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Original Research Article

A COMPARATIVE STUDY OF RESULTS OF CLOSE LATERAL PERCUTANEOUS PIN FIXATION V/S CROSS PERCUTANEOUS PIN FIXATION IN SUPRACONDYLAR FRACTURES OF HUMERUS IN CHILDREN

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ABSTRACT

Background: Supracondylar fractures of the humerus are the commonest injury around the elbow in the children accounting for 60% of all the fractures around the elbow in children. This study was conducted to evaluate the efficacy of close reduction and percutaneous pin fixation by lateral entry pin and crossed pin method and to compare any significant difference exist between losses of reduction by these two methods. **Material and Methods** - This study was done prospectively on the patients having a supracondylar fracture of the humerus with an average follow up 6 months. Patients were divided into two categories in the first category all 25 patients were managed by a cross percutaneous pin fixation method & while in the second category all 25 patients managed by lateral percutaneous pin fixation method with K wires. Final Functional Assessment was done according to the criteria laid down by Flynn. **Results**- In the lateral pin fixation group the overall results were satisfactory in 91.6% cases and the cross pin fixation group the overall results were satisfactory in 95.8% cases. **Conclusion**- We conclude that the lateral pin fixation method is as good as a cross pin fixation method while considering the biomechanical stability of construct, but it does not carry the risk of iatrogenic ulnar nerve injury.

Keywords: Supracondylar fractures, humerus, injury, children, lateral entry pin, fixation.

INTRODUCTION

Psoriasis Supracondylar fractures of the humerus are the commonest injury around the elbow in the children accounting for 60% of all the fractures around the elbow in children. Due to instability of the fracture, it is difficult to maintain reduction without fixation which may result in undesirable late complications e.g. cubitus varus or gunstock deformity.

Close reduction and above elbow slab in flexion and pronation were first described by Ashhurst in 1910 but there was a high incidence of cubitus varus. This occurs because as swelling subsides plaster is not able to maintain the reduction. A high incidence of deformity in a close technique called for an anatomical reduction. This was achieved by open reduction and internal fixation and maintenance of reduction by two cross K-wires. But this procedure was associated with complications like infection, joint stiffness, trochlear vascular insufficiency.

In close reduction and percutaneous pin fixation, there is less risk of infection, fewer chances of elbow stiffness, and good union rates as there is no loss of

fracture hematoma. Short hospital stay and better cosmetic effects are the other advantages. Initially, close reduction and percutaneous pin fixation were done with two cross K wire. Two cross K-wire construct is stable enough to maintain the reduction but there is the risk of ulnar nerve injury (3.3%) due to its close proximity with medial condyle.

To avoid this neurological complication, percutaneous pin fixation was done by 2 or 3 K-wire inserted from lateral condyle but biomechanically it appears less stable then cross K wire. This study was conducted to evaluate the efficacy of close reduction and percutaneous pin fixation by lateral entry pin method and to compare any significant difference exist between losses of reduction by these two methods.

MATERIAL AND METHODS

This study was done prospectively on the patients having a supracondylar fracture of humerus admitted in the Department of Orthopaedics, J.L.N. Medical College & Hospital, Ajmer during the year 2007-2008 with an average follow up 6 months.

This study involved children with closed supracondylar fracture treated with lateral pin fixation and cross pin fixation methods. A total of 50 cases (25 in each category) were studied out of which 48 cases (24 in each category) turned up for the final follow up.

Patients were divided into two categories in the first category all 25 patients were managed by a cross percutaneous pin fixation method & while in the second category all 25 patients managed by lateral percutaneous pin fixation method with K wires. Final Functional Assessment was done according to the criteria laid down by Flynn et al, (1974).**(1)**

Table1. Classification of Patients (Gartland Classification)

Grade	No. of Cases
Grade I	-
Grade II	6
Grade III	
• **Postero-medial displacement**	36
• **Postero-lateral displacement**	6

RESULTS

A total of 48 patients (24 in each group) of supracondylar fractures of the humerus in children were evaluated. We found that most of the patients (81%) are in the age group of 5-10 years. Most of them are boys (83.3%). The left side (66%) was involved in most cases. There were 3 cases (12.5%) of significant cubitus varus in lateral pin fixation and 2 cases (8.3%) in cross-pin fixation. There was a significant loss of range of movement at the elbow in 3 cases (12.5%) in the lateral pin fixation group and 1 case (4.1%) in the cross pin fixation group.

Table2. Age distribution

Age group	Cross Pin Fixation			Lateral Pin Fixation		
	Male	Female	Total	Male	Female	Total
(in years)						
0-4	4	-	4	1	-	1
5-7	13	-	13	7	7	14
8-10	5	-	5	7	-	7
11-13	1	1	2	2	-	2

There was no incidence of iatrogenic nerve injury in both groups. In the lateral pin fixation group, the overall results were satisfactory in 91.6% cases, and in the cross pin fixation group, the overall results were satisfactory in 95.8% cases. We did not find a significant change in the mean value of change in Baumann's angle in both groups (p-value was >0.05) in both groups.

Table3. Sex distribution

Fracture Type	Cross Pin Fixation			Lateral Pin Fixation		
	Male	Female	Total	Male	Female	Total
Type-I	-	-	-	-	-	-
Type-II	3	-	3	3	-	3
Type-III	20	1	21	14	7	21

Table4. Fracture Type

Fracture Type		No. of Cases		Total
		Cross Pin Fixation	Lateral Pin Fixation	
Type-I		-	-	-
Type-II		3	3	6
Type-III	**PM**	**17**	**16**	**36**
	PL	2	4	6

Table5. Neurovascular Injury

Circulatory Compromise			Nerve Injury							
			Cross Pin Fixation				Lateral Pin Fixation			
CPF	LPF	Total	Radial	Ulnar	Median	Total	Radial	Ulnar	Median	Total
1	2	3	-	-	1	1	-	-	1	1

Table6. Change in Baumann's angle

Change in Baumann's angle	No. of Cases	
	CPF	LPF
< 6 Degrees	17	15
6-12 Degrees	5	6
> 12 Degrees	2	3

Table7. Residual loss of range of movement

Residual loss (in degrees)	Time of examination at follow-up	
	CPF	LPF
No loss	14	12
1-5	8	8
6-10	1	1
11-15	-	1
16-20	1	2

Table 8.The complication of Pin Fixation

S.No.	Complication	CPF	LPF
1	Superficial Pin Tract Infection	1	2
2	Significant Varus Deformity (>11^0)	2	3
3	Valgus Deformity (<5^0)	2	-
4	Significant loss of range of motion (>16^0)	1	3

Table9. Final functional results according to Criteria lay down by Flynn et al. (1974)

Results	No. of Cases	
	CPF	LPF
Excellent	23	22
Good	-	1
Fair	-	1
Poor	1	-
Total	24	24

DISCUSSION

Supracondylar fracture of the humerus is one of the commonest fractures in childhood. In children with supracondylar fracture of the humerus with complete displacement, closed reduction, and percutaneous pinning have been the treatment of choice. However, controversy persists regarding the optimal pin fixation method, with the two primary treatment methods being the use of either lateral pin fixation or cross pin fixation.

Medial and lateral entry pin fixation provides better fracture stability but at the cost of possible iatrogenic ulnar nerve injury. In literature, the possible risk is 3.3%. This complication can be prevented by lateral only pin fixation but possibly with less stable fracture fixation.

The number of cases of iatrogenic nerve injury from medial entry pin fixation has varied widely and probably depends on specific pin insertion technique. From a pooled data of 1680 patients from 33 studies that met priority eligibility criteria, the rate of iatrogenic nerve injury from the cross method was 3.3% (Brauer 2007). The majority of iatrogenic nerve injury can be reduced with medial incision and extension of the elbow during medial pin placement. Most of the injuries resolve after wound exploration and replacement of medial pin.

Closed Reduction and percutaneous pin fixation

Swenson (1948) adopted the use of percutaneously placed crossed Kirschner's wires, as previously described by Miller (1939) and reported the first series of 10 cases with good results in all.**(2)**

In 1974 Fowels and Kassab reported 100 cases with displaced supracondylar fractures of the humerus in children treated by closed reduction and fixation with two lateral percutaneous pins, 87.5% of those followed for more than 6 months had satisfactory results.**(3)**

Vicente L Arino (1977) treated 189 supracondylar fractures of the humerus with closed reduction and percutaneous fixation of the fragments with two K-wires inserted through the lateral epicondyle. They had 84% satisfactory results in 189 cases.**(4)**

Jeffrey L. Nacht Malcolm Ecker (1982) reported a series of 38 children with displaced closed extension type supracondylar fractures of humerus treated by closed reduction and fixation by two crossed pins inserted from the medial and lateral condyles with the elbow in acute flexion. They could achieve acceptable results in 19 out of 25 patients based on Flynn's criteria. **(5)**

Roland Royce (1991) reported 143 cases with displaced supracondylar fractures of the humerus in children treated by percutaneous pinning and reported four (3%) neurological complications after treatment, 2 were late ulnar neuropraxia, one ulnar nerve, and one radial nerve injury resulted from insertion of medial K-wires and all four nerve palsies resolved within 6 months. Iatrogenic nerve injury was reported to be 2-3%. **(6)**

All these studies have shown that management of supracondylar fracture in children by closed reduction and percutaneous k wire fixation either by crossed pins or by lateral only pins have comparable results. Although lateral only pin fixation avoids iatrogenic ulnar nerve injury. In our series, we didn't find any iatrogenic nerve injury in any of the groups.

Biomechanical studies have shown that crossed pinning provides stronger fixation than lateral pins. Skaggs DL, Cluck MW, Mostofi A, Flynnn JM, Kay RM (2004) reported lateral pin entry alone was sufficient to successfully treat all the fracture. **(7)** Yen YM, Kocher MS (2008) compared the efficacy of lateral entry pin fixation with that of cross entry pin fixation for operative treatment of completely displaced extension supracondylar fracture of the humerus in children. As far as the loss of reduction is concerned there was no significant difference in patients treated with lateral entry and in those who were treated with crossed pin fixation.**(8)** In a retrospective study conducted by Shamsuddin et al authors concluded that lateral entry pin fixation in supracondylar fracture fixation provides similar biomechanical stability as compared to crossed pin fixation.**(9)**

All these studies concluded that as well as the biomechanical strength of crossed and lateral pin fixation is concerned, they are equally comparable. In our study, we found that both groups had a similar change in final Baumann's angle that was less than 6 degrees. Sibinski M et al in their study recommended two or three parallel or divergent lateral pins in type IIB AND III supracondylar fractures and they found similar results as of crossed pins but without iatrogenic ulnar nerve injury.**(10)**

In a similar study conducted by Ozturkmen Y et al functional and radiographic results were satisfactory in all the patients irrespective of the method of fixation. No significant differences were found between the mean Baumann, humerocapitellar, and carrying angles of the normal and affected sides ($p>0.05$).**(11)** Similar findings were echoed by Foead A in their study.**(12)**

We also found in our study that the outcome which was evaluated based on Flynn criteria had 95.33% excellent result in the CPF group and similarly 91.66% excellent result in the LPF group which were not statistically significant. There was no statistically significant difference was found as far as complications are concerned between the two groups.

CONCLUSION

We conclude that the lateral pin fixation method is as good as a cross pin fixation method while considering biomechanical stability of construct, but it does not carry the risk of iatrogenic ulnar nerve injury which is a major concern while treating a supracondylar fracture of humerus in children. The shortcomings of

this study are that the number of cases is small and we didn't randomize two groups.

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