International Journal of Orthopaedics Sciences

**E-ISSN:** 2395-1958
**P-ISSN:** 2706-6630
IJOS 2025; 11(3): 102-105

www.orthopaper.com
Received: 15-06-2025
Accepted: 17-07-2025

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# A prospective study to evaluate the outcomes of both conservative and surgical treatments for supracondylar humerus fractures among paediatric population

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**DOI:** https://www.doi.org/10.22271/ortho.2025.v11.i3b.3793

**Abstract**
**Background:** Supracondylar humerus fractures (SCHF) account for around 60% of elbow fractures and 85% of surgically treated fractures in the paediatric population. Effective management is crucial to ensure favourable outcomes and prevent complications.
**Aims and Objectives:** The purpose of our study is to determine the functional outcome of conservation versus surgical management of displaced Supracondylar fracture of humerus.
**Materials and Methods:** This prospective study was conducted among 60 patients aged between 5 and 15 years, all diagnosed with displaced supracondylar humerus fractures Gartland type II and III. They were divided into 2 groups for study purpose. Group A includes 30 patients managed conservatively and Group B includes 30 patients managed surgically either closed or open reduction followed by internal fixation using medial and lateral K-wires, along with early elbow mobilization. Both clinical and radiological evaluations were performed, and final outcomes were assessed using Flynn's criteria.
**Results:** By Flynn's criteria, 08 (26.67%) excellent results were obtained in patients who were treated conservatively, and 25 (83.33%) excellent results were obtained in the surgical treatment group and the difference is statistically significant P value <0.05.
**Conclusion:** Early surgical intervention in supracondylar humerus fractures is recommended to minimize the risk of complications and improve functional outcomes.

**Keywords:** Displaced supracondylar fracture, Gartland type II and III, Flynn's criteria, paediatric elbow fractures, closed reduction with K-wires

## Introduction
Supracondylar fractures of the humerus are injuries that occur outside the joint in the lower metaphyseal area of the humerus. These fractures are predominantly found in the developing skeleton, mainly affecting children and younger adolescents [1]. They represent about 65% of fractures in the upper limbs for children aged 5 to 10 years. The frequency is particularly elevated during the early years of life, peaking between the ages of 5 and 8 and then decreasing thereafter. Depending on the direction of displacement of the distal fragment, supracondylar humerus fractures in children are classified into two categories: extension-type (97.8%) and flexion-type (2.2%) [2, 3, 4].
Inadequate treatment of supracondylar humerus fractures can lead to complications such as injury to the neurovascular structures, malunion, and stiffness of the elbow. Non-surgical management, which includes immobilization with a plaster of Paris (POP) cast above the elbow with the elbow bent at 90°, is typically suitable for displaced type I fractures [5]. Type II fractures may also be managed through closed reduction followed by POP immobilization. Type III fractures have multiple treatment options available, such as open reduction with percutaneous K-wire fixation, closed reduction with POP immobilization, closed reduction with skeletal traction, and closed reduction with percutaneous pinning [6]. However, the conventional non-surgical approach of closed reduction and POP immobilization has significant drawbacks, especially in maintaining the alignment of the fracture, which can result in complications like stiffness and malunion during follow-up [7]. Advances in biomechanics, implant design, internal fixation principles, soft tissue management, antibiotic therapies, and

aseptic methods have greatly impacted the treatment of these injuries. As a result, surgical methods such as open reduction with internal fixation and closed reduction with percutaneous pinning have become more favourable for addressing displaced supracondylar humerus fractures, providing better anatomical alignment, functional outcomes, and greater stability of fixation [8].

**Aims and Objectives**

This study aims to evaluate the outcomes of both conservative and surgical treatments for supracondylar humerus fractures by using Flynn's criteria

**Materials and Methods**

**Study Type &** This prospective study was conducted.

**Study Area:** This study was conducted in the Department of Orthopaedics, of Dr. Panjab Rao Deshmukh Memorial Medical College & Hospital.

**Study Period:** This study was conducted for a period of 12 months from April 2024 to March 2025.

**Study Population:** This study consisted of 60 patients aged 5-15 years diagnosed with Type III and Unstable Type II as per Gartland classification Supracondylar fracture of Humerus Group A, which received closed reduction and application of a plaster of Paris (POP) above elbow (& parents were not willing for surgical procedure) and Group B, which underwent closed/open reduction and percutaneous K-wire fixation.

**Inclusion criteria**

1. Patients aged between 5 and 15 years
2. Type III supracondylar humerus fractures (as per Gartland classification)
3. Unstable Type II supracondylar humerus fractures
4. Legal guardians willing to provide informed consent

**Exclusion criteria**

1. Patients with pathological fractures
2. Patients with Gustilo-Anderson Type III open (compound) fractures
3. Patients with additional fractures on the ipsilateral limb
4. Patients with a pre-existing paralytic limb

**Methodology**

After getting ethical clearance from institutional ethical committee & obtaining informed consent from parents, a detailed clinical history was obtained, and thorough clinical examination was performed. Appropriate analgesia was administered, and the affected limb was immobilized using an above-elbow slab. Anteroposterior (AP) and lateral radiographs of the elbow were taken, and fractures were classified using Gartland's classification.

All patients underwent surgery under general anaesthesia. Closed reduction and percutaneous pinning were performed in the supine position with the affected limb placed on a side table. In cases requiring open reduction, the procedure was carried out in the lateral position using a posterior midline incision, with the elbow positioned to face the surgeon. A pneumatic tourniquet was applied to the proximal one-third of the arm. Fracture reduction was confirmed under fluoroscopy in both AP and lateral views. Once satisfactory alignment was achieved, the reduction was maintained by percutaneous insertion of two K-wires (1.2 mm or 1.5 mm in diameter), one medial and one lateral. An above-elbow POP splint was applied with the elbow flexed to 90°.

Patients were reviewed on the 12th postoperative day for suture removal in cases of open reduction. Weekly radiographs were obtained to monitor fracture alignment and assess for any displacement or fixation failure. K-wires were removed at three weeks postoperatively, following radiographic confirmation of adequate callus formation. The POP splint was removed simultaneously, and patients were instructed to begin active range-of-motion exercises, including elbow flexion-extension and forearm supination-pronation.

Caregivers were advised to avoid massage, passive stretching, and to prevent the child from lifting heavy objects for up to 12 weeks postoperatively. Regular follow-up visits were conducted every month for a period of six months. Clinical and radiological assessments were performed to identify any complications and to evaluate range of motion and carrying angle using Flynn's criteria. The results were categorized as excellent, good, fair, or poor based on the loss of range of motion and carrying angle.

**Results**

**Table 1:** Age wise distribution of patients

| Age Group (in Years) | Group A | Group B |
|---|---|---|
| 5-8 | 16 | 17 |
| 9-12 | 09 | 07 |
| 12-15 | 05 | 06 |
| Total | **30** | **30** |

The age distribution of patients in each group is as follows: in the 5-8 years age group, Group A has 16 patients, while Group B has 17 patients. For the 9-12 years age group, Group A consists of 9 patients, and Group B has 7 patients. In the 12-15 years age range, Group A includes 5 patients, while Group B has 6 patients.

**Table 2:** Gender wise Distribution of Patients

| Gender | Group A | Group B |
|---|---|---|
| Male | 19(63.33%) | 21(70%) |
| Female | 11(33.67%) | 09(30%) |
| Total | 30 | 30 |

In Group A, there are 19 male patients (63.33%) and 11 female patients (36.67%), meaning that the majority of patients in this group are male. In Group B, the distribution is similar, with 21 male patients (70%) and 9 female patients (30%), indicating a higher proportion of male patients compared to females.

**Table 3:** Table showing cause, type of injury & side involved

| Cause | Group A | Group B |
|---|---|---|
| Sports Injury (While Playing) | 17(56.67%) | 16(53.33%) |
| Fall From Height | 13(43.33%) | 14(46.67%) |
| Side Involved | | |
| Left | 21(70%) | 18(60%) |
| Right | 09(30%) | 12(40%) |
| Type of Fracture | | |
| Type II | 11(36.67%) | 10(33.33%) |
| Type III | 19(63.33%) | 20(66.67%) |

In Group A, the most common cause of injury was sports-related trauma, accounting for 56.67% of cases, while 43.33% resulted from falls from height. Similarly, in Group B,

53.33% of patients sustained injuries while playing, and 46.67% due to falls. Regarding the side of involvement, the left side was more commonly affected in both groups, with 70% in Group A and 60% in Group B. The right side was involved in 30% of cases in Group A and 40% in Group B. When examining the type of fracture, Type III fractures, which are more severe and displaced, were more frequent, occurring in 63.33% of Group A and 66.67% of Group B. Type II fractures were less common, seen in 36.67% of Group A and 33.33% of Group B.

**Table 4:** Table Showing Functional Outcome BY Flynn's criteria

| Outcome | Group A (N=30) | Group B (N=30) | P VALUE |
|---|---|---|---|
| Excellent | 08 (26.67%) | 25 (83.33%) | <0.05 |
| Fair | 01 (3.33%) | 01 (3.33%) | |
| Good | 17 (56.67%) | 04 (13.33%) | |
| Poor | 04 (13.33%) | 00(0%) | |

In Group A (n=30), the distribution of outcomes based on Flynn's criteria was as follows: 8 patients (26.67%) had *excellent* results, 17 patients (56.67%) had *good* outcomes, 1 patient (3.33%) showed a *fair* result, and 4 patients (13.33%) had a *poor* outcome.

In contrast, Group B (n=30) demonstrated significantly better results, with 25 patients (83.33%) achieving *excellent* outcomes, 4 patients (13.33%) classified as *good*, and 1 patient (3.33%) having a *fair* result. Notably, there were no poor outcomes in Group B.

Applying Chi square we observed that statistical significant difference was observed among both the groups as p value is <0.05.

**Table 5:** Table Showing Complications

| Complications | Group A (N=30) | Group B (N=30) |
|---|---|---|
| Pressure Sore | 00(0%) | 01 (3.33%) |
| Loss of Reduction | 00 (0%) | 04 (13.33%) |
| Pin Tract infection | 00 (0%) | 01 (3.33%) |
| Neurovascular deficit. | 02 (6.67%) | 00(0%) |

In terms of post-operative complications, Group A experienced minimal issues, with 2 patients (6.67%) presenting with neurovascular deficits. There were no cases of pressure sores or loss of reduction in this group. On the other hand, Group B had 1 patient (3.33%) with a pressure sore, 1 patient (3.33%) developing a pin tract infection and 4 patients (13.33%) experienced loss of reduction. However, there were no cases of neurovascular complications in Group B.

## Discussion

In our study majority of patients were in age group of 5-8 years followed by 9-11 and then 12-15. Males were more as compared to females in both the groups. Results were similar to Wilkins KE *et al.* (62.8%) [1], Sharma *et al.* (83.3%) [9], Fowles *et al*. (81%) [10].

Regarding functional outcome we observed that In Group A (n=30), the distribution of outcomes based on Flynn's criteria was as follows: 8 patients (26.67%) had *excellent* results, 17 patients (56.67%) had *good* outcomes, 1 patient (3.33%) showed a *fair* result, and 4 patients (13.33%) had a *poor* outcome. In contrast, Group B (n=30) demonstrated significantly better results, with 25 patients (83.33%) achieving *excellent* outcomes, 4 patients (13.33%) classified as *good*, and 1 patient (3.33%) having a *fair* result. Notably, there were no poor outcomes in Group B.

Similar results were seen in study by Aronson *et al.* (61.5%) [11], Karapinar *et al*. (80.3 %) [12].

Regarding complications we experiences that, Group A experienced minimal issues, with 2 patients (6.67%) presenting with neurovascular deficits. There were no cases of pressure sores or loss of reduction in this group. On the other hand, Group B had 1 patient (3.33%) with a pressure sore, 1 patient (3.33%) developing a pin tract infection and 4 patients (13.33%) experienced loss of reduction.

## Conclusion

Early surgical intervention in supracondylar humerus fractures is recommended to minimize the risk of complications and improve functional outcomes. Based on Flynn's criteria, surgical management demonstrated superior results compared to conservative treatment. Among the surgical techniques, percutaneous K-wire fixation provided better stability and alignment than closed reduction followed by cast application. However, it is important to note that this method was associated with a slightly higher incidence of nerve injuries, underscoring the need for meticulous surgical technique and careful patient selection.

## Limitation of this study

Chances of selection bias could be there.

Results cannot be generalized due to limited sample size.

**Clinical Message:** The clinical message of this prospective study emphasizes that early surgical intervention—specifically, closed reduction and percutaneous pinning with K-wires—significantly improves functional outcomes in paediatric patients with displaced Gartland type II and III supracondylar humerus fractures. The study found that 83.33% of surgically treated patients achieved excellent results, compared to only 26.67% in the conservatively treated group, with a statistically significant difference ($p < 0.05$). This underscores the importance of timely surgical management to minimize complications and enhance recovery.

## Conflict of Interest

Not available

## Financial Support

Not available

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**How to Cite This Article**
Rathod AP, Rathod YB, Baitule R, Pundkar G. A prospective study to evaluate the outcomes of both conservative and surgical treatments for supracondylar humerus fractures among paediatric population. International Journal of Orthopaedics Sciences. 2025;11(3):102-105