Comparison of Lateral and Posterior Surgical Approach in the Treatment of Type III Supracondylar Humeral Fracture in Children: A Retrospective Analysis

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ABSTRACT

Introduction: Among the elbow fractures, the most common elbow fracture observed in children are the supracondylar humeral fracture. The advancement of modern surgical techniques has reduced the incidence rate of compartment syndrome and malunion. For the treatment of supracondylar humeral fractures, techniques such as closed reduction, traction, splint closed reduction, open reduction, k-wire fixation, and percutaneous pinning are used. There are different approaches that are applied for open reduction method which include double incision method (lateral and medial), medial, anterior, posterior and lateral approach. Till date among all these approaches, the posterior approach via muscles of triceps has produced very good results. Different studies have been conducted to compare the anterior and posterior approaches of surgical treatment.

Aim: To compare the results of posterior and lateral surgical approaches while treating the type III supracondylar humeral fracture in children.

Methodology: This study included 82 children, who had undergone the surgical treatment, 52 patients were treated by the posterior approach, and 30 patients were treated by the lateral approach. Both the groups had their follow up till 6 months post-operatively.

Results: It was observed that the posterior approach had a very short surgery time as compared to the lateral approach. The results obtained according to the Flynn's criteria were 80.7% in the posterior group and 80% in the lateral group, and no statistical significance was observed between the two groups.

Conclusion: The posterior approach had shorter operating time as compared to the lateral approach, however, no statistical significance was determined between the two groups in terms of functional results and complications.

Key Words: Supracondylar humeral fracture, Lateral approach, Posterior approach, Children, statistical significance, Functional results

INTRODUCTION

Among the elbow fractures, the most common elbow fracture observed in children are the supracondylar humeral fracture. The advancement of modern surgical techniques have reduced the incidence rate of compartment syndrome and malunion.¹ For the treatment of supracondylar humeral fractures, techniques such as closed reduction, traction, splint closed reduction, open reduction, k-wire fixation, and percutaneous

pinning are used.² The Gartland classification system is used to classify humeral fractures into four types. Type III Gartland fracture is a supracondylar fracture in which any kind of contact with the cortex is completely lost due to displacement.³ In the transverse or frontal planes rotation and in the sagittal plane extension are observed. Similarly, sometimes due to fracture the injuries of soft tissues and nerve vessels are observed. For type III treatment, closed reduction with

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percutaneous pinning is the treatment method of choice, although, when closed reduction doesn't work other methods such as k-wire fixation and open reduction methods are preferred.⁴

There are different approaches that are applied for open reduction method which include double incision method (lateral and medial), medial, anterior, posterior and lateral approach. Till date among all these approaches, the posterior approach via muscles of triceps has produced very good results.⁵ Different studies have been conducted to compare the anterior and posterior approaches of surgical treatment. In one such study it was concluded that the posterior approach is comparatively easier to conduct but it could result in causing the stiffness and circulatory compromise in the lateral condyle.⁶ The current study was conducted to compare the two approaches i.e., lateral and posterior approaches in type III supracondylar humeral fracture in kids.

METHODOLOGY

It was a retrospective study in which 82 children were included who had their extension displacement for type III supracondylar humeral fracture, and had to operate. Permission was taken from the ethical review committee of the institute. For the study, the patients were grouped into two categories; the posterior approach, and the lateral approach. The posterior group included 52 children whereas the lateral group included 30 children. All patients had undergone the general and neurovascular examination, and then immobilization and closed reduction methods were attempted on them. Inadequate reduction and extensive edema is the reason cross k-wire fixation and open reduction method were used. It was made sure that all these surgeries were performed by the same surgeon. All the patients had undergone neurovascular examinations after first day till 2 weeks for the posterior splint exchange and total stitches off. Posterior splint and k-wires were removed after four weeks of surgery, and then the patients were asked to seek medical advice for improving the elbow's motion range from a physiotherapist. Baumann's angle, degree of elbow's angle and motion loss, and the graded scores according to Flynn's criteria were recorded after 2, 4, and 6 months of surgery. Presence or absence of different complications arising from the surgery such as pin tract infection, myositis ossification, cubitus varus, compartment syndrome, deep infection, neurovascular injury, and Volkman's ischemic contracture was also recorded. For statistical analysis, SPSS version 22 was used.

Study design: A retrospective analysis

Place and duration: This study was conducted at Shaheed Mohtarma Benazir Bhutto Medical College and Lyari General Hospital Karachi, Pakistan from Jan 2020 to Jan 2021

RESULTS

The demographic details are described in table number 1. The mean duration observed before the surgery time was observed 20.1 ± 10.8 hours in the posterior group, and 22.9 ± 15.1 hours in the lateral group which was not statistically significant, and the surgery time recorded of posterior group was 20.46 ± 4.39 minutes, and for the lateral group it was 24.97 ± 5.95 which was found to be statistically significant. It was found out after the follow-up that there was no significant difference between Baumann's angles of the two groups. It was also found that the mean values for carrying angle loss, and motion loss was $4.98 \pm 3.8^\circ$ and $6.25 \pm 4.56^\circ$ in the posterior group whereas in the lateral group the values were $6.10 \pm 3.42^\circ$ and $7.10 \pm 3.95^\circ$ respectively as described in Table number 2.

The values of motion loss in the lateral group, 56.7% were characterized as excellent and 23.3% as good and in the posterior group, 61.5% as excellent and 19.2% as good as expressed in Table number 3. It was found that in carrying angle loss 65.4% was regarded as excellent, 19.2% as good, 13.5% as fair and 1.9% as poor in the posterior group whereas in the lateral group 60% as excellent, 20% as good, 16.7% as fair, and 3.3% as poor as described in Table number 4.

The score of carrying loss and motion loss according to the Flynn's criteria, in the posterior group 61.5% as excellent, 19.2% as good, 15.4% as fair and 3.8% as poor whereas in the lateral group 56.7% as excellent, 23.3% as good, 16.7% as fair and 3.3% as poor. Like the previous results, there was no statistical significance between the two groups as described in Table number 5.

There were no serious adverse complications observed in both the groups as described in Table number 6, but minor complications were observed. In the posterior group, early complications included 1.92% had ulnar nerve injury, and 5.77% had pin tract infection whereas in the lateral approach 6.67% had ulnar nerve injury, 3.3% had radial nerve injury, and 16.67% had pin tract infection. The pin tract infection was healed after oral antibiotics and proper dressing. The rate of postoperative complication was around 11.54% patients complained of *cubitus varus* in the posterior group and 13.33% in the lateral group. There was no statistical significance between the two groups.

Table 1: Demographic details of study participants

Characteristic	Posterior approach	Lateral approach	p-value
Mean age $\pm$ SD	7.2 $\pm$ 3.2	6.04 $\pm$ 1.5	0.07
Male:Female	34:18	18:12	0.63
Right arm:Left arm	18:34	13:17	0.43
Displacement type: Extension	52	30	

Table 1: (Continued)

Characteristic	Posterior approach	Lateral approach	p-value
Mean duration before surgery $\pm$ SD (hours)	20.1 $\pm$ 10.8	22.9 $\pm$ 5.95	0.33
Mean duration of follow up $\pm$ SD (months)	7.6 $\pm$ 2.2	7.0 $\pm$ 1.2	0.16

Table 2: Consequences of surgical treatment

Characteristic	Posterior approach	Lateral approach	p-value
Operative treatment	20.46 (4.39)	24.97 (5.95)	<0.001
Baumann's angle of injured elbow	80.00 (5.19)	81.47 (6.12)	0.25
Baumann's angle of normal elbow	77.25 (2.22)	77.63 (2.19)	0.45
Motion loss	6.25 (4.56)	7.10 (3.95)	0.40
Carrying angle loss	4.98 (3.80)	6.10 (3.42)	0.19

Table 3: Loss of motion

Results	Posterior approach	Lateral approach	p-value
Excellent (0°-5°)	32 (61.5)	17 (56.7)	0.97
Good (6°-10°)	10 (19.2)	7 (23.3)	
Fair (11°-15°)	8 (15.4)	5 (16.7)	
Poor (>15°)	2 (3.8)	1 (3.3)	

Table 4: Carrying angle loss

Results	Posterior approach	Lateral approach	p-value
Excellent (0°-5°)	34 (65.4)	18 (60.0)	0.94
Good (6°-10°)	10 (19.2)	6 (20.0)	
Fair (11°-15°)	7 (13.5)	5 (16.7)	
Poor (>15°)	1 (1.9)	1 (3.3)	

Table 5: Overall results according to Flynn's criteria

Results	Posterior approach	Lateral approach	p-value
Excellent	32 (61.5)	17 (56.7)	0.97
Good	10 (19.2)	7 (23.3)	
Fair	8 (15.4)	5 (16.7)	
Poor	2 (3.8)	1 (3.3)	

Table 6: Postoperative complications

Complications	Posterior approach	Lateral approach	p-value
Pin tract infection	3 (5.77)	5 (16.67)	0.11
Ulnar nerve injury	1 (1.92)	2 (6.67)	0.30
Radial nerve injury	0	1 (3.30)	0.37
Cubitus varus	6 (11.54)	4 (13.33)	0.53

DISCUSSION

Among children, 60% elbow fractures are the supracondylar humeral fractures, out of which 97% fractures are extended fractures.⁷ Usually for such fractures percutaneous pinning and closed reduction are the preferred treatment methods.⁸ In some cases (almost 25%), closed reduction method leads to muscle interposition along with a varus malposition which is why open reduction procedure is recommended.⁹ In the open reduction, different approaches are used such as a medial, anterior or lateral approach is used but these approaches are only helpful in having a partial view of fracture which is why it is recommended to combine a lateral incision with a medial incision to have a better and improved view of fracture.¹⁰ It has also been proven by various studies that a posterior approach via triceps muscles gives excellent results.¹¹ This study was conducted to compare the two approaches i.e. the lateral approach, and posterior approach. In this study, it was determined that the posterior approach has multiple advantages over lateral approach but the results we obtained were not statistically significant. The study was quite easy, simple, direct, safe, and short to perform. Posterior approach helps to observe both lateral and medial fracture surfaces, and it helps in having a perfect reduction. Furthermore, this approach helps the surgeon in having a good view and sense of placement of k-wires. Similarly, it was found out that no joint contractures or neurovascular injuries were observed in the posterior approach. Although, the results were quite satisfactory in both the approaches i.e. in posterior approach (61.5% were graded as excellent and 19.2% as good), while in lateral approach the values were quite similar (56.7% were graded as excellent, and 23.3% as good) which is why no statistical difference was determined regarding complications.

CONCLUSION

To conclude, this preliminary study depicted that the posterior approach is an alternative and useful approach to manage the type III supracondylar humeral fracture with a very short surgery duration. Although, in terms of complications and functional results, no statistical significant differences were found in comparison of the two approaches i.e. the lateral and posterior approach.

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