



TO STUDY THE FUNCTIONAL OUTCOME OF BIPLANAR CROSSED PIN K WIRE FIXATION IN DISPLACED SUPRACONDYLAR HUMERUS FRACTURE IN CHILDREN

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ABSTRACT

BACKGROUND: supracondylar humerus fracture represents most common fracture around elbow in children. This type of fracture usually results due to fall while playing or fall from height on outstretched hand. The treatment of displaced supracondylar fracture of the humerus is one of the most challenging one to prevent complications.

METHOD: The study was conducted at department of orthopedics dr. Shankarrao Chavan Government Medical College and Hospital Nanded for treatment of supracondylar humerus fracture. This is a prospective study of 60 cases over period of 18 months (2019-2020)

RESULT: Extension type fractures were seen in 98.33% of the cases as compared to flexion type in 1.66% of the patients. 70% had Gartland type III fractures and 30% had type II fractures. 45 had almost full range of motion, 9 had restricted flexion ranging from >5 to 10 degrees, 4 children had restriction of flexion between 10 to 15 degrees and 2 patients had restricted flexion from 15 to 20 degrees. The average restriction of flexion was 5.83 degrees.

Outcome of patients were graded as per the criteria given by Flynn et al and according to it 46 patients had excellent outcomes, 8 had good results, 4 cases had fair outcomes while only 2 patients had poor results. Out of the 60 patients, 58 (96.66%) had satisfactory outcomes and only 2 (3.33%) had unsatisfactory outcome.

CONCLUSION: Percutaneous kirschner wire pinning is a minimally invasive technique that provides a better functional outcome with minimal complications. Hence we concluded that closed reduction and crossed percutaneous pinning is an effective method of treatment.

KEYWORDS : Supracondylar Humerus Fracture, Kirschner Wire Fixation, Carrying Angle.

INTRODUCTION :

Supracondylar fractures of humerus are the most common type of elbow fracture in children. They account for 50% to 70% of all elbow fractures and are seen most commonly in children between the ages of 4 to 10 years.¹

Incidence of sex predominance is variable in different studies, however, most studies show male preponderance.^{2,3} The fracture has a left sided predominance due to the fact when a child falls from a height, there is an attempt to hold on to something with the dominant arm and thus lands on ground with the non-dominant arm.^{2,4}

Supracondylar humerus fracture usually occur as a result of fall from height or fall while playing. The mechanism of injury includes fall directly on elbow or fall on outstretched hand.³ Supracondylar fracture of humerus which involves lower end of humerus usually involving the thin portion of the humerus through olecranon fossa, or just above the fossa or through the metaphysis. For undisplaced supracondylar humerus fractures Plaster of Paris slab for 3 weeks is one of the best treatment modality since last many years⁵. Different methods have been evolved over time for the treatment of displaced supracondylar fractures of humerus in children, such as⁵ closed reduction and Plaster of Paris slab or cast application, skin traction, overhead skeletal traction, closed reduction and percutaneous pin fixation, closed reduction and posterior intrafocal pinning⁶, closed reduction and lateral external fixation⁷, open reduction and internal fixation.²

The treatment of displaced supracondylar fracture of the humerus is one of the most challenging one to prevent complications because if it is not treated properly it may lead to many complications such as elbow stiffness, malunion, neurovascular injury, compartment syndrome, Volkmann's ischaemic contracture, myositis ossificans.³

MATERIAL AND METHOD:

The study was conducted at department of orthopaedics Dr. Shankarrao Chavan Government Medical College and Hospital Nanded for treatment of supracondylar humerus fracture. This is a prospective study of 60 cases over period of 18 months (2019-2020). In this study the outcome of displaced supracondylar humerus fracture in children treated with biplanar crossed pin k wire were studied. In this study, supracondylar fracture of humerus was classified according to Gartland's classification.^{9,10}

INCLUSION CRITERIA:

- 1) Age group 3 - 11 years.
- 2) Patients with displaced supracondylar fracture of humerus.
- 3) Patients medically fit for surgery.
- 4) Patients with closed fractures.

EXCLUSION CRITERIA:

- 1) Open fractures
- 2) Pathological fractures
- 3) Medical contraindication for surgery
- 4) Associated with neurovascular compromise
- 5) Undisplaced fracture
- 6) Previous fracture in same elbow

METHODOLOGY:

All the patients selected for this study were admitted in tertiary Care hospital. Detailed history and examination of the patient was done according to the protocol. The patients radiograph was taken in Antero-posterior and lateral views. The diagnosis was made by clinical and radiological examination. In this study, supracondylar fracture of humerus was classified according to Gartland's classification. All patients were started on prophylactic antibiotic therapy. Intravenous antibiotic was administered according to the body weight of the children, prior to induction of anesthesia and

continued post-operatively for 3 days. Intravenous antibiotics were withdrawn after 3 days and oral antibiotics were given for further 7 days. The surgical procedure was performed under general anaesthesia or brachial block and position of patient supine with ipsilateral shoulder at edge of table .

Traction along the longitudinal axis with elbow in extension and supination given. At the same time counter traction was given by an assistant by holding proximal portion of arm. Medial or lateral displacements were corrected by valgus or varus forces respectively. After that, posterior displacement and angulation was corrected by flexing the elbow and applying posteriorly directed force from anterior aspect of proximal fragment and anteriorly directed force from posterior aspect of distal fragment. Reduction was confirmed under

Image Intensifier In Different Views:

- Antero - posterior view
- Jones view
- Lateral view

After confirming satisfactory alignment, reduction was maintained by percutaneous k-wire fixation. Above elbow posterior pop splint in 90° elbow flexion of forearm was applied.

K-wires of about 1.2 mm to 2.0 mm were used according to body weight. Two K- wire of equal diameter used. After achieving satisfactory reduction by closed technique, two criss-cross pins were inserted one from lateral epicondyle and one from medial epicondyle. K-wires were introduced with the help of a drill.

First K - wire is passed from postero-lateral corner of lateral epicondyle. The insertion point is in the center of lateral epicondyle (capitulum) because the center of the capitulum is in line with anterior aspect of humeral shaft. The pin must be directed slightly posteriorly. K wire is inserted through the capitulum and then the distal humeral physis. Generally, the pin is aimed 35 degree upward and 10 degree posterior. Pin should avoid the olecranon fossa and should come to rest along the far cortex.

Second K - wire is passed from antero-medial corner of medial epicondyle. K - wire passed obliquely through medial epicondyle , just proximal to olecranon fossa. Once lateral pin has been inserted, bring the elbow out to 80-90 degree flexion prior to placement of the medial K - wire to decrease ulnar nerve subluxation. Another method to prevent ulnar nerve injury during K – wire insertion was by using surgeon's thumb can milk the ulnar nerve back into its posterior position and hold it there. If excessive soft tissue swelling is present, small incision through the skin over medial epicondyle taken and spreading with hemostat.

Both pins were directed 40° to the humeral shaft in sagittal plane and 10° posteriorly. K-wire placement was checked in image intensifier in Antero posterior, Jones view and lateral views in case of closed reduction. And precautions were taken to engage both cortices to cross above the fracture site and not to cross the olecranon fossa. K-wires were bent and kept at least 1 cm outside the skin. Sterile dressing was applied.

K-wires were removed at 4 weeks post-operatively after X-Ray confirmation of satisfactory callus formation.Pop splint was discarded at the same time and patient was encouraged to do active elbow flexion extension and supination - pronation exercises. Patients were advised to avoid massage and passive stretching and not to lift heavy weights till 12 weeks post-operatively. Follow up was done on O.P.D. Basis at 4th week, 12th week and 24th week post operatively. The follow up was done by clinical and radiological evaluation, and results were assessed.

OBSERVATION AND RESULT:

In our study, we found that type III fractures have higher incidence as compared to type II fractures.70% of the patients that is 42 cases had type III fracture and rest 18 cases, 30% had type II fracture, according to Gartland classification.

Table 1: Distribution of the study participants according to Restriction of flexion movement:

Restriction of flexion movement	Number	Percentage
Upto 5	45	75.00%
6 to 10	9	15.00%
11 to 15	4	6.67%
16 to 20	2	3.33%
Total	60	100.0%

Among the 60 participants, the average restriction of flexion was found to be 5.83 degrees. Out of 60 patients, 45 had restriction of flexion upto 5 degrees, 9 had restricted flexion ranging from >5 to 10 degrees, 4 children had restriction of flexion between 10 to 15 degrees and 2 patients had restricted flexion from 15 to 20 degrees.

Table 2 : Distribution of the study participants according to Carrying angle of injured limb as compared to normal side during final follow up

Carrying angle	Normal Limb		Injured Limb	
	Number	Percentage	Number	Percentage
0- 5	0	0%	3	5.0%
5 to 10	0	0%	43	71.67%
11 to 15	60	100.0%	14	23.33%
Total	60	100.00%	60	100.00%

P < 0.05, Significant difference

There was a significant difference between the carrying angle of normal limb and injured limb during final follow up. (p<0.05)

All of the normal limbs had carrying angle of 11 to 15 (100%). While majority of the injured limbs had carrying angles of 5 to 10, with 43 cases (71.67%) and 14 cases had carrying angles of 11 to 15 (23.33%), 3 cases had carrying angles of 0-5 (5%).

Table: 3 Distribution of the study participants according to Loss of carrying angle of affected limb as compared to normal side during final follow up

Loss of carrying angle	Number	Percentage
0 to 5	49	81.67%
5 to 10	10	16.67%
11 to 15	1	1.67%
Total	60	100.00%

Majority of the cases, we saw the loss of carrying angle during final follow up as compared to normal limb was 0 to 5, with 49 cases (81.67%), followed by 5 to 10 in 10 cases (16.67%) and 11 to 15 in one case (1.67%).

In our study, there were 2 patients (3.33%) with pin tract site infection which was cured with antibiotic therapy. A single patient had iatrogenic ulnar nerve injury (1.67%) which recovered after conservative treatment for 8 weeks. One patient came with K wire back out (1.67%) during follow up while a single patient developed cubitus varus (1.67%) post operatively.

Table :4 Distribution of the study participants outcomes as per Flynn criteria

Flynn criteria	Number	Percentage	
Satisfactory (58, 96.66%)	Excellent	46	76.66%
	Good	8	13.33%
	Fair	4	6.66%
Unsatisfactory	Poor	2	3.33%
	Total	60	100.0%

In the present study, of the 60 cases, the clinical outcome

grading was measured as per the Flynn criteria for grading outcomes; 46 (76.66%) of the patients observed excellent results and 8 patients (13.33%) had good results and 4 (6.66%) of the patients observed Fair results that is 58 (96.66%) of satisfactory results. Then 2 (3.33%) of the patients observed Poor results that is Unsatisfactory as per Flynn criteria.

DISCUSSION :

In our study, we found that type III fractures have higher incidence as compared to type II fractures.70% of the patients had type III fracture and 30% had type II fracture, according to Gartland classification. As seen in the studies done by Zamzam¹¹ et al which shows 62.03% of type III fractures and 37.97% of type II fractures. Zhong¹² et al also observed similar results in their study with type III fracture being present in 64.95% of the cases and type II in 35.05% of the cases. There were 2 patient with pin tract site infection which was cured with antibiotic therapy. A single patient had iatrogenic ulnar nerve injury which recovered after conservative treatment for 8 weeks. One patient came with K wire back out during follow up while a single patient developed cubitus varus post operatively. In Srivastava¹³ (2000), study group of 42 patients about 14% had superficial pin tract infection, while 1 patient (2%) had iatrogenic ulnar nerve palsy. In our study, among the 60 participants, the average restriction of flexion was found to be 5.83 degrees. Out of 60 patients, 45 had restriction of flexion upto 5 degrees, 9 had restricted flexion ranging from >5 to 10 degrees, 4 children had restriction of flexion between 10 to 15 degrees and 2 patients had restricted flexion from 15 to 20 degrees. Of the 60 patients enrolled in our study, 49 (81.67%) patients had change in carrying angle less than 5 degree , 10 (16.67%) of them had change between 5-10 degree and 1 (1.67%) of them had change in carrying angle more than 10 degree. Average carrying loss in our study was 3.33 degree . The study conducted by Nacht JL.et al show average carrying angle loss was 5.8 degree and study conducted by Flynn¹⁴et al show average carrying angle loss was 6.2 degree. In the present study, of the 60 cases, the outcome grading was measured as per the Flynn et al¹⁴ criteria for grading outcomes; 46 (76.66%) of the patients observed excellent results and 8 patients (13.33%) had good results and 4 (6.66%) of the patients observed Fair results that is 58 (96.66%) of satisfactory results. Then two (3.33%) of the patients observed Poor results that is Unsatisfactory as per Flynn et al criteria. The Clinical outcome is compared to the studies as given below:

Study done by Pirone⁵ et al showed Excellent results in 78% cases, 16% showed Good results, 1% had Fair outcome while the results were Poor in 5% of the patients.

CONCLUSION:

Hence from our study, We conclude that closed reduction and crossed percutaneous pinning is a effective method of treatment with relatively fewer complications for displaced supracondylar fractures humerus in children and had better functional outcome .

CASE ILLUSTRATION

CASE - I

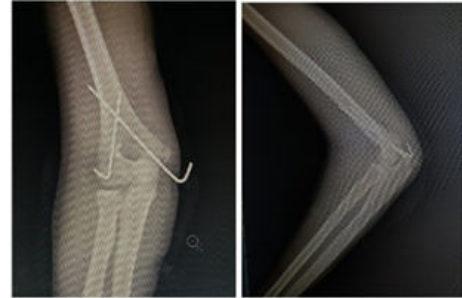
PRE OPERATIVE



PRE OPERATIVE X-RAYS

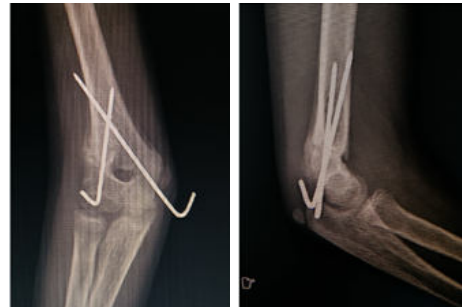


IMMEDIATE POST OPERATIVE X-RAYS



AP VIEW

LATERAL VIEW



4 weeks Post Operative X rays



24 weeks Post Operative X rays



Final Followup

REFERENCES:

1. John AH, Tachdjian's pediatric orthopaedics.4th ed. Philadelphia. Saunders: 2008:2451-2476
2. Lord B, Sarraf KM. Paediatric supracondylar fractures of the humerus: acute assessment and management. British Journal of Hospital Medicine 2011;72(1):M8-M11.
3. Farnsworth CL, Silva PD, Mubarak SJ. Etiology of supracondylar humerus.Ediatr Orthop 1998;18(1):38-42.

4. Houshian S, Mehdi B, Larsen MS. The epidemiology of elbow fracture in children: analysis of 355 fractures, with special reference to supracondylar humerus fractures. *J Orthop Sci* 2001;6:312-5
5. Pirone AM. et al. "Management of displaced extension-type supracondylar fractures of the humerus in children". *J Bone & Joint Surg*, 1988; 70A; 641-650
6. Fahmy et al. Posterior intrafocal pinning for extension-type supracondylar fractures of the humerus in children. *JBJS(B)* 91-B (9):1232
7. Theddy Slongo, MD, Timo Schmid, MD, Kaye Wilkins, DVM, MD, and Alexander Joeris, MD Lateral External Fixation—A New Surgical Technique for Displaced
8. Andrew J. Weiland, et al. Surgical treatment of displaced supracondylar fractures of the humerus in children. *Jbjs* 1978; 60a: 657-661.
9. Conn JR, Wade PA. Injuries of the elbow: A ten year review. *J Trauma* 1961; 1:248-268.
10. Gartland JJ. Management of supracondylar fractures of humerus in children. *Surg Gynecol Obstet* 1949;109:145-54
11. Zamzam MM et al. Treatment of displaced supracondylar humeral fractures among children: crossed versus lateral pinning. *Injury* 2009 Jun; 40:625-630.
12. Zhong ZP, Cao J. Comparison of two approaches for the treatment of supracondylar fractures in children by K-wires. *Zhongguo Gu Shang*. 2009 Oct; 22(10):767-9
13. Srivastava, The results of open reduction and pin fixation in displaced supracondylar fractures of the humerus in children. *Med J Malaysia*. 2000; 55 (suppl.): 44-48.
14. Flynn JC, Mathew JC, Beoit RL. Blind pinning of supracondylar fractures of humerus in children. *JBJS* 1974; 56-A: 263-71.