Research Article

INTERNATIONAL RESEARCH JOURNAL OF PHARMACY

www.irjponline.com

ISSN 2230-8407 [LINKING]

IDENTIFICATION OF POTENTIAL PROGNOSTIC FACTORS AFFECTING THE OUTCOME OF PAEDIATRIC HUMERAL CONDYLE FRACTURES

Dr Naveen Gupta,[1*] Dr Lomash Bharti,[2] Dr. Prabhat Pandey,[3] Dr. Sourav Chopra[4]

[1*]Associate Professor, [2]Assistant Professor, [3,4]Senior Resident, Department of Orthopaedics, Pt. Jawahar Lal Nehru Memorial Medical College, Raipur, Chhattisgarh

Corresponding Author

Dr. Sourav Chopra

Email id: schopra101195@gmail.com

How to cite: Gupta N, Bharti L, Pandey P, Chopra S. Identification of potential prognostic factors affecting the outcome of paediatric humeral condyle fractures. International Research Journal of Pharmacy 2025; 16:11:67-73.

DOI: http://doi.org/10.56802/irjp.2025.v16.i11.pp67-73.

==========

ABSTRACT

Background: In children with mildly displaced or non-displaced LHCF (lateral humeral condyle fractures), problems such as non-union and displacement are frequently observed. Nevertheless, there is a dearth of writing on the subject in the Indian context.

Aim: The purpose of this study was to determine the possible prognostic factors influencing the course of pediatric humeral condyle fractures.

Methods: The current study evaluated 178 individuals with a history of trauma who were admitted to the Institute throughout the specified study period. Demographics, the side of the injury, the fracture's displacement, its treatment, its further displacement, non-union, and other consequences were all recorded. Based on basic radiographs, the fractures were categorized using Jakob's classification, and the displacement was measured in millimeters using lateral and AP (anteroposterior views).

Results According to the study's findings, 20% of the participants had Jacob II and 80% had Jacob I, with a mean age of 6.2±2.8 years. 81% of the participants received non-surgical therapy, whereas 19% underwent surgery. Of the individuals, 27% (n=48) had complications. Non-union, lateral condyle hypertrophy, and alignment disruption were all significantly correlated with higher initial displacement degree. A displacement of more than 1.5 mm was shown to require surgical intervention.

Conclusion: lateral humeral condyle fractures that are minimally displaced or non-displaced exhibit future displacement and non-union. The degree of initial fracture displacement in these fractures is associated with non-union incidence, lateral condyle hypertrophy, and alignment abnormalities. Surgical management is required for displacement more than 1.5 mm.

Keywords Children fractures, Humeral condyle, Jakob classification, Subsequent displacement

INTRODUCTION

According to the widely recognized Milch's classification, LHCF, or lateral humeral condyle fractures, represent the second most common kind of elbow fracture observed in juvenile subjects. Nevertheless, it is not useful for creating a treatment plan. Conversely, using Jakob's classification to inform treatment choices is beneficial. For patients with Jakob's type III fractures, surgical treatment is recommended. Nonetheless, there remains disagreement on the best course of treatment for Jakob's type I and type II fractures. Song's classification method has developed into a more recent and intricate approach that requires surgical management for displacements greater than 1.5 mm. One

According to earlier research, all Jakob's type unstable fractures are caused by the stresses of the collateral radial ligament and extensor muscles, and early surgical treatment is recommended.[1,2]

However, there are needless hazards associated with surgical treatment of fractures that would not heal or displace. Few studies in the literature, on the other hand, describe non-operative therapy that relies on stabilizing cartilaginous hinges to stop additional displacement. In order to prevent additional displacement and non-union, which could lead to a more aggressive delayed surgical strategy, other trials reported initial surgical therapy.[3]
15% of mildly displaced fractures have been reported to have secondary displacement, while 14% of minimally or non-displaced fractures show non-union when treated non-operatively. AVN (avascular necrosis) with fishtail deformity is one of the other sequelae that are not unique to these fractures. These difficulties center on the necessity for precise guidelines for managing these fractures and the clinical ramifications of improper treatment.[4]

MATERIALS AND METHODS

The current study's objectives were to determine the risk factors associated with non-union or secondary displacement, evaluate the rates of complications related to non-operative and surgical management of Jakob's type I and II fractures, and assess the rate of non-union and secondary displacement associated with non-operative management of these fractures.

The study was conducted at the Institute's Department of Orthopedics. Before each participant participated in the study, their parents or guardians gave their verbal and written informed consent. 1434 radiographs taken of pediatric participants following trauma were screened during the specified study period at the Institute. Each patient's treatment plan was created by a specialist physician who selected either CRPP (closed reduction and percutaneous pinning) or splinting.

Additionally, the longarm splint was used to immobilize every individual. All participants were monitored and anteroposterior and lateral radiographs were obtained one week following the incident. Weekly X-rays were taken, and immobilization was maintained for at least four weeks. Only in cases where range of motion was deemed insufficient was standard physical treatment recommended.

Children under the age of fifteen who were diagnosed with minimally displaced or non-displaced lateral humeral condyle fractures as Jakob's types I and II met the study's inclusion criteria. Subjects having Jakob's type III fractures due to the initial management indication of surgery, as well as those with partial or subpar radiological assessment or incomplete data, were excluded from the study.

178 participants who met the inclusion criteria were included in the study. Comprehensive information about each participant, including demographics, mechanism, laterality, length of immobilization, type of fixation and reduction, time to surgery, length of surgical operation, change in management, and complications, was obtained from the individuals' prior medical records.

The maximum displacement of fracture in millimeters was measured using the original lateral and AP radiographs. After that, fractures were categorized using Jakob's system. After a week of the accident, three further radiographs were obtained to look for any indications of subsequent displacement. After eight weeks of follow-up, non-union was defined as the absence of fracture healing.

Radiographs were thoroughly examined at the last follow-up to evaluate any additional issues, such as avascular necrosis and alignment abnormalities (cubitus varus/valgus) (fish-tail deformity or sclerosis with delayed healing), or other complications as lateral humeral condyle hypertrophy. The lateral humeral condylar angle, radiologic carrying angle, and Baumann's angle were measured in order to evaluate the elbow alignment. The complications of fractures treated surgically and non-surgically were compared.

The chi-square test, Fisher's exact test, Mann Whitney U test, and SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk, NY, USA) were used to statistically analyze data collected retrospectively from study participants using ANOVA, chi-square test, and student's t-test. A p-value of less than 0.05 was used as the significance criterion.

RESULTS

The current study evaluated 178 individuals with a history of trauma who were admitted to the Institute throughout the specified study period. Demographics, the side of the injury, the fracture's displacement, its treatment, its further displacement, non-union, and other consequences were all recorded.

Based on basic radiographs, the fractures were categorized using Jakob's classification, and the displacement was measured in millimeters using lateral and anteroposterior views. There were 66 males and 112 females in the research, with a mean age of 6.2±2.8 years, according to demographic and illness data. Low E and high E were the mechanisms of

injury in 146 and 32 cases, respectively, and left and right laterality in 106 and 72 subjects. There were 142 and 36 patients in type I and type II, according to Jakob's classification. The initial AP and lateral displacements were 1.04±1.24 mm and 1.44±1.4 mm, respectively. In 144 and 34 cases, the initial course of treatment was conservative and surgical, while 20 and 14 subjects underwent closed and open reduction, respectively.

In two and thirty-two individuals, respectively, screws and wires were used for fixation. The initial appointment was scheduled after an average of 9.6±2.1 days, the immobilization period was 33.2±11.4 days, the consolidation period was 43.2±18.5 days, and the follow-up period was 9.2±12.5 months (Table 1).

A significant result was observed for surgical follow-up, radiographical follow-up in Jakob type I and II and conservative and surgical management, immobilization days in Jakob type I and II and conservative and surgical management with $p<0.001$ when evaluating the parameters related to the fracture and their management in study subjects. For Jakob types I and II, as well as conservative and surgical therapy, consolidation time and lateral humeral condylar angle (grade) revealed non-significant results ($p=0.11$ and 0.06, respectively). Carrying angle produced non-significant effects in surgical and conservative care ($p=0.23$) and significant results for Jakob's grade ($p=0.04$) (Table 2).

Regarding treatment change in 16 study participants, it was observed that the results were significant for Jakob's classification, initial AP X-ray, and initial lateral X-ray ($p=0.01$, 0.04, and 0.03, respectively), but non-significant for surgical/conservative management ($p=1.00$). Results for conservative/surgical treatment, Jakob's classification, initial AP X-ray, and initial lateral X-ray for avascular necrosis in two participants were not significant ($p=0.08$, 0.14, 0.27, and 0.31, respectively).

Jakob's classification, the initial AP X-ray, and the initial lateral X-ray showed significant results in alignment problems in 12 participants ($p=0.03$, 0.04, and 0.01). Jakob's classification, the initial AP X-ray, and the initial lateral X-ray all indicated significant results for lateral condyle hypertrophy ($p=0.04$, 0.01, and 0.02). Results for secondary displacement in 14 patients were not statistically significant. Only the initial lateral X-ray showed significant results in consolidation, with $p=0.01$ (Table 3).

DISCUSSION

Based on basic radiographs, the fractures were categorized using Jakob's classification, and the displacement was measured in millimeters using lateral and anteroposterior views. The current study's design was comparable to that of earlier research by Song KS et al. (2007) and Li XT et al. (2020), both of which reported study designs similar to this one.

There were 112 females and 66 men in the study, with a mean age of 6.2±2.8 years, according to demographic and illness data. Low E and high E were the mechanisms of injury in 146 and 32 cases, respectively, and left and right laterality in 106 and 72 subjects. There were 142 and 36 patients in type I and type II, according to Jakob's classification. The initial AP and lateral displacements were 1.04±1.24 mm and 1.44±1.4 mm, respectively. In 144 and 34 cases, the initial course of treatment was conservative and surgical, while 20 and 14 subjects underwent closed and open reduction, respectively. In two and thirty-two individuals, respectively, screws and wires were used for fixation.

The mean duration of immobilization was 33.2±11.4 days, and the initial appointment occurred after an average of 9.6±2.1 days consolidation was done for 43.2±18.5 days and mean follow-up duration was 9.2±12.5 months. These findings were similar to those of Edmands EW et al. (2021) and Bakarman KA et al. (2016), whose authors evaluated participants with demographic and illness information similar to the current study.

According to the study's findings, a significant result was observed for surgical follow-up, radiographical follow-up in Jakob types I and II, conservative and surgical management, immobilization days in Jakob types I and II, and conservative and surgical management with $p<0.001$ when evaluating the parameters related to the fracture and their management in study subjects. For Jakob types I and II, as well as conservative and surgical therapy, consolidation time and lateral humeral condylar angle (grade) revealed non-significant results ($p=0.11$ and 0.06, respectively).

The carrying angle produced non-significant results in surgical and conservative management ($p=0.23$) and significant results for Jakob's grade ($p=0.04$). The findings were in line with those of Bridges CS et al. (9) and Silva M et al. (10), who reported fracture-related parameters and their care in children with condyle fractures similar to the current study.

Additionally, it was observed that, with regard to treatment change in 16 subjects, the results were significant for Jakob's classification, initial AP X-ray, and initial lateral X-ray ($p=0.01$, 0.04, and 0.03, respectively), but non-significant for surgical/conservative management ($p=1.00$). Results for conservative/surgical treatment, Jakob's classification, initial AP X-ray, and initial lateral X-ray for avascular necrosis in two participants were not significant ($p=0.08$, 0.14, 0.27, and 0.31, respectively).

Jakob's classification, the initial AP X-ray, and the initial lateral X-ray showed significant results in alignment problems in 12 participants (p=0.03, 0.04, and 0.01). Jakob's classification, the initial AP X-ray, and the initial lateral X-ray all indicated significant results for lateral condyle hypertrophy (p=0.04, 0.01, and 0.02). Results for secondary displacement in 14 patients were not statistically significant. Only the initial lateral X-ray showed significant results in consolidation (p=0.01). These results were consistent with those of James V. et al. (2021) and Zale et al. (2018), whose study results for condyle fracture regarding Jakob's classification, initial AP X-rays, and initial lateral X-rays were similar to those of the current study.

CONCLUSION

The current study concludes, within its limitations, that lateral humeral condyle fractures that are minimally displaced or non-displaced exhibit future displacement and non-union. The degree of initial fracture displacement in these fractures is associated with non-union incidence, lateral condyle hypertrophy, and alignment abnormalities. Surgical management is required for displacement more than 1.5 mm.

REFERENCES

1. Tan, S. H. S., Dartnell, J., Lim, A. K. S., & Hui, J. H. Paediatric lateral condyle fractures: A systematic review. Archives of Orthopaedic and Trauma Surgery, 2018;138:809–817.
2. Wattenbarger, J. M., Gerardi, J., & Johnston, C. E. Late open reduction internal fixation of lateral condyle fractures. Journal of Pediatric Orthopedics. 2002;22:394–398.
3. Song, K. S., Kang, C. H., Min, B. W., Bae, K. C., Cho, C. H., & Lee, J. H. Closed reduction and internal fixation of displaced unstable lateral condylar fractures of the humerus in children. Journal of Bone and Joint Surgery. American Volume, 2008;90:2673–2681.
4. Weiss, J. M., Graves, S., Yang, S., Mendelsohn, E., Kay, R. M., & Skaggs, D. L. A new classification system predictive of complications in surgically treated pediatric humeral lateral condyle fractures. Journal of Pediatric Orthopedics, 2009;29:602–605.
5. Song, K. S., Kang, C. H., Min, B. W., Bae, K. C., & Cho, C. H. (2007). Internal oblique radiographs for diagnosis of nondisplaced or minimally displaced lateral condylar fractures of the humerus in children. Journal of Bone and Joint Surgery. American Volume. 2007;89:58–63.
6. Li X T., Shen, X. T., Wu, X., & Zhou, Z. G. (2020). The routine cutoff displacement of 2 mm may not reliably reflect the stability of paediatric lateral humeral condyle fractures. Injury. 2020;51:2588–2591.
7. Edmonds EW., Bland, D. C., Bastrom, T. P., Smith, M. M., Upasani, V. V., Yaszay, B., & Pennock, A. T. Minimally displaced pediatric humerus lateral condyle fractures: Risk factors for displacement and outcomes of delayed surgery. Journal of Pediatric Orthopedics. Part B. 2021;30:167–173.
8. Bakarman KA, Alsiddiky, A. M., Alzain, K. O., Alkhawashki, H. M., Bin Nasser, A. S., Alsaleh, K. A., Al-Jassir, F. F., & Zamzam, M. M. Humeral lateral condyle fractures in children: Redefining the criteria for displacement. Journal of Pediatric Orthopedics. Part B. 2016;25:429–433.
9. Bridges CS, Taylor, T. N., Pang, L. K., Beauvais, D. H., May, M. M., & Smith, B. G. Infection and nonunion following operative treatment of lateral humeral condyle fractures. Journal of Pediatric Orthopedics. 2023;43:e502–e507
10. Silva M, & Cooper, S. D. (2015). Closed reduction and percutaneous pinning of displaced pediatric lateral condyle fractures of the humerus: A cohort study. Journal of Pediatric Orthopedics. 2015;35:661–665.
11. James V., Chng, A. C. C., Ting, F. L. M., Chan, Y. H., & Ganapathy, S. Lateral condyle fracture of the humerus among children attending a pediatric emergency department: A 10-year single-center experience. Pediatric Emergency Care. 2021;37:e1339–e1344.
12. Zale, C., Winthrop, Z. A., & Hennrikus, W. Rate of displacement for Jakob Type 1 lateral condyle fractures treated with a cast. Journal of Children's Orthopaedics. 2018;12:117–122.

S. No	Characteristics	Values
1.	**Number (n)**	178
2.	**Gender**	
a)	Males	66

b)	Females	112
3.	**Mean age (years)**	6.2±2.8
4.	**Injury mechanism**	
a)	Low E	146
b)	High E	32
5.	**Laterality**	
a)	Left	106
b)	Right	72
6.	**Jacob classification**	
a)	I	142
b)	II	36
7.	**Initial lateral displacement (mm)**	1.44±1.4
8.	**Initial AP displacement (mm)**	1.04±1.24
9.	**Initial management**	
a)	Conservative	144
b)	Surgical	34
10	**Reduction**	
a)	Close	20
b)	Open	14
11	**Fixation**	
a)	Screw	2
b)	Wire	32
12	**Initial appointment (days)**	9.6±2.1
13	**Immobilization (days)**	33.2±11.4
14	**Consolidation (days)**	43.2±18.5
15	**Follow-up (months)**	9.2±12.5

Table 1: Demographic and disease data in study subjects

S. No	Characteristics	Values	p-value
1.	**Surgical follow-up (n)**		
a)	Jacob I	4	**<0.001**
b)	Jacob II	28	
2.	**Radiographic follow-up (months)**		
a)	Jacob I	8	**<0.001**
b)	Jacob II	40	
c)	Conservative	12	**<0.001**
d)	Surgical	46	

3.	**Immobilization time (days)**		
a)	Jacob I	62	**<0.001**
b)	Jacob II	82	
c)	Conservative	64	**<0.001**
d)	Surgical	74	
4.	**Consolidation time (days)**		
a)	Jacob I	94	0.11
b)	Jacob II	106	
c)	Conservative	98	0.55
d)	Surgical	108	
5.	**Carrying angle (grades)**		
a)	Jacob I	16	**0.04**
b)	Jacob II	24	
c)	Conservative	20	0.23
d)	Surgical	22	
6.	**Lateral humeral condylar angle (grade)**		
a)	Jacob I	70	0.06
b)	Jacob II	76	
c)	Conservative	68	**0.04**
d)	Surgical	78	

Table 2: Parameters related to fracture and its management in study subjects

S. No	Parameter	Factor	p-value
1.	**Treatment change (n=16/178)**	Conservative/surgical	1
		Jacob I/II	**0.01**
		Initial AP X-ray	**0.04**
		Initial lateral X-ray	**0.03**
2.	**Avascular necrosis (n=2/178)**	Conservative/surgical	0.08
		Jacob I/II	0.14
		Initial AP X-ray	0.27
		Initial lateral X-ray	0.31
3.	**Alignment disturbances (n=12/178)**	Conservative/surgical	0.07
		Jacob I/II	**0.03**
		Initial AP X-ray	**0.04**
		Initial lateral X-ray	**0.01**
4.	**Lateral condyle hypertrophy (n=144/178)**	Conservative/surgical	0.34
		Jacob I/II	**0.04**

		Initial AP X-ray	**0.01**
		Initial lateral X-ray	**0.02**
5.	**Secondary displacement (n=14/178)**	Conservative/surgical	0.13
		Jacob I/II	0.32
		Initial AP X-ray	0.29
		Initial lateral X-ray	0.41
6.	**Consolidation (n=174/178)**	Conservative/surgical	**0.04**
		Jacob I/II	0.32
		Initial AP X-ray	0.07
		Initial lateral X-ray	**0.01**

Table 3: Different variables in study subjects