

OUTCOME OF MEDIAL APPROACH IN TREATMENT OF SUPRACONDYLAR HUMERUS FRACTURES IN CHILDREN

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Abstract

*Objectives*

The objective of this study was to evaluate the functional outcome of the medial approach for open reduction and internal fixation in pediatric supracondylar humerus fractures, with specific emphasis on elbow range of motion and carrying angle using Flynn's criteria.

*Methodology*

This descriptive study was conducted in the Department of Orthopedic Surgery, Nishtar Hospital, Multan, over a period of six months after ethical approval. A total of 79 children aged 2–12 years, presenting with supracondylar humerus fractures of  $\leq 5$  days duration, were enrolled using non-probability consecutive sampling. Children with neurovascular compromise or prior treatment by bone setters were excluded. All patients underwent open reduction and internal fixation with crossed Kirschner wires through a medial approach performed by a consultant orthopedic surgeon. Patients were followed for three months postoperatively. Functional outcomes were assessed using Flynn's criteria. Data were analyzed using SPSS version 23.

*Results*

The mean age of patients was  $6.8 \pm 2.9$  years, and 65.8% were male. The mean duration from injury to presentation was  $2.6 \pm 1.3$  days. At three months, the mean postoperative elbow range of motion was  $128.4^\circ \pm 9.6^\circ$ , and the mean carrying angle was  $10.7^\circ \pm 3.1^\circ$ . According to Flynn's criteria, excellent to good outcomes were achieved in 88.6% of patients for both range of motion and carrying angle. No major postoperative complications were observed.

*Conclusion*

The medial approach for open reduction and crossed K-wire fixation provides favorable functional and cosmetic outcomes with a low complication rate. It is a safe and effective surgical option for pediatric supracondylar humerus fractures when closed reduction is not feasible.

INTRODUCTION

Supracondylar humerus fractures are the most common fractures comprising 50-70% of upper extremity fractures in the pediatric population aged 3-10 years old.<sup>1</sup> Mainly these fractures are due to fall over outstretched hand and most

commonly in non-dominant hand.<sup>2</sup> These fractures are of two types; flexion and extension types.<sup>3</sup> Depending upon the amount of displacement, the extension type is divided into Gartland type I (without displacement), type II (with displacement but intact posterior cortex)

and type III (with displacement and disruption of both cortices).<sup>4</sup> Type III is common reason for surgical treatment in children.

Although many methods have been described for the treatment of displaced fractures, closed reduction and percutaneous pinning has been accepted as the gold standard treatment method.<sup>5</sup> However, open reduction is indicated if fracture cannot be reduced with a closed approach or reduction is unsatisfactory, or is an open fracture, or vascular injury is present.<sup>6</sup> The approach for open reduction remains a matter of debate. Anterior, medial, lateral, posterior, and double incisions (medial and lateral) have all been used.<sup>7</sup> Advantage of medial approach is better restoration of rotation and medial columnar alignment by direct vision and avoidance of ulnar nerve.<sup>8</sup>

Arif M et al compared medial versus lateral approach in 50 patients of displaced, extension type supracondylar fracture of humerus (Gartland type III). They observed that in medial approach group (n=25), range of motion (Flynn's class) was regarded as excellent in 68%, good in 16%, fair in 8% and poor in 8% patients. Regarding loss of carrying angle (Flynn's criteria of cosmetic deformity), results were excellent in 88% and good in 12% cases.<sup>9</sup> Retrospective cohort of 67 cases of pediatric supracondylar fractures was reviewed by Sahin E et al in which 33 patients were treated with medial approach. According to Flynn's criteria, range of motion (ROM) was perfect in 87.8%, good in 6%, fair in 3% and bad in 3%. Carrying angle change was perfect in 81.8% and good in 18.2% cases.<sup>10</sup>

This study has been planned to assess the functional outcome following medial approach in pediatric supracondylar fractures of humerus. The study results obtained from our local setting will highlight the success rate of this procedure so that we would be able to practice this method in our patients to achieve functionally and cosmetically acceptable upper limb with normal range of movements. There should be one definitive procedure as subsequent change in treatment not only results into psychological trauma to the child but also increases parental anxiety and causes poor outcome.

## METHODOLOGY

This descriptive study was conducted in the Department of Orthopedic Surgery, Nishtar Hospital, Multan, over a period of six months June- Dec 2024. The objective of the study was to evaluate the functional outcome of the medial approach in the treatment of supracondylar humerus fractures in children. Ethical approval was obtained from the Institutional Ethical Review Committee prior to the initiation of the study. The sample size was calculated using the WHO sample size calculator by applying the formula for single population proportion. The frequency of poor outcome in range of motion was taken as 8%, with an absolute precision of 6% and a confidence level of 95%. Based on these parameters, the calculated sample size was 79 patients. Non-probability consecutive sampling technique was used to enroll eligible participants.

Children aged 2 to 12 years, of either gender, presenting with supracondylar humerus fractures of  $\leq 5$  days duration were included in the study. Children with associated neurovascular compromise and those who had been previously maltreated by bone setters were excluded. A total of 79 children fulfilling the inclusion criteria were enrolled after obtaining written informed consent from their parents or guardians. Baseline patient characteristics, including age, gender, and duration of injury, were recorded at presentation. All patients underwent open reduction and internal fixation (ORIF) with crossed Kirschner wires through a medial approach. The surgical procedures were performed by a consultant orthopedic surgeon under standardized operative conditions. Postoperative radiographs of the injured elbow were obtained, and radiographs of the opposite normal elbow were also taken to measure the normal Baumann's angle for comparison and to assess the adequacy of postoperative reduction.

Patients were discharged on the second postoperative day. Stitches and back slab were removed after two weeks, while K-wires were removed after four weeks. All patients were advised to follow a structured home-based range

of motion (ROM) exercise program. Follow-up assessments were conducted fortnightly until three months postoperatively. Functional outcomes, including elbow range of motion and carrying angle, were assessed at three months using Flynn’s criteria by a consultant orthopedic surgeon as per the operational definitions. All observations were documented on a predesigned proforma.

Both quantitative and qualitative variables were analyzed in this study. Quantitative variables included age (years), duration of injury (days), postoperative range of motion (degrees), and carrying angle (degrees) measured at three months. These variables provided objective numerical data for assessing functional recovery. Qualitative variables included gender, outcome categories of range of motion and carrying angle based on Flynn’s criteria (excellent, good, fair, or poor), and overall functional outcome. These variables helped in categorizing and interpreting the clinical results. Data were entered and analyzed using SPSS version 23. The normality of continuous data was assessed using the Shapiro-Wilk test. Quantitative variables such as age, duration of injury, carrying angle, and range of motion were presented as mean and standard deviation. Qualitative variables, including gender

and functional outcomes according to Flynn’s criteria, were expressed as frequencies and percentages. Stratification was performed for age, gender, and duration of injury to determine their effect on functional outcomes, and a p-value of  $\leq 0.05$  was considered statistically significant.

**RESULTS**

A total of 79 children with supracondylar humerus fractures were included in the study during the six-month study period. All enrolled patients completed the follow-up period of three months and were included in the final analysis. No patient was lost to follow-up.

The mean age of the study population was  $6.8 \pm 2.9$  years, with ages ranging from 2 to 12 years. The majority of patients were male, accounting for nearly two-thirds of the study population. The mean duration between injury and presentation was  $2.6 \pm 1.3$  days. All fractures were treated successfully with open reduction and internal fixation using crossed Kirschner wires through a medial approach. Postoperative radiographs demonstrated satisfactory fracture reduction in the majority of cases, with Baumann’s angle comparable to that of the contralateral normal elbow.

**Table 1: Baseline Demographic and Clinical Characteristics of Patients (n = 79)**

Variable	Mean $\pm$ SD / Frequency	Percentage (%)
Age (years)	$6.8 \pm 2.9$	–
Duration of injury (days)	$2.6 \pm 1.3$	–
Gender		
• Male	52	65.8
• Female	27	34.2

Functional outcomes were assessed at three months postoperatively using Flynn’s criteria, focusing on elbow range of motion and carrying angle. The mean postoperative elbow range of motion was  $128.4^\circ \pm 9.6^\circ$ , while the mean carrying angle was  $10.7^\circ \pm 3.1^\circ$ . Most patients achieved excellent to good outcomes in both parameters.

According to Flynn’s criteria for range of motion, 49 patients (62.0%) achieved excellent results, while 21 patients (26.6%) had good outcomes.

Fair outcomes were observed in 6 patients (7.6%), and poor outcomes were seen in 3 patients (3.8%). Similarly, assessment of carrying angle showed excellent outcomes in 46 patients (58.2%) and good outcomes in 24 patients (30.4%). Fair and poor outcomes were observed in 7 (8.9%) and 2 (2.5%) patients, respectively.

Overall, satisfactory functional outcomes (excellent to good) were achieved in 88.6% of patients for range of motion and 88.6% for carrying angle. No cases of postoperative

neurovascular compromise, deep infection, or implant failure were observed during the follow-up period.

**Table 2: Functional Outcomes at 3 Months According to Flynn’s Criteria (n = 79)**

Outcome Category	Range of Motion n (%)	Carrying Angle n (%)
Excellent	49 (62.0%)	46 (58.2%)
Good	21 (26.6%)	24 (30.4%)
Fair	6 (7.6%)	7 (8.9%)
Poor	3 (3.8%)	2 (2.5%)
Total	79 (100%)	79 (100%)

The findings of this study demonstrated that the medial approach for open reduction and crossed K-wire fixation provided favorable functional outcomes in children with supracondylar humerus fractures. The majority of patients achieved excellent to good recovery of elbow range of motion and carrying angle at three months postoperatively, with a low incidence of poor outcomes and minimal complications.

**DISCUSSION**

A total of 79 children with supracondylar humerus fractures were included in the present study during the six-month study period. All enrolled patients completed the three-month follow-up and were included in the final analysis. No patient was lost to follow-up. In contrast, a study published in 2023 reported that closed reduction and percutaneous pinning are the preferred treatment modalities for pediatric supracondylar humerus fractures. However, when closed reduction is not feasible, open reduction using lateral, medial, or posterior approaches can be safely employed <sup>11</sup>. In the present study, the mean age of the study population was 6.8 ± 2.9 years, with an age range of 2 to 12 years. Male patients constituted nearly two-thirds of the study population. The mean duration between injury and presentation was 2.6 ± 1.3 days. Similarly, a study conducted in 2021 concluded that the lateral approach for supracondylar fractures was superior to the medial and posterior approaches in terms of radiological and functional outcomes; however, no statistically significant difference was observed among the three surgical approaches <sup>12</sup>. All fractures in the present study were successfully treated with open reduction and

internal fixation using crossed Kirschner wires through a medial approach. Postoperative radiographs demonstrated satisfactory fracture reduction in the majority of cases, with Baumann’s angle comparable to that of the contralateral normal elbow. Supporting this, a study published in 2012 emphasized that the treatment of supracondylar humerus fractures in children should be individualized, taking into account factors such as the patient’s age, soft tissue condition, and degree of deformity <sup>13</sup>. Functional outcomes in the present study were assessed at three months postoperatively using Flynn’s criteria, with particular focus on elbow range of motion and carrying angle. The mean postoperative elbow range of motion was 128.4° ± 9.6°, while the mean carrying angle was 10.7° ± 3.1°. The majority of patients achieved excellent to good outcomes in both functional parameters. Comparable findings were reported in a 2023 study, which reaffirmed that although closed reduction and percutaneous pinning remain the preferred treatment options, open reduction using medial, lateral, or posterior approaches is a safe and acceptable alternative when required <sup>14</sup>. According to Flynn’s criteria, 49 patients (62.0%) in the present study achieved excellent outcomes in terms of range of motion, while 21 patients (26.6%) demonstrated good results. Fair and poor outcomes were observed in 6 (7.6%) and 3 (3.8%) patients, respectively. Assessment of carrying angle revealed excellent outcomes in 46 patients (58.2%) and good outcomes in 24 patients (30.4%). Fair and poor results were noted in 7 (8.9%) and 2 (2.5%) patients, respectively. These findings are consistent with a study published in 2017, which reported that

both medial and lateral surgical approaches yielded comparable functional and radiological outcomes, with the medial approach offering the advantage of shorter operative time<sup>15</sup>.

Overall, satisfactory functional outcomes (excellent to good) were achieved in 88.6% of patients for both range of motion and carrying angle in the present study. No cases of postoperative neurovascular compromise, deep infection, or implant failure were observed during the follow-up period. These results align with a study published in 2015, which concluded that the posterior approach was equally effective as the combined medial-lateral approach in the management of supracondylar humerus fractures, while also offering reduced operative time<sup>16</sup>.

## CONCLUSION

The findings of this study indicate that the medial approach for open reduction and crossed K-wire fixation is a safe and effective treatment option for pediatric supracondylar humerus fractures. A high proportion of patients achieved excellent to good functional outcomes in terms of elbow range of motion and carrying angle at three months postoperatively. The procedure was associated with satisfactory radiological alignment and a low complication rate. Therefore, the medial approach can be considered a reliable surgical option when closed reduction is not feasible, providing favorable functional and cosmetic results in children.

## REFERENCE

- Shah M, Agashe MV. Supracondylar Humerus fractures: classification-based treatment algorithms. *Indian J Orthop.* 2021;55(1):68-80.
- Ekwedigwe HC, Anyaehie UE, Ede O, Anikwe IA, Eyichukwu GO, Anieze JK. Predictors of early elbow function following paediatric humeral supracondylar fractures: a retrospective analysis. *Niger J Clin Pract.* 2021;24(11):1590-5.
- Kim KY, Conaway W, Schell R, Hennrikus WL. Prevalence of ulnar nerve palsy with flexion-type supracondylar fractures of the humerus. *J Pediatr Orthop B.* 2020;29(2):133-6.
- Teo TL, Schaeffer EK, Habib E, El-Hawary R, Larouche P, Shore B, et al. Is the modified Gartland classification system important in deciding the need for operative management of supracondylar humerus fractures?. *J Child Orthop.* 2020;14(6):502-7.
- Hagebusch P, Koch DA, Faul P, Gramlich Y, Hoffmann R, Klug A. Treatment of grossly dislocated supracondylar humerus fractures after failed closed reduction: A retrospective analysis of different surgical approaches. *Arch Orthop Trauma Surg.* 2022;142(8):1933-40.
- Su Y, Nan G. Evaluation of a better approach for open reduction of severe Gartland type III supracondylar humeral fracture. *J Invest Surg.* 2021;34(5):479-85.
- Karagoz B, Kibar B, Oto O, Malkoc FE. Comparison of lateral, medial, and posterior approaches in the surgical treatment of pediatric supracondylar humerus fractures. *North Clin Istanbul.* 2023;10(2):255-62.
- Teng L, Zhong G, Li HB, Cen SQ, Liu DH, Li L. Combined medial and lateral approach versus paratricipital approach in open reduction and internal fixation for type C distal humerus fracture: a randomized controlled study. *Orthop Surg.* 2023;15(8):62-73.
- Arif M, Azeem M, Khurshid K. Surgical outcome of medial and lateral approach in the treatment of pediatric humeral supracondylar fracture. *J Shaikh Zayed Med Coll.* 2014;5(3):644-7.
- Şahin E, Zehir S, Sipahioglu S. Comparison of medial and posterior surgical approaches in pediatric supracondylar humerus fractures. *Niger J Clin Pract.* 2017;20(9):1106-11.
- Karagoz B, Kibar B, Oto O, Malkoc FE. Comparison of lateral, medial, and posterior approaches in the surgical treatment of pediatric supracondylar

- humerus fractures. Northern Clinics of Istanbul. 2023 Apr 14;10(2):255.
- Memon IA, Rajput IM, Junejo S, Jatoi AA, Kumar D, Ali M. Comparison of Outcome of three Different Approaches for Supracondylar Humerus Fractures in Children. Journal of Pakistan Orthopaedic Association. 2021 Aug 4;33(03):121-5.
- Uçar BY, Demirtaş A, Uçar DE. Treatment approaches and outcomes in childhood supracondylar humerus fractures. European Review for Medical & Pharmacological Sciences. 2012 Jul 1;16(7).
- Karagoz B, Kibar B, Oto O, Malkoc FE. Comparison of lateral, medial, and posterior approaches in the surgical treatment of pediatric supracondylar humerus fractures. Northern Clinics of Istanbul. 2023 Apr 14;10(2):255.
- Şahin E, Zehir S, Sipahioglu S. Comparison of medial and posterior surgical approaches in pediatric supracondylar humerus fractures. Nigerian journal of clinical practice. 2017;20(9):1106-11.
- Wutthipiriyaangkul S. Comparison of posterior and combined medial-lateral surgical approaches in the treatment of supracondylar fractures of the humerus among children. The Thai Journal of Orthopaedic Surgery. 2015 Oct 31;39(3-4):11-6.

