Image Assisted Percutaneous Intramedullary Fixation of Radius and Ulna Shaft Fractures in older Children


*Department of Orthopaedics Railway Hospital and Islamic International Medical College, Rawalpindi; ** Rawalpindi Medical College, *** Department of Paediatrics, Pakistan Institute of Medical Sciences, Islamabad.

Abstract

Background: To assess outcome and complications associated with percutaneous Intramedullary Kirschner-wire fixation for fracture of radius and ulna diaphyseal fractures in older children.

Methods: In this prospective study 17 boys and 7 girls, aged 8-14 years, with unstable displaced fractures of shaft of radius and ulna, were enrolled. All the cases were treated with percutaneous Intramedullary Kirchner wire fixation. The cases were followed up for 6 months with evaluation by repeated X-rays to assess the level of union and function which were graded as perfect, good, fair and poor.

Results: All fractures united in acceptable alignment. At final assessment there were 17 perfect, 6 good and 2 fair. There was no case with poor alignment. The fair clinical outcome was higher in children above 10 years of age.

Conclusion: Intramedullary k-wire fixation plus cast stabilization can provide precise and good fracture reduction, maintains stabilization for fracture healing and results in minimal deformity. It is cost effective and facilitates easy removal of implants after treatment.

Key Words: Intramedullary fixation, Percutaneous K-wire fixation.

Introduction

Childhood injuries contribute significant morbidity and mortality in Pakistan.1 Around one-third of boys and girls sustain at least one fracture before the age of 17. Rates are higher among boys than girls, and male incidence rates peak later than those among females. Diaphyseal forearm fractures are common injuries among children, comprising 3-6% of all pediatric fractures. 2 The standard treatment for forearm fractures in children and adolescents is usually conservative, but re-displacement during casting may occur and results in limitation of function. To achieve anatomic reduction, surgical management using plates, intramedullary rods and external fixation are advocated. 4-7

The treatment of pediatric forearm fracture has changed a lot with the advancement of new technologies. Residual deformity especially angulation in any plane > 10 degrees causes restricted movements at radio-ulnar joints. To avoid this complication there is recent trend to treat radius and ulna diaphyseal fractures surgically with intramedullary devices.

In past the treatment of pediatric fracture outcome was poor due to functional disability and malalignment. The introduction of elastic intramedullary nailing has changed the outcome and the opportunity to stabilize the displaced fracture with less invasiveness. The external fixator is a good treatment for open, comminuted, or special distal diaphyseal fractures in older children and adolescents.

Several studies have concentrated on the amount of residual angulations which is allowable and the potential for remodeling. Fractures in patients over 14 years of age are suggested to be treated as for adults. In children less than 10 years of age with distal third fractures, 30° to 40° of angulations was acceptable. 8 It is suggested that no more than 10° of angulations should be allowed in children over the age of ten.9 Upto 20° of angulations in distal third fractures are acceptable in patients less than 14 years.10 Younger the child, the more distal the fracture and the smaller the angulations, the better the result.11,12 Translation of the fracture is the most important risk factor for poor outcome. Two factors increase the chance of redisplacement of forearm fractures in children: the presence of complete displacement and failure to achieve a perfect reduction. 13 There is a failure rate of 60% if the radial fracture is displaced by more than half the diameter of the radius and 68% after complete displacement. Addition of percutaneous Kirschner wires is advised for cases with high risk of redisplacement.12

Patients and Methods

Between August 2010 and June 2012, 17 male and 7 female patients aged 8 to 14 (mean 10 years) underwent intramedullary K wiring using image intensifier plus above elbow cast immobilization for fractures of both the radius and ulna after failure of
conservative treatment. The correction had been lost during casting and attempts at closed reduction under general anesthesia had failed. Unacceptable reduction was defined as angulations of >20° for children aged <10 years, or angulations of >15° for children aged ≥10 years. The mechanism of injury for most patients was fall while playing, with 3 patients having history of road traffic accident.

With the patient under general anesthesia, the radius was wired from distal to proximal through a small oblique hole just proximal to the physis, whereas the ulna was wired from proximal to distal through a hole just distal to the olecranon apophysis. The wire diameter needed to be about two thirds of the diameter of the medullary canal, ranging from 2.5 mm (n=18) to 3.5 mm (n=6). When the wire reached the fracture site, manipulation and traction were performed under image intensifier and then the wire was pushed into the other fragment. In 2 patients, a small additional incision at the fracture site was necessary to reduce the radius. The extramedullary K wires were bented and were embedded in the skin superficially. An above-elbow plaster cast was applied until sufficient bone healing ensued. (Fig 1-4). The patients were followed up every 2 weeks for the first 2 months and then monthly thereafter. At the final follow-up, clinical outcomes were graded.

Results

After a mean follow-up of 24 weeks (range, 12–30), results were excellent in 17 patients, good in 5, and fair in 2. None was poor. The mean operating time was 45 minutes. The mean time to bone union was 8 weeks (range, 6–10). The mean time in the cast was 8 weeks (range, 5–11). The mean time to implant removal was 8 months (range, 6–10). At final assessment there were 17 perfect, 6 good and 2 fair.

Discussion

The treatment of fractures of the forearm diaphyseal bones in children is showing a changing trend. Previously closed reduction and immobilization in plaster cast was recommended for all of these fractures. The criteria of acceptable reduction varies. The maximal acceptable angulations commonly agreed upon was that it should be no greater than 10 degrees. Some authors believe that open reduction and

<table>
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<tr>
<th>Alignment level</th>
<th>No(%)</th>
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<tbody>
<tr>
<td>Perfect: No complaints/pain with strenuous physical activity and/or loss of &lt;10 forearm rotation</td>
<td>17(68)</td>
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<tr>
<td>Good: Mild complaints/pain with strenuous physical activity and/or loss of 11° to 30° rotation</td>
<td>6(24)</td>
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<tr>
<td>Fair: Mild subjective complaints/pain during daily activities and/or loss of 31° to 90° forearm rotation</td>
<td>2(8)</td>
</tr>
<tr>
<td>Poor: All other results</td>
<td>Nil</td>
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internal fixation are rarely necessary recommending it only for older children after failed closed reduction and/or intramedullary splinting. 14-20 Vainionpaa et al reported that results of open reduction and plating of both radius and ulna shafts were perfect. 5 This technique is also associated with soft-tissue dissection, longer scars, increased risk of infection and then the dilemma of a second operation for removal of the plates. 21 Kucukkaya et al and Ozkaya et al in their studies showed that as compared to plating, intramedullary nailing or snugly fitting wires was a safe, effective, and easy to perform procedure in the management of unstable both bone forearm fractures in children. 21,22 Reported complications were skin irritation from the tips of nails and sensory neuropathy. The use of K wires and plaster with minimal effects on wrist motion has been reported by Bombachi et al in a series, in which stable closed reduction could not be maintained otherwise. 23

Conclusion

Intramedullary K wiring for displaced forearm diaphyseal fractures is convenient, effective and safe operation with minimal complications and excellent recovery in terms of functional and radiological outcome.

References