humerus in children. Journal of Clinical & Diagnostic Research.2017:1-3.
6. Yuyan Na. Comparison of lateral entry with crossed entry pinning for pediatric supracondylar fracture humerus : A meta-analysis. J Orthop Surg Res. 2018;13:68.
7. Nirmal Raj Gopinathan. Outcome analysis of lateral pinning for displaced supracondylar fracture humerus using three k-wires in parallel and divergent configurations. 2018:554- 560.