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Close Reduction And Percutaneous Pinning (CRPP) Versus Open Reduction And Internal Fixation (ORIF) For Fracture Of Lateral Condyle Of Humerus In Children

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Abstract

Objective: To compare the functional outcome of CRPP with ORIF for fracture of the lateral condyle of the humerus in children.

Methods: This randomised control study was conducted in the Orthopaedics Department, Rawalpindi Medical University, Rawalpindi, from 10th January 2021 to 10th July 2021. It included 60 patients aged 2 to 12 years who presented with type II lateral condyle of humerus fracture, according to Jakob's classification. An equal number of participants, i.e., 30, were assigned to each group: the CRPP and ORIF groups. Randomisation was performed by the lottery method. The functional outcome was assessed at the 2nd month postoperatively by using modified Aggarwal criteria.

Results: The patient's age range was 2 to 12 years, and male gender was dominant in both groups. Functional outcome was excellent (93.3%) in the CRPP group as compared to the ORIF group (73.3%), good (6.7%) in the CRPP group versus 10%, fair (0%) in the CRPP group versus 10% and poor (0%) in the CRPP group versus 6.7% (p=0.116).

Conclusion: CRPP could be the treatment of choice as the frequency of functional outcome of closed reduction and percutaneous pinning is statistically similar to that of ORIF.

Keywords: Humeral fracture, closed reduction, Lateral condyle fracture, Displaced, open reduction

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Introduction

The second most common elbow fractures treated operatively are lateral humeral condyle fractures, which account for 17% of all humeral injuries.[2] It occurs mostly in children aged 4-10 years.[3] Several systems are used to classify these fractures, of which the Milch system and the Jakob system are among them.[4] Jakob type-I is a non-displaced fracture < 2mm, type-II is minimally displaced > 2mm without rotation and type-III is displaced more than 2 mm and rotated.[5]
Undisplaced fractures can be managed by casting under close surveillance. While ORIF is considered the standard treatment for type III displaced fractures, treatment of minimally displaced fractures is always controversial.[7] Fractures which are displaced > 2mm should be treated with surgery either by ORIF or CRPP.[8] ORIF is advocated as the method of choice by most experts; others consider CRPP as an alternative approach.[9] Satisfactory and reproducible outcomes have been achieved with CRPP in minimally displaced fractures. It prevents dissection of soft tissues, decreases the chances of scarring of the skin and reduces pain.[10]
Although minimally displaced type II lateral humeral condylar fracture in children is generally managed with open reduction, there is no consensus about the optimal method. No comparative study between CRPP and ORIF has been done before in our local population. We, therefore, conducted this study to compare both these approaches for lateral humeral condylar fracture in children. Results of our study will help to select the better treatment in the management of lateral humeral condylar fractures in children.

Materials And Methods

We conducted this randomised control study in the Department of Orthopaedics, Rawalpindi Medical University, Rawalpindi, from 10th August 2020 to 10th January 2021. It was a randomised controlled study in which a total of 60 patients were involved. An equal number of participants, i.e., 30, were assigned to each group: the CRPP and ORIF groups. The lottery method was adopted for the randomisation of participants. Male and female patients aged 2 to 12 years with radiological evidence of Jacob type-II lateral humeral condylar fracture and fracture no more than one week old were included. Consent was taken from the parents of the patients for participation. Age, gender, and number of days of injury of participants were recorded at the time of enrolment in the study.
For CRPP, no tourniquet was used. Manipulation, reduction and stabilisation of the fracture were done. Two or three K-wires were used in a divergent manner to stabilise. For ORIF, the lateral approach was used, and the fracture was fixed with 2 or 3 K-wires. Postoperatively, an above-elbow POP back slab was applied. At 4 weeks, K-wires were generally removed, and above-elbow POP back slab was applied for another 2 weeks. Functional outcome was assessed at the 2nd month postoperatively by using modified Aggarwal criteria as excellent, good, fair and poor outcomes.
Data was analysed with the statistical analysis program, SPSS version 22. Frequency and percentage were calculated for qualitative variables like gender and functional outcome. Mean and standard deviation were

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calculated for quantitative variables like age and number of days since fracture. Functional outcome between the two groups was compared using the chi-squared test. P - value ≤ 0.05 was taken as significant.

Results

Sixty patients were included. All patients had type II lateral humeral condyle fractures. They were split into two groups, 30 patients in each group. Out of these sixty patients, 43 (71.6%) were males and 17 (28.3%) were females. Male gender was dominant in both groups **(Table 1)**.

Table 1: Frequency and percentage of gender in both groups

Gender	Group-A	Group-B
Male	19 (63.3%)	24 (80%)
Female	11 (36.6%)	6 (20%)
Total	30 (100%)	30 (100%)

Table 2: Mean±SD of patients according to age

Demographics	Mean±SD Group-A	Mean±SD Group-B
Age(years)	**7.600± 1.67**	**8.533± 2.27**

The age range in both groups was from 2 to 12 years. 23 (38.3%) belong to the age group 2 to 7 years, and 37 (61.7%) are aged between 8 to 12 years. The mean patient's age was 7.60 ± 1.67 years in the CRPP group, while 8.53 ± 2.27 years in the ORIF group **(Table 2)**.

The excellent outcome was 93.3% in CRPP and 73.3 % in ORIF, good was 6.7 % in the CRPP group and 10% in the ORIF group. Fair 10% and poor 6.7% outcomes were only recorded with ORIF. The p-value after applying the test was 0.116 **(Table 3)**.

Table 3: Comparison of functional outcome between CRPP and ORIF

Group of Patients	Functional Outcome				P value
	Excellent	Good	Fair	Poor	
CRPP n=30	28 93.3%	2 6.7%	0 0%	0 0%	0.116
ORIF n=30	22 73.3%	3 10.0%	3 10.0%	2 6.7%	

Table 4: Stratification of functional outcome concerning age in both groups

For Age group 2-7 years					
	Functional Outcome				P value
Group	**Excellent**	**Good**	**Fair**	**Poor**	
A	12(92.3%)	1(7.7%)	0(0%)	0(0%)	0.085
B	5(50%)	1 (10%)	2(20%)	2(20%)	
For the Age group 8-12 years					
Group	**Excellent**	**Good**	**Fair**	**Poor**	
A	16(94.1%)	1(5.9%)	0(0%)	0(0%)	1.000
B	17(85%)	2 (10%)	1(5%)	0(0%)	

Table 5: Stratification of functional outcome concerning fracture type in both groups

For Type-I					
	Functional Outcome				P value
Group	**Excellent**	**Good**	**Fair**	**Poor**	
A	20(100%)	0(0%)	0(0%)	0(0%)	1.000
B	18(94.7%)	1 (5.3%)	0(0%)	0(0%)	
For Type-II					
Group	**Excellent**	**Good**	**Fair**	**Poor**	
A	8(80%)	2(20%)	0(0%)	0(0%)	0.097
B	4(36.4%)	2 (18.2%)	3(27.3%)	2(18.2%)	

Discussion

In our study, CRPP was compared with ORIF in terms of the frequency of functional outcomes. Our study showed that both groups showed statistically similar outcomes.

Similar findings were shown by a study conducted by Pennock and Salgueiro[11], comparing ORIF and CRPP for lateral humeral condylar fractures in children, and assumed that fractures (type II) displaced >2mm could be treated successfully by CRPP. 74 patients with type II fractures were included in this study. 23 were in the CRPP group while 51 were in ORIF. 61 % of the patients were males. Major complications were only observed in the ORIF group (6%). Results showed that for managing type II lateral condyle fractures, both ORIF and CRPP have good outcomes, with CRPP having advantages over ORIF. The study concluded that lateral humeral condylar fractures with displacement >2mm can be managed preferably with CRPP.

Similar findings were reported by another study conducted by Silva and Cooper[12] which considered CRPP a feasible alternative for the treatment of lateral condyle of humerus fracture with displacement of 2 to 4 mm. ORIF and CRPP were compared in terms of overall outcome and various factors affecting the outcome such as range of motion, surgical time, formation of lateral spur and complications. The complication rate was lower for the CRPP group, while similar results for range of motion were observed in both groups. Satisfactory outcome was 88.3% and 89.3% in ORIF and CRPP groups, respectively.

A study by Stevenson and Perry showed that successful results with excellent functional outcomes can be achieved for minimally displaced as well as displaced lateral condyle fractures. Proper assessment of displacement and fracture pattern is important to ensure good results 13.

R. Ganeshalingam et al. found that K-wire and screw fixation methods provide good outcomes for treating lateral humeral condylar fractures in children. 235 patients were managed using K-wires, while 101 patients underwent fixation with screw.[14] Sharma A. et al. conducted a retrospective study involving 40 patients with symptomatic lateral condylar fractures with more than three weeks of injury, all of whom were treated with ORIF. The study found that surgical management resulted in good functional outcomes, even in cases where the fracture was treated more than 12 weeks post-injury.[15] Some researchers advocate for early surgical fixation of non-union during childhood, while others suggest that satisfactory outcomes can still be achieved in adults with longstanding non-union. Furthermore, the impact of various surgical techniques on outcomes in lateral condyle non-union remains unclear, as many existing studies lack sufficient statistical power to draw definitive conclusions.[16]

In our study, functional outcomes were excellent in 93.3% of patients treated with CRPP, compared to 73.3% in the ORIF group. These findings align with previous research reporting good to excellent functional outcomes and successful fracture union, even in cases of delayed presentation of lateral condyle humerus fractures.[17] The findings of the present study are consistent with previous reports demonstrating successful outcomes with closed reduction, open reduction, and arthroscopically assisted techniques. Despite these positive results, pediatric lateral condylar fractures remain associated with potential complications, including cubitus varus, cubitus valgus, fishtail deformity, and tardive ulnar nerve palsy.[18] While a previous systematic review reported comparable outcomes in terms of union and infection rates across various fixation techniques, our study observed a notable difference in functional outcomes. Specifically, 93.3% of patients in the CRPP group achieved excellent results, compared to 73.3% in the ORIF group. This suggests that although complication and healing rates may be similar, CRPP may provide better functional recovery in selected patients.

The results of these studies validate the results of our study, concluding that CRPP has similar functional outcomes to ORIF.

In summary, CRPP and ORIF both have excellent functional outcomes in terms of union rate, anatomical reduction and range of motion. CRPP can be a better option, yielding a cosmetically superior result with fewer chances of complications.

Conclusions

CRPP is a minimally invasive treatment option with excellent functional outcomes as compared to ORIF for managing type II fractures of the lateral condyle of the humerus in children.

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