

LATERAL THREE PIN FIXATION FOR SUPRACONDYLAR FRACTURES IN CHILDREN

Hayat Ahmad Khan^{1,*}, Mohammad Ashraf Khan², Mohammad Shahid Bhat³,
Naseemul Gani⁴, Prof Munir Farooq⁵

¹Registrar, ^{2,3}PG Scholar, ⁴Assistant Professor, ⁵Head of Unit(Senior Author),
Bone and Joint Hospital Barzullah Srinagar J&K

***Corresponding Author:**

Email: drhayatkhan@gmail.com

ABSTRACT:

Introduction: Paediatric supracondylar fractures are the commonest elbow injuries encountered in the emergency departments. Most commonly they are the result of a fall on an outstretched hand that causes hyperextension of the elbow. The extension-type supracondylar humeral fractures account for 95% to 98% of all supracondylar fractures. Displaced fractures are treated with closed reduction and percutaneous pinning. However the method of pinning has been a matter of debate (lateral entry vs cross pinning). The issue with the lateral entry pinning like loss of reduction and ulnar nerve injury with the cross pinning method has always kept a doubt in the surgeons mind regarding the method of pinning. The present study was aimed to see functional results of using three lateral pins in type II and III supracondylar fractures and to look for any complications occurring thereafter.

Methods: Forty consecutive patients of type II and III SC fractures were taken up for the study. Three lateral pins were used for all fractures. Using the Flynn criteria, the results were graded as excellent, good, fair or poor by comparing the carrying angle and range of motion with the opposite side.

Results: Among the cohort of forty patients we had 25 males and 15 females. The mean age group was 6.5 ± 3.2 . Sixteen patients had type II fracture while as 24 had type III Gartlands fracture. The union occurred in all cases. At the final follow up, 87.5% patients showed excellent results 10% showed good and 2.5% fair results. There was no case of poor results. There were no iatrogenic nerve palsies, and no patient required additional surgery.

Conclusion: Lateral three pin fixation is a good method for displaced supracondylar fractures and has little or no chances for ulnar nerve injury. This method has an easy learning curve among orthopaedic residents. A randomised control trial comparing it with other methods involving a larger series is needed to look for the effectiveness of this technique.

Keywords: Supracondylar fractures, Lateral three pin fixation, Iatrogenic nerve injury.

INTRODUCTION

Paediatric supracondylar fractures are the commonest elbow injuries encountered in the emergency departments. Supracondylar humeral fractures may be the result of either an extension or a flexion force on the distal humerus. Most commonly they are the result of a fall on an outstretched hand that causes hyperextension of the elbow. [1, 2, 3] These *extension-type* supracondylar humeral fractures account for 95% to 98% of all supracondylar fractures. With hyperextension injuries the distal fragment will be displaced posteriorly. *Flexion-type* supracondylar fractures are rare and occur in only 2% to 5% of cases. The mechanism of flexion supracondylar fractures is usually a direct blow on the posterior aspect of a flexed elbow that results in anterior displacement of the distal fragment.

The three-part classification system was first described by Gartland in 1959. [4] Recently, it has been shown to be more reliable than most fracture classification systems. [5] Type I fractures are non-displaced or minimally displaced. Type II fractures have angulation of the distal fragment (posteriorly in extension injuries and anteriorly in flexion injuries), with one cortex remaining intact (the posterior in extension and the anterior in flexion). Type III

injuries are completely displaced, with both cortices fractured.

Closed reduction with percutaneous pinning has been the standard method of treatment for type II and III injuries. However the method of pinning has been a matter of debate (lateral entry vs cross pinning). The issue with the lateral entry pinning like loss of reduction and ulnar nerve injury with the cross pinning method has always kept a doubt in the surgeons mind regarding the method of pinning. The present study was aimed to see functional results of using three lateral pins in type II and III supracondylar fractures and to look for any complications occurring thereafter.

METHODS

Forty consecutive patients of type II and III SC fractures were taken up for the study. Patients were initially assessed in the emergency room and neuro-vascular status was checked. A detailed history regarding the patient's age, sex, site, mode of injury, time since injury and any associated comorbidity was noted. After radiological evaluation and grading of the fracture, patients were shifted to the operation theatre were closed reduction and percutaneous pinning was done under general anaesthesia. Three

lateral pins were used for all fractures. Fractures were stability was ensured with only two pins were excluded from the study. Patients with compound injuries were also excluded. Long arm posterior slab was used for two to three weeks and range of motion exercises started thereafter. Pins were removed between four to six weeks depending on the patients fracture pattern. The follow up period was minimum of six months. Using the Flynn criteria, the results were graded as excellent, good, fair or poor by comparing the carrying angle and range of motion with the opposite side.

RESULTS

Among the cohort of forty patients we had 25 males and 15 females. The mean age group was 6.5 ± 3.2 . [Table 2] Sixteen patients had type II fracture while as 24 had type III Gartlands fracture. The union occurred in all cases.

Twenty Eight fractures were fixed within 24 hours. Four were operated upon during 48 hours, three patients were operated on day 4 and five patients were operated between day 5 and 8. The delay in surgery was because of delayed referral from periphery in five patients and seven patients had first gone to the traditional bone setters which has been the common cause of mismanaged trauma in this part of the world. Three patients had pre-operative nerve palsy. Two patients got relieved immediately after surgery while one recovered after 4 weeks. At the final follow up, 87.5% patients showed excellent results 10% showed good and 2.5% fair results. There was no case of poor results. [Table 3] One patient had superficial pin tract infection which resolved completely. There were no iatrogenic nerve palsies, and no patient required additional surgery.

Table 1: Flynn criteria [6]

	Loss of carrying angle (Cosmetic factor) in degrees	Loss of movement (Functional factor) in degrees
Excellent	0-5	0-5
Good	5-10	5-10
Fair	10-15	10-15
Poor	> 15	> 15

Table 2: Patient Characteristics

Age	6.5 ± 3.2 years	
Gender		Percentage
Male	25	62.5%
Female	15	37.5%
Fracture Classification		
Type II	16	40%
Type III	24	60%

Table 3: Results

	No. of patients	Percentage	Results
Excellent	35	87.5	Satisfactory
Good	4	10	Satisfactory
Fair	1	2.5	Satisfactory
Poor	0	0	Unsatisfactory



Figure 1: Pre-operative X rays showing fracture in AP and Lateral views



Figure 2: Intra operative image showing the AP and Lateral configuration.

DISCUSSION

Mercer Rang uses the old saying, "Pity the young surgeon whose first case is a fracture around the elbow," [7] Though common—fractures about the elbow account for 5% to 10% of all fractures in children [8, 9, 10, 11, 12] The unique anatomy of the elbow and the high potential for complications associated with elbow fractures make their treatment anxiety producing for many orthopaedic surgeons. Fortunately, with an understanding of the anatomy and adherence to a few basic principles, treatment of such fractures can be straightforward.

To again quote Mercer Rang, the goal of treatment of supracondylar humeral fractures is to "avoid catastrophes" (vascular compromise, compartment syndrome) and "minimize embarrassments" (cubitus varus, iatrogenic nerve palsies).

To achieve this one has to choose the method which will give stability as well as is risk free. Though the cross pinning technique is stable but the associated nerve injury in this method is up to 10.6% as reported by [13]. The 2 lateral pin technique has the issues of stability which depends on the separation of pins at the fracture site, and also the medial comminution. Three lateral pins are however a good choice as it retains the advantage of lateral fixation and improves on the weak link of stability.

Closed reduction with cast application for type II fractures as described by Parikh et al [14] or lateral cross pinning as described by Dorgan is also acceptable mode of treatment for such injuries. [15] Posterior intrafocal pinning for extension type fractures as described by Fahmy et al [16] and minimally invasive technique used by Li et al are also recommended methods. [17]

Controversial topic of method of pinning and number of pins is still a debate as the surgeons with crossed pinning and those with lateral pinning are having years of experience in dealing with such cases and both groups can easily defend their methods.

Skaggs et al. observed no loss of reduction when comparing two groups using crossed wires and lateral wires. There was an increased incidence of iatrogenic nerve injury in 17 out of 160 (10.6%) cases treated with a medial wire [13]. Data pooled from 1455 patients found that the incidence of ulnar nerve iatrogenic injury was 5.04 times higher in medial/lateral wire fixation compared to lateral entry fixation [18]. There is also concern about delayed iatrogenic nerve injury using medial wires [19]. Recently, Kocher et al. have shown there is no statistical difference between medial/lateral wire entry and lateral entry in terms of loss of position in a study with sufficient power to detect 10% difference between the two groups [20]. To attain statistical significance analysing iatrogenic nerve injury is more difficult. It has been suggested that to show a difference in iatrogenic nerve injury between medial/lateral entry crossed wires and lateral entry wires in a suitably powered study with an α of 0.05 and a β of 0.20 (power 80%) would need patient arms of approximately 2000. This study may never prove to be practical [18].

Three lateral pinning is a good alternative but needs to be time tested. We at our orthopaedic institute see an average of 200-300 cases per year. Type I fractures are managed conservatively with posterior long arm slab. Type II fractures by closed reduction and two lateral pins. A third pin is added if they are unstable. Type III fractures are managed with 3 lateral pins. Medial pinning is avoided to prevent iatrogenic nerve injury. The principals of pinning as set by Skaggs were followed who

recommended a third pin whenever there was doubt in stability or the positioning of first two pins.

Forty patients who have completed the desired follow up are hereby presented where 87.5 % showed excellent results and 10 % showed good results. One patient had fair result as per the Flynn criteria with no patient showing poor results. Five patients were first mismanaged by the traditional bone setters and had a delayed referral. All of them did not show the excellent results but the union occurred satisfactorily in all.

CONCLUSION

Lateral three pin fixation is a good method for displaced supracondylar fractures and has little or no chances for ulnar nerve injury. This method has an easy learning curve among orthopaedic residents. A randomised control trial comparing it with other methods involving a larger series is needed to look for the effectiveness of this technique and to see whether the medial pinning can be ignored in all cases.

Conflict of interest: None declared

REFERENCES:

1. Abraham E, Powers T, Witt P, et al: Experimental hyperextension supracondylar fractures in monkeys. *Clin Orthop Relat Res* 1982; 171:309.
2. Ashurst AP: *An Anatomical and Surgical Study of Fractures of the Lower End of the Humerus*, Philadelphia, Lea & Febiger, 1910
3. Malgaigne JF: *Treatise on Fractures*, Philadelphia, JB Lippincott, 1859.
4. Gartland JJ: Management of supracondylar fractures of the humerus in children. *Surg Gynecol Obstet* 1959; 109:145
5. Barton KL, Kaminsky CK, Green DW, et al: Reliability of a modified Gartland classification of supracondylar humerus fractures. *J Pediatr Orthop* 2001; 21:27
6. J. C. Flynn, J. G. Matthews, and R. L. Benoit, "Blind pinning of displaced supracondylar fractures of the humerus in children. Sixteen years' experience with long term follow up," *Journal of Bone and Joint Surgery. Series A*, vol. 56, no. 2, pp. 263-272, 1974.
7. Rang M, Barkin M, Hendrick EB: *Elbow. Children's Fractures*, Philadelphia: JB Lippincott; 1983:152.
8. Iqbal QM: Long bone fractures among children in Malaysia. *Int Surg* 1974; 59:410
9. Landin LA: Fracture patterns in children. Analysis of 8,682 fractures with special reference to incidence, etiology and secular changes in a Swedish urban population 1950-1979. *Acta Orthop Scand Suppl* 1983; 202:1
10. Reed MH: Fractures and dislocations of the extremities in children. *J Trauma* 1977; 17:351.
11. Wiley JJ, McIntyre WM: Fracture patterns in children. In *Current Concepts of Bone Fragility*, Berlin: Springer-Verlag; 1986:159.
12. Worlock P, Stower M: Fracture patterns in Nottingham children. *J Pediatr Orthop* 1986; 6:656.
13. D. L. Skaggs, J. M. Hale, J. Bassett, C. Kaminsky, R. M. Kay, and V. T. Tolo, "Operative treatment of

- supracondylar fractures of the humerus in children: the consequences of pin placement,” *Journal of Bone and Joint Surgery. Series A*, vol. 83, no. 5, pp. 735–740, 2001.
14. Parikh S, Wall E, Foad S. Displaced type II extension supracondylar humerus fractures: do they all need pinning? *J Pediatr Orthop* 2004; 24(4):380–384.
 15. Queally JM, Paramanathan N, Walsh JC, Moran CJ, Shannon FJ, D’Souza LG. Dorgan’s lateral cross-wiring of supracondylar fractures of the humerus in children: A retrospective review. *Injury* 2010; 41(6):568–571.
 16. Fahmy MAL, Hatata MZ, Al-Seesi H. Posterior intrafocal pinning for extension-type supracondylar fractures of the humerus in children. *J Bone Joint Surg {Br}* 2009; 91-B (9):1232–1236.
 17. Li Y, Lee P, Chia WT, Lin H, Chiu F, Chen T, et al. Prospective analysis of a new minimally invasive technique for paediatric Gartland type III supracondylar fracture of the humerus. *Injury* 2009; 40(12):1302–1307.
 18. C. A. Brauer, B. M. Lee, D. S. Bae, P. M. Waters, and M. S. Kocher, “A systematic review of medial and lateral entry pinning versus lateral entry pinning for supracondylar fractures of the humerus,” *Journal of Pediatric Orthopaedics*, vol. 27, no. 2, pp. 181–186, 2007.
 19. J. P. Lyons, E. Ashley, and M. M. Hoffer, “Ulnar nerve palsies after percutaneous cross-pinning of supracondylar fractures in children’s elbows,” *Journal of Pediatric Orthopaedics*, vol. 18, no. 1, pp. 43–45, 1998.
 20. M. S. Kocher, J. R. Kasser, P. M. Waters et al., “Lateral entry compared with medial and lateral entry pin fixation for completely displaced supracondylar humeral fractures in children: a randomized clinical trial,” *Journal of Bone and Joint Surgery. Series A*, vol. 89, no. 4, pp. 706–712, 2007.