

Functional and Radiological Outcome of Gartland Type 2 and 3 Supracondylar Fracture Humerus in Children Treated by Percutaneous Pinning

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ABSTRACT

Background: The supracondylar humeral fractures were the most common fracture of the paediatric elbow with a high incidence between the ages 5 to 14 years. The aim of this study was that to compare the functional and radiological outcome between Gartland type II and III by percutaneous spinning surgery treating method in children.

Study design: The study was cross sectional being conducted at the orthopedic department of Watim Medical College Rawat, Rawalpindi for the duration of six months, from June 2022 to December 2022.

Methodology: The age range was >5 and <13 years. The children age, gender, affected area, post-operative loss of reduction and complications were recorder. The functional and radiological outcomes were follow up at least 7-8 weeks. Flynn's criteria and Baumann angle were used to assess elbow movement after surgery.

Results: A total number of patients was 110 operated for supracondylar humeral fracture which divide into 55 patients in each type of Gartland fractures. The maximum children 82%, $p=0.01^*$ were belong to age group 6-12 years which show significant. The left side 55%, $p=0.009$ was more injured as compared to right side. According to Flynn's rating, Gartland 2 and 3 show significant improvement; $p=0.001^{**}$ of fractures after treatment. All patients had show satisfactory results in terms of loss of carrying angle, and elbow flexion. The data was analyzed by SPSS21.

Conclusions: The percutaneous spinning show better clinical outcome of radiological and functional between two types of fracture Gartland 2 and 3 supracondylar humeral fracture after treatment in children.

Keywords: Humerus, Range of motion, injury, Fracture.

INTRODUCTION

Supracondylar humeral fracture is one of the most common fractures seen in our daily clinical practice. Supracondylar humeral fracture is an extra-articular fracture that occurs in the humerus region. It is almost always a fracture of the immature skeleton that affects children and young teenagers. It accounts for nearly 65% of upper extremity fractures in children aged 5 to 10 years. This fracture occurs frequently in the first five years of life, peaks between the ages of five and eight, and then declines.¹ According to Gartland, 96% of supracondylar fractures are extension type that are further categorised according to the degree of distal fragment displacement.² According to Gartland, the fracture was classified into three types. Type I was nondisplaced, Type II displaced show an intact posterior cortex, and Type III show no cortical contact, which included posteroletral and posteromedial cortical contacts.^{3,4} The different complications of these fractures are loss of reduction, infection, vascular injuries, nonunion, infection and cubitus varus. Both nonoperative and surgical techniques include plaster immobilisation, external fixation, and percutaneous pinning with or without open reduction. To prefer the treatment of displaced supracondylar fracture is percutaneous pinned fixation.⁵ The benefit of percutaneous pinning has quick and attempting to avoid periosteal separation and dissection, which results in a low risk of contamination.⁶ To reduces the risk of nerve injury, infection, and painful traumas.^{7,8} There are two techniques of percutaneous pinning: lateral pinning and cross pinning. There is still disagreement between the two points of view which better stability of fixation and the likelihood that issues will arise. Although crossed pinning provides greater biomechanical stability, the medial pin position raises the risk of ulnar nerve injury. In contrast, lateral pinning is less biomechanically stable but protects the ulnar nerve.⁹ Although the functional end results of fracture are generally excellent, the cosmetic end results are frequently less than average. The functional and radiological outcomes of fracture Supracondylar Humerus should be monitored because they may differ from the immediate post-management status. Percutaneous pinning has been shown in numerous studies to be effective in achieving satisfactory results.¹⁰

METHODOLOGY

The study was cross sectional being conducted at the orthopedic department Watim Medical College Rawat, Rawalpindi for the duration of six months, from June 2022 to December 2022. A total of 110 children ($n=110$) participated with Gartland II and Gartland III supracondylar humeral fractures presented to the emergency department. The age range of children was >5 and <13 years. According to inclusion criteria: included children had no previous elbow trauma, children history, lab tests and x-rays were done. The exclusion criteria include was that no older age, open fracture and Gartland I. The study was approved by the Ethical Review Board, and all of the children's parents provided informed consent. The data was analyzed using SPSS 21. Classification data will be presented as frequency and percentage. The p value was <0.05, indicating that the variables had changed significantly.

RESULTS

A total number of patients $n=110$ which divided into Gartland type 2 and 3 supracondylar humeral fractures each include 55 patients who received percutaneous pinning surgery. The functional and radiological outcomes was evaluated on the basis of demographic characteristics. Flynn's criteria and Baumann angle were used to measure the clinical outcomes.

Table 1: Demographic characteristics

Characteristics		Total No. of Participants N= 110(%)	P-value
Sex	Boys	58(53%)	0.23
	Girls	52(47.2%)	0.08
Age	>5 year	10(9%)	0.88
	6-12 year	90(82%)	0.01*
	<13 year	20(18.1%)	0.41
Fracture side	Left	60(55%)	0.009
	Right	50(45.4%)	0.006

Mean \pm SEM: ANOVA SPS Test* $p<0.0$; ** $p<0.0$; *** $p<0.00$:

Table 2: Flynn's criteria rating and Baumann angle

Rating	Flynn's criteria		Baumann angle	
	Functional limitation of elbow fixation	Cosmetic factor loss in carrying angle	Displacement	Change in angle

Excellent	0-5	0-5	No	<6
Good	6-10	6-10	Mild	6-12
Fair	11-15	11-15	Major	>12
Poor	>15	>15		

According to our interpretation, a total number of patients was 110 and the age range was >5 and <13 years which undergo supracondylar fracture. The most children 82% of 6-12 years;

Table 3: To evaluate functional outcomes by Flynn's rating after surgery

Displacement	Treatment	Flynn's grading of percutaneous pinned cases								P=value	
		Functional				Cosmetic					Total participants
		E	G	F	P	E	G	F	P	N=110	
Gartland II	Percutaneous pinned surgery	53	2		-	48	4	1	2	55	<0.001**
Gartland III	Percutaneous pinned surgery	52	3		-	51	3	-	1	55	<0.001**

Mean ± SEM: ANOVA SPS Test* p< 0.0; **p<0.0; ***p<0.00:

Using Flynn's modified classification to predict clinical outcome in Gartland type 2 and 3 was excellent in (96.3%, 95%) patients, good in (4%, 6%) patients, and no poor rating both type of fracture show significant changes p<0.001**after treatment. All the poor outcomes were due to a poor cosmetic result, but with good or excellent function.

Table 4: Follow up time after surgery

Time	Number of participants N= 110 (%)	P=value
<48 hours	20(18.1%)	0.063
1 week	89(81%)	<0.0001***
>1 week	1(0.9%)	0.173

Mean ± SEM: ANOVA SPS Test* p< 0.0; **p<0.0; ***p<0.00:

According to our interpretation, the delay in treating Gartland type fracture in children, 20 patients (18.1%) had unsatisfactory results in less than 48 hours, including pin infection, loss of motion, loss of carrying angle, and neuropraxia. After one week, 81% of patients had satisfactory and significant results, p<0.0001*** after surgery were seen in Table 4.



Figure 1: At the final follow-up, radiological union/malunion was assessed with an X-ray, and functional outcome was graded by using Flynn's criteria such as excellent, good, fair and poor. In children, the Baumann angle is used to assess the displacement of a supracondylar humeral fracture.

DISCUSSION

The effectiveness of surgical management of displaced supracondylar Humerus fractures in children was dependent on accurate reduction at the initial phase and continued reduction till the union. Percutaneous cross pinning, which has the highest fracture stability, and the most commonly used for treatment method.^{11, 12} According to our study to found that, to evaluate the clinical outcomes of Supracondylar Humerus fractures after treatment with percutaneous cross pinning. A total number of patients was 110 who underwent surgery at our hospital. The most children age range 82% was 6-12 years show significant result p=0.01*which undergo supracondylar fracture. In comparison to

p=0.01*, remaining were 18.1% of greater than 12 years and 9% of less than 6 years. The majority of patients were boys 53% than girls 47.2%. The most fracture side was right side 55% than left side was seen in Table 1.

The Baumann angle, Flynn grade, and fracture complications were used to assess clinical outcomes in the majority of clinical and radiological studies.

girls, there were 53% more boys than girls and this attributed to boys engaging in more outdoor activities than girls. Our study found a predominance of the left side 55% over the right side 45% fractures. This study compare with another study conducted in Pakistan 71% of children was more effected age 5-11 years.^{13, 14} As a result of the arm being forced into extension which increases the pressure on the distal Humerus and extension type fracture injuries were more frequent in all of the patients. Because most paediatric elbow injuries heal quickly with few complications and no need for formal treatment. Supracondylar humerus fractures, clavicle fracture, elbow stiffness and proximal humerus fractures are all common injuries in our practice.^{15, 16} In our finding was that, 81% patients had satisfactory results between time of injury and surgery during one week. Gartland type-2 and type-3 supracondylar humerus fractures were rated as excellent, acceptable, fair, and bad. There were 55 patients total for each of the Gartland types 2 and 3. The Flynn's criteria are typical in that an outstanding outcome was considered to be a carrying angle loss of 5 degrees or less.¹⁷ The medial column compresses more during healing, which has been identified as the reason of the loss of carrying angle. The percutaneous pinned fixation, which has a 99% satisfaction rate and only a 1% minor complication rate, for treating displaced fractures. These results were comparable with other study.¹⁸ Poor initial reduction or inadequate mechanical pinning were regarded to be the causes of the poor outcomes in type 2 and type 3 fractures when the criteria were not followed. Secondary displacement, with a difference in Baumann's angle of more than 5° between the postoperative radiograph and that taken at the time of wire removal.^{19, 20} The patients' radiological union was achieved post-operatively, as shown in fig 1. According to Flynn's criteria, 96.3% of patients had excellent functional outcomes, while 4% had acceptable results. There are no documented poor result. All patients with excellent outcomes had Gartland type II and III fractures, and significant differences outcomes were found between boys and girls; p<0.001**.²¹ There were no major complications found. The most frequently advised method, percutaneous pinning after closed reduction, yields an acceptable aesthetic and functional outcome and has developed into a standard treatment method.²²

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