ORIGINAL ARTICLE

Treatment of Paediatric Supracondylar Fractures of the Humerus: Closed or Open?

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ABSTRACT

Objective: To compare the functional outcome of paediatric supracondylar fractures of the humerus treated with closed reduction and percutaneous (CRP) K wire fixation versus open reduction (OR) and K wire fixation.
Methods: The design of our study was retrospective Cohort and was conducted in Department of Orthopaedics Civil Hospital Karachi. The medical record of all the children who were operated in the time period of 8th March 2019 to 07th September 2020 for type III distal humerus fractures were reviewed. All the children fulfilling the inclusion criteria were called for follow up. Patients were divided into group A (CRP crossed K wire fixation) and group B(OR crossed K wire fixation through posterior midline incision with triceps sparing approach). Functional outcome in both groups was evaluated with Flynn's criteria and graded as Excellent, Good, Fair(satisfactory) and Poor(unsatisfactory).The results of both group A and B were compared and statistical significance documented by calculating P value with Chi-Square test(P <0.05 significant).
Results: The total number of children were 60 and divided equally into Group A (n=30) and Group B(n=30).The mean age of group A was 6±1.1 years and group B 6.9 ± 3.83 years. Male children were 21(70%) in Group A and 18(60%) in group B while female children were 9(30%) and 12(40%) in Group A and Group B respectively.in Group A children results were excellent in 21(70%) and good in 9(30%) children. In group B excellent results were noted in 9(30%), good in 08(26.6%), fair in 6(20%) and poor in 7(23.3%) children. The difference among the excellent, fair and poor outcome of the two groups was found significant(P Value < 0.05)
Conclusion: CRP K wire fixation of supracondylar fractures of the humerus was better than OR K wire fixation because it yielded excellent and good outcome in most patients
Keywords: Fracture, Humerus, Closed reduction, K wire.

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INTRODUCTION

Paediatric supracondylar fractures of the humerus accounts for 13% of all fractures and 60% of elbow fractures in children.[1] The most common aetiology of this fracture is fall during playing.[2] Approximately 95% of these fractures are extension type.[3] Closed reduction with or without K wire fixation is the treatment of choice to treat majority of these fractures.[2,4,5] Open reduction and K wire fixation is done in those cases which are failed to reduce accurately with closed methods due to swelling or soft tissue interposition and in patients with vessel injury at presentation.[6-8] The optimal treatment whether closed or open, of Gartland type III fractures which although accounts for 16.7% of the paediatric supracondylar fractures are however still controversial.[9,10] In our department Gartland Type III fractures are treated with closed reduction and percutaneous K wire fixation. Fractures that are not reduced closely are open through posterior midline triceps sparing approach and stabilized with k wires. We retrospectively analysed and compared the functional outcome of Gartland type III fractures

treated with closed reduction and percutaneous crossed K wire fixation versus open reduction and internal fixation with crossed K wires. We hypothesized that CRP K wire fixation of Gartland type III fractures is better than OR K wire fixation.

METHODS

We conducted this retrospective Cohort study in Civil Hospital Karachi. The medical record of all the children who were operated in time period extending from 08th March 2019 to 07th September 2020 for supracondylar fractures was reviewed. All children of either gender and age with supracondylar fracture humerus Gartland type III[11] operated with CRP two crossed K wire fixation and OR and two crossed K wire fixation through posterior triceps sparing approach and with minimum of one year follow up were enrolled in this study. Children with polytrauma, open fractures and vascular injuries were excluded. The Ethical Committee of our hospital approved our study protocol. The parents or guardians of all such children were contacted through phone and requested to come for a visit to Orthopaedic OPD. Upon arrival informed written consent was taken from parents for participation in study and publication of results.All children were divided into Group A(CRP crossed K Wire fixation) and Group B(OR crossed K wires).Radiographs of the operated elbow were advised and functional evaluation was done with Flynn criteria.[12] We graded our results as per Flynn criteria[12] as excellent, good, fair (satisfactory) and poor (unsatisfactory).

We analysed our data with SPSS(version 23).Important quantitative variables like age was represented as mean±standard deviation while qualitative variables like gender and site of fracture was represented as frequency and percentage. Comparison of functional outcome of both the groups was done and statistical significance was determined by calculating *P* value with the help of Chi-Square test. *P* value if < 0.05 will be considered significant. Data was presented in table where necessary.

RESULTS

Based upon our inclusion criteria 75 parents were contacted for the study but 60 consented and participated in the study. We divided these children into group A and B with 30 patients each. Group A children included closely reduced Gartland type III fractures stabilized with two crossed K wires while group B had all those children who were openly reduced and fixed with two crossed K wires.Group A children had mean age of 6±1.1 years while group B had 6.9±3.83 Years. Male children were 21(70%) in Group A and 18(60%) in group B.Female children were 9(30%) in Group A and 12(40%) in Group B.The number of female children were 9(30%) in group A and 12(40%) in group B. Right supracondylar was noted in 18(60%) in Group A and 12(70%) in Group B.

Table I: Comparison of functional outcome of the two groups.

Flynn criteria	Group A (n=30)		Group B (n=30)		*P* Value
	Number of Patients	Percentage	Number of Patients	Percentage	
Excellent	21	70	09	30	0.003
Good	09	30	08	26.6	0.08
Fair	--	--	06	20	0.000
Poor	--	--	07	23.3	0.000

The aetiology of fracture in majority(76.6%,n=23) of group A and group B(83.3%,n=25) was fall during playing. A comparison of functional outcome in both groups is shown in table I. In group A excellent results were documented in 21(70%) and good in 9(30%) children. In group B excellent results were noted in 9(30%), good in 08(26.6%), fair in 6(20%) and poor in 7(23.3%) children. The closed reduction group had 100% satisfactory functional outcome while open reduction group had 76.6%(n=23) satisfactory outcome and 23.3% (n=7) unsatisfactory outcome. A comparative analysis of excellent, fair and poor outcome among Group A and Group B revealed statistical significance (P value was < 0.05). However we could not found any significant difference in outcome when age, gender and side of fracture was compared in both groups. No neurological injury was noted on examination although in group A 3(10%) children and in group B 1(3.3%) child was reported ulnar nerve neurapraxia after surgery for few weeks and which ultimately recovered.

DISCUSSION

In this retrospective comparative study we documented excellent results in 21(70%) and good in 9(30%) children who were operated with CRP K wire fixation while 9(30%) children had excellent,08(26.6%) had good,6(20%) had fair and 07(23.3%) had poor outcome in open reduction group. When we searched the literature through PubMed, PMC, Google, Google Scholar, Research gate and Pakmedinet.com we found different results reported by authors and the possible reasons were differences in the designs of studies, ages of children, sample size and surgical approaches. Similar to our study Shresh and Uprety[13] treated 37 supracondylar fractures with K wires via closed method and 26 children with open method. Functional outcome as per Flynn criteria revealed excellent results in 9(24.3%) and good in 16(43.2%) children in the closed reduction group while open reduction group has no excellent and good outcome. This difference was statistically significant(P value 0.000).The mean ages of this study participants were 7.29±2.3 and 8.11±2.02 in the closed and open group respectively. Moreover 12 patients in the closed reduction group were Gartland type II fractures.

Ozkoc and Gonc[14] treated 55 children with closed and 44 with open method and noted satisfactory functional outcome in 93% in closed and 71% in open group. These authors concluded that closed reduction and pinning is superior than open K wire fixation.This study however slightly differs from our study as these authors adopted postero medial approach for open reduction while we included those cases which were operated through posterior midline triceps sparing approach. Keskin and Sen[15] assessed the results of 100 children and noted no significant difference in functional outcome.These authors used lateral incision for surgical exposure in their study. In a small sample size randomized controlled trial Kaewpornsawn treated[16] 14 children each with closed and open k wire fixation.He noted excellent functional results in 100% children in closed group and in open group 93% had excellent and 7% had fair results. These results however were not statistically significant(*P* value 1). In one local comparative study Rakha and colleagues[17] could not show any difference in CRP K wires and OR K wire fixation. These authors recommended that paediatric distal humerus fractures may be treated with open technique in facilities that lack image intensifier. In an another local study Talib[18] favored open K wire fixation of distal humerus fractures in his comparative study of 85 children treated with closed methods and 85 with open K wire stabilization. He documented that 71(83.5%) children in closed group had satisfactory results and 14(16.4%) had unsatisfactory outcome while in open group 75(88.1%) children had satisfactory and 10(11.7%) had unsatisfactory outcome. In a comparative study Hussein Al-Algawy[9] treated 33 type III fractures closely and noted excellent outcome in 22(66.6%),good in 8(24.4%),fair in 2(6%) and poor in 1(3%) patient as assessed with Flynn criteria. One patient in this group had pot operative neurapraxia of the ulnar nerve. The functional outcome in open group revealed excellent outcome in 21(63.6%),good in 7(21.2%),fair in 3(9.1%) and poor in 1(3%) patient. The difference in the outcome of their study was not significant statistically. Al-Algawy preferred closed method of K wire stabilization because of less hospital stay and no surgery scar.

Yaokreh and colleagues[19] reviewed their records of 58 children and noted similar functional outcome(satisfactory in 90.9% children in closed and 92% children in open group).Their patients mean age was 7 years and their surgical approach for open reduction was medial. Some interesting interpretations were done by Rossingh[20] after treating 80 distal humerus fractures with closed and open methods. He pointed out that percutaneous treatment was associated with less hospital stay, less deficiency of elbow extension and less chances of cubitus valgus. Ling-Guo[21] evaluated results of 581 children in six studies and noted that both closed reduction and open reduction with k wires had similar functional outcome. They recommended randomized controlled trials to draw meaningful conclusion.

Our study had few limitations and these were small sample size, retrospective design, different operating surgeons and possible lack of a uniform rehabilitation protocol. Further studies are therefore recommended to confirm our results.

CONCLUSION

CRP K wire fixation of the supracondylar fractures of the humerus was better than OR K wire fixation because it yielded excellent and good outcome in most patients. Therefore we recommend that every efforts must be made to treat type III paediatric supracondylar fractures with closed reduction and K wire fixation. Early surgery and experienced hands can ensure CRP K wire fixation.

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