



ORIGINAL RESEARCH PAPER

Orthopaedics

COMPARATIVE STUDY OF FIXATION OF SUPRACONDYLAR FRACTURE OF HUMERUS IN CHILDREN BY MEDIAL AND LATERAL VERSUS LATERAL PINNING

KEY WORDS: Supracondylar fracture humerus, Percutaneous fixation, medial-lateral vs lateral, Iatrogenic ulnar nerve injury

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ABSTRACT

Background: Supracondylar fractures of humerus are one of the most common fractures in paediatric age group. Closed reduction and percutaneous K-wire fixation is one of the most commonly used treatment modality . A observational study was undertaken to compare functional outcome and complications in medial – lateral versus lateral pinning.

Material and methods: This is a observational study . A total of 140 patients of displaced supracondylar fracture aged between 4-14 years, without any compound injury or comminution were enrolled for the study and randomly divided into two groups, each of 70 patients. One group was assigned treatment of medial – lateral pinning and other group with lateral pinning respectively and outcome was evaluated on basis of “FLYNN’S” criteria.

Results: After assessment of 70 patients in each group we found out that FLYNN’S was 84.3% in lateral pinning group and 87% in medial - lateral pinning group. This difference is statistically not significant.

Conclusion: In our study we conclude that, lateral pinning is an equally good treatment choice in these fractures. Also, risk of ulnar nerve injury during placement of medial pin is eliminated in lateral parallel k wires. Both the methods offer consistently satisfactory functional and cosmetic results.

INTRODUCTION

A supracondylar humerus fracture is a fracture of the distal humerus just above the elbow joint. Is the most common type of elbow fracture in children. Some are angulated or displaced and are best treated with surgery. In children, most of these fractures can be treated effectively with expectation for full recovery. Some of these injuries can be complicated by poor healing or by associated blood vessel or nerve injuries with serious complications.

Supracondylar fractures of the humerus are the most common fractures in children under 7 years of age ² and the most common paediatric fracture requiring surgery. ³ Supracondylar fractures may have significant complications including nerve injury, vascular injury, malunion and compartment syndrome. ⁴

Supracondylar fractures are a common elbow injury in children accounting for 16% of all pediatric fractures ⁵ and two-thirds of all hospitalizations for pediatric elbow injuries. ⁶ These are often significant fractures that may be associated with morbidity due to malunion, neurovascular complications, and compartment syndrome. After a closed reduction, percutaneous pinning maintains fracture reduction without the need for immobilizing the elbow in significant flexion.

Of the upper limbs in children, the elbow is the second most common site of occurrence of fractures, surpassed only by forearm fractures. Around 85% of elbow fractures in children occur in the distal humerus, and of these, 55 to 75% are supracondylar fractures, accounting for 3% of all fractures in children. ⁷

Supracondylar humerus fractures are caused by direct or indirect low-kinetic energy traumas, such as falls, which makes the occurrence of comminution, bone exposure or association with other fractures less frequent. ^{8,9}

Treatment with closed reduction, associated with plaster cast immobilization, has been gradually abandoned, particularly due to the higher complication rate, such as loss of reduction, compartment syndrome, and long hospitalization periods. ^{10,11}

The treatment of displaced extension type supracondylar fracture humerus, closed reduction with percutaneous pin stabilization is the current preferred method of treatment. However controversy persist between medial and lateral versus lateral fixation techniques. ¹²

Two major complications associated with percutaneous pinning is iatrogenic ulnar nerve palsy and loss of reduction resulting in cubitus varus deformity. ^{13,14}

The advantage of medial and lateral pinning is increased biomechanical stability, although iatrogenic ulnar nerve palsy chances increases with medial pinning. ¹⁵ Conversely advantage of lateral pinning is avoidance of iatrogenic ulnar nerve palsy but may construct less stable biomechanical. ^{16,17} Some studies reports that there is no significant advantage of cross pins in comparison to lateral pins. ^{18,19}

Hence the present study was done at our tertiary care centre to compare fixation of supracondylar fracture of humerus in children by medial and lateral versus lateral pinning and to assess the functional outcome and various complications of either surgical methods of stabilization.

MATERIAL AND METHODS

A hospital based observational study was conducted with 140 patients to compare fixation of supracondylar fracture of humerus in children by lateral versus medial and lateral pinning. The patients were selected randomly and were divided in the following two groups:

- Group A:** 70 patients underwent surgery for Lateral pinning
- Group B:** 70 patients underwent surgery for Medial - lateral pinning

Data collection Procedure – All the patients 4 to 14 year of age with supracondylar fracture humerus who had undergone preoperative investigations and who were fit for surgery were posted for surgery for medial and lateral versus lateral pinning under supra-clavicular block/general anaesthesia. Postoperative clinical evaluation using FLYNN’S CRITERIA between two methods were evaluated.

Results	Rating	Loss Of Carrying Angle	Loss Of Motion
Satisfactory	Excellent	0-5	0-5
	Good	6-10	6-10
	Fair	11-15	11-15
Unsatisfactory	Poor	>15	>15

INCLUSION CRITERIA-

- 1- Male and female child between 4-14 years of age with supracondylar humerus fracture.
- 2- Extension type 2 and 3 supracondylar humerus fracture with no neurovascular injury.
- 3- The patient parents or guardian who is able to understand the information and willing to take part in the study and regular follow up.
- 4- Fresh injury <4 days.

EXCLUSION CRITERIA-

- 1- Patient who are unfit for anaesthesia.
- 2- Fracture more than 4 days.
- 3- Flexion type and Open fractures associated with neurovascular deficit.
- 4- Patients with coexisting comorbidity of concerning arm, shoulder or hand.
- 5- Patient parents or guardian not willing for operative procedure.

METHODOLOGY

After approval of Scientific committee and Ethical committee study was conducted.

PERIOD OF FOLLOW UP-

Patient were followed up for a period of 6 months at regular intervals. At 0, 1, 2, 3, 6 weeks and 3 month and at 6 months.



Figure - LATERAL PINNING CASE

Showing case 1- (a) pre-operative X-ray, (b) immediate post-operative X-ray (c) X-ray after 3 month follow up d) clinical pictures of flex-ext movement 6 month follow up.



A



A



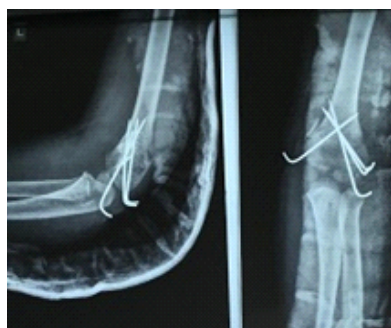
B



B



C



C



D
Figure3- Medial - Lateral pinning case 1 - Showing (a) pre-operative X-ray, (b) immediate post-operative X-ray with slab (c) X-ray shows union after 3 weeks of follow up d) clinical pictures of flex-ext movement at 6 months follow up.

RESULTS
STATISTICAL ANALYSIS

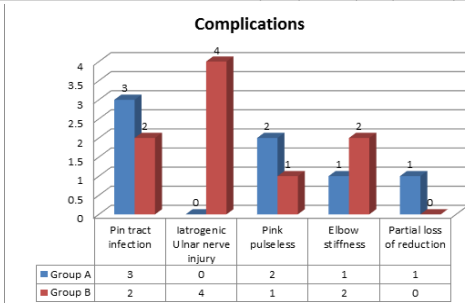
Quantitative data is presented with the help of Mean and Standard deviation. Comparison among the study groups is done with the help of unpaired t test as per results of normality test. Qualitative data is presented with the help of frequency and percentage table. Association among the study groups is assessed with the help of Fisher test, student 't' test and Chi-Square test. 'p' value less than 0.05 is taken as significant.

Distribution of patients according to Complications

There were 3 (4.3%) cases of pin tract infection in Group A while there were 2 (2.9%) cases of pink pulseless and 1 (1.4%) case each of elbow stiffness and partial loss of reduction. In Group B, there were 4 (5.7%) cases of iatrogenic ulnar nerve injury while there were 2 (2.9%) cases each of pin tract infection and elbow stiffness. There was 1 (1.4%) case of pink pulseless. There was no significant association between the groups as per Chi-Square test ($p > 0.05$).

TABLE 9: DISTRIBUTION OF PATIENTS ACCORDING TO COMPLICATIONS

Complications	Group A		Group B		p Value
	N	%	N	%	
Pin tract infection	3	4.3%	2	2.9%	>0.05
Iatrogenic Ulnar nerve injury	0	-	4	5.7%	
Pink pulseless	2	2.9%	1	1.4%	
Elbow stiffness	1	1.4%	2	2.9%	
Partial loss of reduction	1	1.4%	0	-	



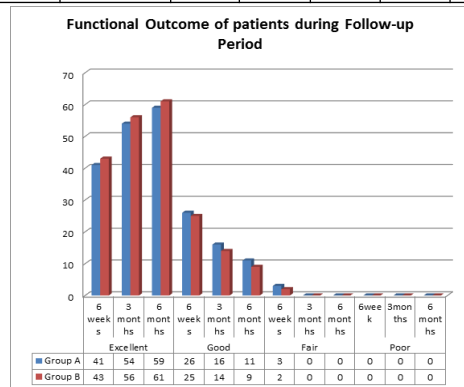
Functional Outcome of patients during Follow-up Period

During 6 weeks follow-up period, 41 (58.5%) and 43 (61.4%) patients in Group A and Group B respectively had excellent score while 26 (37.2%) and 25 (35.8%) patients had good score respectively. Fair score was observed in 3 (4.2%) and 2 (2.8%) patients while poor score was observed in 0 (0%) and 0 (0%) patients respectively. During 3 months follow-up period, 54 (77.2%) and 56 (80%) patients in Group A and Group B respectively had excellent score while 16 (22.8%) and 14 (20%) patients had good score. Fair score was observed in 0 (0%) patients each. During 6 months follow-up period, 59 (84.3%) and 61 (87%) excellent patients in Group A and Group B respectively. Good score was observed 11 (15.7%) and 9 (13%) in group A and B respectively. There was increase

in the functional outcome of patients in both the groups but the increase was statistically not significant as per Chi-Square test ($p > 0.05$)

Table 13: Functional Outcome of patients during Follow-up Period

Flynn Grade	Group A	Group B	p Value	
			N	%
Excellent	6 weeks	41 58.6%	43 61.4%	>0.05
	3 months	54 77.2%	56 80%	
	6 months	59 84.3%	61 87%	
Good	6 weeks	26 37.2%	25 35.8%	>0.05
	3 months	16 22.8%	14 20%	
	6 months	11 15.7%	9 13%	
Fair	6 weeks	3 4.2%	2 2.8%	>0.05
	3 months	0 -	0 -	
	6 months	0 -	0 -	
Poor	6 weeks	0 -	0 -	-
	3 months	0 -	0 -	
	6 months	0 -	0 -	



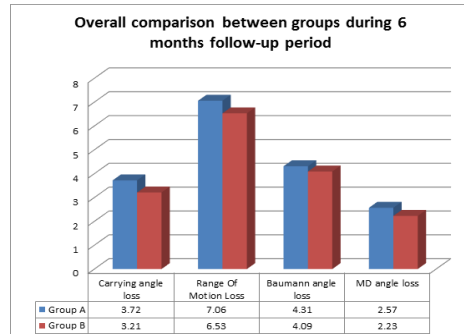
Graph 13: Functional Outcome of patients during Follow-up Period

Analysis of Baumann angle loss and metaphysiodiaphyseal (MD) angle loss in patients during Follow-up Period

The decrease in parameters at 6 months follow-up (Carrying angle loss, Range of Motion loss, Baumann angle loss and MD angle loss) was lesser in Group A as compared to Group B. The difference in improvement between groups was statistically not significant as per Student t-test ($p > 0.05$).

Table 16: Overall comparison between groups during 6 months follow-up period

6 months Parameters	Group A		Group B		p Value
	Mean	SD	Mean	SD	
Carrying angle loss	3.72	0.65	3.21	0.57	>0.05
Range Of Motion Loss	7.06	0.82	6.53	0.70	>0.05
Baumann angle loss	4.31	0.54	4.09	0.29	>0.05
MD angle loss	2.57	0.36	2.23	0.47	>0.05



Graph 16: Overall comparison between groups during 6 months follow-up period

DISCUSSION

The treatment for displaced supracondylar fractures of the humerus in children is closed reduction and percutaneous pin fixation. However, there is still a discrepancy in ideas regarding the optimal technique, whether lateral or crossed pin fixation is better. According to earlier studies, the advantage of medial-lateral entry pin fixation is that there is increased biomechanical stability as compared to the lateral pin, although iatrogenic ulnar nerve injury may result from placement of the medial pin. On the other hand, the advantage of lateral entry pin fixation is avoidance of iatrogenic ulnar nerve injury, although the construct may be less stable biomechanically.

During 6 weeks follow-up period, 41 (58.5%) and 43 (61.4%) patients in Group A and Group B respectively had excellent score while 26 (37.2%) and 25 (35.8%) patients had good score respectively. Fair score was observed in 3 (4.2%) and 2 (2.8%) patients while poor score was observed in 0(0%) and 0 (0%) patients respectively. During 3 months follow-up period, 54 (77.2%) and 56 (80%) patients in Group A and Group B respectively had excellent score while 16 (22.8%) and 14 (20%) patients had good score. Fair score was observed in 0 (0%) patients each. During 6 months follow-up period, 59 (84.3%) and 61 (87%) excellent patients in Group A and Group B respectively. Good score was observed 11 (15.7%) and 9 (13%) in group A and B respectively. There was increase in the functional outcome of patients in both the groups but the increase was statistically not significant as per Chi-Square test ($p > 0.05$).

There was decrease in the carrying angle loss and range of motion loss in both the groups during the follow up and improvement was noted in the carry angle and range of motion values within both the groups. It was observed that the difference in improvement between groups was statistically not significant as per ANOVA test ($p > 0.05$).

In the present study, there was decrease in the Baumann angle loss and MD angle loss in both the groups during the follow up and improvement was noted in the Baumann angle and MD angle values within both the groups. It was observed that the difference in improvement between groups was statistically not significant as per ANOVA test ($p > 0.05$). The decrease in parameters at 6 months follow-up (Carrying angle loss, Range of Motion loss, Baumann angle loss and MD angle loss) was lesser in Group A as compared to Group B. The difference in improvement between groups was statistically not significant as per Student t-test ($p > 0.05$). Prashant K et al⁸² noted similar observation in their study.

Prashant K et al prospective, single-blinded randomized control study comparing the efficacy in terms of stability, functional outcome and iatrogenic ulnar nerve injury between lateral entry pin fixation and medial-lateral entry pin fixation of completely displaced supracondylar fractures of the humerus in children reported no patient in either group had a major loss of reduction. There was a mild loss of reduction in two cases and both were in the lateral entry group. Although radiological and clinical union occurred within a similar time period without any residual deformity, the loss of both the range of motion and the carrying angle was greater in these two patients compared to those without loss of reduction. However, there were no significant differences ($P = 0.05$) between groups regarding change in the Baumann angle, MD angle, carrying angle, or total elbow motion.

CONCLUSION

Longitudinal clinical evaluation showed that, in general, children treated for supracondylar humeral fractures had good outcomes on the Flynn Score. Radiographic evaluation of Baumann's angle proved very useful for assessing pre- and post-operative changes. Thus, we suggest that there is no

significant difference between the use of medial and lateral and lateral K-wire configurations—both groups have good outcomes. The two methods were comparable, both from clinical and radiographic points of view. Both groups achieved a satisfying outcome with similar results in joint function recovery and complications.

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