INTRAMEDULLARY KIRCHNER WIRE FIXATION OF UNSTABLE RADIUS-ULNA FRACTURES IN CHILDREN

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ABSTRACT

Objectives: To evaluate the results and outcome of paediatric unstable fractures of radius and ulna treated by Kirchner wire fixation.


Setting: Department of Orthopaedics and Trauma, Khyber Teaching Hospital, Peshawar.

Patients: Children with displaced fractures of both forearm bones, in whom closed manipulation had failed.

Methodology: The children were treated with open reduction and internal fixation of both forearm bones with Kirchner wires (K wires). Under general anesthesia and tourniquet control the fractures were fixed by retrograde method. Patients were followed every month for clinical and radiological union of fracture and for any complications. The K wires were removed after healing of fractures. The patients were assessed for symptoms such as pain, ability to participate in physical activities or sports, and physical examination was done to see range of motion of wrist, elbow and forearm. Grading of the results was done according to modified Price criteria.

Results: The total number of patients was 22. Sixteen were males and six were females. The age range was 6-12 years with an average age of 9.5 years. In most cases the middle third was involved. The average time of surgery was 65 minutes (range 50-95 minutes). The average time for clinical and radiological union was 9.2 weeks. The mean interval between the initial surgery and removal of the K wires was 3.2 months. At final assessment there were 18 excellent, two good and two fair results.

Conclusion: In unstable fractures involving both forearm bones, open reduction and internal fixation (ORIF) with Kirchner wires have excellent results amongst children.

KEY WORDS: Fracture Forearm, Kirchner wires, Open Reduction, Internal Fixation

INTRODUCTION

Fracture of forearm bones in children is extremely common. Most forearm fractures in children can be treated conservatively. Union is rarely a problem. There are a number of important principles that should be followed to achieve the ideal goal of fracture healing without deformity or dysfunction. As long as the physes are open remodeling can occur. The remodeling capacity depends on age, the site of fracture, the direction of angulation and its magnitude. Rotational deformity does not remodel. Unplated fractures can be safely treated in cast. For displaced fractures closed reduction and casting is successful in the majority of cases. However some fractures redisplace, and it becomes essential to reduce and fix them with either percutaneous pins or open reduction. Internal fixation can be achieved either with plates-screws or intramedullary pins. Open reduction and internal fixation can provide accurate and stable fixation, but soft tissue exposure may lead to complications such as infection, neurovascular injuries, scarring and delayed union or non-union. Removal of plates may also be associated with significant complications.

Over the past 30 years intramedullary fixation has become more popular than plates and screws for unstable fractures in the paediatric population. Intra-
medullary fixation is generally considered a safe and effective method, but there are certain complications like compartment syndrome, non-union and refracture after removal of the pins\textsuperscript{12,16,19}.

We treat most closed fractures of forearm in children with conservative methods. For unstable fractures intra-medullary Rush pins or Kirchner wires are used for fixation. This study evaluates the outcome of those unstable forearm fractures in which open reduction and fixation was done with Kirchner wires (K wires).

**PATIENTS & METHODS**

From July 2004 to May 2007, 22 children with displaced fractures of both bones of the forearm in whom closed manipulation had failed, were treated with open reduction and internal fixation of both forearm bones with Kirchner wires (K wires).

Informed consent was taken from all the patients. Under general anesthesia and tourniquet control radius was fixed first through a small dorsal incision. A Kirchner wire of appropriate thickness was first drilled down with flexed and ulnarly deviated wrist so that the wire exit on the dorsolateral side of the radius. The fracture was than reduced and the wire driven up to the radial head. Similarly ulna was fixed by first driving the K wire up to the olecranon process and after reduction of the fracture down to the styloid process. After checking stability both wounds were closed and the forearm put in a long plaster slab for 3-4 weeks. Patients were followed every month for clinical and radiological union of fracture and for any complications. The K wires were removed after healing of the fractures. The cases were followed up for six months. They were assessed for symptoms such as pain, ability to participate in physical activities or sports, and physical examination was done to see the range of motion of the wrist, elbow and the forearm. Angulation was measured on radiographs. The results were graded according to the modified Price et al criteria\textsuperscript{20} (Table I).

**RESULTS**

The total number of patients was 22. Sixteen were males and six were females. The age range was 6-12 years with an average age of 9.5 years. In most cases the middle third was involved (Table II). The average time of surgery was 65 minutes (range 50-95 minutes). All the patients completed at least 6 months follow up.

The average time for clinical and radiological union was 9.2 weeks. Two patients had a superficial wound infection which resolved with dressings and antibiotics. Six patients had problem with impingement of K wires. Two patients had transient weakness of thumb extensors. The mean interval between the initial surgery and removal of the K wires was 3.2 months. The average operation time for removal of the wires was 22 minutes. There was no incidence of refracture after removal of

### Table I. Grading of results according to Price et al\textsuperscript{20} criteria

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Symptoms</th>
<th>Loss of Forearm Rotation</th>
</tr>
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<tbody>
<tr>
<td>Excellent</td>
<td>No complaints with strenuous activity</td>
<td>&lt; 15(^\circ)</td>
</tr>
<tr>
<td>Good</td>
<td>Mild complaints with strenuous activity</td>
<td>15-30(^\circ)</td>
</tr>
<tr>
<td>Fair</td>
<td>Mild complaints with daily activities</td>
<td>30-90(^\circ)</td>
</tr>
<tr>
<td>Poor</td>
<td>All other results</td>
<td>&gt; 90(^\circ)</td>
</tr>
</tbody>
</table>

### Table II. Demography of 22 patients

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>16 (72.8%)</td>
</tr>
<tr>
<td>Female</td>
<td>6 (27.2%)</td>
</tr>
<tr>
<td><strong>Mean age</strong></td>
<td>9.5 years</td>
</tr>
<tr>
<td><strong>Site of fracture</strong></td>
<td></td>
</tr>
<tr>
<td>Proximal third</td>
<td>2</td>
</tr>
<tr>
<td>Distal third</td>
<td>2</td>
</tr>
<tr>
<td>Middle third</td>
<td>18</td>
</tr>
</tbody>
</table>

### Table III. Outcome of K Wire Fixation

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>18</td>
<td>81.8%</td>
</tr>
<tr>
<td>Good</td>
<td>2</td>
<td>9.1%</td>
</tr>
<tr>
<td>Fair</td>
<td>2</td>
<td>9.1%</td>
</tr>
</tbody>
</table>
wires. At final assessment the range of motion was recorded for wrist, elbow and forearm. There was greater loss of pronation than supination. The wrist movements were more affected than elbow. The results were excellent in 18 cases, good in two and fair in two cases as depicted in Table III.

**DISCUSSION**

The aim of the treatment of any fracture should be to promote union of the fracture with restoration of maximal function. Most paediatric fractures can be treated by conservative methods with excellent results. Over 90% of forearm fractures in children can be safely treated with cast immobilization, but some fractures are unstable or redisplacement may occur in cast, requiring fixation either with closed or open methods. Closed reduction of paediatric forearm fractures under image intensifier and percutaneous fixation is preferred, when the facilities are available. Open reduction and internal fixation with plates and screws has been used in children, but the complication rates are high and there are added risks related to the removal of the implants.

Over the past 30 years intramedullary fixation is gaining popularity due to easy surgical technique, good functional results and decreased trauma during the removal of the wires. All our fractures united within the expected time, though union is usually not a problem. Even open fractures have been found to heal well. Smith et al and Yuan et al reported union in all of their patients. Ogonda et al had only one delayed union and one non union of ulna in his series. Mittal et al had reported a case of refracture of ulna with elastic nail in-situ. We also feel that stiff K wires are better than elastic nails for two reasons, the reduction is stable due to contour mismatch between the wire and bone and the wires can be easily driven with a drill. There were some fears of epiphyseal growth arrest at distal radius or olecranon apophyses in past. Recent studies have shown no evidence of growth disturbance. The good to excellent functional results in over 90% of our patients make K wires a good choice for forearm fractures.

**CONCLUSION**

Unstable fractures of both forearm bones in children can be internally fixed with K wires with excellent to good functional results.

**REFERENCES**


