Functional Outcome of Displaced Extraarticular Distal Radius Fracture by Kapandji Intrafocal Fixation

RC Dirgha Raj*, Adhikari BR**, Sherchan B***, Khadka T****

*Associate professor, ** Assistant professor, *** Tutor ****Resident Department of Orthopaedics, NAMS, Bir Hospital, Kathmandu, Nepal

ABSTRACT

INTRODUCTION: Intrafocal pinning of distal radius fractures was described first by Kapandji in 1976. It is indicated in unstable distal radius fractures without significant intra-articular displacement which provides the surgeon with a simple and effective, minimally invasive method of improving alignment and stability of these unstable fractures.

METHODS: Thirty Patients attending ER/OPD of Bir Hospital, NAMS with distal radius fracture who meets the criteria were enrolled in the study. Prospective interventional study during the periods of 8 months (Jan, 2011 to Aug, 2011) The operation was performed either under regional anaesthesia (brachial plexus block) or general anesthesia. Reduction was done under image intensifier guidance and intrafocal pinning was done with 2 K wires as described by Kapandji. Above elbow slab was applied for 3 weeks. K wires were removed at 6th week. Follow up done with radiological and functional evaluation on 1st week, 3rd week, 6th week, 12th week and 6th month.

RESULTS: Among the 30 cases, 24(80%) patients were female and 6(20%) were male. The female /male ratio was 5:1. Majority (83%) of patient sustained injury due to trivial trauma. All fractures united by 6 weeks. In final follow up at 6th month, assessment of range of motion was showed good range of motion. Functional evaluation was done with Gartland & Werley's Demerit point system (modified by Sarmiento et al). According to the score, there were 28 patients (93%) in either excellent or good group and rest 2 patients (7%) had fair result. None of the patient had poor results.

CONCLUSION: Kapandji intrafocal pinning provides a stable fixation and good functional outcome in extraarticular distal radius fractures. Complications are relatively few.

KEY WORDS: Kapandji Technique- intrafocal pinning- distal radius fracture

INTRODUCTION

Fractures of the distal radius are the most common fractures of the upper extremity representing 17% of all fractures treated each year. Although distal radius fractures are seen most commonly among female over 40 years, young adults make a significant portion of the cases. In females, the incidence rises sharply after the age of 40 from approximately 36.8/10000 to 115/10000 at the age of 70. The sharpest increase in incidence occurs in elderly females; has been linked to estrogen withdrawal and decreased bone density.

About 90% of all distal radius fractures are caused by compressive loading on the dorsiflexed wrist. Treatment of displaced distal radius fracture has changed over period of time. In the past, closed reduction with cast immobilization was considered the treatment of choice. However conventional method of reduction and cast immobilization often result in unsatisfactory anatomical and functional outcomes with varying degree of deformity and disability. The
stability of fracture is the most important factor to be considered when determining treatment. Recent studies have highlighted the importance of achieving and maintaining near anatomical reduction and stability, when treating distal radius fracture. Guidelines for an acceptable reduction are articular step off less than 2mm, radial shortening less than 5mm and dorsal tilt less than 10 degrees.

In last 20 years, more sophisticated internal & external fixation techniques and devices for the treatment of displaced fractures of distal end of radius have been developed. In 1976, Kapandji described a very simple and minimally invasive method of Kirschner wire osteosynthesis in which the wires are inserted from the dorsal aspect “intrafocally”- i.e. into the fracture gap. The technique was modified further and good results were obtained. The initial technique was described using two pins for unstable articular fractures in young adults. The indications since then have been expanded to include fractures with minimally displaced intraarticular fragments and elderly patients.³

METHODS

This was a prospective interventional study done at Department of Orthopaedics, Bir hospital. Total 35 cases were studied. Out of them 5 cases were lost during the follow up, only 30 cases were included for the study. Patients of age ranging from 30-75 years with closed extra articular distal radius fractures (Frykman’s type I and II) were included in this study.

Surgical procedure

Patients were positioned supine in operation table. Preoperative intravenous antibiotic was given. Patient was preferably plan for day care surgery using brachial plexus block or GA. Reduction was performed with traction and counter traction under image intensifier guidance. Stab incision was made; 2 mm K wire directly inserted into the fracture gap, initially directed at 90 degrees. The fracture was aligned, and the K wire anchored at an angle of 45 degrees towards the opposite cortex. The maneuver was repeated for the lateral part of the fracture gap with second K wire. K wires were bent & cut just above the skin. Above elbow slab was applied. Postoperative check x-ray was taken and patients were discharged home next day.

Follow up was done at 1st, 3rd, 6th weeks, 3 and 6 months of post operative period. After 3 weeks of immobilization; above elbow plaster slab was removed followed by physiotherapy & mobilization. K wires were removed after 6 weeks and called for subsequent follow upto 6 months for fracture union, functional and anatomical evaluation.

Functional Evaluation

Demerit point system of Gartland and Werley’s with Sarmiento et al. modification (functional evaluation)⁸

Excellent - 0-2
Good - 3-8
Fair - 9-20
Poor - 20 and above

Anatomical Evaluation:
Radial Tilt (RT), Volar Tilt (VT), Radial Length (RL)

Radigraph of opposite wrist were used for normal values. If such radiograph not available, normal average values RT =23°, VT=11°, RL=12mm were used.¹⁰

Figure 1. Radiological Measurements

(Reproduced from Campbell’s Operative Orthopaedics, 11th edition; 2008)
Statistical method

The selected data were analyzed with the help of SPSS (Statistical package for social science) windows program 16.5 version. The student t-test quantitative variables were used and values of P < 0.05 were considered significant with confidence level of 95% throughout the study.

RESULTS

Among 30 patients, 12 patients (40%) were in the age group 40-50 years, 10 patients (33%) in the age group 51-60 years, 5 patients (17%) in the age group 61-70 years and 3 patients (10%) in the age group 71-75 years. The mean age was 54.77 years and standard deviation was 10.731.

There were 24 females (80%) and 6 males (20%). 19 patients (63%) had fracture involving left wrist and remaining 11 patients (37%) had fracture involving right wrist.

The mode of injury in 25 patients (83%) was trivial fall, in 4 patients (14%) was road traffic accident and 1 (3%) patient was injured due to domestic violence.

Clinical and radiological sign of union was noted in 2nd follow up onwards. In 7 cases (23%), sign of union of fracture was observed at 3rd week and all 30 cases, (100%) fracture united by 6th week.

Pain was assessed in injured side using Visual Analogue Score (VAS) at 1st week, 3rd week, 6th week, 12th week and at 6th month. The mean value was 3.63, 2.10, 1.30, 0.90 and 0.63 respectively; which revealed VAS improved in subsequent follow up and insignificant amount of pain was present at final follow up.

Range of Motion

The mean wrist dorsiflexion at 6th week, 12th week and 6th month were 35°, 40° and 75° respectively. At 6th month, mean dorsiflexion of injured wrist was similar to dorsiflexion of uninjured wrist. P-value >0.05.

Palmar flexion showed gradual improvement of injured wrist from 30°, 65°, respectively on 6th and 12th weeks follow up period. On final follow up at 6th month, the mean value was 75° which was comparable to that of mean palmar flexion (80°) of uninjured wrist, (p-value being 1.0.)

The mean supination at 6th week, 12th week and 6th month was 70°, 70° and 75° respectively. The mean supination measured at final follow up was comparable to mean supination of unaffected wrist (80°) & the p value was more than 0.05.

The mean pronation of injured wrist at 6th week, 12th week and 6th month was 65°, 75° and 80° respectively. There was gradual improvement in pronation over the period and final value was comparable to that of uninjured side (80°). P-value >0.05.

The serial measurements of radial deviation during the follow up period revealed gradual increase in radial deviation and the mean radial deviation at final follow up (15°) was comparable to that of uninjured side (15°). P-value >0.05.

The mean ulnar deviation at 6th week, 12th week and 6th month was 20°, 25° and 30° respectively. The mean ulnar deviation of final follow up was comparable to that of uninjured side which was 35°. P-value > 0.05.

Radiographic Measurements

The mean radial height on 1st, 3rd, 6th and 12th weeks and 6th months post operatively was 9.43mm, 9.33mm, 9.23mm, 9.23mm and 9.23mm respectively. Radial height of uninjured wrist was 10.53mm. (P-value > 0.05).
Radial inclination (Mean value) on 1st, 3rd, 6th and, 12th weeks and 6th month was 20°, 21°, 21°, 21° and 22° respectively. Radial inclination (Mean value) of uninjured side was 23° (P-value > 0.05.)

The mean volar tilt was 6°, 6°, 6°, 6° and 7° of 1st, 3rd, 6th and 12th weeks and 6th month respectively. The mean volar tilt of uninjured wrist was 8° (P value > 0.05.)

Functional evaluation was done at 6th week, 12th week and 6th month according to Gartland and Werley’s Demerit Point System (modified by Sarmiento et al). At 6th week, there were 28 patients who scored good results and 2 scored fair result. None of the patient scored excellent or poor result in this periods. At 12th week, 3 patients had excellent, 25 patients had good and 2 had fair results. None of the patient had poor result. At final follow up at 6th month, 9 patients had excellent, 19 patients had good and rest 2 patients had fair results. Overall at final follow up 93.33% patients had either excellent or good results, only 2 patients had pin tract infection, which were resolved with antibiotic therapy and after pin removal. One patient had reflex symphathetic dystrophy, which was resolved with physiotherapy

**DISCUSSION**

Patient with fractures of distal radius constitute major portion of cases attending orthopaedic OPD / emergency for treatment. While anatomical reduction can usually be achieved by closed manipulation in distal radius fractures, there is still no agreement regarding the most appropriate way of maintaining reduction. To achieve good reduction and maintain the reduction throughout immobilization periods in distal radius fracture is difficult due to its anatomical peculiarity. Jack C. Hughstone, Columbus Georgia emphasized on deforming forces of muscles like pronator quadrates, brachioradialis and weight of hand itself.

The technique of introducing the Kirschner wires through the styloid process of the radius was first described in 1913 by Lambotte. Since then, numerous studies have demonstrated good and excellent results after Kirschner wire osteosynthesis of distal radial fractures. Fritz et al. reported frequent application of Kirschner wire osteosynthesis in elderly patients. Clancey reported good functional results after Kirschner wire osteosynthesis but found better results in younger than in elderly patients.

Intrafocal pinning of distal radius fractures was described first by Kapandji in 1976. It is indicated in unstable distal radius fractures without significant intra-articular displacement. It provides the surgeon with a simple and effective, minimally invasive method of improving alignment and stability of unstable fractures.

There were 30 cases of distal radius fracture in our study, the age ranged from 40 to 72 years, mean age was 54.77 years. P.C. Strohm, C.A. Muller, T. Boll & U. Pfister in their study had 81 patients with the mean age of 69 years (range 29 years to 89 years). However, their mean age of 69 is in comparison of our study is high; because inclusion criteria of our study consisted of age group 40 to 75 years while they have treated patient up to age 89 years. Ruschel, Paulo Henrique; Albertino, Walter Manna & Juliano De Bortoli in their study included patients of age 22 to 69 years with the mean age of 49 years, which is comparable to our study.

In our study, there were 24 female patients (80%) and 6 male patients (20%). The data reflects female predominance (Male: Female ratio: 1:5). P.C. Strohm, C.A. Muller, T. Boll & U. Pfister included 81 patients in their study. Out of these patients, 70 patients were female (86%) and 11 patients were male (14%), which is comparable to our study.

In our study, out of 30 distal radius fractures, 19 fractures (63%) occurred in non dominant hand and rest 11 fractures (37%) in dominant hand; in contrast, study done by Ruschel, Paulo Henrique; Albertino, Walter Manna & Juliano De Bortoli, 29 distal radial fractures; 21 fractures occur in dominant hand and rest 8 fractures occur in non dominant hand.

In our study, pain was assessed according to VAS score ranged from 2-6 with mean value of 3.63 and standard deviation was 1.189. The value improved on subsequent follow up and final score at 6th month was 0.63 (Std. deviation 0.615) which is comparable with the study done by Dowry Paul A., Patterson Stuart D., King Grahm J., Roth James H. & Chess, David.

In final follow up at 6th month range of motion, radiological assessment, functional evaluation (Gartland and Werley’s Demerit point system), visual pain analogue (VAS) and general complications were recorded. Assessment of range of motion showed dorsiflexion of 65 to 75° with mean value.
of 70°, palmarflexion of 70° to 80° with mean value of 75°, supination of 70 to 80° with mean value of 75°, pronation of 70° to 80° with mean value of 75°, ulnar deviation of 30° to 40° with mean value of 35° and radial deviation of 10° to 15° with mean value of 12°. According to radiological assessment, mean radial height was 9.23mm, mean radial inclination was 21° and mean volar tilt was 6°. These all parameters were improved than previous follow up, which were comparable with the results of various studies.

Finally, in our study, functional evaluation was done with Gartland & Werley’s Demerit point system (modified by Sarmiento et al). According to the score, there were 9 patients (30%) in good group, 19 patients (63%) had good results and rest 2 patients (7%) had poor result. None of the patient had poor results. Ruschel Paulo et al. in their study “Treatment of unstable distal radius fracture by modified Kapandji’s intrafocal method” concluded that Kapandji’s intrafocal fixation technique showed to be effective for the treatment of unstable, extra-articular distal radius fractures. There were 72.1% of excellent and good results in three months; 89.7% in six months; and 96.6% in 12 months. Our results were also comparable with this study. Possible cause of obtaining better results could be due to the younger age group of patients in our study.

There were two (7%) cases of pin tract infection and one (3%) case of reflex sympathetic dystrophy in our study. P.C. Strohm, C.A. Muller, T. Boll & U. Pfischer observed complication in 17% of cases in their study however complication rate was lower with Kapandji intrafocal pinning group. Lower rate of complications in our study was possibly due to small sample size and young age group of patients.

CONCLUSION

Kapandji technique is a simple, cheap, minimally invasive and effective method for the treatment of unstable extra articular distal radius fractures, with good functional results. It should not be used alone for patients with severe osteopenia, marked dorsal radial comminution, and an associated distal metaphyseal ulna fracture and in patients with both volar and dorsal comminution of the distal radius.

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