

Dorgan's lateral cross pinning for displaced pediatric supracondylar fractures of the distal humerus

Robin Shrestha *

Department of Orthopaedics, Purbanchal University Teaching Hospital, Morang, Nepal.

International Journal of Science and Research Archive, 2024, 13(02), 887–892

Publication history: Received on 29 September 2024; revised on 09 November 2024; accepted on 11 November 2024

Article DOI: <https://doi.org/10.30574/ijrsra.2024.13.2.2139>

Abstract

Background: Supracondylar humeral fractures are the most common elbow fractures seen in children. Although closed reduction and percutaneous pin fixation is the treatment of choice for displaced supracondylar fractures of the humerus in children, controversy about which pin configuration is best in treating these fractures is ongoing. Some advocate lateral entry pins only while others advocate medial and lateral entry pins. In this study I utilized Dorgan's cross lateral technique to fix such fractures which is believed to have the advantages of both the conventional pinning techniques.

Objectives: To evaluate the functional and cosmetic outcome and complications of cross lateral pinning.

Methods: Thirty cases of supracondylar humeral fractures were treated by closed or open reduction with cross lateral pin fixation under fluoroscopic guidance. The elbow was immobilized for a period of 4 weeks after which the pins were removed and physiotherapy initiated. At the end of 12 weeks the patients were evaluated clinically and radiologically and final results were assessed as per Flynn's criteria.

Results: According to Flynn's criteria, the cosmetic result in my study was evaluated as excellent in 25 cases (83%) and good in 5 cases (17%) and functional result was evaluated as excellent cases in 23 (77%) and good in 7 cases (23%). There were no cases of post operative loss of reduction of fractures. Six cases (20%) had pin tract infection while 24 patients (80%) had no complications at all.

Conclusions: Cross lateral method of pinning for treating supracondylar fractures is a useful method of fixation as it gives stabilization like medio-lateral pinning and minimizes the risk of injuring the ulnar nerve like lateral pinning.

Keywords: Cross lateral pinning; Dorgan's technique; Flynn's criteria; Supracondylar fractures

1. Introduction

Supracondylar fracture is the most common fracture in children, accounting for 50 – 60% of all fracture around elbow joint and 30% of all extremity fractures.^{1,2} Five methods of treatment for displaced supracondylar extension type fractures are described in the literature. These are closed reduction and above elbow casting, Blounts technique,³ skeletal traction, primary closed reduction and percutaneous fixation and open reduction and fixation.⁴ Although conservative treatment is popular, with the advent of the image intensifier which facilitates accurate pin placement, it is no longer acceptable to hear “not bad for a supracondylar fracture.”

Controversy about which pin configuration is best in treating these fractures is while ongoing, some advocate lateral entry pins only and others advocate medial and lateral entry pins.⁵ Pinning with lateral pins only has the advantage of

*Corresponding author: Robin Shrestha

avoidance of inadvertent injury to the ulnar nerve by avoiding the medial entry site. However, the disadvantage is the reduced mechanical stability of the construct. Medial and lateral entry pins have the advantage of enhanced mechanical stability of the construct and disadvantage is the potential iatrogenic injury to the ulnar nerve with the medially placed pins.^{6,7,8,9}

The lateral cross pinning technique introduced by Dorgan is a good choice in pediatric supracondylar fracture as it reduces the possibility of ulnar nerve damage as in lateral pinning and achieves the same level of stabilization as medio-lateral fixation.^{10,11}

2. Materials and methods

Between April 2021 and December 2022, 30 cases of Gartland type II and III supracondylar fractures of children were managed with Dorgan's lateral cross pinning technique in the Orthopedic Department of Morang Sahakari Hospital, Morang, Nepal. There were 22 males and 8 females. The minimum age of the patient was 3 yrs, maximum age was 12 yrs and mean age was 7.77 yrs \pm 2.95 SD. Right side was involved in 10 patients and left side was involved in 20 patients. There were 23 cases of type II Gartland fractures and 7 cases of type III Gartland fractures. 20 (7%) out of 30 patients sustained injury due to fall from height, 7 patients (23%) sustained injury due to fall on level ground and 3 patients (10%) sustained injury in road traffic accident. All the cases were of extension type. Five (17%) cases were open while 25 (83%) cases were closed in nature.

All the cases were operated utilizing the Dorgan's lateral cross pinning technique. The longitudinal traction was applied with one hand, placing the forearm in supinated position and assistant applying counter traction at the shoulder. Then the elbow was fully flexed while the olecranon was pushed anteriorly with the thumb to correct sagittal deformity. Those cases where closed reduction failed, open reduction was done through lateral incision. After successful reduction maneuver, the pulse and capillary perfusion of the hand were evaluated. Then the fracture stabilization was achieved by introduction of two lateral 1.5- 2 mm kirschner wires. The first pin was introduced starting from the lateral condyle in retrograde direction (ascending) to advance to cross the fracture site until it perforated contralateral cortex by 1-2 mm. The second pin was introduced in an antegrade (descending) direction from a lateral approach, starting proximal to the fracture line and advancing it across the fracture site into the medial condyle. The descending pin did not perforate medial condyle more than 1-2 mm which was verified by the C-arm. The adequacy of reduction was evaluated with C-arm in the AP view. For the lateral view, the c-arm was rotated under the table rather than rotating the elbow. The pins were bent and cut off outside the skin and a well- padded, above elbow, posterior back slab was applied and elbow was held in 60 -90 degrees of elbow flexion

At 4 weeks post-operatively check x-ray was done, posterior slab and pins were removed and advised for physiotherapy. At 12 weeks post-operatively the range of movement and carrying angle were measured and X-ray was taken to measure the Baumann's angle. All the patients were then assessed according to Flynn's criteria. Data were entered in excel master-sheet with coding of the variables, SPSS version 22 was used for the evaluation and p value was taken as significant if less than 0.005.

3. Results

In my study 12 out of 30 cases were operated on the same day of injury, 15 cases were done on day 1, 2 cases were done on day 2 and 1 case was done on day 3 and mean time from injury to operation was 0.73 days (p value = 0.000) and K wire was removed at the end of 4th week (p value = 0.000).

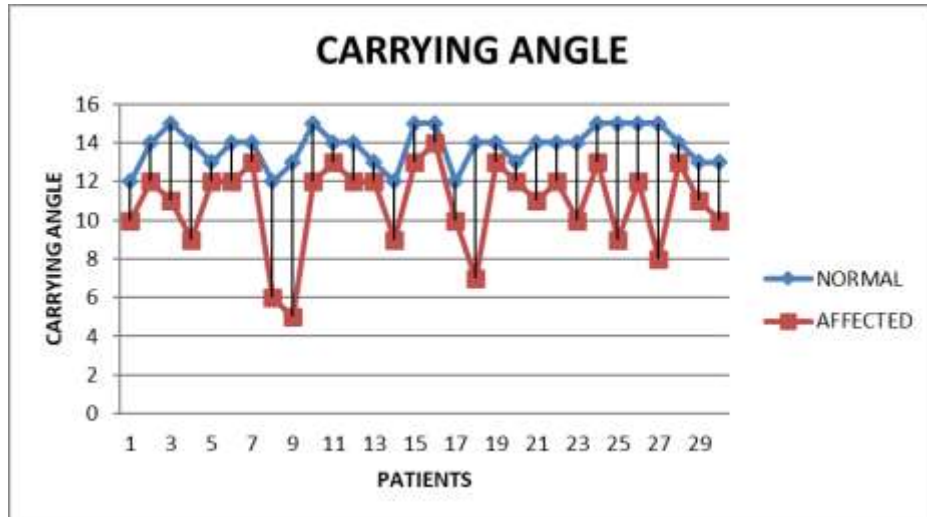


Figure 1 Carrying angle

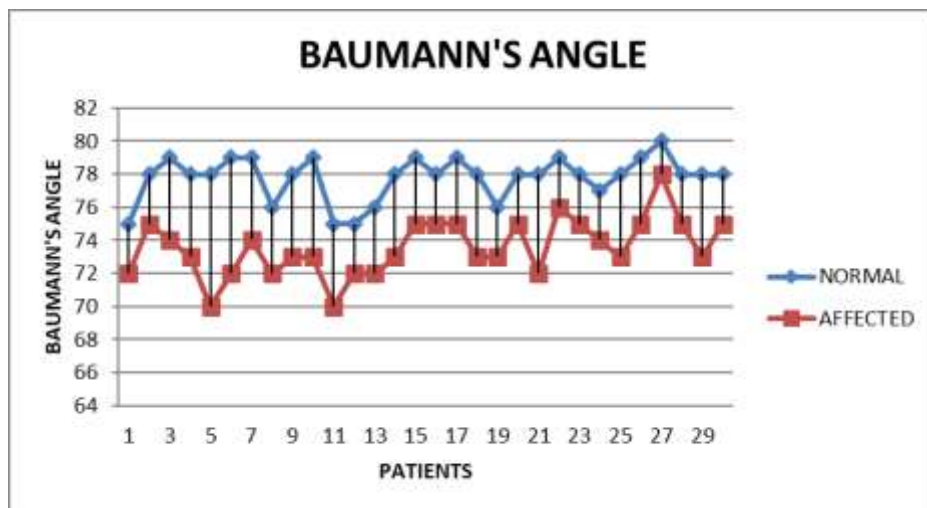


Figure 2 Baumann's angle



Pre-op X-rays



Post- op X-rays



X-rays at 12 weeks

Figure 3 Pre-operative x-rays, post-operative x-rays and x-rays at 12 weeks

According to Flynn's criteria, the cosmetic result in my study was evaluated as excellent in 25 cases (83%) and good in 5 cases (17%). There were no fair or poor cases in this study. The difference was statistically significant (0.000).

Flynn's functional result was evaluated as excellent in 23 cases (77%) and good in 7 cases (23%) while there were no fair or poor cases. The difference was statistically significant (p value = 0.003).

There were 6 cases (20%) of pin tract infection while 24 patients (80%) had no complications at all (p value = 0.001). None of the cases had loss of reduction post operatively.

4. Discussion

This type of fracture is most common in children less than 10 yrs of age with peak incidence between age 5 and 8 yrs.¹² Traditionally, boys have had a higher incidence of this type of fracture but even higher rate of incidence in girls have been reported in some series. Extension supracondylar fracture of the humerus accounts for approximately 97% of supracondylar fracture while flexion injuries account for 3%.^{13,14}

In my study, on the affected side the mean carrying angle was 10.86 degrees \pm 2.22 SD and mean loss was 2.86 degrees \pm 2.05 SD. The mean Baumann's angle on the affected side was 73.56 degrees \pm 1.74 SD and mean loss was 4.23 degrees \pm 1.38 SD. My results were comparable to a similar study done by Queally JM et al. where the mean carrying angle of the injured elbow was 15 degrees (range 10-20 degree) and mean change in Baumann's angle was 4.2 \pm 1.6 degrees.¹⁵ Williamson DM et al. had shown that 95% of normal elbows had a Baumann angle of 64-81 degrees in his study.¹⁶ The mean extension was 2.4 degrees \pm 1.81 SD and flexion was 135.56 degrees \pm 2.28 SD on the injured side and loss of motion was 3.43 degrees \pm 2.25 SD in my study. I found that my study compared well with a study done by Queally JM et al., where the mean degree of extension was 3 degrees and mean degree of flexion was 128 degrees.¹⁵

Recent studies have shown that insertion of two lateral cross pins will provide a biomechanically stable fixation avoiding the risk of ulnar nerve.^{2,11,15,17}

In this study out of 30 patients there were 6 cases (20%) of pin tract infection while 24 patients had no complications at all. Complications like compartment syndrome, vascular injury, myositis ossificans, significant malunion or non union were not seen. The most frequent problem complication while performing medial K-wire is iatrogenic ulnar nerve injury.^{15,17,18,19} It was however, not seen in my study. I did not find any cases of secondary displacement of k-wires and loss of reduction. All the cases of pin tract infection were treated successfully by pin site dressing and oral antibiotic. A potential complication of this technique is injury of radial nerve at the proximal pin entry. This can be prevented by making the point of entry of second k-wire in the metaphysis and not in the diaphysis and posterior to mid-coronal plane.¹⁸ A further long term study should and will be conducted by the authors to assess the late complications.

The strength of this study is the standardized and scientific manner in which the procedure was carried out. The limitations of this study include the length of the study and it being a single cohort study with no matched comparative groups of other techniques included. Area for future study includes a biomechanical comparison of this technique with other popular conventional techniques.

5. Conclusion

I found the functional and cosmetic outcome that this method of fixation is comparable to the other conventional methods and has the advantages of medio-lateral pinning technique in terms of stabilization and of lateral pinning technique in terms of protecting the ulnar nerve. Hence I can firmly conclude that cross lateral pin fixation for treating supracondylar fractures is a method that provides stabilization with safety.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from the parents all individual participants included in the study

References

- [1] Farley FA, Patel P, Craig CL, Blakemore LC, Hensinger RN, Zhang L et al. Pediatric supracondylar humerus fractures: treatment by type of orthopedic surgeon. *J Child Orthop* 2008; 2:91-5.
- [2] Eberhardt O, Fernandez F, Ilchmann T, Parsch K. Cross pinning of supracondylar fracture from lateral approach. Stabilisation achieved with safety. *J Child Orthop* 2007; 1: 127-33.
- [3] Blount WP, Schulz I. Fractures of the elbow in children. *JAMA* 1951;146:699-704.
- [4] Mazda K, Boggione C, Fitoussi F, Penneçot G. Systematic pinning of displaced extension-type supracondylar fractures of the humerus in children From Robert Debré Hospital, Denis Diderot - Paris VII University, France. *J Bone Joint Surg [Br]* 2001;83:888-93.
- [5] ZZamzam MM, Bakarman KA. Treatment of displaced supracondylar humeral fracture among children; crossed versus lateral pinning. *J Injury* 2008;3806;1-6.
- [6] Brauer CA, LeeBM, Bae DS. A systematic review of medial and lateral entry pinning versus lateral entry pinning for supracondylar fractures of the humerus. *J PediatrOrthop* 2007;27:181-6.
- [7] Dezfuli B, Larkins C, Ruth JT, Truchan LM. Pediatric Supracondylar Fractures: Are Medial Pins Indicated? *Ann OrthopRheumatol* 2014;2(2):1016.
- [8] Fowler TP, Marsh. Reduction and pinning of supracondylar humerus fractures in the prone position. *J Orthop Trauma* 2006;20:277-81.
- [9] Gordon JE, Patton CM, Luhmann SJ, Bassett GS, Schoenecker PL. Fracture stability after pinning of displaced supracondylar distal humerus fractures in children. *Journal of Paediatrics Orthopaedics* 2001;21:313-8.
- [10] Memisoglu K, Kesemenil CC, Atmaca H. Does the technique Of lateral cross wiring (Dorgans' technique) reduce iatrogenic ulnar nerve injury. *International Orthopaedic (SICOT)* 2011;35:375-8.

- [11] Shannon FJ, Mohan P, Chacko J. Dorgan's percutaneous lateral cross-wiring of supracondylar fractures of the humerus in children. *J PediatrOrthop* 2004;24:376-9.
- [12] Weinberg J, Belthur MV. The role of Lateral entry Steinmann pins in the treatment of Paediatric supracondylar humerus fracture. *J Child Orthop* 2010;4: 455-9.
- [13] Leitch KK , Kay RM, Tolo VT, Storer SK, Skaggs DL. Treatment of multidirectionally unstable supracondylar humeral fractures in children. *J Bone Joint Surg* 2006;88:980-5.
- [14] Scaglione M, Giovaneli D, Fabbri L, Dell'Oma D, Goffi A, Guido G. Supracondylar humerus fractures in children treated with close reduction and percutaneous pinning. *MusculoskeletSurg* 2012;96:111-6.
- [15] Queally JM, Paramanathan N, Walsh JC, Moran JC, Shannon FJ, D'Souza LG. Dorgans' lateral Cross-wiring of supracondylar fractures of the humerus in children: A retrospective review. *Injury* 2010;41(6):568-71.
- [16] Williamson DM, Coates CJ, Miller RK, Cole WG. Normal characteristics of the Baumann (humerocapitellar) angle: an aid in assessment of supracondylar fractures. *J PaediatrOrthop* 1992;12(5):636-9.
- [17] El-Adl WA, El-Said MA, Boghdady GW, Ali AS. Results of treatment of displaced supracondylar humeral fractures in children by percutaneous lateral cross-wiring technique. *Strategies Trauma Limb Reconstr* 2008;3:1-7.
- [18] Wind WM, Schwend RM, Armstrong DG. Predicting ulnar nerve location in pinning of supracondylar humerus fractures. *J PediatrOrthop* 2002; 22: 444-7.
- [19] Belhan O, Karakurt L, Ozdemir H, Yilmaz E, Kaya M, Serin E, et al. Dynamics of the ulnar nerve after percutaneous pinning of supracondylar humeral fractures in children. *J PediatrOrthop* 2009; 18: 29-33.