

# COMPARISON OF IMAGE ASSISTED PERCUTANEOUS INTRAMEDULLARY KIRSCHNER WIRE STENTING WITH CLOSED REDUCTION FOR FRACTURES OF RADIUS AND ULNA IN CHILDREN

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## ABSTRACT

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| <i>Objective</i>                     | <i>To evaluate the results of image assisted percutaneous intramedullary Kirschner wire stenting and closed reduction and plaster casting for displaced simple fractures of radius and ulna in children.</i>  |
| <i>Study design</i>                  | <i>Comparative study.</i>   |
| <i>Place &amp; Duration of study</i> | <i>Department of orthopedics, Combined Military Hospital (CMH) Peshawar between June 2005 and December 2007.</i>  |
| <i>Methodology</i>                   | <i>Forty- six children of both sexes, between the ages of 4 to 11 years with simple unilateral fractures of both forearm bones were included. Patients were divided into two groups. In group I, 24 children (Males n=15, Females n=9) were selected for treatment by image assisted closed reduction and percutaneous snugly fitting K-wire intramedullary fixation (closed reduction and internal fixation / CRIF) followed by triangular bandagae support over the dressings. In group II 22 children (Males n=13, Females n=9) were treated with image assisted closed reduction followed by POP support for the full duration (average 6 weeks) till early fracture union was achieved (closed reduction without fixation / CRWF). Selection of the patients for the two groups was done by randomising the patients with closed envelope method based on double blind technique. Results of both methods were compared.</i> |
| <i>Results</i>                       | <i>At a mean follow-up of 6 months, all the patients of group I displayed good functional results with an excellent recovery in the range of movements of radioulnar joints and with a notably less incidence of any residual problems. None had any angulations or nonunion, premature epiphyseal closure or residual pain. In group II residual angulations of 6 to 12 degrees was encountered in 6 children and 6 had rotational malunions. Three patients developed cross synostosis between radius and ulna. Two children had loss of 10 degrees of extension of elbow (FFD 10 degrees). Moreover the average time to regain elbow range of movements / function in these children, was found to be longer.</i>  |
| <i>Conclusions</i>                   | <i>Image assisted closed reduction of displaced fractures of radius and ulna in children coupled with k wire intramedullary stenting was found to be a far superior option for treatment of displaced closed fractures of radius and ulna in children as compared with closed reduction of these fractures with plaster casting only.</i>   |
| <i>Key words</i>                     | <i>Fractures in children, Image assisted closed reduction, K wire fixation.</i>   |

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## INTRODUCTION:

Fracture of the forearm bones is one of the most common fractures encountered in children all over the world.<sup>1,2,3</sup> These injuries are managed in majority of centres, on a conservative note with closed reduction and splintage.<sup>4</sup> Perfect anatomical reduction

is however not always catered for religiously as remodelling of bone growth in children is banked upon for the correction of any residual deformity.<sup>5</sup> However Sarmiento et al, Matthews et al and Tarr and Garfinkel,<sup>6,7,8</sup> have shown with convincing evidence that except in very young children, intrafragmental residual angulation greater than 10 degrees in forearm bones fractures, must be corrected since remodelling is unpredictable. The same was substantiated by the results of the studies of Daruwalla and Hogstrom.<sup>9,10</sup>

Angulation has been shown to badly affect the range of pronation and supination of the forearm.<sup>10,11</sup> Nilsson, Price, Younger and Fuller showed with unrefutable evidence that the loss in range of pronation and supination is directly proportional to the degree of rotational malunion.<sup>12-15</sup> Many authors also, in order to avoid malunions in displaced forearm bones fractures in children, have advocated various implant usage such as dynamic compression plates, intramedullary rods, elastic nails and external fixation devices as dictated by the fracture dynamics.<sup>16-22</sup>

In this study we present our experience of internal fixation using K wire under image intensifier versus closed reduction with POP application of forearm fractures in children.

### METHODOLOGY:

This comparative study was conducted at the Department of Orthopaedics at CMH Peshawar between June 2005 and December 2007. Forty-six children of both sexes between the ages of 4 to 11 years were the cohort. They presented with a simple unilaterally displaced, recent fracture of the diaphysis of both bones of the forearm. The mean initial angulation was 11-19 degrees in the lateral plane and 9-13 degrees in the anteroposterior plane for radius and 12-15 degrees in lateral and 11-13 degrees in anteroposterior plane for ulna.

In patients of group I (n=24) closed reduction of displaced fractures was carried out by manipulation under image intensifier followed by maintenance of reduction with snugly fitting intramedullary K wires. Only triangular bandage support was given over the dressings. Group II patients (n=22) were managed with image assisted simple closed manipulation followed by POP casting. All the patients were followed up for 6 months and at the end of the predetermined period inferences were drawn.

Assesment crieterion included return of good function, presence or absence of residual pain, incidence of cross synostosis, malunion, premature

epiphyseal closure and residual angulation or deformity.

**Technique:** An informed written consent was obtained. Procedure was done under general anaesthesia. The injured limb was positioned on a radiolucent table and closed manipulation of the fractures was carried out under image intensifier. In group I patients we performed additional stabilization of the fractures with percutaneously introduced intramedullary K wires under image-intensifier control. Wires of 1.6 to 3mm were used with at least 85% apposition of the fractured bone ends in both AP and lateral views (this was deemed a procedural necessity before proceeding to percutaneous intramedullary K wiring). Diameter of the K wire selected for intramedullary stenting was determined based on the "on table assessment" of the medullary cavity, so as to obtain a snug fit.

The wire was inserted through lateral or the distal dorsal cortex of the radial styloid for fractures of the radius proximal to the epiphysis and through the tip of the olecranon for fractures of the ulna. As both bones of the forearm were fractured, the radius was reduced and wire stented first. If the ulna had then reduced spontaneously then its wire stenting was performed, otherwise ulna manipulation was done and then fixed with intramedullary K wire. The K wires were passed across the fracture site as far as the distal metaphysis taking care not to breach its growth plate. All this was done under direct vision using the image intensifier. The entry point on the skin was enlarged and the wire cut and bent to prevent migration. The limb was then supported with triangular bandage over the dressings at wire entry points. The wires were removed at an average of four to six weeks post operatively, once radiographic evidence of new bone at fracture site was seen. Group II patients were treated similarly with image assisted closed reduction but the only support offered was the plaster casting.

### RESULTS:

At a follow-up of 6 months all those patients of group I whose fractures were treated with post manipulation percutaneous K wire fixation, displayed good functional results with an excellent recovery in the range of movements of radioulnar joints, with a notably less incidence of any residual problems. None had any angulations or nonunion, premature epiphyseal closure or residual pain.

In group II patients who were treated with closed reduction and plasters casting only, residual angulations of 6 to 12 degrees were encountered

angulations of 6 to 12 degrees were encountered in six children and six had rotational malunions. Three patients developed cross synostosis between radius and ulna. Two children had a fixed flexion deformity of elbow of 10 degrees. The average time to regain function in these children was also long as compared to those treated by CRIF with K wires (table I).

### DISCUSSION:

The treatment of fractures of the forearm bones in children is showing a changing trend. In the 1960s closed reduction and immobilization in plaster was all that was recommended for all of these fractures,<sup>5</sup> and the criteria of acceptable reduction varied among various authors.<sup>10-12,16</sup> The maximal acceptable angulations commonly agreed upon was that it should be no greater than 10 degrees.<sup>13-15</sup> Some authors believe that open reduction and internal fixation are rarely necessary recommending it only for older children after failed closed reduction and/or intramedullary splinting.<sup>10,13</sup> Vainionpaa et al reported that results of open reduction and plating of both radius and ulna shafts were excellent.<sup>17</sup> However 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.<sup>18</sup>

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.<sup>18,20</sup> They reported few complications, but these included 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.<sup>21</sup> All had good results without complications. Schranz et al reported their experience with external fixation, but its use is rare and limited to compound fractures.<sup>22</sup>

Intramedullary K wiring for displaced forearm diaphyseal fractures was found to be a convenient, effective and safe operation with minimal complications and excellent recovery in terms of quality of life, cosmesis avoidance of rotational deformities, avoidance of a re-operation as seen with plates, good return of function, little or no residual pain, ease of making a grip with good strength along with an excellent radiographic evidence of healing of fractured radius and ulna.

### CONCLUSION:

In displaced simple fractures of both radius and ulna in children, image assisted closed reduction of the fractures coupled with percutaneous snugly fitting intramedullary K wire stabilization is superior to simple closed reduction and casting.

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**Table I: Comparison Between the Outcome of The two Methods of Treatment of Displaced Forearm Fractures**

| Method of treatment                | CRIF(Group I) | CRWF(Group II) |
|------------------------------------|---------------|----------------|
| Number of patients                 | 24            | 22             |
| Good return of function            | 23            | 12             |
| Residual pain                      | 2             | 7              |
| Period of immobilisation           | 4-6 weeks     | 6-8 weeks      |
| Cross synostosis                   | nil           | 3              |
| Malunion                           | nil           | 6              |
| Residual angulation                | nil           | 6              |
| Non union                          | nil           | 3              |
| Fixed flexion deformities of elbow | nil           | nil            |
| Time to regain function (weeks)    | 6- 8          | 7- 13 weeks    |

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