

## FUNCTIONAL AND RADIOLOGICAL OUTCOME IN CROSS VERSUS LATERAL PINNING TECHNIQUE IN THE MANAGEMENT OF CLOSED SUPRACONDYLAR FRACTURE IN CHILDREN: A NON RANDOMISED CONTROLLED TRIAL

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### Abstract

**Background:** The use of K-wires for closed reduction of supracondylar humerus fractures has become the established method of treatment, but there are varying perspectives on the specific approach used. Functional and radiological outcome in cross versus lateral pinning technique in the management of closed supracondylar fracture in children. **Materials and Methods:** The Non-randomized controlled trial was carried in the department of Orthopaedics, RIMS Imphal. Protocol preparation and approval was taken during August to December 2020. 202 patients (101 patients with cross pinning technique and 101 patients with lateral pinning technique were treated) and 2 patients were lost to follow-up. All the Patients with closed displaced Gartland's type III extension type supracondylar humerus fractures aged between 2-14 years, Irreducible fracture by closed reduction and Duration of fracture within 7 days were included in this study. **Result:** The cosmetic outcome as per Flynn's grading for elbow who underwent cross pinning showed excellent outcome in 88% cases, good results in 11% cases and fair outcome in 1% cases whereas the patients who underwent lateral pinning showed excellent outcome in 72% cases, good results in 27% cases and fair outcome in 1% cases. In the present study, according to Skaggs Criteria, there was no loss of reduction in 94% cases and 6% cases with mild loss of reduction in cross pinning group whereas there was no loss of reduction in 89% cases and 11% cases with mild loss of reduction in lateral pinning group. **Conclusion:** Finally, we conclude that both operative methods of fixation of displaced supracondylar humerus fractures, cross pinning and lateral pinning techniques gives satisfactory results in terms of safety and efficacy.

## INTRODUCTION

Supracondylar humerus fractures in children are commonly seen in day to day practice. Supracondylar humerus fractures (SHF) comprise 17% of all pediatric fractures and are second in frequency to forearm fractures. According to an epidemiological study, the incidence of fracture supracondylar humerus is 308/100000 per year in the general population. It is also the commonest pediatric fracture around the elbow.<sup>[1]</sup> Supracondylar fracture of the humerus is the second most common fracture in children (16%) and the most frequent before the age of 7 years.<sup>[2]</sup> Pediatric supracondylar fractures can be challenging to treat and are most common elbow fractures in children, accounting for 75% of all pediatric elbow injuries. There are well-known

complications associated with supracondylar fractures and their treatment like neurovascular injury, compartment syndrome, and malunion leading to cubitus varus. In displaced fractures the incidence of vascular compromise has been reported between 12% and as high as 19-20%. The amount of neurological complication has ranged between 10% and 20%, with the most common nerve palsy being the anterior interosseous nerve. The rate of compartment syndrome is estimated to be between 0.1% and 0.3% and in the presence of an ipsilateral forearm fracture can increase to 9%. The occurrence of deformity from malunion varies in the literature; it has been estimated to be 4.2% using data pooled from 1455 patients.<sup>[3]</sup> The median nerve along with the brachial artery crosses the elbow joint. Anterior Interosseous Nerve branch (AION) of the median

nerve is most prone to get involved in postero-lateral displacement of the distal fracture fragment.<sup>[4]</sup>

## MATERIALS AND METHODS

The Non-randomized controlled trial was carried in the department of Orthopaedics, RIMS Imphal. Protocol preparation and approval was taken during August to December 2020. 202 patients (101 patients with cross pinning technique and 101 patients with lateral pinning technique were treated) and 2 patients were lost to follow-up.

### Inclusion Criteria

1. Patients with closed displaced Gartland's type III extension type supracondylar humerus fractures aged between 2-14 years
2. Irreducible fracture by closed reduction
3. Duration of fracture within 7 days

### Exclusion Criteria

1. Open fractures
2. Patient medically unfit
3. Associated neurovascular impairment following fractures
4. Comminuted ipsilateral fracture of distal humerus or elbow joint

### Methodology

The patients after admission were examined by a senior consultant. They were allocated into two groups. The first group was treated with cross pinning and the other group by lateral pinning technique with two K-wires. Comparisons were made between the two groups on the basis of radiological, functional and cosmetic outcomes after each procedure. The followings procedures were followed:

Informed written consent was taken accordingly. All details of participating individuals were recorded. The fractures were assessed by antero-posterior and lateral view x-rays. All routine investigations (Blood routine examination, urine routine examination, electrocardiograph, bleeding time, chest x-rays, blood sugar, liver function test, kidney function test, and serum electrolytes) was done on all patients. Patients were prepared for operative procedure either with cross-pinning or lateral pinning. Operation was done under General Anesthesia (GA)

**Operative techniques:** All the patients were undergoing open reduction and internal fixation (ORIF) with Kirschner's wires (pins) under the control of tourniquet. The pin size was selected according to the weight of the child (weight < 20 kg 1.5mm size; > 20 kg 2mm size).

Two standard medial and lateral approaches were used for distal humerus.

**Positioning:** Patient was made lie in supine position and affected limb was kept in extension on the operating table.

**Draping:** The skin over the arm and forearm were prepared by soap scrub and application of the povidone iodine 10% solution. The operative field was draped with sterile sheets and placing the towel

clips. A vertical drape was applied to allow C-arm image intensifier if required to be used with extra safety.

**Cross Pinning:** Technique of operation: Surgery was performed under general anesthesia. With the patient in supine, the injured limb was placed on the hand table in abduction and external rotation. Under aseptic precautions, a medial incision was made starting from the medial epicondyle and extending proximally for 3-4 cm. The ulnar nerve, often displaced anteriorly in a flexed elbow, was identified and mobilized to the length of the skin incision. The brachialis and triceps were elevated judiciously from the proximal fragment and the fracture hematoma drained. The elbow was flexed and gentle traction applied to disengage and visualize the distal fragment. After achieving the anatomical reduction as possible, a medial K-wire was introduced to stabilize the fracture. The entry point was made over anterior part of medial epicondyle and engaged the posterior cortex of the humerus. The lateral pin was placed from the lateral epicondyle and to engage the opposite cortex. Elbow movements were checked. The wires were cut long to facilitate subsequent removal without anesthesia. The tourniquet was removed and wound washed with saline. After checking for capillary refill, the subcutaneous tissue and skin were closed in layers. The elbow was immobilized in splint at 90 degrees in flexion in supination. All patients were given pre operative prophylactic antibiotics.

**Lateral Pinning:** A lateral incision was made starting from lateral epicondyle and extending proximally 3-4 cm. The plane between the brachioradialis and triceps muscle was visualized and cut down to reflecting the brachioradialis anteriorly and the triceps posteriorly. The elbow was made to flex to 200 to 300 and gentle traction and flexion with the thumb pressing the olecranon anteriorly. The quality of reduction is assessed by inspecting the lateral column and the fracture line anteriorly and posteriorly under direct vision. Generally, the fracture inter-digitate to lock the reduction. Two k-wires were inserted from the lateral condyle across the fracture site either in parallel or in divergent configuration with adequate separation at fracture site. The elbow was maintained in 60 degrees to 80 degrees flexion to prevent posterior tilt.

**Post-Operative Management:** Postoperatively, the elbow was immobilized in a posterior plaster slab with limb elevation. A cephalosporin antibiotic was administered prior to the operation and then 12 hourly for 5 days after surgery. The patients were discharged from the hospital between 5-7 days after the operation. During follow-up in the OPD clinical-radiological evaluation was performed for maintenance of reduction (at first follow-up) and functional outcome, which included range of elbow motion, measurement of carrying angle, Baumann's angle, metaphyseal-diaphyseal angle and any complications including neurovascular status, superficial and deep infection. Suture removal was

done on the 14th day post-operative day during the follow-up in OPD. The follow-ups schedule was included as 2nd, 4th, 6th postoperative weeks and at 3 months and finally at 6 months. The radiological evaluation was performed next day by AP and lateral views next day after the surgery and at 2 weeks, 4 weeks, 6 weeks, 3 months and finally at 6 months. In the 4th week, the pins were removed without anesthesia in the OPD. At 3rd and 6th months follow-up, the children were evaluated for full function, minor limitation of function and major loss of function. The final results were graded as excellent, good, fair and poor, according to the loss of range of motion and loss of carrying angle using the criteria of Flynn et al.



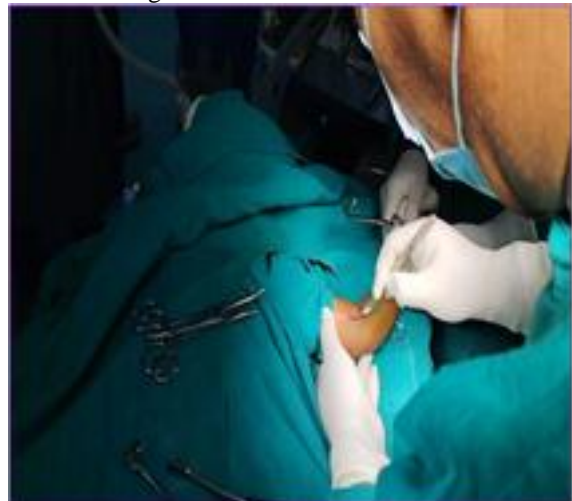
**Figure 1:** Instruments used for supracondylar fracture fixation, A- K- wires, B- Reduction clamp, C- K- wire bender, D- K- wire cutter and bender, E- Wire cutter, F- Power drill



**Figure 2:** Skin preparation of the operated site with 10% betadine and draped

**Statistical Analysis:** Data was checked for completeness and consistency. Informed written consent was taken. All details of participating individuals were recorded. Data was entered and analysed using SPSS V. 21 for window. Descriptive data is presented using percentage and frequency for

variables like sex, fracture side, mode of injury, complications and mean with standard deviation for time of union, duration of surgery, duration of hospital stay, metaphyseal-diaphyseal angle loss, carrying angle loss, range of motion at elbow. Chi-square test was used for the categorical data such as functional outcome, cosmetic outcome between cross and lateral pinning technique. A p-value <0.05 was considered significant.



**Figure 3:** A medial incision was made starting from medial epicondyle and extending proximally for 3-4cm



**Figure 4:** Dissection of soft tissues and ulnar nerve protected



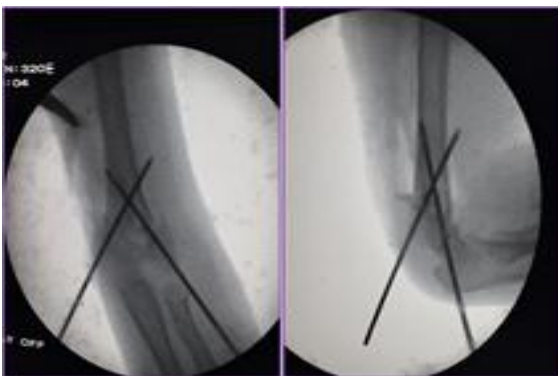
**Figure 5:** Fracture reduction and a medial K-wire was passed



**Figure 6:** K-wire was passed through the lateral epicondyle



**Figure 10:** Range of Motion at elbow at 6 months of follow-up



**Figure 7:** Reduction confirmed using fluoroscopic image intensifier



**Figure 11:** Skin preparation of the operated site with 10% betadine and draped and medial skin incision was marked using skin marker pen



**Figure 8:** Immediate Post-operative X-ray



**Figure 12:** A medial incision was made starting from medial epicondyle and extending proximally for 3-4cm



**Figure 9:** Post operative X-ray at 6 months of follow up



**Figure 13:** Dissection of soft tissues and ulnar nerve protected



Figure 14: Fracture reduction and a 2 K-wires were passed through the lateral epicondyle



Figure 18: Post operative X-ray at 6 months of follow up

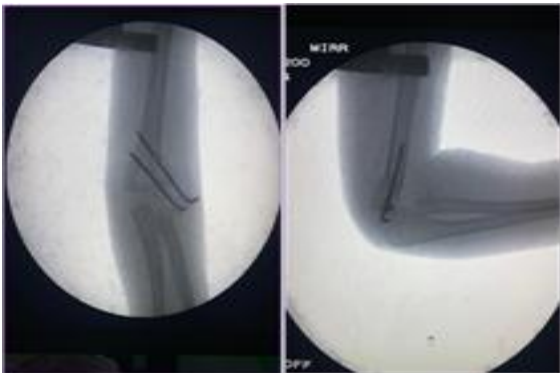


Figure 15: Reduction confirmed using fluoroscopic image intensifier



Figure 19: Range of Motion at elbow at 6 months of follow-up



Figure 16: Immediate Post-operative X-ray



Figure 20: Range of Motion at elbow at 6 months of follow-up



Figure 17: Post operative X-ray at 6 months of follow up

## RESULTS

Patients with Gartland's type III extension type supracondylar humerus fractures were prospectively recruited during the study period. A total of 202 patients who met the criteria for inclusion were included in the study of which 101 patients were

operated by Cross-pinning and 101 patients by Lateral pinning. 2 patients were lost to follow-up. The study was done in the Department of Orthopaedics, Regional Institute of Medical Sciences, Imphal. Implant removal was done for all the patients in both groups. The following results and observation were made at the end of the study. The data collected were then analyzed.

The mean age of all patients in cross pinning group was  $6.87 \pm 1.77$  years with a range of 4 to 10 years while that of lateral pinning group was  $6.59 \pm 1.66$  years with a range of 4 to 10 years. The age group of 7-10 years comprised the highest number of patients (52.5%). These are graphically represented in [Table 1].

There were 67 males (67%) and 33 females (33%) for cross pinning group with a male to female ratio of 2.03:1 and 59 males (59%) and 41 females (41%) in Lateral pinning group with a male to female ratio of 1.43:1 in our study. These are represented in [Table 1]. The left elbow was predominantly involved in both the groups, 63% in cross pinning group and 52% in lateral pinning group. Fall while playing was the most common mode of injury in both the groups which was seen in 82 cases (82%) for Cross pinning group and 76 cases (76%) for Lateral pinning group. Fall from height was next to fall while playing in cross pinning group and lateral pinning group seen in 15 cases and 20 cases respectively. Maximum patients were operated within 3 days of injury in cross pinning group which accounted for 41 patients (41%) with a mean of  $2.76 \pm 0.9$  days whereas maximum patients were operated within 2 days of injury in lateral pinning group which accounted for 36 patients (36%) with a mean of  $2.21 \pm 0.9$  days. These are represented in [Table 1].

Maximum patients in cross pinning group were hospitalized for 3 to 4 days with a mean of  $3.19 \pm 0.69$  days whereas maximum patients in lateral pinning group were hospitalized for 3 to 4 days with a mean of  $3.06 \pm 0.72$  days. Maximum patients of cross pinning group had union within 7 to 8 weeks with a mean of  $6.32 \pm 1.13$  weeks while maximum patients of lateral pinning group had union within 4 to 6 weeks with a mean of  $6.2 \pm 1.11$  weeks.

Maximum patients had Baumann angle loss of 1 to 3 degrees in cross pinning group which accounted for 78% cases with a mean of  $2.98 \pm 1.11$  whereas maximum patients had Baumann angle loss of 4 to 6 degrees in lateral pinning group which accounted for 53% cases with a mean of  $3.71 \pm 1.27$ .

Maximum patients had a metaphyseal-diaphyseal angle loss of 1 to 3 degrees with a mean of  $2.44 \pm 0.84$  degrees for 87% cases in cross pinning group and  $2.56 \pm 0.76$  degrees for 90% cases in lateral pinning group. Maximum patients had a carrying angle loss of 4 to 6 degrees in cross pinning group for 49% cases with a mean of  $4.28 \pm 1.94$  degrees while maximum patients had a carrying angle loss of 4 to 6 degrees in lateral pinning group for 57% cases with a mean of  $4.98 \pm 2.06$  degrees. Maximum patients had a loss of Elbow ROM of less than 10 degree for both cross pinning (84% cases) and lateral pinning (64% cases) groups with a mean of  $6.4 \pm 3.12$  degrees and  $7.62 \pm 3.16$  degrees. More than 10 degrees of loss in elbow ROM was seen in 16% cases of cross pinning group and 36% cases of lateral pinning group.

In the present study, the functional outcome as per Flynn's grading for elbow who underwent cross pinning showed excellent outcome in 71% cases, good results in 18% cases and fair outcome in 11% cases whereas the patients who underwent lateral pinning showed excellent outcome in 51% cases, good results in 35% cases and fair outcome in 14% cases.

The cosmetic outcome as per Flynn's grading for elbow who underwent cross pinning showed excellent outcome in 88% cases, good results in 11% cases and fair outcome in 1% cases whereas the patients who underwent lateral pinning showed excellent outcome in 72% cases, good results in 27% cases and fair outcome in 1% cases.

In the present study, according to Skaggs Criteria, there was no loss of reduction in 94% cases and 6% cases with mild loss of reduction in cross pinning group whereas there was no loss of reduction in 89% cases and 11% cases with mild loss of reduction in lateral pinning group.

In the present study, maximum patients had no complications. In the cross pinning group, there were 7% cases of pin tract infection, 6% cases of elbow stiffness, 5% cases of cubitus varus deformity and 4% cases of iatrogenic ulnar nerve injury. In the lateral pinning group, there were 11% cases of pin tract infection, 13% cases of elbow stiffness, 5% cases of cubitus varus deformity and no case of iatrogenic ulnar nerve injury.

Maximum patients in cross pinning group were operated in more than 50 minutes with a mean time of  $45.26 \pm 6.53$  minutes whereas maximum patients in lateral pinning group were also operated in more than 40 minutes with a mean time of  $40.62 \pm 5.45$  minutes.

**Table 1: Basic parameter in two groups.**

Age in years	Cross pinning	Lateral pinning	Total
1-4	11(11%)	12(12%)	23(11.5%)
5-6	32(32%)	40(40%)	72(36%)
7-10	57(57%)	48(48%)	105(52.5%)
Mean $\pm$ sd	$6.87 \pm 1.77$	$6.59 \pm 1.66$	$6.73 \pm 1.72$
Gender			
Female	33(33%)	41(41%)	74(37%)
Male	67(67%)	59(59%)	126(63%)
Side of elbow Affected			
Left	63(63%)	52(52%)	115(57.5%)

Right	37(37%)	48(48%)	85(42.5%)
Mode of injury			
Fall while playing	82(82%)	76(76%)	158(79%)
Fall from height	15(15%)	20(20%)	35(17.5%)
RTA	3(3%)	4(4%)	7(3.5%)

**Table 2: Time interval between trauma and surgery and duration of hospital stay and union time in two groups.**

Time interval between trauma and surgery	Cross pinning	Lateral pinning	Total	
1	9(9%)	25(25%)	34(17%)	P<0.001**, Significant, Chi-Square Test
2	28(28%)	36(36%)	64(32%)	
3	41(41%)	32(32%)	73(36.5%)	
4	22(22%)	7(7%)	29(14.5%)	
Duration of hospital stay				P=0.316, Not Significant, Fisher Exact Test
1-2	13(13%)	21(21%)	34(17%)	
3-4	84(84%)	77(77%)	161(80.5%)	
>4	3(3%)	2(2%)	5(2.5%)	
Union time				P=0.322, Not Significant, Chi-Square Test
4-6	49(49%)	57(57%)	106(53%)	
7-8	51(51%)	43(43%)	94(47%)	

**Table 3: Baumann and metaphyseal diaphyseal and carrying angle loss in two groups**

Baumann angle loss	Cross pinning	Lateral pinning	Total	
1-3	78(78%)	47(47%)	125(62.5%)	P<0.001**, significant, chi-square test
4-6	22(22%)	53(53%)	75(37.5%)	
7-10	0(0%)	0(0%)	0(0%)	
Metaphyseal diaphyseal angle loss				P=0.654, not significant, chi-square test
1-3	87(87%)	90(90%)	177(88.5%)	
4-6	13(13%)	10(10%)	23(11.5%)	
7-10	0(0%)	0(0%)	0(0%)	
Carrying angle loss				P=0.028*, significant, fisher exact test
1-3	39(39%)	22(22%)	61(30.5%)	
4-6	49(49%)	57(57%)	106(53%)	
7-10	11(11%)	20(20%)	31(15.5%)	
>10	1(1%)	1(1%)	2(1%)	

**Table 4: loss of elbow ROM in two groups**

Loss of elbow Rom	Cross pinning	Lateral Pinning	Total	
<10	84(84%)	64(64%)	148(74%)	P=0.002**, significant, chi-square test
>10	16(16%)	36(36%)	52(26%)	

**Table 5: Flynn's criteria for functional and cosmetic outcome**

FLYNS criteria for functional outcome	Cross pinning	Lateral Pinning	Total	
Excellent	71(71%)	51(51%)	143(71.5%)	P=0.006**, significant, chi-square test
Good	18(18%)	35(35%)	45(22.5%)	
Fair	11(11%)	14(14%)	12(6%)	
Total	100(100%)	100(100%)	200(100%)	
Flynn criteria for cosmetic outcome				P<0.001**, significant, chi-square test
Excellent	88(88%)	72(72%)	139(69.5%)	
Good	11(11%)	27(27%)	46(23%)	
Fair	1(1%)	1(1%)	15(7.5%)	

**Table 6: SKAGGS Criteria**

SKAGGS criteria	CROSS pinning	Lateral pinning	Total	
NONE	94(94%)	89(89%)	183(91.5%)	P=0.310, Not Significant, Chi-Square Test
MILD	6(6%)	11(11%)	17(8.5%)	

**Table 7: Complications**

Complications	Cross pinning	Lateral pinning	Total	
Cubitus varus	5(5%)	8(8%)	13(6.5%)	P=0.098+, significant, fisher exact test
Elbow stiffness	6(6%)	13(13%)	19(9.5%)	
Iatrogenic ulnar nerve injury	4(4%)	0(0%)	4(2%)	
Pin tract infections	7(7%)	11(11%)	18(9%)	

## DISCUSSION

In our study, the mean age of the patients was found to be  $6.87\pm 1.77$  and  $6.59\pm 1.66$  in cross pinning and lateral pinning group respectively, which was comparable to other studies done by Naik LG et al.<sup>[5]</sup> where  $6.28\pm 2.03$  and  $7.20\pm 2.03$  in cross and lateral respectively. Govindasamy R et al<sup>6</sup> also showed similar mean age. In our study supracondylar humerus fractures occurs mostly in between 7-10 years of age which is similar to the study done by Sapkota K et al,<sup>[7]</sup> where peak incidence of is between 5 to 11 years. We found that in cross pinning group 67% were found to be males and 33% patients were females which is similar to study done by Singh S et al,<sup>[8]</sup> where 74% males and 25% were females. In lateral pinning group mostly, patients were male (59%) and 41% were females comparable to the study done by Jatin B et al<sup>9</sup> and study done by Pavone et al.<sup>[9,10]</sup>

In our study, 63% of the patients found to have left side affected in cross pinning group which was similar to study done by Singh SK et al,<sup>[11]</sup> where as 52% of the patients' left side was affected in lateral pinning group comparable to study done by Kumar P et al.<sup>[12]</sup> In our study majority of our patients sustained fractures following fall while playing accounting for 82% in cross pinning and 76% in lateral pinning group which was comparable to study done by Jatin B et al.<sup>[9]</sup> In Hussain S et al,<sup>[13]</sup> series of 42 patients with supracondylar fractures, 18 patients sustained injury due to fall while playing. In our study, majority of patients were operated within the 48-72 hours since time of injury and delay in operation was due to late admission to hospital. Patients (41%) underwent operation within 72 hours in cross pinning where as 36% were operated within 48 hours comparable to study done by Patil S et al.<sup>[14]</sup> In our study, the mean operation time was  $45.26\pm 6.53$  and  $40.62\pm 5.45$  in cross and lateral pinning respectively which is comparable to study of Jatin B et al,<sup>[9]</sup> and statistically significant similar to study done by Naik LG et al.<sup>[5]</sup> In our study the average duration of hospital stay in case of cross pinning was  $3.19\pm 0.69$  days and in case of lateral pinning was  $3.06\pm 0.72$  days which was comparable to study done by Govindasamy R et al,<sup>[6]</sup> average hospital stay was 3 days with the range of 1 to 7 days. In our study, fracture union occurred in all patients in 4 to 8 weeks' time with mean  $6.32\pm 1.13$  in cross pinning whereas  $6.20\pm 1.11$  in lateral pinning which is comparable to studies done by Pathania VP et al,<sup>[15]</sup> where average union time was 7 weeks and also comparable with the study of Manandhar RR et al.<sup>[16]</sup> In our study, the Baumann's angle loss was statistically significant with mean of  $2.98\pm 1.11$  and  $3.71\pm 1.27$  in cross and lateral pinning group respectively which is comparable to study done by Sapkota et al,<sup>[7]</sup> where loss was  $5.65\pm 0.73$  and  $5.06\pm 0.15$  in cross and lateral pinning group respectively and was statistically significant and was also comparable with the study of

Khawaja MK et al.<sup>[17]</sup> In our study, M-D angle (metaphyseal-diaphyseal angle) was statistically not significant with a mean of  $2.44\pm 0.84$  and  $2.56\pm 0.76$  in cross and lateral pinning respectively which is similar to study done by Patil S et al.<sup>[14]</sup> In our study we found loss of range of motion with a mean of  $6.4\pm 3.12$  and  $7.62\pm 3.16$  which is comparable with study conducted by Kumar P et al.<sup>[12]</sup>

In the present study, the functional outcome as per Flynn's grading for elbow who underwent cross pinning showed excellent outcome in 71% cases, good results in 18% cases and fair outcome in 11% cases whereas the patients who underwent lateral pinning showed excellent outcome in 51% cases, good results in 35% cases and fair outcome in 14% cases which is similar to study by Devkota P et al.<sup>[18]</sup> The cosmetic outcome as per Flynn's grading for elbow who underwent cross pinning showed excellent outcome in 88% cases, good results in 11% cases and fair outcome in 1% cases whereas the patients who underwent lateral pinning showed excellent outcome in 72% cases, good results in 27% cases and fair outcome in 1% cases which is comparable with study of Arun KN et al.<sup>[19]</sup> In the present study, according to Skaggs Criteria, there was no loss of reduction in 94% cases and 6% cases with mild loss of reduction in cross pinning group whereas there was no loss of reduction in 89% cases and 11% cases with mild loss of reduction in lateral pinning group which is similar to the study done by Abubeih HM et al,<sup>[20]</sup> where 93.9% patients had no loss of reduction, 6.1% patients had mild loss of reduction in lateral pinning group and 88.2% patients with no loss of reduction in cross pinning group. In our present study maximum patients had no complications. In the cross- pinning group, there were 7% cases of pin tract infection, 6% cases of elbow stiffness, 5% cases of cubitus varus deformity and 4% cases of iatrogenic ulnar nerve injury. In the lateral pinning group, there were 11% cases of pin tract infection, 13% cases of elbow stiffness, 5% cases of cubitus varus deformity and no case of iatrogenic ulnar nerve injury. Kumar P et al,<sup>[12]</sup> in their study also reported pin tract infections and iatrogenic ulnar nerve injury. All the patients in our study underwent open reduction and internal fixation (ORIF) whereas most of the studies in the journals were treated with closed reductions and percutaneous pinning techniques. Initially closed reduction was tried and our study included those patients with irreducible fracture even after 2 attempts. It has been reported that repeated and forced maneuvers during closed reduction in patients who were treated with repetitive manipulations may lead to myositis ossificans.<sup>[21]</sup>

## CONCLUSION

Finally, we conclude that both operative methods of fixation of displaced supracondylar humerus fractures, cross pinning and lateral pinning



techniques gives satisfactory results in terms of safety and efficacy.

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