

## Displaced Supracondylar Fractures of the Humerus in Children: Treatment by Open Reduction and Internal Fixation by Two Crossed Kirschner Wires

\* Haque MR,<sup>1</sup> Haque AM,<sup>2</sup> Hamid F,<sup>3</sup> Hossain MD<sup>4</sup>

Between January 2008 and December 2008 a total of 21 children with a displaced supracondylar fractures of the humerus were managed by open reduction and internal fixation by two crossed kirschner wires. The final outcome was assessed using functional and cosmetic criteria used by Flynn and associates. Of this 21 patients, 17(80%) showed a “satisfactory” results. Excellent results were achieved in 13 (60%) patients, good in 3 (17%) patients, fair in 1 (3%) patients and poor in 4 (20%) patients. Open reduction and internal fixation with two crossed Kirschner wires is a safe and effective way of management of displaced supracondylar fractures of humerus in children. It can be effectively used in a hospital where there is availability of general orthopedic expertise.

[Dinajpur Med Col J 2010 Jan; 3 (1):25-28]

**Key words:** Humerus, supracondylar fracture, radial nerve palsy.

### Introduction

Supracondylar fractures of the humerus are among the commonest fractures in children.<sup>1</sup> Serious complications can develop if treatment is not done properly. There are numerous series discussing their management. However, no single method of management is suitable for all supracondylar fractures of the humerus in children<sup>2</sup>.

Closed reduction and pop casting is commonly used to manage these fractures since long. Traction has been used in the management of supracondylar fractures since 1939 when Duhlop<sup>3</sup> described straight arm traction with the elbow extended. Skeletal traction with a k-wire<sup>4</sup> or a screw anchor<sup>5</sup> have also been reported. Many recent studies have reported satisfactory clinical outcome with closed reduction and kirschner wire fixation.<sup>6,7,8</sup> Open reduction of displaced supracondylar fractures followed by k-wire fixation, is an excellent method of

management in experienced hands with strict adherence to protocols<sup>9</sup>.

We have treated 21 displaced supracondylar fracture of humerus in children, open or closed by open reduction and internal fixation by two crossed k- wire during the period of January 2008 to December 2008. We present our method and result with this type of management.

### Methods

We treated 21 supracondylar fractures of the humerus in children between January and December 2008 using the technique of open reduction and crossed k- wire fixation.

Of 21 patients, 14 were boys and 7 were girls. Age ranges from 5 to 12.5 years with a mean age of 7.6 years (Table I). Eleven of the 21 fractures were open and 10 were closed. The extension type fractures were classified using the Gartland classification (Table II).<sup>10</sup> All

1. \*Dr. Md. Reazul Haque, MS (orthopaedics), Consultant, Ortho surgery unit, Pabna General Hospital, Pabna, Bangladesh. email :drreza1959@yahoo.com

2. Dr. ANM Mozammel Haque, FCPS(Surgery), Assistant Registrar, Pabna General Hospital, Pabna.

3. Dr. Farzana Hamid, MBBS, Medical Officer, Pabna General Hospital, Pabna.

4. Dr. Md. Delower Hossain, MBBS, Medical Officer, Pabna General Hospital, Pabna

\* For correspondence

fractures in this study were Gartland type III. Concomitant injuries included one contralateral femur fracture and one ipsilateral distal radial fracture. Symptoms of nerve palsy were observed in 3 patients before surgery: radial nerve in 2 and median nerve in 1. In two patients, radial artery pulse was absent at presentation. All open fractures were treated directly by open reduction and crossed k-wire fixation within 24 hours of hospital arrival while manipulation under general anesthesia was initially tried for all closed fractures. The interval between injury and operation in closed fractures ranged from

3 - 7 days (average 5). The period of fixation in long arm back slab ranged from 3 to 4 weeks (average 3.3), after which the pins and the slab were removed and active and passive exercise began.

Post-operative follow-up was carried out at one week, three weeks, three months, and at six months after discharge from hospital, with AP and lateral radiograph of the injured elbow at each visit. The final outcome was assessed using Flynn et al.'s functional and cosmetic criteria (Table III).<sup>11</sup>

Table I: Details of the patients

Case	Sex	Age	Type of Fracture (Open/Closed)	Garthland Type	Associated Injuries
1	M	5.9	open	III	
2	M	7.4	open	III	
3	F	6.4	open	III	Vascular insufficiency
4	M	9.8	closed	III	
5	M	11.3	open	II	Ipsilateral distal radial fracture
6	M	10.2	open	III	
7	F	7.5	open	III	Radial nerve palsy
8	M	5.9	open	III	
9	F	7.3	closed	III	
10	F	9.8	open	III	Contralateral femur fracture
11	M	7.2	closed	III	
12	F	7.3	closed	III	
13	M	5.0	closed	III	
14	F	8.2	open	III	
15	M	6.1	closed	III	Radial nerve palsy
16	M	6.5	closed	III	
17	M	5.2	closed	III	Median nerve palsy
18	M	12.5	open	III	
19	F	8.3	open	III	
20	M	5.8	closed	III	
21	M	6.0	closed	III	vascular insufficiency

F = female; M= male

#### Operative technique:

After the patient is put under general anaesthesia, the injured upper limb was sterilized and the fracture was reduced bilaterally. While the fracture reduction is held by assistant, k-wire fixation is performed by the surgeon. The first wire is

inserted from the lateral part of the distal fragment toward the proximal fragment posteromedially. Then the medial epicondyle is felt by firm pressure with thumb and the second k-wire is crossly inserted. We used a strong smooth pin 1.6 mm in diameter to gain stable fixation strength. Part of the inserted

wire, which was exposed outside the skin, was bent at a 90° angle and cut to leave about 1 to 2 cm of wire. After surgery, the area is thoroughly covered with cotton padding and a long arm slab is applied to maintain the forearm in a neutral position.

Table II: The Gartland classification of extension type supracondylar fracture

Type	Displacement
I	Undisplaced
II	Displaced (with intact posterior cortex)
III	Displaced (no cortical contact)

Table III: Flynn et al.'s criteria

Resulting rate		Cosmetic factor (change in carrying angle)	Functional factor (motion loss)
Satisfactory	Excellent	0-5*	0-5*
	Good	6-10	6- 10
	Fair	11-15	11-15
Unsatisfactory	Poor	>15	>15

\*Degrees

**Results**

Out of 21 patients studied, 13(60%) had an excellent, 3 (17%) a good, 1 (3 %) a fair and 4 (20 %) a poor outcome (Table IV).

Table IV: Summery of the result

Resulting rate		
Satisfactory	Excellent	13(60%)
	Good	3 (17%)
	Fair	1(3%)
Unsatisfactory	Poor	4 (20%)

Out of 21 patients studied,13(60%)had an excellent,3 (17%) a good,1 (3 %) a fair and 4 (20 %) a poor outcome (Table IV).

**Discussion**

The goals of management of a displaced supracondylar fracture are to recover full function in a cosmetically normal elbow .It can be difficult to obtain and maintain reduction in supracondylar fractures of the humerus with severe displacement. Although some investigators have reported a satisfactory outcome with closed reduction and casting, the fracture may still be unstable and excessive elbow flexion may cause a Volkmann’s ischaemic contracture. At present, closed reduction and k-wire fixation is widely used. However, in patients with severe oedema and those who are in danger of developing a compartment syndrome, closed reduction can be difficult and open reduction using a minimal incision has been suggested.<sup>12</sup>

In our study, there was no significant difference in the incidence of complication with respect to the interval between injury and operation. Similarly, the duration of operation didn’t affect the treatment outcome. We had a mean duration of surgery of 1 hour. No patient developed a Volkmann’s contracture, complete loss of reduction or myositis ossificans. Post-operative infections occurred in 7 patients (33%).These included 5 patients who developed a superficial infection at the site of insertion of k-wire and two patients who sustained a deep infection. The superficial infection resolved rapidly after removal of the wires but the deep infection continued for longer and lead to poor outcome. Another major factor for poor outcome was varus deformity. Four patients (20%) developed varus deformity of elbow at final follow-up although 3 of them was satisfactory, according to the functional factor of Flynn et al.’s criteria.

Open reduction and internal fixation by k-wire is an excellent method of management of supracondylar fractures of humerus in

children when the fracture is open or good reduction could not be achieved by closed means. The outcome of management in our

study were comparable with those of recent large studies (Table V).

Table V: Comparison of outcomes of this and other studies.

Author/s	Mode of treatment	Outcome Measures used	Excellent (%)	Good (%)	Fair (%)	Poor (%)	Number of patients
Davies et al <sup>13</sup>	K wire	Flynn's criteria	56	21	3	21	34
Mazda et al <sup>14</sup>	K wire	Flynn's modified criteria	91.6	4.6	0	3.7	116
Reitmann et al <sup>15</sup>	K wire	Flynn's criteria	55	24	9	12	65
Our study	OR & K wire	Flynn's criteria	60	17	3	20	21

### References

- Cheng JEY, Shen WY. Limb fracture pattern in different pediatric age groups :a study of 3350 children. *J Orthop Trauma*, 1993; 7:15-22.
- Piggot J, Graham HK, McCoy GF. Supracondylar fractures of the humerus in children :treatment by straight lateral traction. *J Bone Joint Surg[Br]*1986;68-B:577-83.
- Duhlop J. Transcondylar fractures of the humerus in childhood. *J Bone Joint Surg* 1939;21:59-73.
- Smith FM. Kirschner wire traction in elbow and upper arm injuries .*Am J Surg* 1947; 74: 770-87.
- Palmer EE, Niemann KMW, Vesely D, et al. Supracondylar fracture of the humerus in children. *Bone Joint Surg [Am]* 1978; 60-A: 653-6.
- Alborger PD, Weider PL, Betz RR. Supracondylar fracture of the humerus in children. *J Pediatr Orthop* 1992; 12:16-9.
- Aronson DD, Prager BI. Supracondylar fracture of the humerus in children. *Clin Orthop* 1987; 219 : 174-84.
- Garbuz DS, Leitch K, Wright JG. The management of supracondylar fractures in children with an absent radial pulse. *J Pediatr Orthop* 1996;16:594-6.
- O'Hara LV, Barlow JW, Clarke NM. Displaced supracondylar fracture of the humerus in children; audit changes practice. *J Bone Joint Surg [Br]*2000;82-B:204-10.
- Gartland JJ. Management of supracondylar fractures of the humerus in children. *Surg Gynecol Obstet* 1959;109:145-154
- Flynn JC, Mathews JG, Benoit RL. Blind pinning of displaced supracondylar fractures of the humerus in children: sixteen years experience with long firm follow-up. *J Bone Joint Surg [Am]* 1974;56-A: 263-72.
- Canale ST. Fractures and dislocations in children. In: Crenshaw AH,ed. *Campbell's operative orthopedics*.vol 2, Eighth ed.St louis etc: Mosby Year Book Inc, 1992:1055-248.
- Davies RT, Gorczyca JT, Pugh K. Supracondylar humerus fracture in children: comparison of operative treatment methods. *Clin Orthop* 2000;376:49-55.
- Mazda K, Boggione C, Fitoussi F, et al. Systemetic pinning of displaced extension type supracondylar fractures of the humerus in children: a prospective study of 116 consecutive patients. *J Bone Joint Surg [Br]* 2001; 83-B: 888-93.
- Reitmman RD, Waters P, Millis M. Open reduction and internal fixation for supracondylar humerus fractures in children.*J Pediatr Orthop* 2001;21: 157-61.