Gartland Type III Supracondylar Fractures in Children; Percutaneous Fixation with Two Kirschner Wires from Lateral Side

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Each author of this article fulfilled ALL 04 Criteria of Authorship:
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ABSTRACT

Objectives: To determine the outcome of percutaneous stabilization of two Kirschner wires from the lateral side in pediatric supracondylar fracture of the humerus.
Methods: We conducted this study in the Department of orthopedics, Mardan Medical Complex, from 1st January 2021 to 30th December 2021. After ethical committee approval and informed consent from parents, consecutive patients with type III supracondylar fractures were selected for close reduction and percutaneous pinning (CRPP) from the lateral side. A total of 41 patients including 34 male and 7 female were included in the study. Patients in the age group of less than 15 with Gartland type III supracondylar fractures were meeting the inclusion criteria underwent close reduction and percutaneous fixation (CRPF) with k-wires done from the lateral side only under an image intensifier. Open fractures failed close reduction, polytrauma patients, and vascular injury were excluded. Postoperative results were assessed according to Flynn's criteria.
Results: All 41 patients with type III supracondylar fractures were reduced and closely underwent CRPP from the lateral side with a male to female ratio of 4.8:1. Mean age at the time of injury was 7.56 years (range of 4-15). Most of them had an injury on the left side (56.1%) with extension-type fractures being the most common (94.7%). The mechanism of injury was ground-level fall in the majority of cases. Functional results were 70.2% excellent, 19.3 % good, 7.9% fair and 2.6% poor while on the other side cosmetic results were 70.2% excellent, 20.2 % good, 7% fair and 2.6% poor according to the Flynn criteria.
Conclusion: K-wire fixation and removal are easier from the lateral side than from the medial or both medial and lateral with the least chances of ulnar nerve injury. The medial epicondyle wire is close to the ulnar nerve and is at risk for injury during fixation and removal of k.wire. It is an effective method of supracondylar fracture fixation in children. It is an alternative to cross-k wire fixation from both the medial and lateral side.
Keywords: Supracondylar fracture, CRPP, Image intensifier.

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INTRODUCTION

Pediatric supracondylar fracture is the most common injury involving an elbow joint with an estimated figure of 16% of all fractures in children. It is most common in the age group of 6-7 years. Fracture results in the thinner part of the bone following a hyperextension injury(1,2). It is known for its inherent acute and chronic complications(3). Displaced fractures had been a challenge for an orthopedic surgeon. Different modalities of treatments are available for treating this injury. Each type of modality is subject to complications(4).

Optimal treatment depends on the radiographic assessment of the fracture pattern(5). Treatment is tailored according to modified Gartland classification;

Type I injury is treated in a 3-4 week long cast. Type II is treated with closed reduction and cast/ percutaneous pinning. IIB needs closed reduction and percutaneous pinning (CRPP). Similarly, types III & IV are treated by CRPP. If unsuccessful close reduction then an open reduction and internal fixation(ORIF) is the ultimate option[6,7]. The usual acceptable method of K-wires fixation is either a cross pattern or only from the lateral side[8]. Cross pinning is associated with a high rate of ulnar nerve injury[9]. Cross pinning from the lateral aspect is a safe as well as stable fixation method[10]. Closed reduction and percutaneous pinning is a simple, safe, and less invasive method for treating a displaced supracondylar fracture of humerus in children, introduced initially by Swenson and later on by Flynn et al[11,12]. Open reduction can lead to elbow stiffness, scarring, neurovascular compromise, and more hospital stay than close reduction and percutaneous pinning.

The purpose of the current study is to evaluate the effectiveness of close reduction and percutaneous k-wire fixation from the lateral side in stabilizing Gartland type III supracondylar fractures in children in our setup.

METHODS

We conducted the current study in the department of Orthopaedics, Mardan Medical Complex, from 1st January 2020 to December 2020**.** The total number of patients classified as type III injury were 41 including 34 male and 7 female. Patients of either sex with less than 15 years with Gartland III supracondylar fractures on plain Anteroposterior (AP) and lateral x-rays were included in the study. Patients with open injuries, associated with neurovascular injuries and polytrauma were not considered in the study. All fresh cases were initially given first aid in the accident & emergency department, gross deformity corrected and the splints were applied in the ward. After a thorough clinical and radiographic assessment with Anteroposterior and lateral radiographs of the elbow, all patients were scheduled for CRPP on the next available operation list**.** The study was approved by the ethical committee of the hospital. All patients were admitted through OPD or accident & emergency departments. All were preoperatively assessed for the fitness of anesthesia and procedure. Informed consent was taken from their parents or guardians.

Operative Technique

After preoperative assessment for anesthesia all patients underwent CRPP in the supine position and k-wire (1.5 mm/ 2mm), fixation was done through the lateral side only. All patients were given general anesthesia. A pneumatic tourniquet was used in almost all cases. After anesthesia, the limb was elevated for scrubbing and tourniquet inflation. Time is noted before each case for the duration of the tourniquet. The elbow was placed on a fluoroscopic plate form along the side of the body in the supine position. The close reduction was done by longitudinal traction in the extension of the elbow and supination of the forearm. Lateral and medial displacement was corrected by pushing the distal fragment medially or laterally. And then the backward tilt by putting pressure on the olecranon and flexing the elbow. During these manipulations, a special case was taken for pulses. K-wires depending on the size of the arm and age of the patient were passed from the lateral side**.** The position of k-wires was assessed in Anteroposterior and lateral fluoroscopic views. Care was taken to purchase both the near as well as far cortices. Wires were cut just beneath the skin. A long arm back slab was applied in each case with the elbow in flexion about 90 degrees. After fixation, the tourniquet was released. And a long back slab was applied in each case.

Postoperative visits were scheduled as 2nd week for wound examination, 4th week for back slab removal and advised for active ROM exercises, and 6th week for the removal of k-wires. At the final visit in the 12th week for the final results of the procedures. Data was collected for the name, age, sex, side, days to surgery, carrying angle, pain, time to union, and ROM. Results were then assessed according to Flynn's criteria([12]) by comparing the injured and normal elbow for carrying angle and range of motion. Data was analysed by SPSS version 16.

RESULTS

In the current study, 41 patients were operated on for displaced type III supracondylar fracture with k-wire fixation from the lateral side. Out of the 41 patients, 34(82.9%) were male and 7 (17.1%) were female with a ratio of 5:1 as shown in table 1. Their mean age at the time of presentation was 7.6 (range; 4-15) years. 23(56.1%) patients had left extremity fractures while the right elbow was involved in 18(43.9%) cases. The mechanism of injury was just a simple fall on the ground in the majority of cases (65.9%). In 87.8% of patients, the right hand was dominant. Extension-type injury (94.7%) was more common than flexion type (5.3%). Functional results were, 70.2% excellent,

19.3 % good, 7.9% fair while 2.6% poor while cosmetic results are 70.2% excellent, 20.2 % good, 7% fair while 2.6% poor according to the Flynn criteria (table 2).

Table 1: Patient's demographics

Mean age in years	7.56±2.74 SD	Number	Percentage
Gender	Male	34	82.9
	Female	7	17.1
Side of injury	Left	23	56.1
	Right	18	43.9
Fracture type	Extension	39	94.7
	Flexion	2	5.3
Dominant hand	Right dominant	36	87.8
	Left dominant	5	12.2
Mechanism of injury	Simple fall	27	65.9
	Fall from height	13	31.7
	Sports	0	0
	Road traffic accident	1	2.4

Table 2: Outcome according to Flynn's criteria

		Cosmetic factor		Functional factor	
		Number	Percentage	Number	Percentage
Satisfactory	Excellent	29	70.2	29	70.2
	Good	8	20.2	8	19.3
	Fair	3	7.0	3	7.9
Unsatisfactory	Poor	1	2.6	1	2.6

DISCUSSION

The supracondylar fracture should be treated on an urgent basis due to its complications either early or late[13]. The gold standard treatment for a fresh type III supracondylar fracture is closed reduction and percutaneous pinning (CRPP)[14-16]. We operated on 41 patients for displaced fractures type III supracondylar with lateral k-wire fixation. The mean age of our patients was 7.59 years. This is almost similar to study[17] whose mean age was 7.26 years. The side of injury was left in 56.1% of our cases and 35.9% were right similar to a study by Bojovic et al.[17] who also had 59.1% left side and 40.9% right extremity involved. In the present, study extension type (94.7%) injury was most common than flexion type (5.3%). These results are similar to Shoaib et al[11].

Our functional results are 70.2% excellent, 19.3% good, 7.9% fair and 2.6% poor according to Flynn criteria. Cosmetic results are 70.2% excellent, 20.2 % good, 7% fair while 2.6% poor. In another study by Bojovic et al[17] their results were excellent in 62% of cases, good in 23.8 % cases, fair 9.5 and poor in 4.7%. Their cosmetic results were exactly similar to our study. Saleem et al[18] in 2013 showed combined excellent and good results of 94.4%. While 4.55 satisfactory results. Cosmetically 86.5% excellent and good results, 5.6% satisfactory while 7.9% unsatisfactory results. These results are comparable to our results (excellent + good = 89.5%). Cosmetically excellent and good were 86.5% and satisfactory 5.6% which are comparable to our results (70.2+20.2=90.4%). In another study in 2015, Azhar[19], overall, satisfactory results were 93.15% (excellent 80%, good 10.7%, fair 3.7%) which are comparable to our study.

We used two k wires from the lateral side only. Lee et al[20] reported that two k-wires from the lateral side are sufficient for stability which does not need another k-wire fixation from the medial side. This eliminates the chances of injury to the ulnar nerve. According to Brauer et al,[21] chances of the ulnar nerve are 3-4 fold more with cross-wiring. The male-to-female ratio in our study is 2:1. This ratio is the same as 2.08:1 in a study by Bojović et al[17]. There were no major complications like neurovascular injury in our study which is similar to a study done in 2012[17] with a similar technique for wire fixation. They proved it to be a useful technique although cross-wiring has more stability than parallel wiring. There were few cases (7.8 %) of pin site infection

which were treated with local debridement after wire removal and oral antibiotics.

CONCLUSION

Lateral k-wire fixation under image guidance is a minimally invasive technique and an alternative to the more traditional posterior approach, in fresh supracondylar fractures in children with the least chances of iatrogenic ulnar nerve injury.

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