ORIGINAL RESEARCH PAPER

Volume - 15 | Issue - 07 | July - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A PROSPECTIVE COMPARATIVE STUDY OF FUNCTIONAL OUTCOMES OF CROSS PINNING VERSUS LATERAL PINNING IN PAEDIATRIC SUPRACONDYLAR HUMERUS FRACTURES

Orthopaedics

Dr Kashyap Maheshwari*	Resident, Department of Orthopaedics, Zydus Medical College & Hospital, Dahod, India*Corresponding Author
Dr Hardik Patel	Professor and Head, Department of Orthopaedics, Zydus Medical College & Hospital, Dahod, India
Dr Sahil Damor	Associate Professor, Department of Orthopaedics, Zydus Medical College & Hospital, Dahod, India
Dr Chirag Kotwal	Assistant Professor, Department of Orthopaedics, Zydus Medical College & Hospital, Dahod, India
Dr Dhaval Rathva	Resident, Department of Orthopaedics, Zydus Medical College & Hospital, Dahod, India
Dr Harshil Joshi	Resident, Department of Orthopaedics, Zydus Medical College & Hospital, Dahod, India

ABSTRACT

Background: Supracondylar humerus fractures are the most common paediatric elbow fractures. Closed reduction with percutaneous pinning is the standard treatment, but the optimal pin configuration remains controversial. [1-3] **Objective:** To compare functional and clinical outcomes of cross pinning versus lateral pinning in children with displaced supracondylar humerus fractures.**Methods:** A prospective comparative study was conducted on 40 children (<15 years) with Gartland type II–IV fractures treated by closed reduction and K-wire fixation. Outcomes were assessed using range of motion, carrying angle, and Flynn's criteria.**Results:** No statistically significant differences were observed between groups. **Conclusion:** Both techniques provide comparable outcomes; however, lateral pinning offers a safer profile.

KEYWORDS

INTRODUCTION

Supracondylar humerus fractures are the most common elbow fractures in children, accounting for nearly 60–70% of cases. [1,4] These injuries usually occur due to a fall on an outstretched hand and are predominantly extension-type fractures. [4]

These fractures are clinically important because of their proximity to vital neurovascular structures, including the brachial artery and median nerve, which may result in complications such as compartment syndrome and Volkmann's ischemic contracture. [1,13]

Closed reduction with percutaneous pinning is considered the gold standard for displaced fractures. [3,5] Two commonly used fixation techniques include cross pinning and lateral pinning.

Cross pinning provides superior biomechanical stability, particularly against rotational forces. [8] However, it carries a higher risk of iatrogenic ulnar nerve injury. [9,13]

Lateral pinning, on the other hand, avoids ulnar nerve injury and is considered safer, although concerns remain regarding its stability. [6,7]

Recent studies and meta-analyses suggest that both techniques provide comparable outcomes, with lateral pinning offering a better safety profile. [10-12]

MATERIALS AND METHODS

Study Design and Setting

This prospective comparative interventional study was conducted in the Department of Orthopaedics at Zydus Medical College & Hospital, Dahod, between October 2024 and December 2025.

Sample Size

A total of 40 patients were included.

Inclusion Criteria

- Age <15 years
- Gartland type II, III, IV fractures
- Closed fractures
- Treated by closed reduction

Exclusion Criteria

- Type I fractures
- Open fractures
- Open reduction cases

Grouping

- Group A: Cross pinning (n=20)
- Group B: Lateral pinning (n=20)

Surgical Procedure

All patients underwent closed reduction under fluoroscopic guidance followed by percutaneous fixation using K-wires.

Outcome Measures

- Range of motion (flexion and extension)
- Carrying angle
- Flynn's criteria

Statistical Analysis

Data were analyzed using SPSS v25. Chi-square test and unpaired t-test were applied. A p-value <0.05 was considered statistically significant.

RESULTS

Both groups were comparable in demographic and clinical parameters, consistent with previous studies. [18]

There was no statistically significant difference between the groups in:

- Flexion (p=0.61)
- Extension (p=0.11)
- Carrying angle (p=0.28)

Functional outcomes assessed using Flynn's criteria[²] showed:

- Excellent results in 95% (lateral) and 85% (cross pinning)

These findings are consistent with previous literature showing comparable outcomes between techniques. [10,11]

Only one complication (pin tract infection) was observed in the cross pinning group, similar to previous studies reporting low complication rates. [15]

DISCUSSION

The present study demonstrates that both lateral and cross pinning

techniques provide comparable functional and radiological outcomes, consistent with earlier studies. [10-12]

Biomechanically, cross pinning has been shown to provide greater torsional stability. [8] However, the increased risk of ulnar nerve injury remains a significant concern. [13]

Lateral pinning, especially when performed with two or three divergent pins, provides adequate stability while eliminating the risk of ulnar nerve injury. [6,7]

Meta-analyses have consistently shown no significant difference in functional outcomes between the two techniques, although cross pinning may have slightly better stability and lateral pinning a better safety profile. [10-12]

Thus, the choice of technique should be based on fracture stability, surgeon expertise, and intraoperative findings. [20]

CONCLUSION

Both cross pinning and lateral pinning are effective methods for treating paediatric supracondylar humerus fractures.

- Functional outcomes are comparable
- Lateral pinning is safer due to reduced nerve injury risk

Lateral pinning is therefore recommended as the preferred technique in most cases.

LIMITATIONS

- Small sample size
- Single-center study
- Short follow-up duration

DECLARATIONS

Ethical Approval: Obtained
Funding: None
Conflict of Interest: None
Informed Consent: Obtained

FIGURES AND GRAPHS

FIGURE 1 – Treatment Distribution

Type: Bar Graph
Cross Pinning: 20
Lateral Pinning: 20

Caption:
Distribution of patients according to treatment modality.

FIGURE 2 – Age Group Comparison

Type: Clustered Bar Graph

Age Group	Cross Pinning	Lateral Pinning
1–5 yrs	6	4
6–10 yrs	9	15
11–15 yrs	5	1

Caption:
Comparison of age distribution between cross pinning and lateral pinning groups.

FIGURE 3 – Fracture Type Distribution

Type: Clustered Bar Graph

Gartland Type	Cross	Lateral
Type II	7	10
Type III	9	4
Type IV	4	6

Caption:
Comparison of fracture types between both groups.

FIGURE 4 – Range of Motion Comparison

Type: Comparative Bar Graph

Parameter	Cross Pinning	Lateral Pinning
Flexion	138.25°	138.75°
Extension	2.75°	1.50°

Caption:
Comparison of elbow range of motion between the two groups.

FIGURE 5 – Flynn Outcome

Type: Clustered Bar Graph

Outcome	Cross	Lateral
Excellent	17	19
Good	2	0
Fair	1	1

Caption:
Comparison of functional outcomes using Flynn's criteria.

FIGURE 6 – Carrying Angle Loss

Type: Clustered Bar Graph

Loss (°)	Cross	Lateral
Nil	16	19
5°	2	0
10°	2	1

Caption:
Comparison of carrying angle loss between groups.

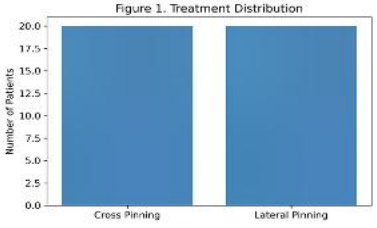
FIGURE 7 – Complications

Type: Bar Graph

Complication	Cross	Lateral
Pin tract infection	1	0

Caption: Comparison of complications between groups.

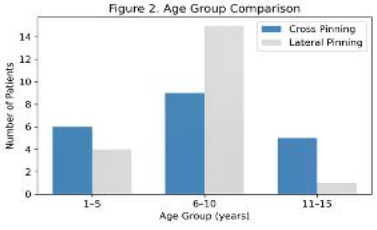
Figure 1 Treatment Distribution



Cross Pinning : 20
Lateral Pinning : 20

Figure 1: Distribution of patients according to treatment modality.

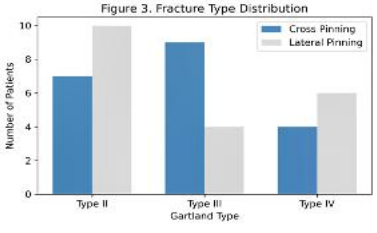
Figure 2 Age group comparison



Age Group	Cross Pinning	Lateral Pinning
1–5 yrs	6	4
6–10 yrs	9	15
11–15 yrs	5	1

Figure 2: Comparison of age distribution between cross pinning and lateral pinning groups.

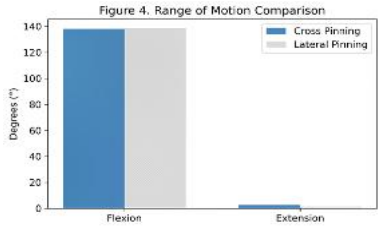
Figure 3 Fracture Type Distribution



Gartland Type	Cross	Lateral
Type II	7	10
Type III	9	4
Type IV	4	6

Figure 3: Comparison of fracture types between both groups.

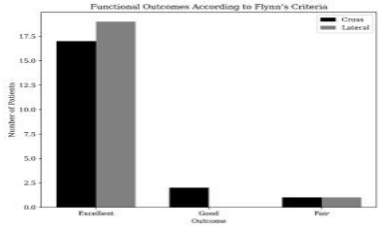
Figure 4 Range of Motion Comparison



Parameter	Cross Pinning	Lateral Pinning
Flexion	138.25°	138.75°
Extension	2.75°	1.50°

Figure 4: Comparison of elbow range of motion between the two groups.

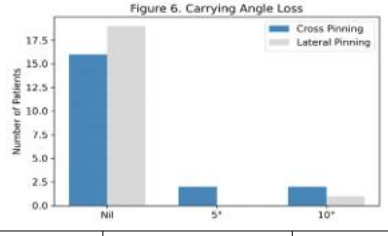
Figure 5 Flynn Outcome



Excellent	17	19
Good	2	0
Fair	1	1

Figure 5: Comparison of functional outcomes using Flynn's criteria.

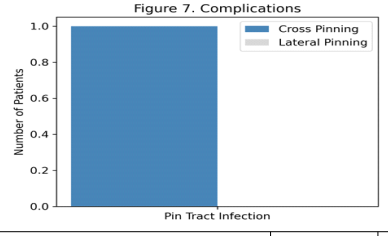
Figure 6 Carrying Angle Loss



Loss (°)	Cross	Lateral
Nil	16	19
5°	2	0
10°	2	1

Figure 6: Comparison of carrying angle loss between groups.

Figure 7 Complications



Complication	Cross	Lateral
Pin tract infection	1	0

Figure 7: Comparison of complications between groups.

REFERENCES (VANCOUVER STYLE)

1. Kumar V, Singh A. Fracture supracondylar humerus: a review. *J Clin Diagn Res.* 2016 Dec;10(12):RE01.
2. Martínez JA, Almero LP, De Anda RC, Botaya EG, Montolio MG, Rey MM. Epidemiological study on supracondylar fractures of distal humerus in pediatric patients. *Rev Esp Cir Ortop Traumatol (Engl Ed)*. 2019 Nov;63(6):394-9.
3. Mulpuri K, Wilkins K. The treatment of displaced supracondylar humerus fractures: evidence-based guideline. *J Pediatr Orthop*. 2012 Sep;32 Suppl 2: S143-52.
4. Kropelnicki A, Ali AM, Popat R, Sarraf KM. Paediatric supracondylar humerus fractures. *Br J Hosp Med (Lond)*. 2019 Jun;80(6):312-6.
5. Vaquero-Picado A, González-Morán G, Moraleda L. Management of supracondylar fractures of the humerus in children. *EFORT Open Rev.* 2018 Oct;3(10):526-40.
6. Rutarama A, Firth GB. Assessment of elbow functional outcome after closed reduction and percutaneous pinning of displaced supracondylar humerus fractures in children. *SA Orthop J.* 2019 Dec;18(4):14-9.
7. Abzug JM, Herman MJ. Management of supracondylar humerus fractures in children: current concepts. *J Am Acad Orthop Surg*. 2012 Feb;20(2):69-77.
8. Sadeq AM. Treatment of supracondylar fracture of the humerus: comparison study between percutaneous fixation by lateral pinning and cross pinning in children. *East Asian J Orthop Res*. 2024 Aug; 1:1-2.
9. Dekker AE, Krijnen P, Schipper IB. Results of crossed versus lateral entry K-wire fixation of displaced pediatric supracondylar humeral fractures: a systematic review and meta-analysis. *Injury.* 2016 Nov;47(11):2391-8.
10. Zhang XN, Yang JP, Wang Z, Qi Y, Meng XH. A systematic review and meta-analysis of two different managements for supracondylar humeral fractures in children. *J Orthop Surg Res*. 2018 Jun 7;13(1):141.
11. Karbach LE, Elfar J. Elbow instability: anatomy, biomechanics, diagnostic maneuvers, and testing. *J Hand Surg Am.* 2017 Feb;42(2):118-26.
12. Martin S, Sanchez E. Anatomy and biomechanics of the elbow joint. *Semin Musculoskelet Radiol.* 2013 Nov;17(5):429-36.
13. Attum B, Thompson JH. Humerus fractures overview. In: *StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing*; 2023 Jul 4.
14. Ichimura K, Kinose S, Kawasaki Y, Okamura T, Kato K, Sakai T. Anatomic characterization of the humeral nutrient artery: application to fracture and surgery of the humerus. *Clin Anat*. 2017 Oct;30(7):978-87.
15. Marion B, Leclère FM, Casoli V, Paganini F, Unglaub F, Spies C, Valenti P. Potential axillary nerve stretching during RSA implantation: an anatomical study. *Anat Sci Int.* 2014 Sep;89(4):232-7.
16. Ilayperuma I, Nanayakkara BG, Hasan R, Uluwitiya SM, Palahepitiya KN. Coracobrachialis muscle: morphology, morphometry and gender differences. *Surg Radiol Anat*. 2016 Apr;38(3):335-40.
17. Bauer AS, Pham B, Lattanza LL. Surgical correction of cubitus varus. *J Hand Surg Am.* 2016 Mar;41(3):447-52.
18. Chen H, Li D, Zhang J, Xiong X. Comparison of treatments in patients with distal humerus intercondylar fracture: a systematic review and meta-analysis. *Ann Med.* 2017 Nov;49(7):613-25.
19. Shenoy PM, Islam A, Puri R. Current management of paediatric supracondylar fractures of the humerus. *Cureus*. 2020 May 15;12(5): e8137.
20. Leung S, Paryavi E, Herman MJ, Sponseller PD, Abzug JM. Does the modified Gartland classification clarify decision making? *J Pediatr Orthop*. 2018 Jan;38(1):22-6.