Management of Displaced Supracondylar Humeral Fractures in Children by Open Reduction and Internal Fixation with K-Wires: A Prospective Study

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ABSTRACT

Background: *Supracondylar fractures of humerus are the commonest injury, constitutes about 65.4% of all fractures around 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. We reported the results of open reduction and internal fixation with K-wires of the displaced (Gartland's type III) supracondylar humeral fractures in children.*

Objectives: *To study the anatomical and functional results of treatment of supracondylar fracture of humerus by open reduction and internal fixation with K-wires.*

Methods: *25 cases of displaced (Gartland's type III) supracondylar fractures treated by open reduction and internal fixation with K-wires were studied between September 2011 – August 2013 at PES Institute of Medical Sciences & Research and followed for an average of 24 months.*

Results: *In our study of 25 patients, all were closed Gartland's type III fractures with mean age of 6.3 years, 13 patients sustained fracture due to fall while playing, 18 had on left side, with posteromedial displacement in 16 patients. 2 patients had associated distal end radius fracture. Majority of patients operated on 2nd day and discharged on 3rd postoperative day. 3 patients had superficial pin tract infection, 2 had traumatic median nerve palsy, 2 had migration of K-wire, 1 had cubitusvarus deformity and 1 had loss of motion >15^0.*

Conclusion: *Open reduction and internal fixation with K-wires gives more stable fixation, better anatomical reduction with negligible complication and can be accepted asthe best method of treatment for irreducible type 3 supracondylar humerus fracture.*

Keywords: *Supracondylar fracture, Gartland's type III, humerus, open reduction, internal fixation, and Flynn's criteria.*

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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 age[1].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 ischemic contracture, neurovascular injury, myositis ossificans, stiffness of elbow and malunion[2].

The management of displaced supracondylar fracture of the humerus is one of the most challenging one to prevent complications. It needs accurate anatomical reduction and internal fixation[3]. There is no controversy in the management of the un-displaced fractures. But 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 fixation[4], closed reduction and Posterior intrafocal pinning[5], closed reduction and Lateral External Fixation[6]. 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 post-operatively or during follow up leads to malunion and elbow stiffness[7].

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 have taken place especially in orthopaedic trauma. A better understanding of bio-mechanics 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 treat

fractures as an acceptable mode of treatment[8], to open reduction and internal fixation with K-wires which gives more stable fixation and better anatomical reduction with minimal complications.

OBJECTIVES

- To study anatomical and functional results of treatment of supracondylar fracture of humerus by open reduction and internal fixation with K-wires.
- To study the complications of the procedure and to study average time duration for union of these fractures.

METHODOLOGY

Twenty five displaced extension type of supracondylar fractures (Gartland's type III) of the humerus in children were treated by open reduction and Internal fixation with K-wires between September 2011 to August -2013.This study was conducted in our hospital attached to PESIMSR, Kuppam, A.P.

The ethical clearance for this study has been taken from Institution. All patients selected for this study were admitted to 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 inpatients, in 7 patients who had gross swelling, and 4 patients who had pucker sign were taken for elective surgery at the earliest without closed reduction. Consent was taken from the patient and attendant for anaesthesia and surgery. All fractures were classified according to modified Gartland's classification

Inclusion Criteria: Patients with age less than 15 years, irreducible fracture by closed reduction, closed supracondylar fractures with vascular compromise, open fractures and fracture with anterior pucker sign were included in the study.

Exclusion Criteria: Patients with age more than 15 years and patients medically unfit for surgery were excluded from the study.

OPERATIVE TECHNIQUE

Under general anaesthesia patient was put in lateral position with fractured elbow facing the surgeon. Sand bags were placed beneath the arm; the forearm was left to hang freely with the elbow flexed. Tourniquet was applied in all patients.

The standard posterior approach was used in all patients. Ulnar nerve was not explored. Triceps muscle was vertically split to expose fractured site. Haematoma was evacuated and saline wash was given to clearly visualize fractured site. Levering the distal end of proximal fragment fracture is reduced. Taking in to consideration the medial and lateral pillar anatomy assessed reduction. Once good reduction was confirmed (Fig. 1a)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 centre 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 (Fig. 1b) 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 anaesthesia. Wound was closed in layers and sterile dressing was applied. Tourniquet was released.Post-operatively the extremity was placed in well-padded posterior splint with elbow flexed to $60^0$to 70^0 and patient was shifted to the ward after recovery from anaesthesia. Post-operative x-ray was taken to confirm reduction on first post-operative day.(Fig.2,3)

Patients were called for follow up at 2 weeks interval after 4 weeks the POP slab was removed.The K wires were removed after 4 weeks. Activerange of motion exercises was encouraged.The patients were examined clinically and radiologically and assessed for range of motion and carrying angle. The final results were evaluated by Flynn's criteria[9] and graded as excellent, good, fair and poor according to loss of range of motion and loss of carrying angle.

Table 1: Mode of violence

Nature of trauma	No of patients	Percentage
Fall from bicycle	8	32
Fall while playing	13	52
Fall from tree	4	16

Table 2: Complications

Complications	No of patients	Percentage
Traumatic median nerve palsy	2	8
Superficial pin tract infection	3	12
Iatrogenic ulnar nerve palsy	0	0
Migration of K-wires	2	8
Restriction of movements	1	4
Operative wound infection	0	0
Cubitusvarus	1	4

Table 3: Loss of range of motion

Loss of Range of Motion	No of patients	Percentage
0-5	16	64
6-10	6	24
11-15	2	8
>15	1	4

Table 4: Loss of carrying angle

Carrying Angle Loss	No of patients	Percentage
0-5	18	72
6-10	5	20
11-15	1	4
>15	1	4

Table 5: functional results based on Flynn's grading system

Results	Rating	No of patients	Percentage
Satisfactory	Excellent	18	72
	Good	5	20
	Fair	1	4
Unsatisfactory	Poor	1	4

Fig. 1(a): Reduction of the fracture.

Fig. 1(b): Fracture fixation by medial and lateral Kwire

Figure2: x-ray showing type 3 postero-medial supracondylar humerus fracture.

Fig. 3: Immediate post-operative x-ray

RESULTS

In our study age distribution was 4 to 15 years. Most of the patients' i.e.18 (72%) was from 4-9 years age group, followed by 5(20%) patients in 10-12 years age group.The average age of patient was 6.3 years. Among them 17 (68%) patients were males and 8 (32%) patients were females.18patients (72%) had the fracture on left side and 7 (28%) patients had fracture of right side. In our study, we had 16 (64%) patients with posteromedial displacement and 9 (36%) patients with posterolateral displacement and only 2(8%) of the patients had associated injury i-e fracture distal radius which was treated conservatively.

The major cause of fracture in our study was fall while playing in 13 patients (52%), followed by fall from bicycle in 8 patients (32%) and in 4(16%) patients was due to fall from tree.(table:1) All cases

included in this study group were fresh fractures that underwent surgery at the earliest possible time(2nd day to 5th day) after admission to hospital. The average interval between fracture and surgery was 3.1 days. Most of the patients i.e., 16(64%) patients were discharged on 2nd postoperative day. Only 9(36%) of the study patients had complication with superficial pin tract infection followed by traumatic median nerve palsy and migration of K-wires and there were no any patients with iatrogenic Ulnar nerve palsies and operative wound infection. (Table: 2)

Most of the patient 16(64%) had only 0-5degree loss of range of motion, and>15 degree loss was found in only one patient. (Table: 3) At the final follow up, 0-5 degree carrying angle loss of the affected extremity was noted in 18 (72%) patients. 11-15 degrees carrying angle loss was noted in only one (4%) patient. Gross loss of carrying angle i.e., more than 15 degrees is observed in only 1 patient in our study.(Table:4)

Based on Flynn's grading system, 24(96%) patients had satisfactory results. Of these 24 patients, 18(72%) patients were rated as excellent, 5(20%) patients were rated as good& one patient as fair and 1 (4%) patient was rated as poor.

DISCUSSION

The aim of treatment of supracondylar fractures is to achieve functionally and cosmetically satisfactory results with negligible complications, assuring low cost in treatment. 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 fractures by open reduction and internal fixation with K- wires.

In our study group average age was 6.3 years was almost similar when compared to various other studies.[2,3,4,12,13] Male to female patient ratio was found to be 60:40 in our study whereas few other studies showed 52:48 and 85:15[14,15]. Most of our patients 13 (52%) sustained fractures due to fall while playing which was similar to other studies.[15,16] In the present study 64% of the patients had posteromedial displacement of fracture while other studies showed 75% -81%[4,10,18].

In our study 14(56%) patients operated on 2nd day of hospitalization in contrast to studies study where majority of cases were operated within 24 hours of injury [2,12,19]; the delay in operation is due to late admission to hospital. Most of the patients were discharge in the third postoperative day and only few were discharged at 4th and 5th days due to presence of swelling.Of 25 cases we had 2(8%) traumatic median nerve and median nerve palsy occurred in a patient with posterolateral displacement but luckily that patient did not have any vascular injury, but in other studies shows 13% and 42.5%[2,17].Our study 64% of the patients had 0-5^{0}loss of range of motion and 8% showed 6-10^0 and 4% had > 10^0 loss of motion whereas other study showed 9.6%,7.7% and 1.9% respectively[2].

In the present study at final follow only 1(4%) patient had more than 15^{0}loss of carrying angle whereas in other study it showed as 13.46%[2,12]. The results of our study showed favourably excellent result when compared to other studies of open reduction and internal fixation with 96% satisfactory results according to Flynn's criteria of treatment of type III supracondylar fracture of humerus in children.

CONCLUSION

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 can be accepted as a best method of treatment for irreducible type 3 supracondylar humerusfractures.

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