

# MODIFIED KAPANDJI WIRING TECHNIQUE FOR UNSTABLE FRACTURES OF DISTAL END OF RADIUS

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## ABSTRACT

*Objective* To assess the results of modified Kapandji wiring technique in unstable Colles' fractures.

*Study design* Descriptive study

*Place & Duration of study* At Ziauddin Hospital Karachi, from September 2005 to August 2006.

*Patients and Methods* A total of one hundred and eight five adult patients presented in our centre with fractures of lower third of radius during the study period. Of these only twenty eight adult patients were included who had unstable fractures of the distal end of radius.

*Results* There were nine male and nineteen female patients. Average age was 51 years. Three to four Kirschner-wires were used to stabilize the fracture. According to AO classification system thirteen were type A2, nine were type A3, and six type C1 fractures. X rays revealed good anatomical reconstruction consistent with a good wrist function. There was a much shorter period of rehabilitation as compared with plaster of Paris casts. No major complication occurred with this technique.

*Conclusions* For unstable fractures of the lower end of radius, intrafocal Kapandji wiring is a safe and successful method for achieving good results. It is easy to learn and perform. The device employed has a low cost.

*Key words* Kapandji wiring technique, Radius-fractures, Colles' fracture.

## INTRODUCTION:

The treatment of displaced Colles' type fractures of the distal part of the radius remains a challenge.<sup>1</sup> The technique of introducing the Kirschner (K) wires through the styloid process was first described in 1913 by Lambotte.<sup>2</sup> Since then numerous studies have shown good to very good results after Kirschner wire osteosynthesis of distal radial fractures and have become an acceptable procedure for the treatment of fractures

For Surgical treatment of the unstable Colles' fracture many authors have modified Kapandji technique, some using one or two extra wires either intrafocal or through the styloid process and few using non threaded wires.<sup>4-8</sup> Basic benefit being more stable fracture than conservative casts. It also allows early range of motion. This method is preferred in elderly patients with reduced bone quality.<sup>4</sup> The technique is simple and complications are few.<sup>5</sup> There is a strong correlation between functional outcome and both dorsal angle and radial length at union. There are various classifications used by different surgeons at different times to classify Colles' fracture. Of these some commonly liked and used are AO Classification,<sup>9</sup> Frykman classification and Universal classification of distal radius fractures.<sup>10,11</sup>

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The goal of this study was to assess the results of modified intrafocal wiring method of Kapandji and to compare it with other techniques.

**PATIENTS AND METHODS:**

The study was conducted from September 2005 to August 2006 at orthopedics department of Ziauddin Medical University Karachi. Total of one hundred and eight five adult patients presented in our centre with fractures of lower third of radius. Of these only twenty eight adult patients were included in our study, fulfilling the criteria - Fractures with volar angulations of more than 20 degrees, marked comminution of the dorsal cortex and radial shortening of more than 10 mm on x ray - antero posterior and lateral views of the wrist (table 1).

Other patients not falling into the above description were managed either conservatively in plaster of Paris cast after close reduction or treated surgically with open reduction and internal fixation using volar or dorsal plates. Patients selected from the above criteria were managed again by closed reduction, if failed; they were then treated by modified Kapandji wiring method.

In this approach under general anesthesia, three to four K wires were passed through the fracture line and crossed into the opposite cortex, using the image intensifier. Plaster of Paris cast was then applied below the elbow. Hand was elevated in a cuff and collar sling. Post operative radiographic results were assessed on day 1, second week and sixth post operative week, for satisfactory reduction. It was also checked if any loss of reduction or height of the radial styloid process occurred and to see the progress of callus formation.

Oral cefuroxime was given for three to five days, depending on the general health and quality of skin of the patient. Plaster of Paris cast was removed on third or fourth week and range of motion exercises encouraged. K-wires removed in sixth post operative week under local anesthetic. Patients were advised an exercise plan in physiotherapy department, stressing initially more on the range of motion of wrist joint, metacarpo phalayngeal joints, proximal and distal inter phalayngeal joints .Once achieved then muscle strengthening exercises of the wrist and hand muscles started. Along with this a home plan was also given for exercises.

**RESULTS :**

Twenty eight patients were included in this series. There were nine male and nineteen female patients. Average age of the patients was 51 years (range, twenty eight to seventy two years). In twenty two patients three K-wires and in six patients four K-wires were used. According to AO classification system thirteen were type A2, nine were type A3, and six of type C1 fractures.

X rays revealed good anatomical reconstruction of the distal radius. The loss of the range of motion was minimal and consistent with a good wrist function. There was a much

shorter period of rehabilitation and earlier recovery of the hand function, than the patients treated conservatively in plaster of Paris casts. A minor loss of reduction by dorsal impaction was observed in the follow-up evaluation, but it had not much functional relevance.

K-wire superficial infection was the major complication faced in four patients in this study. They were treated with local dressings and oral antibiotic therapy. Temporary paraesthesia/nerve irritation persisting from two days to twenty weeks was also observed in four patients, though none had a permanent deficit. None of our patients had tendon injury or rupture, which are typical complication, especially injury of the extensor pollicis longus tendon (table 2).

**DISCUSSION:**

Kapandji wiring technique can be performed as a primary treatment for distal radial fractures. The indication for Kirschner wire osteosynthesis is secondary displacement of a fracture that was initially reduced and held in a plaster cast or the fractures that cannot be stabilized in plaster cast. Kapandji technique is one of the better ways of treating unstable Colles' fractures. It results in decrease in time spent in plaster cast, stability of fracture fragments and early rehabilitation with good post operative range of motion.

Table 1: Criteria for distal radial fracture instability	
1	> 10 degrees loss of angulation.
2	> 5 mm of axial radial shortening.
3	> 2 mm of articular incongruity.
4	Comminution of one cortex across the mid axial line on lateral X-ray.
5	Comminution of both dorsal and palmar cortices.
6	An irreducible fracture.
7	Loss of reduction.

Table 2: Complications	
Complications	Number of Patients n=28
Temporary paraesthesia / nerve irritation	4 (14.2%)
Kirschner wire superficial infections	4(14.2%)
Wire migration	2 (7%)
Swelling	2 (7%)
Reflex sympathetic dystrophy	3 (10.7%)

In a study by Earnshaw et al 25% of the patients had a re-adjustment of the fracture while the limb was in plaster cast and required operative stabilization. The initial reduction was maintained for more than five weeks in only 29% of the patients.<sup>12</sup> Kirschner wire osteosynthesis is mainly indicated for Colles's fractures located close to the joint (AO types A2 and A3) and for certain AO type C fractures as well, which was the basis of choice of cases in our study. There are studies done by different authors to compare the stability of Kapandji wiring method with the conventional K-wiring technique of Willenegger, for the fractures of distal radius, in a biomechanical model. According to Kapandji, dorsal K-wiring, using different angles of the K-wire, (parallel and diagonal alignment of the K-wires) showed a higher reactive torque and stiffness especially when applied at a smaller angle to the axis of the radius.<sup>13</sup>

Fritz et al. reported application of Kirschner wire in elderly patients.<sup>4</sup> Clancey reported good results after Kirschner wire osteosynthesis, but found better results in younger patients than in elderly ones,<sup>2</sup> as found in our series. Several studies including our own, have shown that there is little correlation between the radiological outcome and functional outcome in older patients.<sup>1,2,4</sup> Patients with poor signs of healing on radiographs had little pain and good clinical range of motion. A number of studies have shown very good results of original Kapandji method.<sup>15-17</sup> The advantage of this method is that it creates a dynamic osteosynthesis as opposed to the purely static fixation achieved by the Willenegger technique.<sup>4,15</sup> The intrafocal insertion of the Kirschner wires improves dorsal buttressing, which in turn counteracts the tendency towards recurrent dorsal tilting. The insertion of wires into the fracture gap reduces the time required for imaging.<sup>1</sup> Firtz et al modifies this method by putting one or two Kirschner wires into the styloid process,<sup>4</sup> as is the case in six of our patients with very unstable fractures.

Azzopardi et al did a study for unstable, extra-articular fractures of the distal radius to compare the outcome of immobilizing in a cast alone with that using supplementary percutaneous pinning.<sup>6</sup> They concluded that patients treated by percutaneous wires had a statistically significant improvement in dorsal angulations (mean 7), radial length (mean 3 mm) and radial inclination (mean 3 mm) at one year.<sup>18</sup>

Kreder et al did a trial study to show the results of indirect reduction and percutaneous fixation versus open reduction and internal fixation for displaced intra articular fractures of the distal radius.<sup>7</sup> Severely comminuted AO type-C3 intra articular fractures of the distal end of the radius are difficult to treat. Failure to achieve and maintain nearly anatomic restoration can result in pain, instability, and poor function. There was no statistically significant difference in the radiological restoration of anatomical features or the range of movement between both the groups. During the period of two years, patients who underwent indirect reduction and percutaneous fixation had a more rapid return of function and a better functional outcome than those who underwent open

reduction and internal fixation. Based on the results they recommend no to use the dorsal plates for treating complex intra-articular fractures of the distal radius.

One of the important advantages of the modified Kapandji wiring is the shorter period of immobilization in a plaster cast, compared to the time spends in plaster cast for other methods of Kirschner wire fixation. Kapandji even reported very good anatomical and functional results without any post operative splinting.<sup>15</sup> However in our series we gave support with plaster cast to our patients for 3-4 weeks, depending upon the age and quality of bone. The complication rates in our study are comparable to most of the other studies like that of Strohm et al, except for reflex sympathetic dystrophy which was as high as 10.7% in our study in comparison to 3% in their series.

Colles' fracture patients who received physiotherapy immediately following cast removal were compared with patients who received no active therapy following cast removal in a prospective randomized study by Watt CF et al.<sup>18</sup> Patients who attended physiotherapy achieved significantly greater increases in wrist extension and grip strength after 6 weeks compared to patients who received no active therapy. In our series plaster cast immobilization was shorter and physiotherapy started much earlier than the conservative treatment. We also agree with their observation as same is the case in our series as patients achieved normal range of motion and strength earlier with physiotherapy.. There are certain established advantages of Kapandji wiring over conventional Kirschner wiring and close manipulations in plaster casts, some of which are early rehabilitation, good radial height maintenance, good volar tilt angle and of course decrease x-ray exposure. Most importantly it is easy to learn and perform and the device employed has a low cost.

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