e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2025; 16(10); 49-53

Original Research Article

A Comparative Study of Cross Pinning Versus Lateral Pinning in Fracture Supracondylar Humerus in Children

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Received: 20-08-2025 / Revised: 19-09-2025 / Accepted: 20-10-2025

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Conflict of interest: Nil

Abstract:

Background: Supracondylar fractures of the humerus are the most common elbow injuries in children, primarily affecting the 5–10-year age group. Proper stabilization is crucial to prevent complications like malunion, cubitus varus, and nerve injury. Two major pinning techniques cross pinning and lateral pinning are commonly used, but the optimal method remains debated due to concerns about mechanical stability and iatrogenic ulnar nerve injury.

Aim: To compare the clinical and functional outcomes of cross pinning versus lateral pinning in the surgical management of displaced pediatric supracondylar humerus fractures using Flynn's criteria.

Materials and Methods: This longitudinal, hospital-based comparative study included 72 children (36 in each group) aged 2–12 years with Wilkins modified Gartland type IIB and III fractures. Patients underwent either cross pinning (medial and lateral entry) or lateral pinning (two or three lateral pins). Postoperative outcomes including loss of carrying angle, elbow range of motion, pin tract infection, and ulnar nerve injury were assessed. Data were analyzed using t-tests and chi-square tests.

Results: Both groups had comparable demographics and fracture types. Loss of carrying angle (<5°) and elbow movement were similar between groups ($p > 0.05$). Pin tract infections were slightly higher in the cross-pinning group (11.11% vs 5.56%). Ulnar nerve neuropraxia occurred only in the cross-pinning group (5.56%), resolving after pin removal. Cross pinning showed slightly better mechanical stability, especially in Type III fractures, but lateral pinning demonstrated a superior safety profile with zero nerve injuries.

Conclusion: Both techniques provide satisfactory functional and cosmetic outcomes. However, lateral pinning is safer, especially in swollen elbows or when nerve visualization is limited. The choice of pinning technique should be individualized based on fracture type, surgeon's experience, and patient safety.

Keywords: Supracondylar Humerus Fracture, Cross Pinning, Lateral Pinning, Gartland Classification, Ulnar Nerve Injury, Pin Tract Infection, Carrying Angle, Closed Reduction, Percutaneous Pinning.

Introduction

Supracondylar fractures of the humerus are the most common type of elbow fracture in children. They mostly affect kids between 5 to 8 years of age and make up about 60% of all elbow fractures in this age group.[1] These fractures usually happen when a child falls on an outstretched hand while playing.[2]

The area just above the elbow (supracondylar region) is a weak point in the growing bones of children, which makes it more likely to break. Most of these fractures are extension-type, which occur when the elbow is straight during the fall. [3,4] A much smaller number are flexion-type, which occur when the elbow is bent during injury.[5]

To understand how serious the fracture is, doctors use the Gartland classification. It ranges from Type I (mild, no displacement) to Type III and IV (severe, with full displacement or instability). Treatment depends on the type of fracture. [6-7]

Mild fractures are treated with a cast, but more serious ones need surgery. A common surgical

method is percutaneous pinning, where thin metal wires (K-wires) are used to hold the broken bone in place. There are two main pinning techniques: [8-9]

1. **Cross Pinning (one wire from each side):** Offers strong fixation but carries a risk of injury to the ulnar nerve, especially during the insertion of the medial pin.
2. **Lateral Pinning (wires only from the outer side):** Safer for the nerve but may be less stable in certain cases.

There is still debate over which method is better. This study compares the outcomes, safety, and effectiveness of cross pinning versus lateral pinning in treating displaced supracondylar fractures in children. [10-11]

Aim and Objective: The aim of this study is to compare the outcomes of cross pinning (medial and lateral) and lateral pinning techniques in treating displaced supracondylar fractures of the humerus in children. The objective is to evaluate and compare both techniques based on elbow movement, carrying angle, complications like ulnar nerve injury or pin tract infection, and overall functional and cosmetic results using Flynn's criteria.

Materials and Methods

This hospital-based comparative study was conducted in the Department of Orthopaedics and Trauma Centre, Sardar Patel Medical College, Bikaner, over a period of 18 months from July 2023 to December 2024. The study included 72 pediatric patients (aged 2–12 years) diagnosed with displaced supracondylar humerus fractures (Gartland type IIB and III). Patients were randomly divided into two groups: 36 underwent cross pinning (medial and lateral entry), and 36 underwent lateral pinning (two or three lateral pins).

Inclusion criteria included children with closed, isolated supracondylar fractures of the humerus, and whose guardians gave informed consent. Exclusion criteria were pathological fractures, compound fractures, associated head injury, ulnar nerve injury at presentation, Gartland type I or IIA fractures, and refusal to participate.

Sampling was done using simple random sampling, and the sample size was calculated using the formula: $N = 2 \times Z^2 \times p(1-p)/d^2$, which yielded 72 total participants (36 per group), assuming a 10% error and 95% confidence level based on prior prevalence data.

All patients underwent closed reduction and percutaneous pinning under general anesthesia. Post-operative care included slab application and pin site monitoring. Data was collected on demographic variables, fracture type, clinical findings, and post-operative outcomes.

Statistical analysis was done using Primer software version 6.0. Descriptive statistics, Chi-square test, and Student's t-test were used. A p-value of <0.05 was considered statistically significant. Ethical clearance and informed consent were obtained for all participants.

Results

In this study comparing cross pinning and lateral pinning in pediatric supracondylar humerus fractures, a total of 72 children were equally divided into two groups of 36 each. The majority of cases in both groups were between 5–10 years of age. There was no significant difference in age, gender, or urban-rural distribution between the groups. Slip and fall was the most common mode of injury, particularly in the lateral pinning group. Type 3 fractures were more common in the cross-pinning group, while type 2B fractures were more common in the lateral pinning group.

The oxygen saturation (SPO_2) levels were significantly higher in the cross-pinning group, while hemoglobin levels showed no significant difference. Pin configuration varied significantly, with the cross-pinning group using both medial and lateral pins, and the lateral group using only lateral pins. There was no significant difference in loss of carrying angle or elbow range of motion between the groups. Pin tract infections were slightly more common in the cross-pinning group. Two cases of ulnar nerve neuropraxia were observed only in the cross-pinning group, with full recovery after medial pin removal.

Overall, both techniques provided satisfactory outcomes. Cross pinning was preferred for more unstable fractures, while lateral pinning offered a safer profile in terms of nerve protection.

Table 1: Age Distribution

Age Group	Cross Pinning (%)	Lateral Pinning (%)
<5	11.11	36.11
5-10	83.33	58.33
>10	5.56	5.56

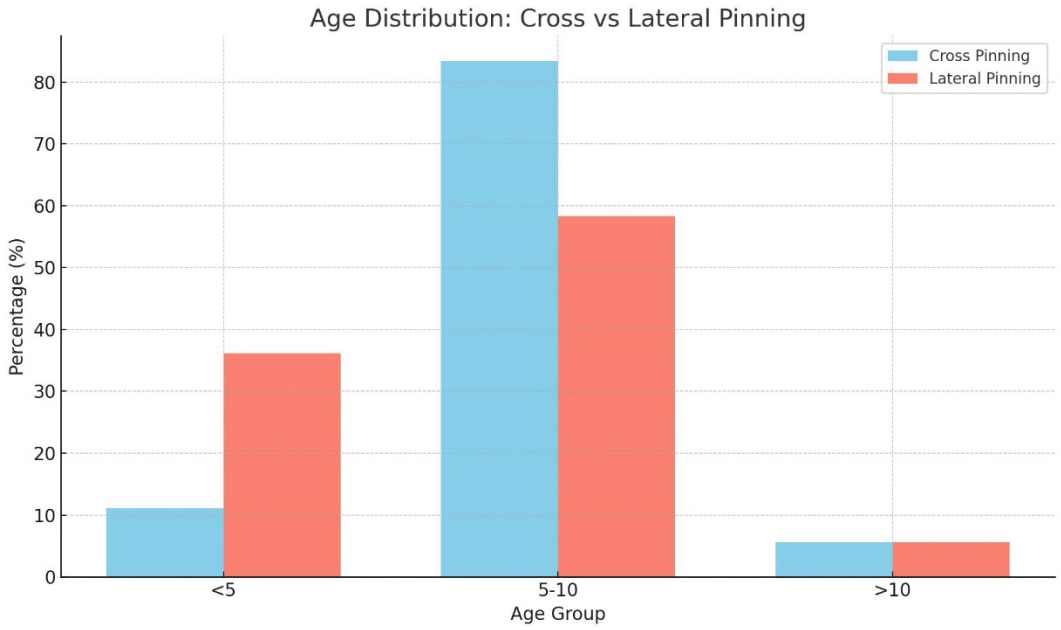

Figure 1: Age distribution: Cross vs Lateral Pinning

Table 2: Gender Distribution

Gender	Cross Pinning (%)	Lateral Pinning (%)
Male	44.44	63.89
Female	55.56	36.11

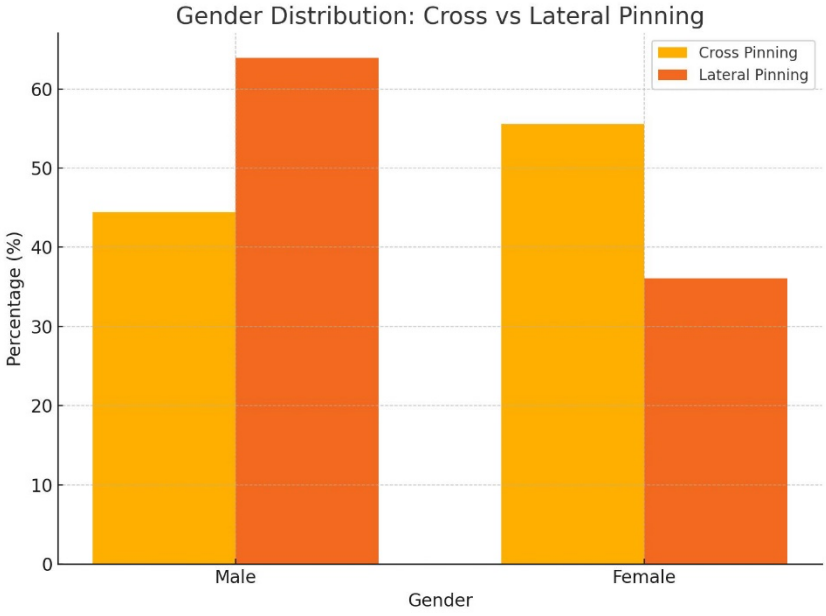

Figure 2: Gender distribution: Cross vs Lateral Pinning

Table 3: Pin Tract Infection

Infection Status	Cross Pinning (%)	Lateral Pinning (%)
Present	11.11	5.56
Absent	88.89	94.44

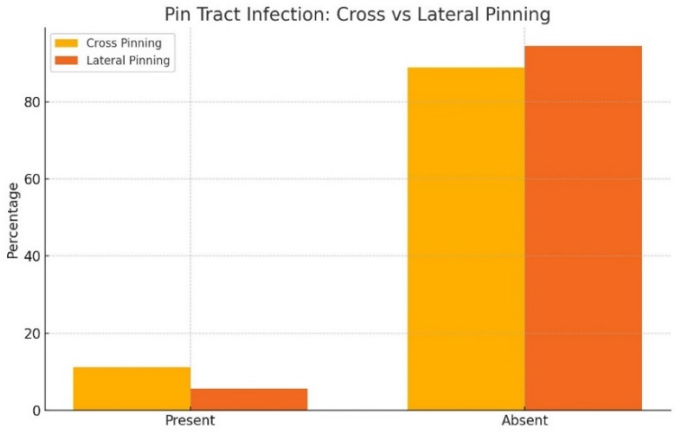

Figure 3: Pin tract infection: Cross vs Lateral Pinning

Table 3: Loss of Carrying Angle

Angle Loss	Cross Pinning (%)	Lateral Pinning (%)
Up to 5°	77.78	75.0
Up to 10°	19.44	19.44
Up to 15°	2.78	5.56

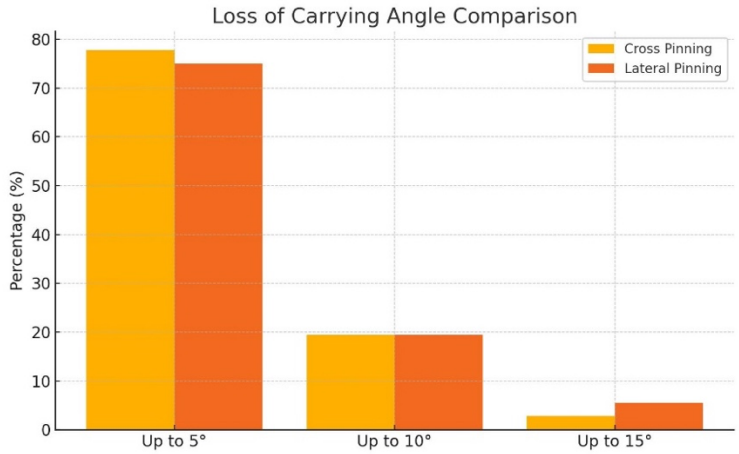

Figure 4: Loss of Carrying angle Comparison

Table 4: Ulnar Nerve Status

Status	Cross Pinning (%)	Lateral Pinning (%)
Normal	94.44	100.0
Neuropraxia	5.56	0.0

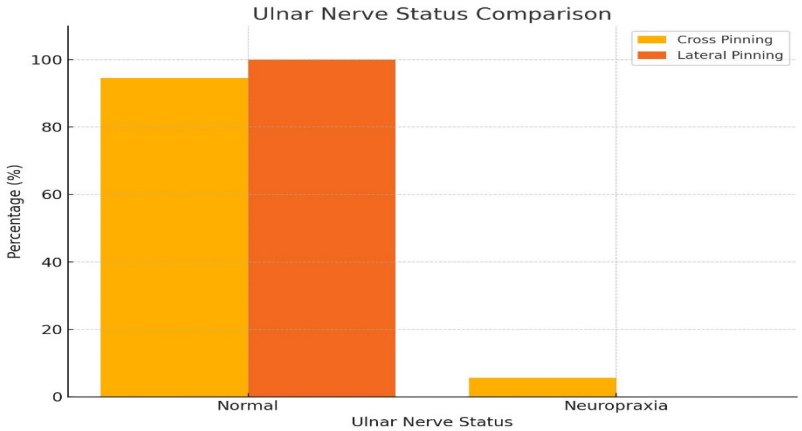

Figure 5: Ulnar nerve status comparison

Discussion

This study compared cross pinning and lateral pinning techniques for treating displaced supracondylar humerus fractures in children. The majority of cases in both groups were aged 5–10 years, aligning with previous studies like those by Patel et al. and Gijo et al., which showed high fracture incidence in this age group due to increased outdoor activity.

Although gender differences were noted (more males in lateral pinning, more females in cross pinning), the difference was not statistically significant. Urban patients formed the majority in both groups, likely reflecting easier access to healthcare services.

Slip and fall was the most common injury cause, especially in the lateral pinning group, whereas cross pinning saw more sports-related injuries. Type 3 fractures were more often treated with cross pinning, supporting its preference for unstable fractures due to better mechanical stability.

Loss of carrying angle and elbow motion was minimal and similar across both groups, indicating both techniques were functionally effective. However, ulnar nerve neuropraxia was observed only in the cross-pinning group (5.56%), consistent with studies by Maity et al. and Zhao et al., which emphasized the higher nerve injury risk with medial pin use.

Pin tract infections were slightly more in the cross-pinning group, but rates were low and manageable. Overall, both techniques showed good outcomes, but lateral pinning offered a safer profile, especially regarding nerve protection, without compromising functional recovery. Surgeon experience, fracture type, and patient safety should guide technique selection.

Conclusion (Short – Single Paragraph): Both cross pinning and lateral pinning are effective techniques for treating displaced supracondylar humerus fractures in children, providing good functional and cosmetic outcomes. While cross pinning offers slightly better stability in unstable fractures, it carries a higher risk of ulnar nerve injury. Lateral pinning is safer and avoids this risk, making it a preferred choice, especially in cases with swelling or when nerve protection is a concern. The choice of technique should be based on fracture type, surgeon's expertise, and individual patient factors.

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