Original Article

Effect of Additional K-wire Fixation in Distal Radial Metaphyseal Fracture Campare to Only Cast Immobilization in Children

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Abstract

Background and Objectives: *Distal metaphyseal fractures of the radius are the most common childhood fractures (20.2%)[1]. The most commonly use treatment modality is closed reduction & immobilization in plaster. Conservative treatment is gold standard in long term follow up of children with distal radius metaphyseal fracture[2]. The aim of this study was to determine the effect of Kirschner wire (K-wire) fixation after closed reduction of radial metaphyseal fractures with high risk of redisplacement in children.*

Materials and methods: *This study was made in the Jahurul Islam Medical College Hospital in the time period of June 2019 & December 2019. In this retrospective study 30 cases were studied in two groups. In group1 (n=15), conisted of 10 boys & 5 girls, with a mean of age 5.8 years (ranges 2.5 to 12.00; SD 2.6 years) only above elbow plaster immobilization was applied following closed reduction and in group 2 (n=15), consisted of 11 boys & 4 girls with a mean age of 7.8 years (range 4.00 to 13.00; SD 2.7 years), K-wire fixation was performed after closed reduction. The implant was choosen which is about 40-45% of the diameter of the cavity. In that case K-wire is a very user friendly, cheaper, and easily can be manipulated in follow up. Stainless steel K-wire of 10-15 cm in length and 1.5-1.8 mm in diameter were choosen most of the cases. In this study we observed radiologically redisplacement between two groups.*

Results: *Among group-1 re-displacement was noted after one week in three patients (20%), for which they were revised with reduction and pinning. Fifteen patients were initially treated by closed reduction and pinning. In these patients we saw no redisplacement after six weeks immobilization in a forearm cast. One patient had pin tract infection. We recommend closed reduction and pinning as a predictable and safe alternative for unstable distal metaphysealradius fractures.*

Conclusion: *Additional fixation with k wire after reduction of distal metaphyseal radial fracture in children minimizes the redisplacement risk and the subsequent risk of a reintervention.*

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Introduction

Distal metaphyseal fractures of the radius are the most common childhood fractures (20.2%)[1]. The most commonly use treatment modality is closed reduction and immobilization in plaster. Conservative treatment is gold standard in long term follow up of children with distal radius metaphyseal fracture[2]. The most important problem in this treatment is to maintain the reduction in a plaster brace; loss of reduction and malunions are frequently seen[3, 4].

Redisplacement within the first two weeks after reductionis reported in 7–34%[5,6,7,8]. In children with significant remaining growth capacity, remodeling may occur. Generally, in children with remaining growth of two or more years, coronal angulations of <10 and sagital angulations of <30 are accepted, expecting that remodeling during growth will correct residual deformity[5,6].

Risk factors for redisplacement include complete initial displacement, presence of an ipsilateral ulna fracture and obliquity of the fracture[9]. Closed reduction and Percutaeneous pinning by K-wire is described as an alternative treatment in these fractures[10,11,12]. K-wires are also commonly called “pins”. Advantages of K-wire fixation includes minimum damage to the vascular supply, less soft tissue injury, shorter operating time & hospital stay. Complications such as neurapraxia, hypertrophic scarring and pin-tract infection have been reported after percutaeous pinning[13,14].

This study compares the redisplacement after close reduction with or without pinning in metaphyseal distal radius fractures.

Materials and methods

We retrospectively studied 30 patients who were treated between June 2019 and December 2019 for a metaphyseal fracture of the distal radius. In the first group, 15 were treated by closed reduction and cast immobilization in an above-elbow cast for four weeks followed by a forearm cast for two weeks. Radiographs were taken one and six weeks after reduction. We measured the angle between the shaft of the radius and the line perpendicular to the physis (fig 1a). After one week redisplaced cases underwent closed reduction and pinning.

The second group consisted of 15 patients who were treated by closed reduction and immediate percutaneous pinning (fig 1b). The decision to perform pinning after reduction depended on the surgeon’s choice and his appreciation of instability. After pinning, patients were placed in a forearm cast for 4 to 6 weeks, depending on their age. Radiographs were taken one week and 4 to 6 weeks after reduction and pinning. The pins were removed at the time of cast removal.

Results

The group 1 consisted of 10 boys and 5 girls, with a mean age of 5.8 years (range 2.5 to 12.00; SD 2.6 years). Mean angulation before reduction was 22.13° (range 14° to 55° ; SD 14.2°). Two were completely displaced. One week after reduction and casting, mean angulation was 8.7° (range 2° to 30°, SD 7.5°). Three patients underwent secondary closed reduction and pinning after one week because of redisplacement (Figure 2) : two had a dorsal angulation of 30°, and one had dorsal displacement of 8 millimeters. Six weeks after reduction and casting, the mean angulation was 18.6° (range 8° to 25°, SD 4.46°)(figure:1). Seven children (23.3%) had a dorsovolar or radioulnar angulation of more than 15° after six weeks (figure-3).

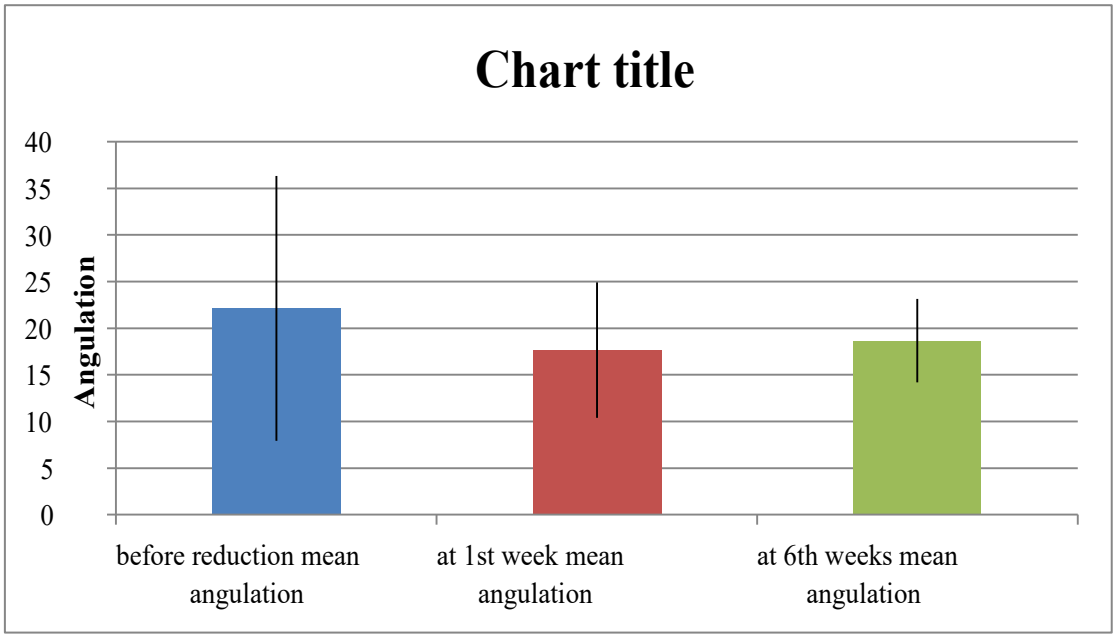

Figure 1 : Angulation of metaphyseal fracture in Ggroup 1 of children in subsequent follow up

The group 2 consisted of 11 boys and 4 girls with a mean age of 7.8 years (range 4.00 to 13.00 ; SD 2.7 years). Two of the metaphyseal fractures were completely displaced. The mean angulation in the other thirteen patients before reduction was 35° (range 25° to 60°, SD 16.9°). The mean angulation was 3.4° (range 1° to 6° ; SD 1.6°) one week after reduction and pinning, and it remained unchanged six weeks after treatment (fig 2). There was one patient with a postoperative pin tract infection that healed with oral antibiotics and wound care. No other complications were seen.

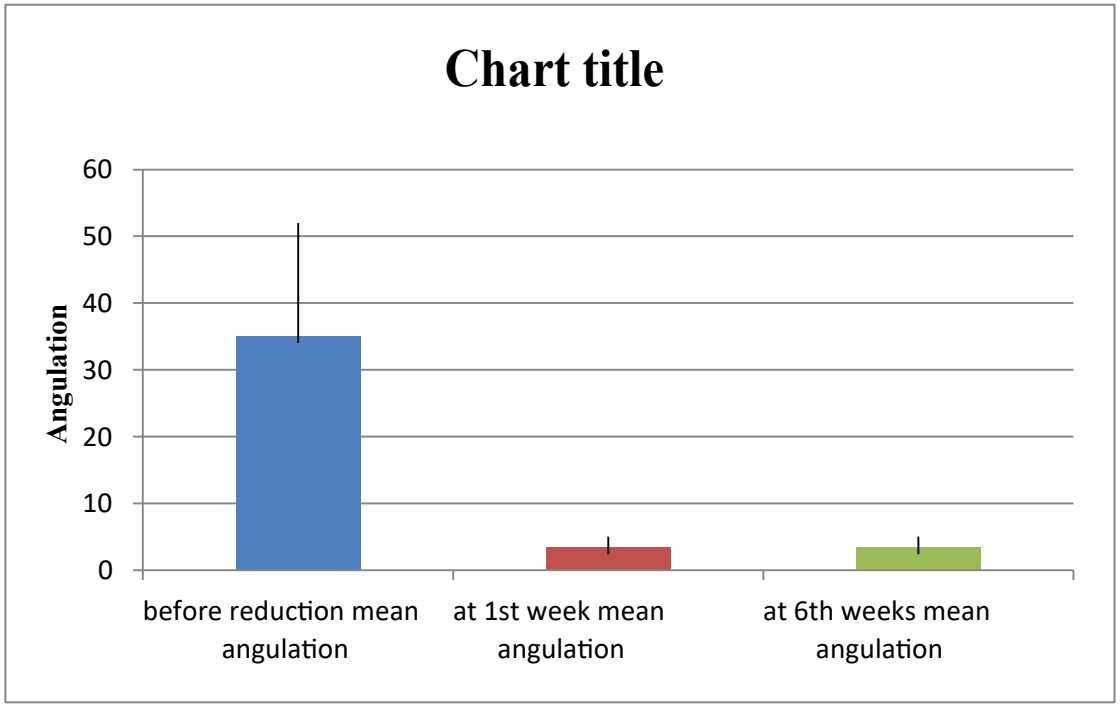

Figure 2 : Angulation of metaphyseal fracture in group 2 of children in subsequent follow up

Image 1: Before reduction

Image 2: After reduction with cast (fracture redisplaced)

Image 3: Percutaeneous pinning under C-ARM

Image 4: Percutaeneous pinning and forearm cast (no fracture displacement)

Discussion

Displaced metaphyseal distal radius fractures in children with a dorsovolar or radioulnar angulation of more than 15° or more than 5 mm of displacement are generally treated by closed reduction and cast immobilization. These fractures have a high tendency to be unstable in the first 24 days after reduction. A properly padded and moulded cast minimizes the risk of redisplacement[15,16]. Residual dorsal angulation has a high potential for remodelling[17,18]. Deformities remodel within an average of 7.5 months in children with an open physis, an angulation of less than 15°, and shortening of less than 1 cm[19].

In this study we see the high rate of redisplacement after reduction. Three out of fifteen (20%) patients showed a marked displacement after reduction and cast immobilisation.Leemput WV and RidderKD (2009)[20]. found displacement eleven out of twenty four (45.8%). After reduction and pinning no redisplacement were seen. Same result was found in Leemput WV. et all(2009) (20) studies. Miller BS, Taylor B., et al(21) (2005) found 39% of the patients loss of initial reduction requiring further intervention, which is similar to our study. Incomparison, there were no cases of loss of reduction in the patients who underwent percutaneous pin fixation[21].

Percutaneous pinning has some advantages. After conventional reduction and cast immobilization, patients have to be followed up radiographically during the first three weeks ; this is not necessary after reduction and pinning. Metaphyseal radial fractures have a higher tendency to redisplaced in a forearm cast compared to an above elbow cast. I therefore always apply an above-elbow cast in fractures treated by reduction without pining, but a simple, better tolerated forearm cast can be applied after pinning.

The study shows that the percutaneous pinning in case of metaphyseal fracture in children is considered in case of displaced fracture, un-displaced fracture after reduction without pinning is not considerable in this study. So it is confidently say that percutaneous pinning in case of distal metaphyseal fracture of radius in children is much better than other methods if patients had been randomly allotted th the two treatment groups.

Conclusion

We conclude that completely displaced fractures of the distal radius in children have a high propensity for redisplacement, despite satisfactory initial reduction. Supplementary percutaneous K-wire fixation resulted in a significantly better maintenance of the alignment of the fracture.

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