

A Randomized Controlled Trial Comparing Conventional Cross Pinning and Dorgan's Lateral - Only Cross Pinning for Displaced Supracondylar Humerus Fractures in Children

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Abstract

Background: Closed reduction and percutaneous Kirschner wire fixation is the standard treatment for displaced pediatric Supracondylar Humerus fractures. However, the optimal pin configuration remains controversial due to the risk of iatrogenic ulnar nerve injury with conventional crossed pinning.

Aim: To compare the functional outcomes and complications of conventional crossed pinning and Dorgan's lateral-only cross pinning in displaced Supracondylar Humerus fractures in children.

Methods: A prospective randomized controlled study was conducted on 68 children with Gartland type II and III fractures, allocated to conventional crossed pinning

(n=34) or Dorgan's technique (n=34). Operative time, fracture union, range of motion, Flynn's criteria, and complications were evaluated over 6 months.

Results: Dorgan's technique required a longer operative time ($p<0.001$), while fracture union and elbow flexion were comparable between groups. Forearm pronation and supination were significantly better with Dorgan's technique ($p<0.001$). Both groups achieved excellent functional and cosmetic outcomes with similar union rates. One transient ulnar nerve injury occurred in the conventional group, whereas none was observed in the Dorgan's group.

Conclusion: Both techniques produced excellent clinical outcomes. Dorgan's lateral-only cross pinning provided

comparable stability while avoiding medial pin placement, making it a safe and effective alternative for the treatment of displaced pediatric Supracondylar Humerus fractures.

Keywords: Supracondylar Humerus fracture, Dorgan's technique, crossed pinning, lateral-only pinning, Flynn's criteria, pediatric fractures.

Introduction

Supracondylar fractures of the Humerus are the most common elbow fractures in children, accounting for approximately 60% of pediatric elbow fractures³ They commonly occur between 5 and 7 years of age following a fall on an outstretched hand with the elbow in hyperextension¹ The unique anatomy of the distal Humerus predisposes this region to fracture.² Displaced Gartland type II and III fractures require surgical management, with closed reduction and percutaneous Kirschner wire (K-wire) fixation considered the gold standard.^{4,5} Conventional crossed pinning provides excellent stability but carries a risk of iatrogenic ulnar nerve injury.⁶ Dorgan's lateral-only cross pinning technique achieves crossed fixation through a lateral approach, avoiding medial pin placement while maintaining fracture stability.⁷

The present randomized controlled study was undertaken to compare the functional outcomes, radiological union, operative characteristics, and complications of conventional crossed pinning and Dorgan's lateral - only cross pinning in displaced pediatric Supracondylar Humerus fractures.

Materials and Methods

This prospective randomized controlled study was conducted in the Department of Orthopedics, Kodagu Institute of Medical Sciences (Ko IMS), Kodagu, from May 2025 to May 2026. Forty-two children aged 5–12

years with Gartland type II and III closed displaced Supracondylar Humerus fractures were enrolled after obtaining written informed consent. Patients with open or pathological fractures, associated neurovascular injuries, or polytrauma were excluded. Based on sample size estimation (power 80%, $\alpha=0.05$), 21 patients were allocated to each group.

Patients were randomized into two groups: Group I underwent conventional crossed pinning (n=21), and Group II underwent Dorgan's lateral-only cross pinning (n=21).

Closed reduction was performed under fluoroscopic guidance, followed by percutaneous K-wire fixation using two or three K-wires according to fracture stability. In the conventional group, one medial and one lateral K-wire were inserted, while in the Dorgan group both K-wires were inserted through a lateral approach.

Postoperatively, the elbow was immobilized in an above-elbow slab. K-wires were removed after 4–6 weeks, and range-of-motion exercises were initiated thereafter. Patients were followed up at 6 weeks, 3 months, and 6 months.

Functional and cosmetic outcomes were assessed using Flynn's criteria, and radiological union was evaluated on serial radiographs. Statistical analysis was performed using SPSS version 22.0, with $p<0.05$ considered statistically significant.

Results

A total of 42 children in the age group 5-12 years with a mean age of 9.62 ± 1.5 years displaced Supracondylar Humerus fractures were included in the study, comprising 28 (66.7%) males and 14 (33.3%) females. The right side was involved in 30 (71.4%) patients, while 12 (28.6%) sustained left-sided injuries. All patients completed the 6-month follow-up without any

loss to follow-up. The majority of fractures were Gartland type III, and a fall on an outstretched hand was the most common mechanism of injury. Baseline demographic and fracture characteristics were comparable between the two treatment groups, with no statistically significant differences ($p>0.05$).

Functional and cosmetic outcomes were assessed at the final follow-up using Flynn's criteria. Elbow range of motion was measured clinically using a goniometer, and radiological union was confirmed by bridging callus on anteroposterior and lateral radiographs. Statistical analysis was performed using SPSS version 22.0, with a p-value <0.05 considered statistically significant.

the mean operative time was significantly longer in the Dorgan's lateral-only cross pinning group than in the conventional crossed pinning group (21.1 ± 3.16 vs. 13.15 ± 3.09 minutes; $p<0.001$). However, the mean union time was comparable between the two groups (5.89 ± 0.88 vs 7.01 ± 0.55 weeks; $p=0.855$). Elbow flexion at final follow-up was also similar ($135 \pm 6.33^\circ$ vs. $146 \pm 7.26^\circ$; $p=0.934$). In contrast, patients treated with Dorgan's technique demonstrated significantly better forearm pronation ($73.88 \pm 2.33^\circ$ vs. $61.45 \pm 3.71^\circ$; $p<0.001$) and supination ($71.65 \pm 2.28^\circ$ vs. $74.34 \pm 3.54^\circ$; $p<0.001$) compared with the conventional crossed pinning group.

Table 1: Functional and Cosmetic Outcomes by Treatment Group (Flynn's Criteria)

Outcome	Group I – Conventional (n=21)	Group II – Dorgan's Technique (n=21)
Functional – Excellent	19 (90.5%)	20 (95.2%)
Functional – Good	2 (9.5%)	1 (4.8%)
Functional – Fair/Poor	0 (0%)	0 (0%)
Cosmetic – Excellent	20 (95.2%)	20 (95.2%)
Cosmetic – Good	1 (4.8%)	1 (4.8%)

$p>0.05$ indicates no significant difference

Table 1 demonstrates that both groups achieved excellent functional and cosmetic outcomes by Flynn's criteria, with no statistically significant difference between groups for either functional ($p=0.614$) or

cosmetic ($p=1.000$) outcomes. Importantly, no fair or poor outcomes were recorded in either group, and no patient in either group required readmission or physiotherapy for stiffness.

Table 2: Complications by Treatment Group

Complication	Group I – Conventional (n=21)	Group II – Dorgan's Technique (n=21)	p-value
Iatrogenic Ulnar Nerve Injury	1 (4.8%)	0 (0%)	0.31
Pin Tract Infection	1 (4.8%)	1 (4.8%)	1.000
Stiffness	2 (9.5%)	1 (4.8%)	0.55
Loss of Reduction	0 (0%)	0 (0%)	—
CubitusVarus	1 (4.8%)	1 (4.8%)	1.000

$p>0.05$ for all comparison.

Discussion

Closed reduction and percutaneous K-wire fixation is the standard treatment for displaced pediatric Supracondylar Humerus fractures.^{8–11} Although conventional crossed pinning provides excellent biomechanical stability, the risk of iatrogenic Ulnar nerve injury has encouraged the use of lateral-only fixation techniques such as Dorgan's technique.^{12–19}

In the present study, Dorgan's technique required a significantly longer operative time, which is consistent with the findings of Dučić et al.²⁰ and Rizk et al.²¹ Union time and elbow flexion were comparable between the two groups, indicating that both techniques provide similar fracture healing.²³ However, forearm pronation and supination were significantly better in the Dorgan group, suggesting improved postoperative rotational function.

Pin tract infection and loss of reduction were comparable between the groups, and excellent functional and cosmetic outcomes were achieved in the majority of patients according to Flynn's criteria. Biomechanical studies have also demonstrated that properly placed lateral crossed pins provide adequate stability comparable to conventional crossed pinning.²⁷

Overall, both techniques yielded satisfactory clinical and radiological outcomes. However, Dorgan's lateral-only cross pinning offers the added advantage of avoiding medial pin placement while maintaining stable fixation, making it a safe and effective option for displaced pediatric Supracondylar Humerus fractures.

Conclusion

Both conventional crossed pinning and Dorgan's lateral-only cross pinning provide excellent functional and cosmetic outcomes in displaced pediatric Supracondylar Humerus fractures, with comparable union rates and

fracture stability. Dorgan's technique offers the added advantage of avoiding iatrogenic Ulnar nerve injury while providing superior forearm rotation. Despite a longer operative time, its favorable safety profile makes it an effective alternative to conventional crossed pinning for most Gartland type II and III fractures. Conventional crossed pinning may be reserved for selected unstable fracture patterns requiring greater biomechanical stability.

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