CLOSED REDUCTION AND PERCUTANEOUS PINNING IN DISPLACED SUPRACONDYLAR HUMERUS FRACTURES IN CHILDREN

Abhijit Sarkar¹, Rakesh Rajput², Tapan Kr. Chattopadhyay³

¹Associate Professor, Department of Orthopaedics, Tripura Medical College.

²Associate Professor, Department of Orthopaedics, Tripura Medical College.

³Professor, Department of Orthopaedics, Tripura Medical College.

ABSTRACT

BACKGROUND

Displaced supracondylar fractures of the humerus in children are common paediatric injuries treated by orthopaedic surgeons. Literature is very clear that these fractures should be reduced and fixed in optimal position to avoid complications like neurovascular injuries and residual deformity. Of the various methods available for the treatment of these fractures, closed reduction and percutaneous pinning has shown improved results.

MATERIALS AND METHODS

The study was conducted in the Department of Orthopaedics, Tripura Medical College, Hapania, Agartala, during the period of September 2010 to December 2012, 42 cases of supracondylar humeral fractures (Gartland Grade-II and Grade-III) with less than 1-week old were included in this study. They were treated with closed reduction and percutaneous pinning with Kirschner wires under image intensifier guidance. Clinical outcome was assessed according to Flynn's criteria.^{1,2,3,4}

RESULTS

The mean age at the time of operation was 6 years (Range 2-10 years) and the average follow-up was 16.3 months (Range 8-26 months). As per Flynn's criteria results were graded, excellent – 37 (88.09%), good – 03 (7.14%), fair – 1 (2.38%), poor – 1 (2.38%).

CONCLUSION

Closed reduction and percutaneous pinning is a good and effective treatment for displaced supracondylar fractures in children.

KEYWORDS

Displaced Supracondylar Fractures, Closed Reduction, Percutaneous Pinning.

HOW TO CITE THIS ARTICLE: Sarkar A, Rajput R, Chattopadhyay TK. Closed reduction and percutaneous pinning in displaced supracondylar humerus fractures in children. J. Evolution Med. Dent. Sci. 2016;5(31):1638-1641, DOI: 10.14260/jemds/2016/386

INTRODUCTION

Supracondylar fracture is one of the commonest fracture in children, account for 60% of all fractures around the elbow joint and represent approximately 3% of all fractures in children.³

Displaced supracondylar fractures of humerus have always presented a challenge to the orthopaedic fraternity. Many methods have been proposed ranging from closed reduction and plaster cast immobilization to percutaneous pinning and even open reduction and internal fixation with Kirschner wire fixation.^{4,5,6,7,8,9}

Literature is very clear that displaced supracondylar fracture in children (Gartland type II and III) should be fixed. Closed reduction and percutaneous pinning was initially described by Swenson and later popularized by Flynn et al.^{4,10}

It is a simple procedure with excellent result and biomechanically most stable as compared to other operations. The purpose of the study was to evaluate the role of closed reduction and percutaneous pinning in displaced supracondylar fracture of humerus in children.

MATERIALS AND METHODS

In a prospective study closed reduction and percutaneous pinning for 42 displaced supracondylar fractures of the humerus were performed at Tripura Medical College and Dr. BRAM Teaching Hospital, Hapania, Agartala.

The indication for pin fixation was Gartland Grade-II and III fractures. Out of the total 42 fractures, 30 were Grade-II and 12 were Grade-III. The maximum fractures were due to fall on outstretched hand. Fractures older than 1 week were not included. There were 26 males and 16 females. The age of the patients ranged from 2-10 years (mean age 6 years). Left elbow were involved in 22 cases and right elbow were involved in 20 cases; 27 cases had posteromedial displacement and 15 cases had posterolateral displacement.

Traction was given under general anaesthesia with the elbow in 20-30 degrees, forearm supination with an assistant applying counter traction and after disimpaction of fracture medial and lateral displacement was corrected by applying a varus or valgus force. The angulation was corrected by flexing the elbow with continued traction and pressure by thumb. The radial pulse was observed at regular interval during entire procedure. Reduction was checked by fluoroscopy; once it was acceptable the assistant held the elbow in the same position and one smooth Kirschner wire (1.5 to 2.0 mm) was passed from the lateral epicondyle, in most of the cases 2nd Kirschner wire was used from the centre of the medial epicondyle. The pins should cross each other 1.5 cm–2 cm above the fracture line. In a few cases, we used one additional Kirschner wire from the lateral side additional.

Financial or Other, Competing Interest: None.

Submission 19-02-2016, Peer Review 02-03-2016,

Acceptance 05-03-2016, Published 16-04-2016.

Corresponding Author:

Dr. Abhijit Sarkar,

Associate Professor,

Department of Orthopaedics,

Tripura Medical College,

Agartala-14.

E-mail: amarkanti@yahoo.com

DOI: 10.14260/jemds/2016/386

Medial and lateral crossed wire used in most cases, as this has proven to be the most stable construct.

Sometimes, we have introduced one additional Kirschner wire from medial or lateral side. The whole procedure was done under C-arm image intensifier control. The pins were cut off subcutaneously. An above elbow plaster slab was applied in supination in 80-100 degrees of elbow flexion. Patients were discharged after 48-72 hours. The patients were received at weekly intervals. Kirschner wires were removed when radiological unions were found satisfactory and active exercise started. Followup evaluation was done at weekly intervals for 6 weeks, monthly for 6 months and 3 monthly intervals thereafter. At each review, patients were evaluated clinically and radiologically on the basis of Flynn's criteria^{11,12}

Results/ Ratings	Cosmetic Factor, Carrying Angle Loss (Degrees)	Functional- Factors, Movement Loss (Degrees)	Overall Rating
Excellent	0-5	0-5	The lower of the two ratings and an elbow with a varus deformity is automatically graded as poor
Good	5-10	5-10	
Fair	10-15	10-15	
Poor	>15	>15	

Table 1: (Flynn's Criteria).^{11,12,13}

RESULTS

Out of 42, all the patients were available for followup. The mean followup was 16.3 months (8-26 months). There were no local complications like wound infections at final followup using Flynn's modified classification.^{7,12} Table-II the clinical result was Excellent in 37 patients (88.09%), Good in 3 patients (7.14%), Fair in 1 patient (2.38%) and Poor in 1 patient (2.38%). The poor result was due to cosmetic result, but with good or excellent function.

The average anaesthesia time was 38 minutes (Range 20-60 minutes); 38 patients were treated with 2 crossed K-wires, in 4 patients with unstable fractures, 2 lateral K-wires were employed in addition to the medial one K-wire.

Fig. 1: Preoperative X-ray of a supracondylar fracture humerus Gartland Grade-III

Fig. 2: Postoperative X-ray of a supracondylar fracture humerus Gartland Grade-III

DISCUSSION

Various methods of treatment have been advocated in the form of closed reduction and above elbow plaster cast application, skin/skeletal traction, primary closed reduction and percutaneous pinning and open reduction and internal fixation by Kirschner wires.^{4,5,11} Closed reduction and percutaneous pinning is the preferred treatment in Grade-II and Grade-III displaced supracondylar fracture in children (Table-II).

Swenson reported excellent result using crossed pin fixation, but others have suggested the pin placed from the lateral condyle in a parallel or crossed configuration to minimize the risk of iatrogenic ulnar nerve injury.¹⁴ Although injury to ulnar nerve from the medial pin is a major concern, especially when fracture is associated with swelling, its incidence is 2% to 3%.¹⁵ The frequency of this complication in reported series ranges from 0 degrees to 5 degrees.^{16,17}

In our series, it was none. Compartmental syndrome another complication of percutaneous pinning in supracondylar fracture humerus in children, Lee et al. have similar observation, was not found in our series.¹⁸

Although modern pinning techniques have reduced the incidence of cubitus varus deformity. This continues to be the most common complication following pinning of supracondylar fracture of the humerus.^{5,18} The cause of deformity is coronal rotation or tilting or a combination of both, of distal fragment.^{9,19} The most important factor correlating with the final varus deformity following close reduction and percutaneous pinning is the difference in Baumann's angle between the operated and normal side.⁵ In all patients Baumann's angle was restored within 4 degrees of the uninjured site. In addition, other criteria like the restriction of the clear space between olecranon and capitellum and transaction of the capitellum by anterior humeral line on the lateral radiograph were also employed.

Also the carrying angle was assessed by fully extending the elbow after the crossed pinning was complete. None had cubitus varus deformity at a minimum followup of 8 months. Our study results agree with other studies, which have reported that cubitus varus is caused by inadequate reduction.^{12,20} Another major concern with delayed treatment is the inability to achieve satisfactory closed reduction because

of swelling, thus produce higher chance of conversion to open reduction has been reported in literature, ranging from 3 degrees to 46 degrees.^{21,22} In our series closed reduction and percutaneous pinning was successful in all cases with good-to-excellent result 96.2%.

Recent studies comparing the relative strength of fixation afforded by different configurations of pin placements have crossed medial and lateral pins to be the most stable configuration biomechanically.^{23,24} Many studies published on the results of percutaneous pinning differ in their clinical grades of patients. Though most studies have a very few poor

results, usually less than 5-10%, there is not a clear match in terms of good and excellent results. In general, the studies with long-term followup results show a higher percentage of excellent results like the studies from Flynn et al.¹² Pirone et al. etc.¹⁶ The reason for a few of the patients in our study, not falling into the excellent results category were a little terminal limitation of flexion and extension. This was more commonly seen in the patients who had short followup around 8 months. Possibly in long followup, the range of movement of elbow would be improved.

Treatment	Authors	No. of Cases	Lost to Followup (%)	Flynn's Global Classification (%)			
				Excellent	Good	Fair	Poor
1. Closed reduction and cast	Hadlow et al. ⁸	55	46	55	26	04	16
2. Olecranon traction	Suffon et al. ⁹	15	12	58	18	17	07
	Hadlow et al. ⁸	12	48	05	25	00	25
	Paradis et al. ¹³	24					
3. Closed reduction and lateral K-wiring	Boyd and Arouson. ⁷	17	28	08	14	04	01
	Hadlow et al. ⁸	07	05	71	29	00	00
	Mazda et al. ⁶	90	08	91	04	00	04
4. Percutaneous cross pinning	Flynn et al. ¹²	52	16	81	14	04	02
	Mehserle and Meehan. ²⁵	33	27	07	21	03	06
	Suffon et al. ⁹	32	33	66	22	02	01
5. Open reduction and K-wiring	Hadlow et al. ²⁶	5	17	06	04	00	00
	Mazda et al. ⁶	26	00	92	04	00	04
6. Present study Percutaneous pinning	-----	42	00	37	03	01	01

Table 2: Clinical Findings Compared with other Series in the Literature

CONCLUSION

From the present study, it could be concluded that closed reduction and percutaneous pinning is a sound and effective modality for the treatment of displaced supracondylar fracture in children even in presence of swelling.

REFERENCES

- Otsuka NY, Kasser JR. Supracondylar fracture of the humerus in children. J Am Acad Orthop Surg 1997;5(1):19-26.
- Kasser JR, Beaty JH. Supracondylar fracture of the distal humerus Rockwood and wilkins Fracture in children. New York Lippin Cott Wiliam and Wilkons 2001;5th ed:p 577.
- Saroff DA. Time to treatment: the question of beneficial surgical delays. J Bone Joint Surg Am 2001;83-A(11):1755-1756.
- Dunlop J. Transcondylar fracture of the humerus in childhood. J Bone Joint Surg Am 1939;21(1):59-73.
- D'Ambrosia RD. Supracondylar fractures of humerus- prevention of cubitus varus. J Bone Joint Surg Am 1972;54(1):60-66.
- Mazda K, Boggione C, Fitoussi F, et al. Systematic pinning of displaced extension-type of supracondylar fractures of the humerus in children. A prospective study of 116 consecutive patients. J Bone Joint Surg Br 2001;83(6):888-893.
- Harri IE. Supracondylar fracture of the humerus in children. orthopedics 1992;15(7):811-817.
- Hadlow AT, Devane P, Nicol RO. A selective treatment approach to supracondylar fracture of the humerus in children. J. Pediatr Orthop 1996;16(1):104-6.
- Sutton WR, Green WB, Georgopoulos G, et al. Displaced supracondylar humeral fractures in children, a comparison of results and casts in patients treated by skeletal traction versus percutaneous pinning. Clin Orthop 1992;278:81-7.
- Swenson O. The treatment of supracondylar fractures of the humerus by Kirschner wire trans-fixation. J Bone Joint Surg Am 1948;30(4):993-997.
- Gartland JJ. Management of supracondylar fractures of humerus in children. Surg Gynecol Obstet 1959;109:145-154.
- Flynn JC, Matthews JG, Benoit RL. Blind pinning of displaced supracondylar fracture of the humerus in children. 16 years' experience with long term follow-up. J Bone Joint Surg Am 1974;56(2):263-272.
- Webb AJ, Shermann FC. Supracondylar fracture of the humerus in children. J. Pediatr Orthop 1989;9(3):315-25.
- Mostafavi HR, Spero C. Crossed pin fixation of displaced supracondylar humerus fractures in children. Clin Orthop Relat Res 2000;376:56-61.

15. Dodge HS. Displaced supracondylar fractures of the humerus in children: treatment by Dunlop's traction. *J Bone Joint Surg Am* 1972;54:1408-1418.
16. Pirone AM, Graham HK, Krajbich JI. Management of displaced extension-type supracondylar fractures of the humerus in children. *J Bone Joint Surg Am* 1988;70:641-50.
17. Royce RO, Dutkowsky JP, Kasser JR, et al. Neurologic complications after K-wire fixation of supracondylar humerus fractures in children. *J Pediatr Orthop* 1991;11(2):191-194.
18. Leet AI, Frisancho J, Ebrahimzadeh E. Delayed treatment of type-III supracondylar humerus fractures in children. *J Pediatr Orthop* 2002;22(2):203-207.
19. Iyengar SR, Hoffinger SA, Townsend DR. Early versus delayed reduction and pinning of type-III displaced supracondylar fracture of the humerus in children: a comparative study. *J Orthop Trauma* 1999;13CD:51-55.
20. Jones KG. Percutaneous pin fixation of fracture of the lower end of the humerus. *Clin Orthop Relat Res* 1967;50:53-69.
21. Cramer KE, Devito DP, Green NE. Comparison of closed reduction and percutaneous pinning versus open reduction and percutaneous pinning in displaced supracondylar fractures of the humerus in children. *J Orthop Trauma* 1992;6(4):407-412.
22. Hart GM, Wilson DW, Arden GP. The operative management of the difficult supracondylar fracture of the humerus in the child. *Injury* 1977;9(1):30-34.
23. Zoints LE, Mckellop HA, Hathaway R. Torsional strength of pin configurations used to fix supracondylar fracture of the humerus in children. *J Bone Joint Surg Am* 1994;76:253-256.
24. Herzenberg Jt, Koreska J, Carroll NC, et al. Biomechanical testing of fixation technique for pediatric supracondylar elbow fractures. *Orthop Trans* 1998;12:678-679.
25. Mehserle WL, Meehan PL. Treatment of displaced supracondylar fracture of the humerus (type-III) with closed reduction and percutaneous cross pin fixation. *J. Pediatr Orthop* 1991;11:705-11.
26. Paradis G, lavallie P, Gagnon N, et al. Supracondylar fracture of the humerus in children: technique and result of crossed percutaneous K-wire fixation. *Clinic Orthop* 1993;297:231-7.