



# Medial Pinning (Cross Pin Construct) of Supracondylar Fractures: Our Experiences with This Technique at Tertiary Care Centre

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## Abstract

**Background:** Supracondylar fracture of distal humerus is the most common paediatric fracture. Closed reduction and percutaneous Kirschner wire (pin) fixation is the standard method of managing displaced Gartland Type III supracondylar humerus fractures. Closed reduction with percutaneous pinning (CRPP) with two lateral pins is quite effective technique for management of majority of supracondylar fractures requiring fixation. However, if the fracture requires third pin for adequate stability, then the dilemma regarding the positioning of third wire occurs, with both methods having their pros and cons. **Purpose:** To compare methods of fixation with regards to maintenance of reduction, neuropathy, functional and radiological outcome and to assess the role of medial pin in management of supracondylar fractures. **Material and Methods:** Prospective study done in Department of Orthopaedics, Government Medical College and Hospital, Jammu from January 2019 to December 2019. Baumann's angle recordings done at post op. as well as at subsequent follow-ups. Flynn's criteria are used for comparing and deducing our results. **Results:** Medial-lateral pinning has shown to have better outcomes than the lateral only pin construct in terms of Flynn's criteria as well as change in Baumann's angle. **Conclusion:** With meticulous placement of medial pin; medial-lateral pinning can be used safely in management of type III supracondylar fractures with better stability and better functional and cosmetic outcome as well.

## Key Words

Baumann's angle, Closed reduction, Flynn's criteria, Gartland's Type III supracondylar humerus fracture

## Introduction

Supracondylar fracture of distal humerus is one of the common paediatric fractures that are encountered in Orthopaedics practice. About 85% of children are within 4-11 years of age. These fractures account for 6 % of all pediatric fractures (1,2). These fractures are Classified by Gartland classification system. Type III fractures are unstable fractures which require operative intervention (2).

Closed reduction with percutaneous pinning (CRPP)

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**Manuscript Received:** 15 July 2020; **Revision Accepted:** 25 December 2020;

**Published Online First:** 10 June 2021

**Open Access at:** <https://www.jkscience.org/>

is the treatment of choice. Varus and rotational defects quite common after these injuries, therefore main focus of our management is adequate reduction and thence avoidance of these complications. Neurovascular injuries and compartment syndrome also associated with these injuries. Median nerve is the most commonly affected nerve in these injuries, while ulnar nerve is most common iatrogenically injured nerve in these fractures.

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**Cite this article as:** Choudhary N, Gupta S, Mahajan N, Mahajan R, Saharan A. Medial pinning (cross pin construct) of supracondylar fractures: our experiences with this technique at tertiary care centre. JK Science 2021;23(2):89-93.

**Material and Methods**

This is a prospective study done in Department of Orthopaedics, Government Medical College and Hospital, Jammu from January 2019 to December 2019.

**Inclusion Criteria:**

All children with Gartland type III supracondylar fracture of distal humerus presenting within a week were included.

**Exclusion Criteria:**

- Open fractures
- Associated vascular injury
- Compartment syndrome

Fractures were classified as per Gartland classification. Baumann’s angle (1,3) recordings done at post op. as well as at subsequent follow-ups. Flynn’s criteria are used for comparing and deducing our results (4) (Table 1). A total of 106 patients reported to emergency, out of these 79 subjects were managed by CRPP. Out of these, 48 cases were managed by 2 lateral pins and rest cases which were (79-48=31) required more stable fixation (on intra-op stability testing). Out of these 31 patients of our interest 19 were managed by lateral-medial pinning and 12 were managed by only lateral pin construct. One case had median nerve injury (pre-operative). No case of any vascular injury.

**Table 1: Flynn’s Criteria for Grading Functional and Cosmetic Outcome in Supracondylar Fractures in Children**

Rating	Cosmetic Factor (Carrying Angle Change)	Functional Factor (Loss of Motion)
Excellent	0-5	0-5
Good	6-10	6-10
Fair	11-15	11-15
Poor	>16	>16

**Operative Procedure:**

**“Lateral Pinning”**

One pin was placed into the distal fragment, beginning laterally, directed obliquely toward the medial column, and then driven across the fracture site, and through the medial cortex of the distal humeral metaphysis proximal to the fracture site. The second pin is positioned up the lateral column in a direction divergent to the first, which maximizes pin separation at the fracture site. This is the

key point of this procedure (5). A third pin is inserted between the first and second pins (5,6,7). The wires were then bent, cut and left outside the skin, facilitating their removal. The pulse and capillary perfusion of the hand were evaluated after reduction, after fixation and then postoperatively. All the elbows were immobilized using a well-padded posterior above elbow slab with elbow flexed to 60- 90° as tolerated (Figure 1).

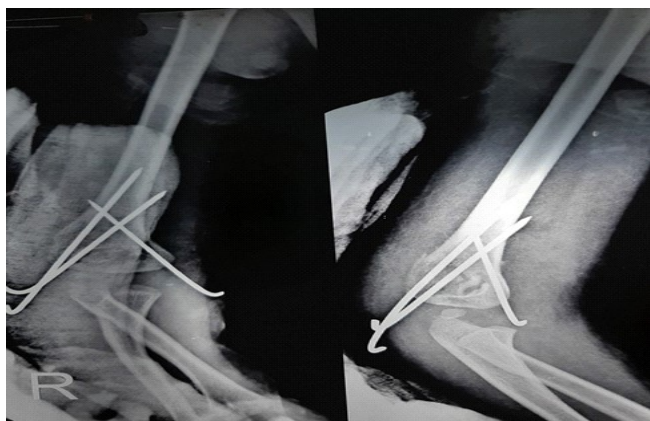


**Figure 1: Post-op radiograph of supracondylar fracture managed by 3-lateral pins**

**“Medial-Lateral Pinning”**

The two lateral pins are inserted in the same fashion as described above. The medial epicondyle was identified, and the tip of the fingernail of the surgeon’s non-dominant thumb placed at the edge of the medial epicondyle. The surgeon held the smooth K-wire close to its sharp end to pass it percutaneously onto the medial epicondyle, with the patient’s elbow flexed no more than 45°. The use of the pincer grip to hold the wire close to its sharp end with controlled identification of the medial epicondyle reduced the risk of slippage or plunging in of the wire and the need to make multiple attempts or passes. The starting point was confirmed with fluoroscopy and the wire driver was engaged onto the K-wire for drilling (8,9,10). The elbow was maintained in 45° or less of flexion throughout in preparation for K-wire insertion, so as to prevent anterior subluxation of the ulnar nerve over the medial epicondyle (which happens in flexion). For the passage of the medial pin, an anteriorly directed force was applied to the distal humeral fragment using the thumb of the surgeon’s free hand to correct for residual extension. The K-wire was inserted at an angle of 45° to the longitudinal axis of the humerus shaft. The K-wire placement was checked with fluoroscopy in both the lateral and anteroposterior views. The wires were then

bent, cut and left outside the skin, facilitating their removal. The pulse and capillary perfusion of the hand were evaluated after reduction, after fixation and then postoperatively. All the elbows were immobilized using a well-padded posterior above elbow slab with elbow flexed to 60- 90° as tolerated (Figure 2).



**Figure 2: Post-op radiograph of supracondylar fracture managed by 2 lateral and 1 medial pin (crossed-pin group)**

Radiologic assessment measured by Baumann’s angle: measured immediately postoperative and at the final follow up. Clinical assessment made on the basis of Flynn *et al.* criteria. Neurological examination done at immediate post op and at subsequent follow up visits. The paired-samples *t* - test was used to determine the significance of any change in the Baumann’s angle. Chi-square test was used to compare the results of Flynn’s criteria in both groups.

### Results

The mean age in our study was 6.7 years (4-10 years). The mean age in group 1 (medial-lateral group) was 5.5 years while that in group 2 (only lateral pinning group) was 4.2 years. Males had a higher incidence than females [18 males (58%) and 13 females (42%)]. The ratio was 10:8 (M:F) in group 1 and 8:5 (M:F) in group 2. The distribution in both the study groups regarding age and sex was found to be statistically insignificant (*p* value >0.5). Most common mechanism of trauma was fall.

Mean change in Baumann’s angle in lateral pin only group ( $3.94 \pm 2.16^\circ$ ) was more as compared to medial-lateral pin group ( $1.74 \pm 1.08^\circ$ ) and the change in Baumann’s angle (immediate post-op angle vs angle at final follow-up) was statistically significant in lateral pin only group ( $p=0.04$  vs  $p=0.07$ ) (Table 2), showing more loss of reduction in lateral-only group. Cosmetic and

**Table 2: Comparison of Baumann’s Angle in Both Groups of Patients (Mean  $\pm$  SD) and *p*-value for Each Group**

	Immediate Post-Operative Angle	Angle at Final Follow-up	<i>p</i> -value
Medial-Lateral Group	21.37 $\pm$ 4.09	19.63 $\pm$ 3.94	0.07
Lateral only Group	21.42 $\pm$ 3.57	17.48 $\pm$ 3.74	0.04

**Table 3: Cosmetic Outcomes in Both Groups on Basis of Flynn’s Criteria**

	Crossed Pin Group (N=19)	Lateral Pin Group (N=12)	<i>p</i> -value
Excellent	17(89%)	6(50%)	0.047
Good	1(5.5%)	4(33.33%)	
Fair	1(5.5%)	2(16.67%)	
Poor	0	0	
Total	19	12	

**Table 4: Functional Outcomes in Both Groups on Basis of Flynn’s Criteria**

	Crossed Pin Group (N=19)	Lateral Pin Group (N=12)	<i>p</i> -value
Excellent	17(89%)	5(41.67%)	0.038
Good	1(5.5%)	3(25%)	
Fair	1(5.5%)	3(25%)	
Poor	0	1(8.33%)	
Total	19	12	

function outcomes were statistically better in crossed pin group as compared to lateral pin only group ( $p=0.047$  and  $p=0.038$  respectively) (Table 3&4)

In our set of 31 patients, we had a subset of 6 patients with comminuted supracondylar fractures, of these, 4 (four) were managed with lateral-medial pin construct and 2 (two) were managed with only lateral pin construct. Of the 4 (four) cases managed by lateral-medial pinning, 2 had excellent (50%); 1 good (25%) and 1 had fair (25%) cosmetic outcome, while 1 excellent (25%); 2 good (50%) and 1 fair (25%) functional outcome on the basis of Flynn’s criteria. Of the 2 (two) cases managed by lateral only pinning both cases had fair (100%) cosmetic outcome, while 1 case had fair (50%) while other had poor (50%) functional outcome on the basis of Flynn’s criteria.

In our study we encountered one case of iatrogenic



nerve (ulnar nerve) injury in crossed pin group which was managed conservatively with observation at subsequent follow-ups. Full recovery occurred by 10 weeks. There was no incidence of any vascular injury in both groups. We had 5 cases of infection (2 in only lateral group and 3 in medial lateral group). All were superficial pin tract infections and were managed with local wound care and oral antibiotics. The *p*-value calculated for complications in both study groups is 0.81 which shows neither techniques to be superior/inferior based on complication rates.

### Discussion

Closed Reduction with Percutaneous Pinning (CRPP) with two lateral pins is quite effective technique for management of majority of supracondylar fractures requiring fixation. However, if the fracture requires third pin for adequate stability, then the dilemma regarding the positioning of third wire occurs, with both methods having their pros and cons. Various studies have recently debated over the appropriate pin construct with each method having their respective limitations.

In our study, medial-lateral pinning has shown to have better outcomes than the lateral only pin construct in terms of change in Baumann's angle as well as in terms of Flynn's criteria and this correlates with results of comparative study done by Abubeih *et al.* (11) which showed mean change in Baumann's angle in lateral-only group ( $3.6 \pm 2.4^\circ$ ) more compared to other group ( $2.8 \pm 1.6^\circ$ ), in our study the values were  $3.94 \pm 2.16^\circ$  and  $1.74 \pm 1.08^\circ$  respectively showing more loss of reduction in lateral-only group. A multicentre collaborative cohort study conducted by Claireaux *et al.* (12) also demonstrated better stability in cross pin constructs than in only lateral pin constructs in terms of change in Baumann's angle. They compared the mean changes of Baumann's angle with respect to various pin configurations and found that 3-crossed pin technique was associated with least changes in mean Baumann's angle than lateral pinning group ( $2.47 \pm 1.18^\circ$  vs  $6.77 \pm 2.68^\circ$ ), showing better hold of reduction in medial-lateral group. The subjects with only lateral pinning had significant changes in Baumann's angle comparing values at immediate post-op. and at final follow-up in comparison with subjects managed by medial-lateral pinning. Skaggs *et al.* (4) in their study clearly mentioned difference in Baumann's angle to be the most important criteria in assessment of loss of reduction.

The results of medial-lateral pinning are even more so

favourable in communitated fractures and this was also depicted in a report framed by James *et al.* (9) which clearly showed better clinical and radiological outcome in cases of severe supracondylar fractures managed by use of medial-lateral pin construct than by lateral construct alone, however small sample size is a limiting factor in our study.

Lateral pinning has shown to have benefit in terms of risk of IUNI and it was demonstrated in various studies viz, James *et al.* (9), Lee *et al.* (10), Begovic *et al.* (13). In their studies Skaggs *et al.* (4), Guy *et al.* (5), Sapkota *et al.* (6), Gopinathan *et al.* (14), Govindasamy *et al.* (15) have demonstrated risk of IUNI with medial pin at a rate of 2-6%. All injuries were neurapraxias with no report of any permanent ulnar nerve injury (1,2,5,9,11,15,16). However, meticulous pin insertion as described in their study by Woo *et al.* (7) and by Edmonds *et al.* (8) has significantly reduced chances of IUNI. We abided by this technique and did not encounter a single case of IUNI in any of our 19 subjects who were managed by medial pin along with lateral pins.

### Conclusion

With meticulous placement of medial pin; medial-lateral pinning can be used safely in management of type III supracondylar fractures with better stability and better functional and cosmetic outcome as well.

### Financial Support and Sponsorship

Nil.

### Conflicts of Interest

There are no conflicts of interest.

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