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Functional outcome and complications of displaced supracondylar fracture in pediatric population treated with open reduction internal fixation with K wires

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Abstract

Objective: The objective of this study was to analyse clinical outcome of treatment of supracondylar fracture of humerus by open reduction and internal fixation with K-wires and to analyse complications of the procedure.

Introduction: Treatment of displaced supracondylar humerus fracture (SCHF) is a challenge to the orthopaedic surgeon owing to its neurovascular and other complications.

Open reduction and K-wire fixation is widely accepted standard treatment and is an effective way in managing such fracture with goals of obtaining correction and maintenance of alignment, avoiding deformity, and getting functional range of elbow movement. The aim of our study was to evaluate the functional results of open reduction and internal fixation with k wires in the treatment of displaced (Gartland's type III) supracondylar fractures of the humerus.

Methods: 50 cases of displaced (Gartland's type III) supracondylar fractures treated by

Open reduction and internal fixation with K-wires were studied between february 2013 – January 2016 at our institution and followed for an average of 6 months.

Results: In our study of 50 cases, all were closed Gartland's type III fractures with mean age of 6.3 years, posteromedial displacement in 32 patients. 4 patients had associated distal end radius fracture. Majority of patients operated on 2nd day and discharged on 3rd postoperative day. 32 had 0-5° loss of range of motion, 36 had 0-5° loss of carrying angle. 6 patients had superficial pin tract infection, 4 had traumatic median nerve palsy, 4 had migration of K-wire, 2 had Cubitus varus deformity and 2 had loss of motion >15.

Keywords: supracondylar fracture humerus; K-wire, internal fixation, Gartland's

1. Introduction

The management of displaced supracondylar fracture of the humerus is one of the most challenging one to prevent complications such as Volkmann's ischemic contracture, Neurovascular injury, Myositis ossificans, Stiffness of elbow and Malunion [1]. It needs accurate anatomical reduction and internal fixation. So no longer it is acceptable to near —not bad for a supracondylar fracture [2].

There is no controversy in the management of the un-displaced fractures. But various modalities of closed reduction treatment have been proposed for the treatment of displaced supracondylar fractures of the humerus in children but difficulty in reduction, loss of reduction postoperatively or during follow up leads to malunion and elbow stiffness [3].

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 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 open reduction and internal fixation in fractures as an acceptable mode of treatment [4].

Various studies have shown that for displaced supracondylar fractures of humerus, open reduction and internal fixation with K-wires gives more stable fixation, better anatomical reduction with minimal complications. So still open reduction and internal fixation with K-

wires is the most commonly accepted treatment of displaced (Gartland Type3) supracondylar fractures of the humerus in children.

The purpose of our investigation is analyse clinical outcome of treatment of supracondylar fracture of humerus by open reduction and internal fixation with K-wires and to analyse the complications of the procedure.

2. Materials & Methods

2.1 Study design: Prospective study

2.2 Source of data: The data for this study was collected from 50 patients fulfilling the inclusion/exclusion criteria admitted as IP in Kadimi hospital during the period from February 2013 to January 2016

2.3 Inclusion criteria

- a. Age less than 15 years
- b. Irreducible fracture by closed reduction.
- c. Closed supracondylar fractures with vascular compromise.

- d. Open fractures
- e. Fracture with anterior pucker sign

2.4 Exclusion criteria

- a. Age more than 15 years
- b. Patients medically unfit for surgery

3. Methodology

The ethical clearance for this study has been taken from Institution. All patients selected for this study were admitted kadimi 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 14 patients who had gross swelling, and 8 patients who had pucker sign were taken for elective surgery at the earliest without closed reduction.

3.1 Classification

All fractures were classified according to modified Gartland's classification

Table 1: Modified Gartland's classification [5]

Type1	Undisplaced	Fat pad present acutely
Type2	Hinged posteriorly	Anterior humeral line anterior to capitellum
Type3	Displaced	No meaningful cortical continuity
Type4	Displaces in to extension and flexion	Diagnosed with manipulation under image
Medial comminution (not truly separate type)	Collapse of medial column	Loss of baumann angle

3.2 Procedure

- a. Open reduction and internal fixation with k wire fixation was performed for the patients
- b. Patients were called for follow up after 4 weeks the POP slab was removed.
- c. The K. wires were removed after 4 weeks.
- d. Further follow ups were done at 12 weeks and 24 weeks.
- e. The patients were examined clinically and radiologically,

assessed for range of motion and carrying angle.

3.3 Functional results

The final results were evaluated by Flynn's criteria [7]. The results were graded as excellent, good, fair and poor according to loss of range of motion and loss of carrying angle.

Table 2: Flynn's Grading System

Result	Rating	Cosmetic factor: Carrying angle loss (degrees)	Functional factor: motion loss (degrees)
Satisfactory	Excellent	0-5	0-5
	Good	6-10	6-10
	Fair	11-15	11-15
Unsatisfactory	Poor	>15	>15

4. Results

Observation and analysis of results were done in 50 patients who were operated in our hospitals in relationship to age, sex, type of injury, laterality of fracture, fracture pattern, associated injuries. Time of surgery, duration of stay in hospital, complications of treatment and functional outcome.

4.1 Age distribution

This study was done to find out the age incidence in our Indian setup and to know the type of fracture incidence.

Table 3: Age Distribution

Age	No of patients	Percentage
4-6	16	32
7-9	20	40
10-12	10	20
13-15	4	8

In our series age distribution was 4 to 15 years. Majority of the patients i.e. 36 (72%) were from 4-9 years age group, followed by 10(20%) patients in 10-12 years age group,

followed by 4(8%) patients in 13-15 years age. The average age of patient was 6.3 years.

4.2 Fracture pattern

Table 4: Classification of Fracture Pattern

Fracture pattern	No of patients	Percentage
Type3posteromedial	32	64
Type3posterolateral	18	36

In our study, we had 32 (64%) patients with posteromedial displacement and 18 (36%) patients with posterolateral displacement

4.3 Days of hospitalization

Table 5: Number of days of Hospitalisation

Hospital stay (days)	No of patients	Percentage
3	32	64
4	10	20
5	8	16

Majority of the patients i.e., 32(64%) patients were discharged on 2nd postoperative

4.4 Post-operative complications

Table 6: Post-operative complications

Complications	No of patients	Percentage
Traumatic median nerve palsy	4	8
Superficial pin tract infection	6	12
Iatrogenic ulnar nerve palsy	0	0
Migration of K-wires	4	8
Restriction of movements	2	4
Operative wound infection	0	0
Cubitus varus	2	4

4.5 Loss of range of motion

Table 7: Loss of range of motion

Loss of range of motion	No of patients	Percentage
0-5	32	64
6-10	12	24
11-15	4	8
>15	2	4

4.6 Carrying Angle Loss

Table 8: Carrying angle loss

Carrying Angle Loss	No of patients	Percentage
0-5	36	72
6-10	10	20
11-15	2	4
>15	2	4

At the final follow up, 0-5 degree carrying angle loss of the affected extremity was noted in 36 (72%) patients. 11-15 degrees carrying angle loss was noted in only two (4%) patient and. Gross loss of carrying angle i.e., more than 15 degrees is observed in two pts our study.

4.7. Functional results based on flynn's grading system

Table 9: Functional Results based on Flynn's Grading System

Results	Rating	No of patients	Percentage
Satisfactory	Excellent	36	72
	Good	10	20
	Fair	2	4
Unsatisfactory	Poor	2	4

In our study, 48(96%) patients had satisfactory results. Of these 48 patients, 36(72%) patients were rated as excellent, 10(20%) patients were rated as good & 2 patients as fair and 2(4%) patients were rated as poor.

5. Discussion

5.1 Age incidence

In our series of 50, 36 (72%) of the patients were between 4 - 9 years age group with an average age being 6.3 years.

Table 10: Age Incidence

Series	Average age in years
Ramsey RH <i>et al</i> [6]	7
Pirone AM, <i>et al</i> [7]	6.4
Kumar R, <i>et al</i> [8]	8
Andrew J <i>et al</i> [1]	6.7
Mazda K, <i>et al</i> [9]	5.7
Wilkin KE, <i>et al</i> [10]	6.7
Present study	6.3

5.2 Fracture Pattern

In our study of 50 patients 32 (64%) had posteromedial displacement, 18 (36%) posterolateral displacement.

Table 11: Fracture Pattern

Series	Posteromedial	Posterolateral
Aronson DD, <i>et al</i> [11]	75	25
Mostafavi HR, <i>et al</i> [12]	81	19
Pirone AM, <i>et al</i> [7]	81	19
Present study	32	18

5.3 Number of days of stay in hospital

In our series of 50 patients, about 32(64%) of the patient discharged in 3 days of operation and 18(36%) patients discharged at 4th and 5th days due to presence of swelling. So these patients were kept for observation.

Table 12: Number of days of hospitalization

Series	No of days of hospitalization
Mazda K, <i>et al</i> [9]	2
Andrew J, <i>et al</i> [1]	5
Ramsay RH, <i>et al</i> [6]	3.66

5.4 Complications

In our series of 50 cases we had 4 traumatic median nerve and. Median nerve palsy occurred in a patient with posterolateral displacement but luckily that patient did not have any vascular injury.

In a Andrew J, *et al* [1] series of 52 cases he came across 5 preoperative neurological deficits. 2 patients had combined radial and median nerve and one each of radial, ulnar and median. All patients recovered in 2 weeks postoperatively.

In Srivatsava [13] study group 42. 2% of the patient had nerve injury.

We had 6 cases of superficial pin tract infection. 4 out of 6 subsided with antibiotics in 10 days but in one patient infection disappeared after removal of the K- wire, but there was no deep or bone infection.

In Srivastava [13] study group of 42 patients about 14% had superficial pin tract infection.

Ramsey RH, *et al* [6] study of 15 cases, one patient had pin tract infection that had healed after 2 weeks of treatment.

In our study we had 2 cases of cubitus varus deformity, two cases of proximal migration of K-wire, this may be due to failure to pierce in the opposite cortex during insertion. Later the Kwire was removed under general anaesthesia.

5.5 Loss of range of motion

In our study of 50 patients, 32 patients had loss of range of motion of 0 - 5°, 12 had 6-10°,

4 had 11-15° and two patients had >15° of range of motion.

In Andrew *et al* [2] 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°.

5.6 Loss of carrying angle

In the present study at final follow up 0-5° of carrying angle loss were seen in 36(72%) patients, 2(4%) patient had more than 15° loss of carrying angle.

In Ramsey RH, *et al* [6] series of 15 patient, 12 were considered essentially normal with carrying angle loss of less than 3-4° but 3 patient had 5 to 15° of varus deformity with out significant motion at elbow.

In Andrew *et al* ^[1], study of 52 patients, five patients had varus angulation of <10°, 6 had 10-20° and two had varus deformity of >20°. Supracondylar fracture of humerus is most common injury around elbow. Injuries to blood vessels and nerves may be more dangerous than the fracture itself especially Volkmann’s contracture which was one of the most frightening complication. In our study of 50 patients majority of the patients underwent surgery with in 48 hours. K-wire were removed at 4weeks and all patient showed radiological union at 4 weeks of follow up. We have started flexion and extension elbow exercises at the end of 4 weeks. In our series we had 4 traumatic median nerve palsy all recovered in a matter of 4 to 6 months postoperatively. 6 patients had superficial pin tract infection and recovered with a course of antibiotics. 2 patient had proximal and 1 patient had distal migration of K-wire, which was removed later. 2 patient had cubitus varus deformity and they were advised to undergo corrective osteotomy but patient refused because they had good range of painless motion with only cosmetic deformity. Moreover, in the recently published Clinical Practice

Guidelines from the American Academy of orthopaedic surgeons ^[14] it was recognised that some supracondylar humeral fractures cannot be reduced with a closed technique. The need for open reduction is determined by the pattern of the fracture, soft-tissue interposition, patient characteristics and surgeon experience. Although surgical treatment creates risk of infection, the improved outcomes (as per Flynn’s criteria) and decreased risk of neuro-vascular complications out weigh the risk ^[15]. The results of our study showed favorably 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. 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.

5.7 Comparison between present study and other methods of treating

Table 13: Displaced Supracondylar fracture

Treatment	Author	Total No. of	Flynn's grading system			
			Excellent	Good	Fair	Poor
Closed reduction and application of a cast	Pirone <i>et al</i> ^[7]	101	51 (51%)	27 (27%)	3 (3%)	20 (20%)
Percutaneous Kirschner-wire fixation	Pirone <i>et al</i> ^[7]	96	75 (78%)	15 (16%)	1 (1%)	5 (5%)
Skeletal traction	Pirone <i>et al</i> ^[7]	24	16 (67%)	5 (21%)	1 (4%)	2 (8%)
Open reduction and internal fixation	Pirone <i>et al</i> ^[7]	9	6 (66%)	1 (11%)	0 (0%)	2 (22%)
Percutaneous Kirschner wire fixation	Flynn <i>et al</i> ^[7]	52	42 (80%)	7 (14%)	1 (4%)	1 (4%)
Open reduction and K- wire fixation	Present study (2013-2016)	50	36 (72%)	10 (20%)	2 (4%)	2 (4%)

5.7 Cases
5.7.1 Case 1



5.8 Case 2





5.7.2 Case 2



5.7.3 Complications



6. Conclusion

In our series of 50 patients who underwent open reduction and internal fixation with K- wires for closed extension type of

supracondylar fracture, we came to following conclusion.

- Open reduction and internal fixation gives more stable fixation, better anatomical reduction with minimal

complication. So it is safe and effective method of fixation especially with neurovascular injury.

- Common in 4-6 years of age group with male predominance.
- Posteromedial displacement is most common displacement.
- The period of hospitalization is less so it reduces the cost of treatment.
- Cubitus varus deformity is less, compared to other methods due to better anatomical reduction and stable fixation.
- Elbow stiffness is less compared to other modalities of treatment due to early mobilization of elbow.
- Open reduction is absolutely indicated in patients with fracture with neurovascular injury, irreducible fracture, and open fracture.
- Open reduction and internal fixation with K-wires gives excellent functional and cosmetic results when done at appropriate time for displaced supracondylar fracture humerus.

supracondylar humerus fractures. *J Am Acad Orthop Surg.* 2012; 20:328-330.

15. Kishore M. New pediatric supracondylar humerus fractures CPG; *J Am Acad.*

7. References

1. Andrew J Weiland, *et al.* Surgical treatment of displaced supracondylar fractures of the humerus in children. *JBJS* 1978; 60A:657-661.
2. Canale S. Terry ed. Fractures and dislocations in children. Chapter-33, In: Campbell's operative orthopaedics, 10th edn, New York: Mosby. 2003; 2:1437-1451.
3. Yusof *et al.* Displaced supracondylar fracture of humerus in children – comparative study of the results of closed and open reduction. *Med J Malasia.* 1998; 53:52-58.
4. Fleuriau-Chateau, McIntyre, Letts. To review with irreducible supracondylar fractures requiring open reduction in children and to propose guidelines for an open approach to supracondylar fractures. *Can J Surg* 1998; 41(2):112-118.
5. Flynn JC, Mathews JG, Benoit RL. Blind pinning of displaced supracondylar fractures of the humerus in children. *JBJS.* 1974; 56A:263-272.
6. Ramsey RH, Griz J. Immediate open reduction and internal fixation of severely displaced supracondylar fractures. *Clin Orthop.* 1973; 90:130-134.
7. Pirone AM *et al.* Management of displaced extension type supracondylar fractures of the humerus in children. *JBJS.* 1988; 70A:641-650.
8. Kumar R *et al.* Surgical management of the severely displaced supracondylar fracture of the humerus in children. *J Injury.* 2002; 33(6):517-522.
9. Mazda K *et al.* Systemic pinning of displaced extension type supracondylar fractures of the humerus in children. *JBJS.* 2001; 83B(6):888-893.
10. Wilkins KE. The operative management of supracondylar fractures. *OrthopClin N- Am.* 1990; 21(2):269-289.
11. Aronson DD, Prager BI. Supracondylar fractures of the humerus in children – A modified technique for closed pinning. *Clin Orthop.* 1987; 219:174-183.
12. Mostafavi HR, Spero C. Crossed pin fixation of displaced supracondylar humerus fractures in children. *Clin Orthop.* 2000; 376:56-61.
13. Srivastava, The results of open reduction and pin fixation in displaced supracondyl fractures of the humerus in children. *Med J Malaysia.* 2000; 55:44-48.
14. Mulpuri K, Hosalkar H, Howard A. AAOS clinical practice guideline: the treatment of pediatric