

Treatment Of Displaced Fracture Neck Radius In Children By Closed Reduction Using K-Wire And Percutaneous Intramedullary Pinning

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Abstract

Introduction: In this study, a novel method involving closed reduction by K-wire and percutaneous intramedullary pinning for the treatment of displaced/markedly angulated fracture neck radius in children has been done. The management of such injuries has been a widely debated topic and even now it remains a controversial topic. The general notion is that, for fractures with angulation of less than 30° a conservative approach should be used whereas in the case of fractures with angulation of more than 30° or a translation of more than 50%, a more aggressive approach should be used. We have described the relevance of this method, as a viable alternative to the existing methods.

Method: The method used to treat the fracture of the neck radius is a new technique which uses the principles of two already established methods for the treatment of angulated fracture of neck radius, the percutaneous reduction by K-wire and the fixation by percutaneous intramedullary pinning with K-wire. We present a retrospective study conducted between 2004 to 2014 involving 15 patients of severely displaced fracture neck radius in children.

Result: The results were evaluated based on a number of parameters, namely, pain, range of motion and disability. According to these parameters, the patients were assessed and graded as excellent, good, fair and poor. Out of 15 patients studied, 10 had excellent results, 4 good and 1 patient had a fair result.

Conclusion: We believe, this method has a good success rate and also overcomes a number of uncertainties which exist with currently prevalent methods. A significant advantage with our method is that it has a very low complication rate. In our study, none of the cases had complications such as synostosis, heterotrophic calcification, nerve injury or osteonecrosis of radial head. In addition to that, there was no secondary loss of reduction.

Keywords: children; neck radius fracture; percutaneous K-wire reduction; intramedullary fixation with K-wire

Introduction

Incidence of Radial Neck fracture in children ranges from 5 - 8.5% of total elbow fractures [1]. Age of occurrence varies from 4 to 14 years with the mean age ranging from 9 to 10 years [1,2,3]. Both males and females are almost equally affected [1,2,3].

Most frequent mode of injury is fall on outstretched hand with elbow extended and forearm in supination causing

valgus strain [4].

Management of these injuries is somewhat controversial, conservative treatment is more favored but more aggressive treatment is needed with high energy trauma, advanced age, associated injury and cases treated with open reduction with or without internal fixation generally had poorer results [3,5].

We report a retrospective study of 15 patients of displaced/markedly angulated fracture neck radius in children, conducted between 2004 to 2014 treated using percutaneous reduction by K-wire and fixation by intramedullary pinning with K-wire introduced from radial styloid.

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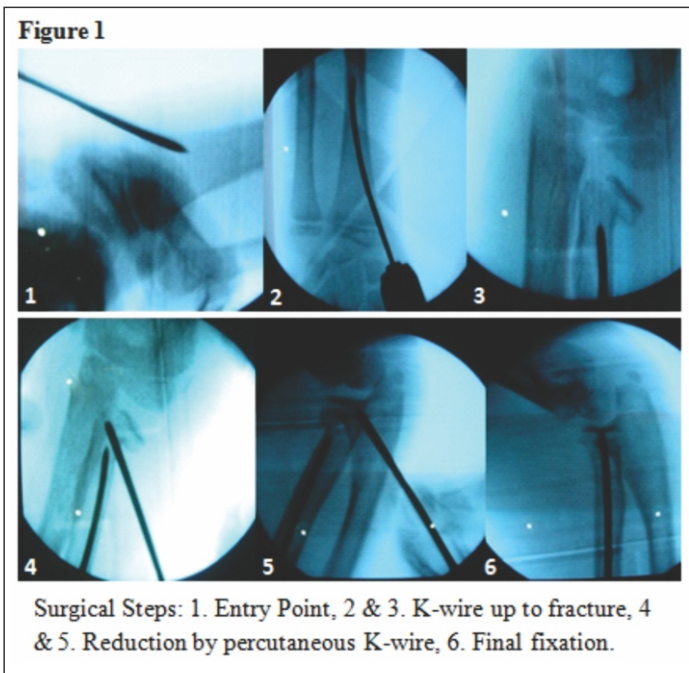
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Material & Methods

A novel method was used to treat the fracture of the neck radius which combines the principles of two already established methods for the treatment of angulated fracture of neck radius, the percutaneous reduction by K-wire [6] and the fixation by percutaneous intramedullary pinning with K-wire [7]. Out of the 15 cases studied, 8 were male and 7 were females aged between 6 - 15 years (Mean 9.5 years). According to Salter and Harris Classification, there were type I (n=5) and type II (n=10) patients. According to Judet Classification [8], out of 15 patients, 8 were Grade 3, 4 were Grade 4a, and 3 were Grade 4b (Table 1). Associated injuries are fracture of proximal ulna (n=2), fracture of ulna shaft (n=4), dislocation of elbow joint (n=1). The time from injury to treatment ranges from 0 to 8 days.

Under anesthesia, elbow is screened under C-arm image intensifier and position of maximum angulation is determined and recorded. K-wire (1.8 - 2.0mm thick) mounted over T-handle is introduced from radial styloid (proximal to radial epiphysis) and driven proximally up to distal margin of fracture. Reduction is achieved by introducing another K-wire (2 - 2.5mm thick) at the fracture site

and head fragment is elevated and reduced [6]. After the reduction, intramedullary K-wire is driven in to the proximal fragment (Fig. 1). Elbow joint is kept free from the fixation. K-wire was kept outside the skin for future removal at 3-4 weeks after surgery. Limb was kept in a long arm cast with elbow at 90° flexion for 4 weeks. As per the progress of fracture consolidation, passive and active movements were started. Associated ulna fractures were treated by closed reduction and percutaneous intramedullary pinning. In one patient neck fragment was displaced significantly while head fragment remained in position (Chambers Group 2A - Monteggia Variant) [1,9]; there was also associated ulna fracture. Both the fractures were treated by closed manipulation and pinning (Fig 4).

Results

Patients were followed up regularly at 1 month, 2 months and 6 months and results were evaluated according to pain, range of motion and disability and graded as excellent, good, fair and poor (Table 2). Out of 15 patients, 10 (67%) had excellent, 4 (26.3%) had good and 1 (6.7%) had fair result. We followed our patients ranging from 9 months to 4.5 years (mean follow up 1.8 years).

Poorer results are attributed to higher fracture grades, elder children, associated injury and open reduction [6,10,11]. In one 6-year-old girl we had to do open reduction and intramedullary pinning - she had a fair result.

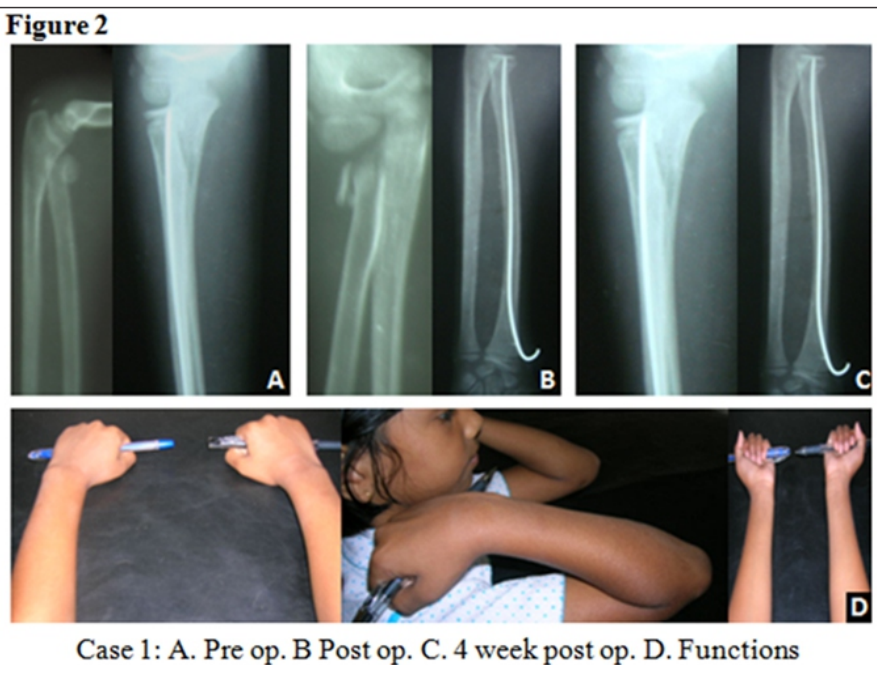
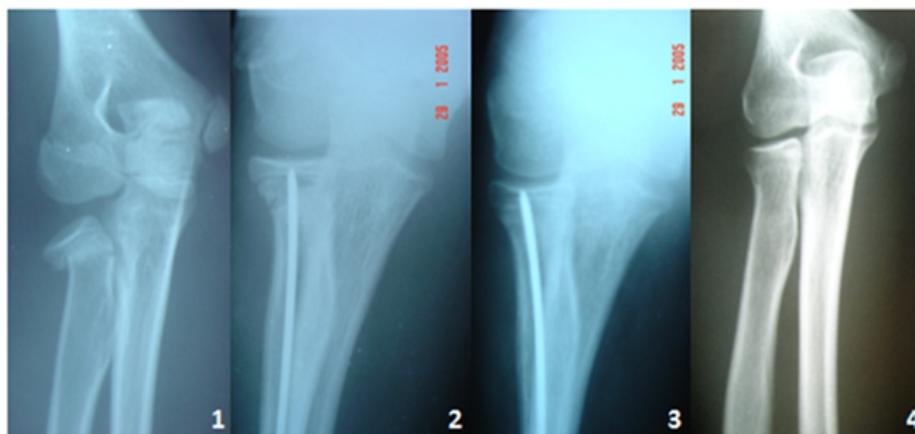


Figure 3

Case 2: 1. Pre op. 2. Post op. 3. Follow up 4. 4 year post op.

casting. They did not use any means of fixation for these fractures involving the neck radius. They reported incidence of secondary loss of reduction in cases with higher degree of displacement.

J.A. Steele, H. Kerr Graham [6] in their study of 36 cases with angulation more than 30°, used reduction technique by leverage with percutaneous K-wire. They too did not use any fixation for the fracture. They also reported re-displacement of reduction.

Tarallo et al. [13] compared the result of fracture neck radius in children treated by closed reduction and percutaneous pin fixation versus closed reduction and fixation by elastic stable intramedullary nailing (ESIN). In his study, he found comparable results in both the techniques.

Methaizeau et al. [7,14] described a technique of reduction as well as fixation of severely tilted neck radius fracture in children by bent intramedullary pin. Later on many authors [15,16,17] have reported good to excellent results by using intramedullary pin for reduction and fixation. Limitation of this technique is that the completely displaced fracture neck radius cannot be reduced by their technique. In our series we achieved the reduction of the fracture by introducing a K-wire in the fracture site and leverage the head

Complications

Complication included – Restricted range of motion (n=3) and Pin tract infection (n=2) which was treated successfully by antibiotics. In our series no case had synostosis, heterotrophic calcification, nerve injury and osteonecrosis of head radius. Results of our series are comparable to other series.

Conclusion & Discussion

Treatment of fracture neck radius in children is based on the degree of displacement, presence of associated injury and age of patient. There is general agreement amongst the surgeons that patients of fracture neck radius with Judet Type I and Type II are to be treated by conservative means by putting the limb in a long arm cast for a period of 3 to 4 weeks [1,12]. There is not much consensus amongst the authors for the treatment of cases with higher degree of tilt/translation. The management of these types of fractures (Judet Type 3,4a and 4b) ranges from closed reduction and plaster immobilization to percutaneous/open reduction and intramedullary fixation/K-wire fixation.

Bryan Hsi Ming Tan et al. [12] reviewed in his study, 108 children with neck radius fractures. He treated the patient based on degree of displacement. Treatment ranged from casting without manipulation, closed reduction and casting, percutaneous K-wire assisted reduction and casting, open reduction and

Figure 4

Case 3: A. Pre op. B Post op. C. 6 weeks post op. D. Functions

Table 1: Judet Classification for radial neck fractures

Judet Classification for radial neck fractures			
Grade	Epiphyseal tilt	Translation	No. of Cases
1	0°	<3mm	-
2	<30°	<50%	-
3	30°-60°	>50%	8
4a	60°-80°	>100%	4
4b	80°-90°	>100%	3

Table 2: Results Table

Rating	Motion	Pain	Disability	No. of Patients	%
Excellent	Normal or near normal	Nil	Nil	10	67
Good	Slight motion limitation	Occasional	Minimal	4	26.3
Fair	Moderate limitation	During Activity	Moderate	1	6.7
Poor	Marked Limitation	During Activity	Severe	0	0

fragment and by doing so we reduce the fracture [7] and then we fixed the fracture by intramedullary K-wire introduced from radial styloid.

With this technique we not only succeeded in reducing completely displaced fractures of the neck radius but also prevented secondary loss of reduction by fixing them with the intramedullary K-wire which maintains the fracture in

reduced position. Results of our series are comparable to other studies with fewer complications.

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