

Original article:

A study of supracondylar fractures of humerus in children by open reduction and internal fixation with kirschner wires

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Abstract:

Background: Supracondylar fractures of humerus is the commonest injury, constitutes about 65.4% of all fractures about the elbow in children. Displaced supracondylar fracture of humerus demand great respect and challenging one to treat, since it requires accurate anatomical reduction and internal fixation to prevent complications. So in this study we reported the results of open reduction and internal fixation with K-wires in the displaced (Gartland's type III) supracondylar fracture humerus in children.

Materials & Methods: 30 cases of displaced (Gartland's type III) supracondylar fractures treated by open reduction and internal fixation with K-wires were studied between September 2011 to August 2013 at our institution and followed for an average of 24 months.

Results: We came across 36 male patients and 14 female patients. Majority of the cases (38) were due to high energy trauma of road traffic accidents involving relatively younger patients. At the end of five months, all except four patients could mobilize independently without any aid. We did not come across complications like fracture of femur and failure of fixation and no reoperations were required.

Conclusions: Proximal femoral nails are a good implant for subtrochanteric fracture of the femur. The advantages include minimal exposure (closed technique), better stability and early mobilization. Fractures united in all cases and postoperative functional outcome was satisfactory. PFN could be preferred implant of choice in treating subtrochanteric fractures especially in elderly since it allows early and stable mobilization.

Key-words: Supracondylar fracture humerus; K-wire, Internal fixation

Introduction:

Supracondylar fracture of humerus is the commonest injury around elbow in children. It constitutes about 65.4% of all the fractures about the elbow in children. The occurrence rate increases progressively in the first five years of life to peak between 5 - 7 years of age¹. The supracondylar fracture of humerus demand great respect in treatment because if it is not treated properly it may give rise to many complications such as Volkmann's ischaemic contracture, Neurovascular injury, Myositis ossificans, Stiffness of elbow and Malunion². It needs accurate anatomical reduction and internal fixation. So no longer is it acceptable to near "not bad for a supracondylar

fracture"³. Various modalities of treatment have been proposed for the treatment of displaced supracondylar fractures of the humerus in children, such as closed reduction and plaster of paris slab application, skin traction, overhead skeletal traction, closed reduction and percutaneous pin fixation and open reduction with internal fixation⁴.

Closed reduction with splint or cast immobilization and treatment with traction has traditionally been recommended for displaced supracondylar fractures, but difficulty in reduction, loss of reduction postoperatively or during follow up leads to malunion and elbow stiffness⁵. During early part of the century there was a reluctance to recommend open reduction of

supracondylar fracture. But now a lot of changes in medical field has taken place especially in orthopaedic trauma. A better understanding of biomechanics quality of implants, principles of internal fixation, soft tissue care antibiotics and asepsis have all contributed to the radical changes. Thus we have advanced from the conservative approach to open reduction and internal fixation in fractures as an acceptable mode of treatment⁶. Our objectives were to study age, sex and side incidence of supracondylar fracture of humerus and average time duration for union of these fractures after surgical treatment of supracondylar fracture of humerus by open reduction and internal fixation with K-wires along with any complications that may arise.

Materials and Methods:

Thirty closed extension type of supracondylar fractures (Gartland's type III) of the Humerus were treated by open reduction and Internal fixation with K-wires between September 2012 to August -2013. The study was conducted in Sri Siddhartha Medical College, Tumkur.

Inclusion Criteria :

- 1) Age less than 15 years
- 2) Irreducible fracture by closed reduction.
- 3) Closed supracondylar fractures with vascular compromise .
- 4) Open fractures

Exclusion Criteria :

- 1) Age more than 15 years
- 2) Patients medically unfit for surgery.

The ethical clearance for this study has been taken from Institution. All patients selected for this study were admitted in Sri Siddhartha Medical College Hospital and examined according to protocol and associated injuries if any were noted. X-rays

were taken in two planes. A trial closed reduction done in 27 patients, in 3 patients who had gross swelling, were taken for elective surgery at the earliest without closed reduction. All fractures were classified according to Gartland's classification

Gartland's Classification chart:

Type-I Non displaced

Type-II Displaced (with intact posterior cortex)

Type-III Displaced (no cortical contact)

a. Posteromedial

b. Posterolateral

Operative technique :

Under general anaesthesia, patients were put in lateral position with fractured elbow facing the surgeon. The standard posterior Campbell's approach was used in all patients. Ulnar nerve was identified and isolated. Triceps muscle was vertically split to expose fractured site. Haematoma was evacuated and saline wash was given to clearly visualize fractured site. Fracture was reduced by leaving the distal end of proximal fragment posteriorly. Reduction was assessed by taking in to consideration the medial and lateral pillar anatomy. Once good reduction was confirmed, if the fracture is posteromedial type, the medial pin was placed first through the apex of the medial epicondyle. The lateral pin was placed at the center of lateral epicondyle obliquely across fracture site to engage the opposite cortex of the proximal fragment. The fractures were secured with 1.2 mm – 2.0mm K-wires depending upon the age of the patient at an angle of 30° in coronal plane to engage in opposite cortex on both side. Fracture stability was assessed, the elbow extended and carrying angle was measured and compared to that on the non-affected side. The pins were bent and cut off outside the skin to allow removal in the outpatient clinics without anesthesia. Wound was closed in layers and sterile dressing was applied. Tourniquet was released. Postoperatively the extremity was placed in well padded posterior splint with elbow flexed to 90° and patient was shifted to the ward after recovery from anaesthesia. Patients were called for follow up after 3 weeks the POP slab was removed. Active range of motion exercises were encouraged and a special mention and warning was given after the removal of splint about avoiding massage and passive stretching of elbow joint. The K. wires were removed after 4 to 6 weeks with further follow ups done at 12 weeks and 24 weeks. The patients were examined clinically and

radiologically, assessed for range of motion and carrying angle. The final results obtained were evaluated by Flynn's criteria⁷. The results were graded as excellent, good, fair and poor according to loss of range of motion and loss of carrying angle.

Results:

Observation and analysis of results were done in 30 patients who were operated in our hospital in relationship to age, sex, type of injury, laterality of fracture, fracture pattern, associated injuries, time of surgery, duration of hospital stay, complications of treatment and functional outcome. In our series majority of 18 (60%) of patients were found to be between age group of 4-6 years (Table 1). The least number of cases are found in the age group between 13-15 years. The average age of the patient is 7 years. Majority of the patients were males i.e., 18 (60%) and 12 (40%) patients were females. The most commonest cause of injury was fall while playing 15 patients, followed by fall from bicycle in 12 patients and in 3 patients it was due to fall from tree (Table 2).

19 patients were discharged on the second postoperative day. Postoperative complications ranging from traumatic median nerve palsy, superficial pin tract infection, iatrogenic ulnar nerve palsy, migration of K-wires & malunion (varus) were encountered (Table 3).

21 patients had loss of range of motion between 0-5°, one patient had >15° loss of range of motion.

Eighteen patients had carrying angle loss of 0-5°, 2 had >15° and remaining patient 6-15°. Functional Results Based on Flynn's Grading System showed that we had 93% (28 patients) satisfactory results and 2 patients with unsatisfactory result (Table 4).

Discussion:

Supracondylar fracture of humerus is the commonest injury around elbow in children¹. Supracondylar fracture of humerus demand great respect in treatment because if it is not treated properly, it may give rise to neurovascular compromise, difficulty in obtaining or maintaining reduction and poor

late results because of stiffness of elbow or malunion². Most frequently used methods of treatment are closed reduction and application of cast, skeletal traction, closed reduction and percutaneous K-wire fixation and open reduction and internal fixation with K-wires⁴.

The present study was undertaken to verify the claims of various authors regarding surgical management of supracondylar fracture humerus in children and outcome of treatment of these fracture by open reduction and internal fixation with K-wires.

In Edward E Palmar et al⁷ series of 78 patients with supracondylar fractures, 69 patients sustained injury due to fall while playing.

Fransworth CL et al⁸, in her series 70% of cases sustained fracture due to fall.

In our study of 30 patients 20 (66.7%) had posteromedial displacement, 10 (33.3%) posterolateral displacement which was consistent with other studies.

In our study 2 patients had fractures of distal end of radius on same side.

In Mazda et al⁹ series of 116 patients 7 patients had ipsilateral forearm bone fracture.

Pirone AM⁴, et al in his series of 230 patients, there were 20 injuries of the ipsilateral forearm, 18 fractures of the distal third of the radius and ulna, one fracture of the middle 3rd of radius and ulna and one Monteggia fracture dislocation.

Millis MB¹⁰, et al noted 8.33% of associated fractures.

19 (63.4%) Patients operated on 2nd day of hospitalization in our study.

In Ramsey RH, et al¹¹ study of 15 cases all cases were operated within 24 hours of injury.

David L Skuggs et al¹², of 204 patients average interval of time of injury and operation was 1.4 days. In Andrew J Weiland et al², study of 58 cases, 51 patients underwent surgery within 24 hours.

In our series majority of patients were operated within 4-8-72 hours and delay

Loss of range of motion :

In our study of 30 patients, 21 patients (70%) had loss of range of motion of 0-5°, 6 had 6-10°, 2 had 11-15° and only one patient had >15° of range of motion.

In Andrew et al² series of 52 patients, Five patients suffered a moderate loss in range of motion. 1 patient had extension loss of <10°, and 3 had flexion loss of less than 10° and last patient had flexion and extension loss of >10°.

Loss of carrying angle :

In the present study at final follow up 05° of carrying angle loss were seen in 18 patients (60%), 2 (6.7%) patient had more than 15° loss of carrying angle.

In Andrew et al², study of 52 patients, five patients had varus angulation of <10°, 6 had 10-20° and two had varus deformity of >20°. In our study of 30 patients majority of the patients underwent surgery within 48 hours. We have started flexion and extension elbow exercises at the end of 3 weeks and K-wire were removed between 4 and 6 weeks and all patient showed radiological union at 4 weeks of follow up.

In our series we had 1 traumatic median nerve palsy and 3 iatrogenic ulnar nerve palsy. Though in all cases ulnar nerve was isolated before putting K-wire, the palsy was thought to be due to stretching of nerve and all recovered in a matter of 4 to 6 months postoperatively. Four patients had superficial pin tract infection and recovered with a course of antibiotics. One patient had proximal migration of K-wire which was removed later. Five patients had cubitus varus deformity and they were advised to undergo corrective osteotomy but all patients refused because they had good range of painless motion with only cosmetic deformity.

COMPARISON BETWEEN PRESENT STUDY AND OTHER METHODS OF TREATING DISPLACED SUPRACONDYLAR FRACTURE

Treatment	Author	Total No. of cases	Flynn's Grading System			
			Excellent	Good	Fair	Poor
Closed reduction and application of a cast	Pirone et al	101	51 (51%)	27 (27%)	3 (3%)	20 (20%)
Skeletal traction	Pirone et al	24	16 (67%)	5 (21%)	1 (4%)	2 (8%)
Open reduction and internal fixation	Reitman et al	65	18 (55%)	8 (24%)	3 (9%)	4 (12%)
Closed reduction and percutaneous K-wire fixation	Flynn et al	52	42 (80%)	7 (14%)	2 (4%)	1 (2%)
Open reduction and internal fixation with K-wires	Pirone et al	9	6 (66%)	1 (11%)	0	2 (22%)
	Mazda et al	26	24 (92%)	1 (4%)	0	1 (4%)
Open reduction and K-wire fixation	Present study (2006)	30	18 (60%)	7 (23.3%)	3 (10%)	2 (6.7%)

The results of our study showed favorably excellent result when compared to other studies of open reduction and internal fixation with 93% satisfactory results according to Flynn's criteria of treatment of type III supracondylar fracture of humerus in children.

To conclude open reduction and internal fixation with K-wires gives more

stable fixation, better anatomical reduction with negligible complication.

So open reduction and internal fixation with K-wires is the most commonly accepted treatment of displaced supracondylar fracture humerus in children when done at appropriate time.

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Nature of trauma	No. of patients	Percentage
Fall from bicycle	12	40
Fall while playing	15	50
Fall from tree	3	10

Results	Rating	No. of patients	Percentage
Satisfactory	Excellent	18	60
	Good	7	23.3
	Fair	3	10
Unsatisfactory	Poor	2	6.7

Age in years	No.of patients	Percentage
4-6	18	60
7-9	6	20
10-12	3	10
13-15	3	10

Complications	No.of patients	Percentage
Traumatic median nerve palsy	1	3.3
Superficial pin tract infection	4	13.3
Iatrogenic ulnar nerve palsy	3	10
Migration of K-wires	1	3.3
Malunion – varus	4	13.3

