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Original Research Article

COMPARATIVE STUDY OF FUNCTIONAL OUTCOME OF DISPLACED PAEDIATRIC SUPRACONDYLAR HUMERUS FRACTURE FIXED WITH TWO LATERAL KIRSCHNER WIRES AND CROSSED KIRSCHNER WIRES

Dr. Abhishek Chaturvedi[1] (Senior Resident), Dr. Surendra Singh Yadav[2] (Associate Professor), Dr. Vivek Kumar Gupta[3] (Senior Resident) & Dr. Satyam Kumar Kumre[4] (Senior Resident)

Dept. of Orthopaedics, Gajara Raja Medical College, Gwalior M. P.[1,2,3&4]

Corresponding Author: Dr. Satyam Kumar Kumre

ABSTRACT

Introduction: Supracondylar fracture of the humerus are the most common fracture in children between the age of 5-7 years and the most common pediatric fracture requiring surgery supracondylar fracture may have significant complication including nerve injury, vascular injury and compartment syndrome

Aims and Objectives: To find mechanical stability in cross and lateral Kirshner wire fixation. To find radiological outcome in cross and lateral Kirshner wire fixation. To study iatrogenic ulnar nerve injury in cross Kirshner wire fixation

Materials and Methods: This study was conducted in J.A.H. group of hospital attached to Gajra Raja Medical College Gwalior between October 2019 to August 2021. During this period 40 cases of displaced supracondylar fractures of humerus in children were treated with cross pinning and lateral pinning with Kirschner wires according to odd and even randomisation. The total study population comprised of 40 children.

Results: Patients with supracondylar humerus fracture treated with 2 cross K wire and 2 lateral K wire groups compared on the basis of carring angle, Baumann angle, lateral rotation percentage and ulnar nerve palsy. Among two groups the final outcome was excellent among 19 cases and 16 cases in 2 cross K wire and 2 lateral K wire group respectively, one case and 3 cases had good outcome respectively and only one case among lateral K wire group had fair outcome but the result is not statistically significant.

Conclusion: This study, 2 cross k-wire as well as 2 lateral k-wire fixation [divergent] provided equally functional and radiological outcomes as well as equal mechanical stability as compared to medial-lateral pinning without risk of ulner nerve injury in most of the patients, indicating that lateral fixation[divergent] method also provide equally functional and radiological outcome and equal mechanical stability as compared to medial-lateral pinning without risk of ulner nerve injury.

Keywords: Supracondylar fracture humerus, k-wire fixation, carrying angle, Baumann angle, ulnar nerve palsy.

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1. INTRODUCTION:

Supracondylar fracture of the humerus are the most common fracture in children between the age of 5-7 years and the most common pediatric fracture requiring surgery supracondylar fracture may have significant complication including nerve injury, vascular injury and compartment syndrome[1].

Epidemiology: Supracondylar fracture of humerus represent 3%[1] of all paediatric fractures. Extension injuries accounts for 98% of supracondylar fracture of humerus. Flexion injuries result from direct trauma to the posterior aspect, of the distal humerus of falling on to flexed elbow (accounts 2% of all cases.). And more difficult to reduced and have worse outcome a/w ulnar nerve injury. The most common mechanism of injury, when patient falls on to a outstretched hand with arm fully extended[2].

To classify these injury Gartland classification is used which is given below:-

Classification (Gartland Classification)

- Type I : Undisplaced or minimally displaced.
- Type II: Displaced but with intact posterior cortex
  (a) Stable with posterior angulation
  (b) Unstable with posterior angulated and rotated
- Type II: Completely displaced
  III A : Posteriomedial
  III B : Posteriolateral
- Type IV :Fracture with multidirectional instability

Displaced fractures will need reduction and stable fixation with kirschner wire to prevent varus and rotational future deformity[3]. Kirshner wire fixation can be done with two methods which is mention below.

- Cross Kirshner wire fixation
- Only lateral kirschner wire fixation.

Many studies have established the fact that cross kirschner wire fixation method provide more mechanical stability[3] but there is risk of Iatrogenic ulnar Nerve injury during medial Kirshner wire insertion. Lateral kirschner wire fixation also provide good stability without risk of ulnar nerve injury but wire placement should be proper divergent of parallel as suggested by many studies.

Now here we aim to study functional and radiological outcome as well as mechanical stability of these two of fixation method for displaced Supracondylar humerus fracture and study stability of the fixation of post operative follow up.

Aims and Objectives:

- To find mechanical stability in cross and lateral Kirshner wire fixation.
- To find radiological outcome in cross and lateral Kirshner wire fixation.
- To study iatrogenic ulnar nerve injury in cross Kirshner wire fixation

2. MATERIALS AND METHODS:

This study was conducted in J.A.H. group of hospital attached to Gajra Raja Medical College Gwalior between October 2019 to August 2021. During this period 40 cases of displaced supracondylar fractures of humerus in children were treated with cross pinning and lateral pinning with Kirschner wires according to odd and even randomisation. The total study population comprised of 40 children.

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Inclusion Criteria:

- Isolated Supracondylar fracture humerus
- Age between 3 to 10 years.
- All closed supracondylar fracture humerus gartland type 2 and 3
- Compound displaced supracondylar humerus fracture gustilo anderson type I.
- Duration of injury less than 1 week.

Exclusion Criteria:

- Age more than 10 years.
- Compound fracture with gustilo anderson type 2 and 3.
- Duration of injury > 1 week.
- Polytrauma

Statistical analysis:

Data will be collected, complied and analyzed. The different statistical tests as percentage, proportions and chi square will be applied. As soon as the patient was admitted, A detailed history of mode of injury and initial treatment was obtained from parents and children. The distal neurovascular status was thoroughly examined. Examination of the patient was done. Case sheet will be prepared. The patients radiograph was taken in antero-posterior and lateral views. The diagnosis was established by clinical and radiological examination.

In this study, supracondylar fracture of humerus was classified according to Gartland's classification.

- Type I: Undisplaced Supracondylar fracture of humerus.
- Type II: Displaced Supracondylar fracture with intact posterior cortex.
- Type III: Displaced Supracondylar fracture with no cortical contact.

a) Postero-medial
b) Postero-lateral.

Temporary closed reduction was done on admission and above elbow posterior pop slab was applied in 90° of flexion at elbow. The limb was elevated to reduce swelling of the elbow.

All patients were taken for elective surgery as soon as possible after necessary blood, urine and radiographic pre-operative work-up.

Patients' attenders were explained about the nature of injury and its possible complications. Patients' attenders were also explained about the need for the surgery and complications of surgery. Written and informed consent was obtained from the parents of the children before surgery.

All patients were started on prophylactic antibiotic therapy. Intravenous cephalosporin’s were used. It was administered according to bodyweight of the children, prior to induction of anaesthesia and continued at 12 hourly intervals post- operatively.

OPERATIVE TECHNIQUE:

Anaesthesia:

All patients were taken up for surgery under general anaesthesia.

Patient Positioning:

Patient was positioned supine with ipsilateral shoulder at the edge of the table.

Painting and Draping:

Affected elbow, arm a forearm was scrubbed, painted and drapped leaving the elbow, lower

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third of arm and upper third of forearm exposed.

Technique of closed reduction:

Longitudinal traction with elbow in extension and supination was given. At the same time counter traction was given by an assistant by holding proximal portion of arm.

Figure 1: PATIENT POSITIONING & PAINTING AND DRAPPING

Continuing traction and counter traction, medial or lateral displacement were corrected by valgus or Varus force respectively at fracture site.

After that, posterior displacement and angulation was corrected by flexing the elbow and simultaneously applying posteriorly directed force from anterior aspect of proximal fragment and anteriorly directed force from posterior aspect of distal fragment.

If an adequate reduction is obtained the elbow should be capable of smooth and almost full flexion. Confirm the adequacy of reduction under image intensifier in two views.

1. Antero-posterior view.
2. Lateral view by externally rotating the arm After getting satisfactory alignment reduction was maintained by percutaneous k-wire fixation.

After experiencing failure to obtain a satisfactory reduction after two or three manipulations we considered open reduction.

Introduction of K-wires:

Stainless steel kirschner's wire of about 1.6mm to 2.0mm were used. We used two cross k-wire, one from medial epicondyle and one from lateral condyle. After achieving satisfactory reduction via closed technique, K- wires were introduced with the help of a power drill under image intensifier control.

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Selection of first pin placement was done according to initial fracture displacement. In cases of postero medial displacement we preferred to put medial pin first while in cases of postero lateral displacement lateral pin was put first.

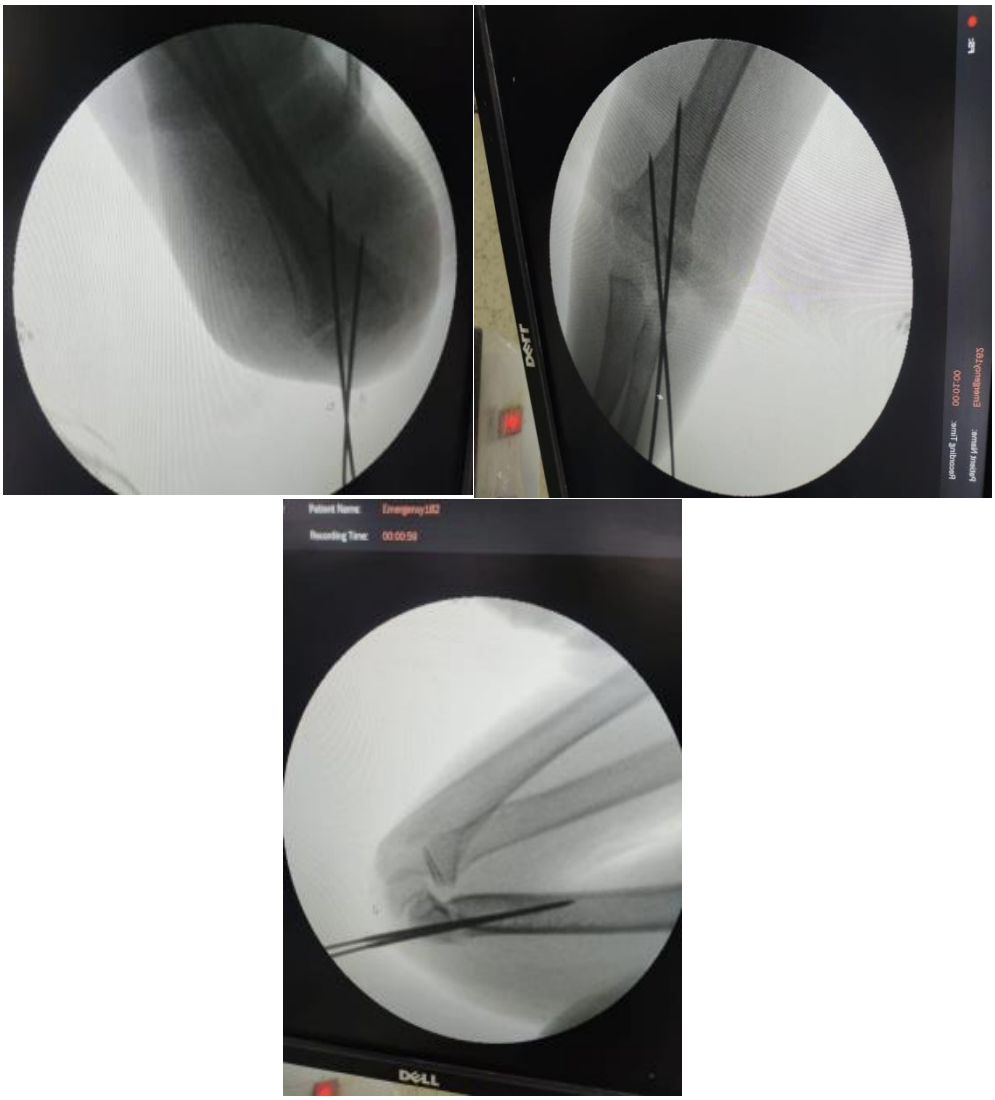

Figure 2: Intra operative C-Arm Images

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Figure 3: Kirschner wire's Cut and bent

Medial pin entry was from tip of the medial epicondyle and lateral pin was entered at the centre of the lateral condyle. Both pins were directed 40° to the humeral shaft in saggital plane and 10° posteriorly.

K-wire placement was checked in image intensifier in antero-posterior and lateral views.

K-wires were bent and kept at least 1 cm outside the skin. Sterile dressing was applied. Above elbow posterior pop splint in 90° elbow flexion and midprone position of forearm applied.

Post – Operative management:-

Post-operatively, operated limb was elevated on a drip-stand and patient was encouraged to move fingers.

At 2nd post-operative day, check dressing was done and condition of the operative wound or pin site were noted. Following dressing, check xray in ap & lateral views were done.

Patients in whom closed reduction was done were discharged on 3rd or 4th post- operative day, with oral antibiotics.

Patients in whom open reduction was done, were discharged after 5 days with oral antibiotics. These patients were reviewed on 12th postoperative day on O.P.D. basis for

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suture removal.
K-wires were removed at 4 weeks post-operatively after X - Ray confirmation of satisfactory callus formation. Pop splint was discarded at the same time and patient was encouraged to do active elbow flexion extension and supination – pronation extercises.
Patients were advised not to lift heavy weight till 12 weeks post-operatively. Follow up was done on O.P.D. basis at 2^{nd}, 3^{rd} and 6^{th} week postoperatively.
The follow up was done by clinical and radiological evaluation, and results were assessed based on:

1. Pintract infection
2. Movements of the elbow.
3. Carrying angle of the elbow compared with normal elbow.
4. Union of the fracture.
5. Baumann's angle
6. Lateral rotation percentage
7. Anterior humeral line

3. RESULTS

Table 1. Sex-wise distribution of patients			
	Method of fixation		
Sex	2 Cross K wire	2 lateral k wire	Total
	Number (%)	Number (%)	
FEMALE	8(40)	6(30)	14(35)
MALE	12 (60)	14 (70)	26 (65)
Total	20 (100)	20 (100)	40 (100)
Chi square test -0.440, p value- 0.507			

Table 1 shows most of the patients (60% and 70%) belong to male gender in group 2 Cross K wire and 2lateral K wire respectively. Which is not significant.

Table 2: Age distribution of patients		
	Mean	Standard deviation
2 Cross K wire	7.6	1.635
2 lateral k wire	7.2	1.765
T test- 0.743, p value-0.762		

Table 2 shows Mean age of the patients among two groups is almost same 7.6 ±1.635years and 7.2 ±1.765 years and not significant statistically.

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Table 3. Patients with Fracture type			
	Method of fixation		
Gartland Number	2 Cross K wire	2 lateral k wire	Total
	Number (%)	Number (%)	
2	6(30)	6(30)	12(30)
3	14 (70)	14 (70)	28 (70)
Total	20 (100)	20 (100)	40 (100)
Chi square test -00, p value- 1.0			

Table 3 shows the type of fracture was also same among both groups as 70 % belong to gartland type 3 and 30% belong to gartland type 2.

Table 4: Mobility according to angle of flexion and extension				
Angle	2 Cross K wire	2 lateral k wire	t test	p value
	Mean± SD	Mean± SD		
Flexion	131.5± 6.51	129.5± 7.6	0.894	0.377
Extension	10± 9.73	8± 8.33	0.698	0.489

Table 4 shows there is no much difference in the mobility angles among both groups. Flexion and extension angle was 131.5±6.51 and 10 ±9.73 in 2 cross K wire group and 129.5± 7.6 and 8±8.33 in 2 lateral K wire group and the result is not significant.

Table 5: Carrying angle of normal and operated elbow				
Angle	2 Cross K wire	2 lateral k wire	t test	p value
	Mean± SD	Mean± SD		
Carrying angle of normal elbow	10.6± 1.43	11.85±2.37	2.021	0.052
Carrying angle of operated elbow	8.95±1.61	9.5± 2.31	0.876	0.387
t test	3.42	3.16		
p value	0.001	0.003		

Table 5 shows carrying angle of normal elbow was 10.6±1.43 and 11.85±2.37 among 2 cross K wire and 2 lateral K wire groups respectively and statistically not significant. Carrying angle of operated elbow was 8.95±1.61 and 9.5±2.31 among 2 cross K wire and 2 lateral K wire groups respectively and statistically not significant.

Table 6: Baumann's angle of normal and operated elbow at different intervals				
Angle	2 Cross K wire	2 lateral k wire	t test	p value
	Mean± SD	Mean± SD		
Baumann angle of normal elbow	12.1±2.71	16.15±3.51	4.08	0.000*
Baumann angle [immediate postoperative]	13.05±2.87	15.05±3.59	1.945	0.059
Baumann angle of operated elbow at 4 weeks	11.95±3.68	15.1±5.81	2.048	0.047*

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The Baumann angle of 2 lateral K wire group patients is higher (16.15±3.51) when compared to the group 2 cross K wire (12.1±2.71) and which is statistically significant. (p value – 0.000) The Baumann angle when assessed immediately after the operation and at 4 weeks after operation, showed significant change among both the groups with the p value of 0.059 and 0.047 respectively. Angle was more in 2 lateral K wire group.

Table 7: Lateral rotation percentage at different intervals				
	2 Cross K wire	2 lateral k wire	t test	p value
Lateral rotation percentage	Mean± SD	Mean± SD		
post-operative	2.1±3.87	2.7±4.61	0.446	0.658
At healing	6.25±9.06	14.9±15.28	2.177	0.036*

Table 7 shows the mean lateral rotation percentage was 2.1± 3.87 and 2.7±4.61 among 2 cross K wire and 2 lateral K wire group respectively immediately after operation and which was not significant. The mean lateral rotation percentage was 6.25±9.06 and 14.9±15.28 among 2 cross K wire and 2 lateral K wire group respectively immediately after operation and which was significant with angle being more in 2nd group. (p value -0.036)

Table 8. Neurovascular Injury of patients			
	Method of fixation		
Injury	2 Cross K wire	2 lateral k wire	Total
	Number (%)	Number (%)	
Not seen	17(85)	20 (100)	37(92.5)
Ulnar nerve injury seen	3 (15)	0 (0)	3 (7.5)
Total	20 (100)	20 (100)	40 (100)
Chi square test -3.23, p value- 0.07*			

Table 8 shows Ulnar nerve injury was seen among 3 patients of the group 2 cross K wire and none in 2 lateral K wire and which shows statistically significant value. (p value- 0.07)

Table 9. Anterior humeral line at the healing			
	Method of fixation		
Anterior humeral line	2 Cross K wire	2 lateral k wire	Total
	Number (%)	Number (%)	
Just touching anterior 1/3rd of capitellum	1(5)	0 (0)	1(2.5)
Pass through anterior 1/3rdthird of capitellum	1(5)	7 (35)	8 (20)
Pass through middle 1/3rdthird of capitellum	18 (90)	13 (65)	31 (77.5)
Total	20 (100)	20 (100)	40 (100)
Chi square test -6.03, p value- 0.043*			

Table 9 shows at the time of healing, he anterior humeral line was passed through middle 1/3rd of capitellum in most of the cases (90% and 65%) among 2 cross K wire and 2 lateral K

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wire group respectively, 5% and cases anterior humeral 35% line passed through anterior 1/3rd of capitellum and only one case among 2 cross K wire group passed just touching the anterior 1/3rd of capitellum, the statistical result was significant (p value- 0.043)

Table 10: Anterior humeral line at the time of surgery			
	Method of fixation		
Anterior humeral line	2 Cross K wire	2 lateral k wire	Total
	Number (%)	Number (%)	
Pass through anterior 1/3rdthird of capitellum	1(5)	2 (10)	3 (7.5)
Pass through middle 1/3rdthird of capitellum	19 (95)	18 (90)	37(92.5)
Total	20 (100)	20 (100)	40 (100)
Chi square test -0.36, p value- 0.548			

Table 10 shows at the time of surgery, except one case among 2 cross K wire and two cases among 2 lateral K wire group which passed through anterior 1/3rd of apitellum, rest all passed through middle 1/3rd of capitellum. And this is not statistically significant.

Table 11. Final outcome of patients			
	Method of fixation		
Final outcome	2 Cross K wire	2 lateral k wire	Total
	Number (%)	Number (%)	
Excellent	19(95.0)	16(80)	35(87.5)
Good	1 (5)	3 (15)	4 (10)
Fair	0(0)	1 (5)	1(2.5)
Total	20 (100)	20 (100)	40 (100)
Chi square test -1.418, p value- 0.492			

Table 11 shows The final outcome was excellent among 19 cases and 16 cases in 2 cross K wire and 2 lateral K wire group respectively, one case and 3 cases had good outcome respectively and only one case among lateral K wire group had fair outcome but the result is not statistically significant. (p value- 0.492).

4. DISCUSSION

The displaced supracondylar fracture of the humerus is one of the most difficult injuries orthopaedic surgeons have to deal with. Closed or open reduction and kirschner wires are used to maintain the reduction in children with displaced supracondylar fractures of the humerus. The outcome of surgical treatment is determined by the accuracy of the initial reduction and the maintenance of such reduction till union.

The optimum method for pin fixation of displaced supracondylar humerus fractures in children is still up for dispute. Crossed medial and lateral k-wire fixation, as well as lateral k-wire fixation alone, are the most prevalent treatment modalities. Cross pinning has the advantage of providing the best fracture stability, however iatrogenic ulnar damage can occur during the medial pin placement. The benefit of lateral pinning is that it prevents iatrogenic ulnar nerve injury, but it is less biomechanically stable.

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Hilton et al discovered that cross pinning provided superior rotational stability than lateral pinning in biomechanical investigations using an adult cadaver and a paediatric bone model. However, adequate pin entry site, pin design, and quantity of pins applied by lateral side can provide the same level of stability as cross pinning.[4]

This randomised prospective interventional trial was carried out at the J.A. Group of Hospitals, Gwalior, at the Department of Orthopaedics and Trauma Centre (M.P.). The average patient age in this series was 7.6 years, with males outnumbering females [M:F=1.5:1]. The age range is 2 to 10 years. A total of 58.17 percent of cases occurred in the 5-8 age range. The typical age at presentation, according to **Flynn and Matthews et al**.[1974], was 6 years and 7 months. They recorded 38 boys to 34 girls in their series.
The average age of presentation of supracondylar humerus fracture was 7.1 years, according to **Alcott, Bowden et al.** (1977), with boys predominating 44 to 25 girls. In terms of presentation age, the current series yields similar results. Males outnumbered females in the series because boys engage in more outside play than girls. **Musa et al**. conducted a two-year prospective analysis based on 30 patients of type 3 gartland's fracture treated with crossed percutaneous pinning. With a mean age of 7.6 years, the age group ranged from 2 to 13 years.

In our research, 26 occurrences (or 65 percent) occurred as a result of a fall on an outstretched hand while playing, and As demonstrated in our series, falling from a tree is another mode of trauma prevalent in Indian scenarios. According to other experts, the most common cause of supracondylar fracture is a fall on an outstretched hand.

Experimentally, **Abraham and coworkers**[1982] demonstrated that force applied to a hyperextended elbow is conveyed to the anterior aspect of the elbow via the olecranon fossa. As a result, little power is necessary to cause injury, and even minor trauma to an outstretched hand can result in a supracondylar humerus fracture.

As a result, we can conclude that children's outdoor activity is high in this age group, and that parents should take preventative measures for their children while playing outdoor games in order to prevent it.

We had three cases of partial ulnar nerve injury [neuropraxia] in our study, out of a total of 20 (15%) cases of crossed pinning of supracondylar humerus fractures in children. In the cross pinning group, **Skaggs et al** found 8% ulnar damage. To avoid ulnar nerve injury, we used the flexion extension approach[5]. In our situation, the ulnar nerve damage was entirely healed after three months. duration. In the lateral pinned case, we likewise found no nerve damage, which is consistent with Skaggs et al's findings. With medial pinning, **Prashant et al**. found a 6% rate of iatrogenic ulnar nerve palsy and none with lateral pinning.[6] **Brown et al**. examined 162 fractures and found four occurrences of direct nerve damage. In an examination of 56 nerve injuries, **Blakey et al**. discovered two ulnar nerves transected by wires.[7] **Lyons et al**. observed satisfactory outcomes following iatrogenic ulnar nerve injury caused by crossed K-wire fxation, regardless of whether the wire was removed, the nerve examined, or conservative treatment was used.

Thus, nerve injury can be avoided by using a 15 degree flexion in short of full extension during medial pin placement and a tiny incision over the medial epicondyle prior to pin

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placement in cross k wire fixation. Divergent k-wire arrangement was done in our study series in lateral k-wire fixation.

Skaggs et al. stressed the importance of increasing the spread throughout the fracture site and contacting enough bone in both the proximal and distal fragments while using lateral-entry pins for fixing.[8]

Lee and **colleagues** discovered that two divergent lateral pins separated at the fracture site were superior to crossed pins in both extension and varus loading, but were equal in valgus.[9]

Radiological stability is assessed intraoperatively, postoperatively, and at the time of healing in our study series using two parameters: the baumann angle and the lateral rotation percentage.

In our study, the mean boumann angle of cross k wire fixation in 20 patients was immediate post-operative 13.052+_87 and at the time of healing[at 4 week] 11.95+_3.68 and the mean boumann angle of lateral k wire fixation in 20 patients was immediate post-operative 15.05+_3.59 and at the time of healing[at 4 week] 15.1+_5.81 which is comparable with the normal range of baumann angle i.e. 9-26 degree, indicating that radiological stability

Similarly, the mean lateral rotation percentage of cross k wire fixation in 20 patients was immediate postoperative 2.1+_3.87 and at the time of healing[after 4 weeks] 6.25+_9.06, and the mean lateral rotation percentage of lateral k wire fixation in 20 patients was immediate postoperative 2.7+_4.61. and at the time of healing[at 4 week] 14.9+_15.28, indicating that cross k wire has greater rotational stability than lateral k wire, however the difference between the two groups is minor.

After analysing radiographs, **Zenios et al**. found that SCH fractures that are rotationally stable intraoperatively after wire fixation are unlikely to displace postoperatively, as evidenced by changes in baumann angle and lateral rotation percentage, and concluded that SCH fractures that are rotationally stable intraoperatively after wire fixation are unlikely to displace postoperatively.[10]

In their investigation, **Foed et al**. found that the baumann angle difference in medial-lateral pin fixation was 5.96 degrees and 5.30 degrees in 2 lateral pin fixation.[11]

In our investigation, there was no significant difference in mobility angles between the two groups. In the 2 cross K wire group, the flexion and extension angles were 131.5+_6.51 and 10.9+_9.73, respectively, and 129.5 +_7.6 and 8+_8.5.33 in the 3 cross K wire group. At 6 weeks, there are 33 in 2 lateral K wire groups, and the effect is not noteworthy. The carrying angle of the normal elbow was 10.6+_1.43 and 11.85+_2.37 in the two cross K wire and two lateral K wire groups, respectively, with no statistical significance.

The carrying angle of the operated elbow was 8.95+_1.61 and 9.5+_2.31 in the two cross K wire and two lateral K wire groups, respectively, with no statistical significance.

In a prospective randomised controlled research of 66 children with an average age of 5.78 years, **Foed et al** found that in medial-lateral pin fixation and 2 lateral pin fixation, the difference in carrying angle between injured and normal elbows was 3.57 degrees and 3.70 degrees, respectively. In medial-lateral pin fixation, the extension and flexion losses were 7.14 and 8.68 degrees, respectively, and 7.11 and 11.26 degrees in medial-lateral pin fixation.[11]

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Degree in 2 lateral pin fixation, respectively. In medial-lateral pin fixation, the baumann angle difference was 5.96 degrees, while in 2 lateral pin fixation, it was 5.30 degrees.
The AHL's position on a lateral radiograph of the elbow can be used to assess the severity of supracondylar humeral fractures and the quality of fracture reduction. The AHL's typical position, on the other hand, is still debatable. It varies depending on the size of the capitellar ossification and the age of the patient.
In our research, we found that In the majority of cases, the anterior humeral line was passed through the middle 1/3rd of the capitellum at the time of healing (90 percent and 65 percent in the 2 cross K wire and 2 lateral K wire groups, respectively), 5% and 35% in the 2 cross K wire and 2 lateral K wire groups, respectively, and only one case in the 2 cross K wire group. The statistical finding was significant because the group passed just touching the front 1/3rd of the capitellum.
The AHL was first characterised by Rogers et al., who stated that it should pass through the middle portion of the capitellum in all children under the age of 2.5 years.
According to **Omid et al**. and **Turhan et al**., this line should intersect the capitellum in the middle third.[12]
The AHL went through the middle third of the capitellum in only 52 percent of normal elbows under 10 years of age, according to Herman et al. However, in children fewer than 4 years of age, the AHL is as likely to pass via the anterior third as the middle third. Thus, the anterior humeral line, which should be carried through the middle 1/3rd of the capitellum intraoperatively and postoperatively, should be evaluated because it indicates if we have accomplished reduction and whether it was maintained further postoperatively or not.

5. CONCLUSION

In this study, 40 patients with supracondylar humeral fractures (Gartland types 2 and 3) were treated surgically with closed reduction and percutaneous Kirschner's wire fixation on two cross and two lateral sides. After assessing, analysing, and evaluating the data, the following conclusions were reached.
Supracondylar humerus is common in children under the age of ten years old due to anatomical characteristics of the distal end of the humerus and elbow in this age group, and with a male preponderance due to boys' increased outdoor activity.
Supracondylar humerus fractures are most commonly caused by a fall onto an outstretched hand. Because the fracture is associated with a high risk of serious complications, a thorough distal neurovuscular evaluation is required.
Closed reduction can be used to accomplish anatomical reduction. Because malunion is common, proper reduction must be performed before Kirschner wire fixation in both the antero-posterior and lateral views.
In the management of supracondylar humerus fractures in children, lateral k-wire fixation is a safer procedure to avoid iatrogenic ulnar nerve injury.
Thus, in our study, 2 cross k-wire as well as 2 lateral k-wire fixation [divergent] provided equally functional and radiological outcomes as well as equal mechanical stability as compared to medial-lateral pinning without risk of ulner nerve injury in most of the patients, indicating that lateral fixation[divergent] method also provide equally functional and radiological outcome and equal mechanical stability as compared to medial-lateral pinning without risk of ulner nerve injury.

Work Attributed to: Gajara Raja Medical College, Gwalior, Madhya Pradesh- 474002

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Author's Contribution: AC, SKK- concept and design of the study, prepared first draft of manuscript; Interpreted the results; reviewed the literature and manuscript preparation; Concept, coordination, preparation of manuscript and revision of the manuscript

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