

## ORIGINAL ARTICLE

# Comparison of Efficacy between Open and Close Reduction in Supracondylar Fracture of Humerus in Children Using Flynn's Criteria

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## ABSTRACT

**Objective:** To compare the efficacy between open and close reduction in supracondylar fracture of humerus in children using Flynn's criteria.

**Study Design:** Randomized control trial.

**Place and Duration of Study:** Department of Orthopaedic Surgery, Chandka Medical College Hospital, Larkana from 1<sup>st</sup> April 2019 to 31<sup>st</sup> March 2022.

**Methodology:** One hundred patients were enrolled and divided into two groups (open reduction and closed reduction groups). Each group had 50 patients. Fracture-fragments which were reduced through open reduction protocol or closed reduction were operated under highly standardized care and fixation was performed through K wiring in cross wise pattern.

**Results:** Most of the children were male in both groups with only 20 and 24% females in open and closed reduction groups respectively. The efficacy analysis presented that open reduction efficacy was only 8-10 percent respectively in 5-10 and 11-15 years children respectively. The Flynn criteria also presented that 31 cases of open reduction were having an excellent grade followed by 14 with good.

**Conclusion:** Open reduction method to be superior over closed reduction with higher number of satisfactory scores and efficacy.

**Keywords:** Efficacy, Supracondylar fracture, Flynn's criteria, Open reduction, Close reduction

## INTRODUCTION

Supracondylar humerus (SH) fractures are considered as second most frequent type of fracture which are seen mostly in pediatric cases. The estimated prevalence of SH fractures in children in around 50-60% of the total number of fractures. The most vulnerable age been 4 to 11 years with 85% of the children to be suffering from supracondylar fracture.<sup>1</sup> Majority of these children have gender biased with male children been more vulnerable to fall and accidents than female children.<sup>2-4</sup>

Children with SH fractures have a high risk of complicated fractures which required high skills for treatment.<sup>5</sup> The management of the complicated fractures is more difficult and requires long time treatment plan. As complete satisfactory treatment is the first priority.<sup>6</sup> There are different kind of reduction methods which applies casting with plaster or skin traction through another bone or by pinning and using K wires.<sup>7,8</sup>

There are various type of injuries which might occur as a result of these processes. Some of these injuries can be Volkmann-ischemic injury, vascular/ nervous injury, deformity caused by cubitus varus or myositis-ossificans.<sup>9</sup> Majority of the consultant facilitate the close reduction method while in certain cases open reduction have also been observed for internal fixation by the surgeons.<sup>10,11</sup> The present study was designed to assess the most appropriate method of surgery for long-term health benefits of a child.

## MATERIALS AND METHODS

This randomized control trial was conducted at Department of Orthopaedic Surgery, Chandka Medical College, Hospital, Larkana from 1<sup>st</sup> April 2019 to 31<sup>st</sup> March 2022. Majority of the fractures were a result of fall in children. Those supracondylar fractures of humerus which resulted from any fabricated low calcium bone in children with any related bone complications were excluded. A total of 100 patients were enrolled and divided into two groups equally. The two groups were designated as open reduction and closed reduction group. Each group had 50 patients. The sample size was generated through WHO sample size calculator where calculations were based on two proportions P1=99.18% and P2 as 88.90% with 80% power of test and 5% the level of significance.

The efficacy was measured as satisfactory results through Flynn's criteria at a follow-up of 16 weeks post-operative. The criteria for grading through Flynn's criteria include excellent as 0-5 while good as 6-10 and fair as 11-15. Patients radiological imaging was conducted for proper assessment and understanding of the fractures through AP and lateral imaging. All the patients went under general anesthesia under pediatric supervision. All the demographic, clinical details were added in the well-structured questionnaire. Fracture-fragments which were reduced through open reduction protocol or closed reduction were operated under highly standardized care and fixation was performed through K wiring in cross wise pattern. Each patient 16 week follow up was recorded where efficacy of the procedure was also noted. Goniometer was used to assess the range of elbow movement. Data was analyzed in terms of Fischer exact test and with also using Chi square test. SPSS software was used for this purpose of version 26. P value <0.05 was measured significant.

## RESULTS

The mean age of open reduction and closed reduction group had no significant variance. There was also no difference within ages in both groups, however majority of the children belonged to 5-10-year group. Most of the children were male in both groups with only 20 and 24 % females in open and closed reduction groups respectively (Table 1).

Table 1: Age and Gender distribution among open and closed reduction groups (n=100)

Variables	Open Reduction (n=50)	Closed Reduction (n=50)	P value
Age (years)	7.41±1.86	7.38±1.74	0.67
0-5	14 (28%)	12 (24%)	0.77
5-10	31 (62%)	34 (68%)	1.21
11-15	5 (10%)	4 (8%)	0.95
Gender			
Male	38 (76%)	40 (80%)	0.66
Female	12 (24%)	10 (20%)	0.73

The comparative analysis of both groups showed that majority of the children had a fall history as the cause of their SH

fracture. Closed reduction had slightly decreased time between injury occurrence and surgical procedure while hospital stay post operative was higher in closed reduction group. Open reduction took significantly higher time in metal removal but had higher risk of complications than closed reduction method (Table 2).

The efficacy analysis presented that open reduction efficacy was only 8-10 percent respectively in 5-10 and 11-15 years

children respectively. In open reduction methods there was higher number of the left side SH fractures than in closed reduction (Fig. 1).

The change in Baumann's-angle was noticed to be having a lower means and standard deviation in open reduction angle. The Flynn criteria also presented that 31 cases of open reduction were having an excellent grade followed by 14 with good (Table 3).

Table 2: Comparison of hospital parameters within open and closed reduction group

Parameter	Closed Reduction (n=50)	Open Reduction (n=50)	P-value
Mechanism of injury: Fall (cases)	48 (96%)	42 (84%)	>0.05
Mechanism of injury: Trauma while playing (cases)	2 (4%)	7 (14%)	
Mechanism of injury: RTA (cases)	-	1 (2%)	
Time between injury and surgery (days)	1.32 ± 1.55	2.16 ± 3.32	0.843
Hospital stay time (days)	1.18 ± 0.95	1.16 ± 0.46	0.243
Metal removal time (months)	1.61 ± 1.60	3.77 ± 6.08	0.071
Cast removal time (months)	1.95 ± 1.67	1.90 ± 1.45	0.901
Overall complications (cases)	2 (4%)	1 (2%)	0.593
Ulnar nerve injuries (cases)	1 (2%)	1 (2%)	>0.05
Hypertrophic scar (cases)	1 (2%)	-	0.468
Vascular injury (cases)	-	-	-
Infections (cases)	-	-	-

Table 3: Baumann's angle change measured in both groups

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Parameter			Closed Reduction	Open Reduction	P value
Change in Baumann's-angle			8.22±6.34	5.91±4.40	0.344
Baumann's angle post-surgery			68.12±9.93	70.85±7.27	0.232
Baumann's angle post-union (degrees)			72.57±7.91	74.40±6.91	0.342
Baumann's angle change (Flynn's criteria)	Satisfactory	Excellent (0°–5°)	26	31	0.222
		Good (5°–10°)	10	14	
		Fair (11°–15°)	11	3	
	Unsatisfactory	Poor (>15°)	3	2	

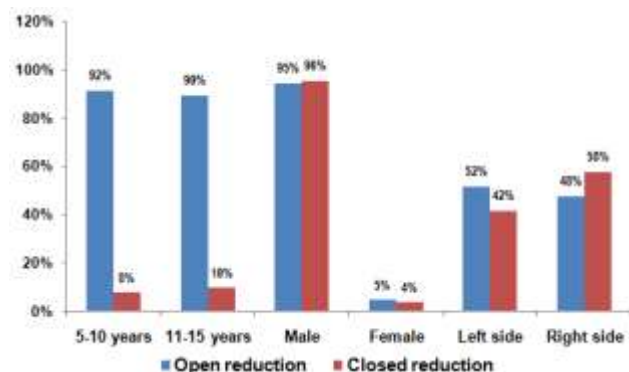


Fig 1: Efficacy comparison within groups

## DISCUSSION

Supracondylar fractures are one of the most common fractures with majority been pediatric cases involved. There is a need of emergent reduction for saving the inadequate-reduction which can result into cubitus varus.<sup>12</sup> The fragment which has been displayed can result into damaging of the nearby structures which can further lead into artery transection as well as thrombosis or decreased arterial flowing which can cause Volkmann's ischemia contractures.<sup>13</sup>

The fact that closed reduction procedure is much quicker than the open reduction. It is also associated with the lesser complication than open reduction. Open reduction though gives extra options of foreign body resection as well as hematoma dissections.<sup>14</sup>

The comparison of functional outcomes of closed reduction and open reduction in operative pediatric procedures has been conducted in various studies as well as the current research. Less extensive studies have also the benefit on requirement of lesser anesthesia and reduced duration of hospital stay.<sup>15,16</sup> The present

study the results obtained through closed reduction showed less hospitalization duration requirement than open reduction.<sup>17,18</sup>

However, they findings of Flynn's score showed significant better results in open reduction with more satisfactory results than closed reduction. The level of satisfaction with fewer cases in poor scoring was recorded in the present study in terms of open reduction while closed reduction had higher number of cases having unsatisfactory scores. Similar has been reported in other researches as well.<sup>19,20</sup>

## CONCLUSION

Both techniques have skills in reduction but overall analysis shows open reduction method to be superior over closed reduction with higher number of satisfactory scores and efficacy.

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