ORIGINAL RESEARCH

# Functional and Radiological Outcome of Fragment Specific Fixation of Displaced Distal End Radius Fractures With Multiple Percutaneous K Wires

**Harish Pai[1], Sudheendra P R[2], Girishkumar K[3]**

## ABSTRACT

**Introduction:** Distal radius fractures are common fractures in orthopaedic practice and many methods or combination of methods have been advised .The aim of our study is to know the functional and radiological outcome of fragment specific fixation of displaced distal end radius fractures with multiple percutaneous k wires.

**Materials and methods:** patients with displaced distal end radius fractures from Jan 2013 to Aug 2014 were included in this prospective study. Patients who were excluded were fracture with shearing force (like Barton's), and severe comminuted fractures with bone loss. X- Rays were taken before and after surgery, and repeated at the time of removal of k wires and six weeks later .final functional outcome and radiological outcome assessed at the end of twelve months.

**Results:** 30 patients were analysed, mean age was 55 years, male to female ratio of 3:2, radiologically average loss of radial length was 1.2 mm, radial angle 2.3 degree, palmar tilt 4.4 degree, negative ulnar variance 0.3mm. 12 Patients(40%) had excellent results ,16(53.3%) had good results, 2 (6.6%) had fair results as per Stewart et all radiological criteria. 16 patients(53.3%) had excellent results , 12 (40%)had the good ,1(3.3%)had fair and one(3.3%) had poor functional result as per Sarmiento's criteria.

**Conclusion:** Stable fixation of displaced distal radius fractures can be achieved with multiple fragment specific k wires with satisfactory functional and radiological results.

**Keywords:** Distal radius fractures, k wires, fragment specific fixation.

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**Conflict of Interest:** None

## INTRODUCTION

Distal radius fractures are commoner fractures accounting 18 – 20% of all fractures.[1] Stable fractures or minimally displaced fractures can be treated satisfactorily with closed reduction and cast application. Displaced fractures treated conservatively leads to loss of reduction, malunion, secondary osteoarthritis of wrist, carpal instability and resultant pain.[2] Two most common forms of surgical fixation are a) percutaneous k wire fixation and b) open reduction and internal fixation by plate and screws. Percutaneous k wires are shown to be a simple technique, yet preventing redisplacement and late collapse of the fracture.[3] Many techniques of k wire fixation have been explained in the literature, most common among them were divergent k wire fixation from radial styloid, Kapandji intrafocal pinning, modified Kapandji pinning, cross K wire pinning and so on. All of them showed good or satisfactory results functionally; but in preventing late collapse or radiological outcome modified kapandji technique fared better than others in most comparative studies. We tried a different technique for displaced distal radius fracture where each k wire tries to maintain the important parameters which are radial angle, radial length, palmar tilt, negative ulnar variance and intra articular congruency. The aim of the study was to analyse the radiological and functional outcomes of displaced distal radial fractures treated by fragment specific fixation with fragment specific k wires.

## MATERIALS AND METHODS

We selected patients who had displaced distal end radius fractures from Jan 2013 to Aug 2014 were in-

cluded in this prospective study. Total 30 patients were taken in to study; patients who had displaced distal radius fractures and skeletally mature were included. Patients who were excluded were fractures with shearing force (like Barton's)[AO 23-B2 and 23-B3], and severly comminuted fractures with bone loss[AO 23-C3]. Patients who had ipsilateral other bony injury or soft tissue injury, bilateral wrist injuries and patients who presented late (more than two weeks) were excluded. On plain radiographs fractures were divided in to extra articular and intra-articular. Extra articular fractures were divided in to without comminution or with comminution. Intra articular fractures were divided in to undispalced fractures and displaced fractures with a step between scaphoid and lunate fossa.

Procedure is done under brachial block or under GA, Standard reduction technique followed, checked under image intensifier. Stabilization done as follows.

1)Intra articular fracture stabilization – try to achieve reduction between radial fossa and lunate fossa a) if reduction achieved pass 1.2 mm k wire from lateral side of radial styloid latero medially just subchondral to lunate fossa which will act as raft to prevent redisplacement (Figure-1). Release of traction should hold articular step, If not then b) pass one more 1.2 mm k wire from same level in latero medially direction but entry point 5mm ventral to primary k wire so that they are parallel in lateral view but looks overlapping in A P view. c) If reduction is not achieved then pass 1.2 mm k wire in radial styloid and reduce as joy stick manoeuvre, and pass stabilizing k wire as explained earlier. Once intrarticular fracture is fixed, then proceed to further stabilization as explained in extrarticular fixation.

2) Extra articular fracture stabilization- Once reduction achieved, a)1.8 or 2mm k wires passed from radial styloid to medial cortex , one more diverging k wire required if comminution present in lateral cortex (Figure-2). B) One more 1.8 or 2mm k wire from dorso medial (lunate fossa) to ventro lateral direction (Figure-3). C) 1.5 or 1.2 mm k wire additionally may be required for if other major comminuted fragment present.

3) Once distal radius is fixed check clinically; a) radial styloid and ulnar styloid relation and b) ulnar head stability (Distal Radio Ulnar Joint or DRUJ) in supination and pronation. radial shortening or subluxation of ulnar head clinically (more common subluxation in pronation), this can also be checked under c- arm by keeping in true lateral position and see the radiograph in supination and pronation; if both distal radius and ulnar head are overlapping in both supination and pronation then it is stable, if not then pass 2 mm k wire from ulna to radius mediolaterally (DRUJ k wire) (Figure-4) in reduced position (usually supination).

4) In case of die punch fracture k wire is passed from proximal to distal from lateral to medial in the direction of die punch element till it reaches the subchondral level; then instead of drilling, gently tap or punch the k wire so that it elevates the articular fragment, (Figure-5) if not one more k wire in same direction in AP view but ventral in lateral view and proceed as before .once articular fragment elevated proceed as explained in intraarticular stabilization. (Figure-6 )

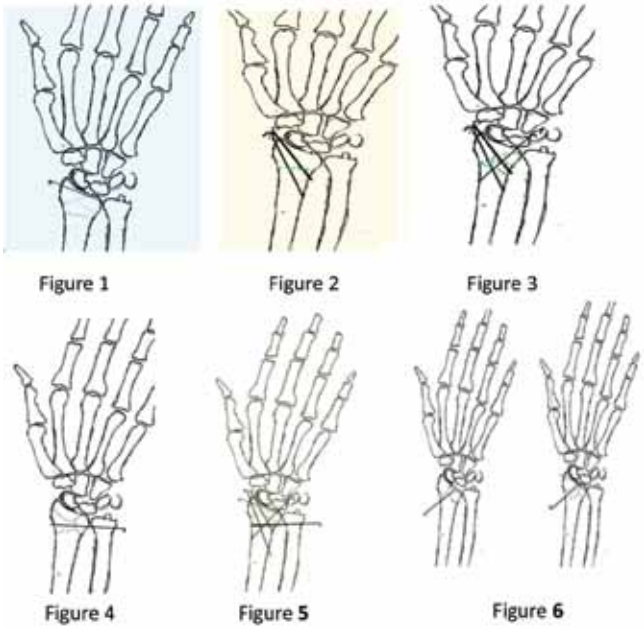


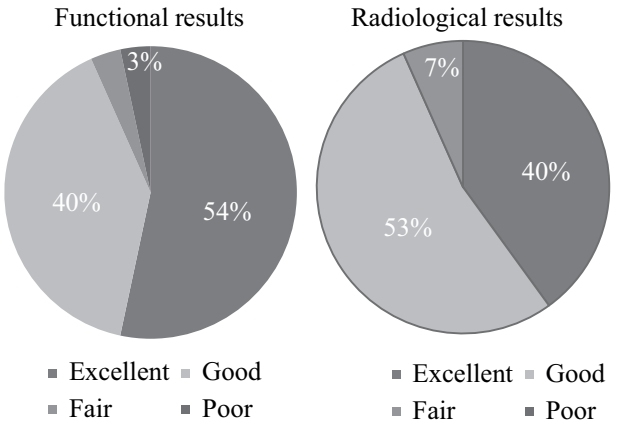

**Figure-1:** Iintra articular step stabilized by raft or subchondral k wire (maintains radial angle and prevents redisplacement of intra articular step); **Figure-2 and 3:** Radial styloid k wires, and cross k wires(maintain radial length and palmar tilt); **Figure-4:** DRUJ k wire (maintains DRUJ stability and negative ulnar variance); **Figure-5:** Combination of multiple fragment specific k wires; **Figure-6:** Die punch k wire with raft k wire.

After stabilization, pin site dressing done, above elbow slab applied in case of DRUJ stabilization. Otherwise below elbow slab is applied. DRUJ k wire removed 4 weeks after and other wires at 6 weeks. Further follow up is done at 3months, 6months and at one year. Radiological outcome was assessed by Stewart et all[4] criteria and functional outcome was assessed by Sarmientos[5] criteria.

## STATISTICAL ANALYSIS

As this is a descriptive study; radiological and functional evaluation done with frequency values, these

frequency distribution represented in Pie chart 1 and table 1.




**Pie chart-1:** Radiological and functional results

| | Excellent | Good | Fair | Poor |
|---|---|---|---|---|
| Radiological outcome | 12 | 16 | 2 | 0 |
| Functional outcome | 16 | 12 | 1 | 1 |

**Table-1:** Radiological and functional results

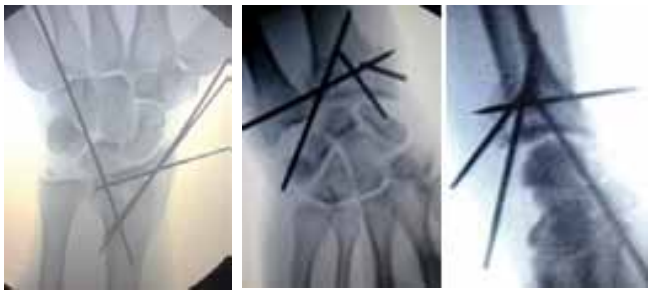
## RESULTS

In our study, out of 30 patients, 18 patients had RTA ( Road traffic Accident) and 12 had fall at home; age of the patients ranging from 21 years to 64years with mean age of 55 years.17 Patients were male and 13 were female; 60 percent were dominant hand fractures, and 40 percent non-dominant hand. 13 had extra articular fracture 17 had intra articular fracture. Intra op 8 needed DRUJ stabilization. We didn't get any patients with lunate fossa die punch fracture in our series.

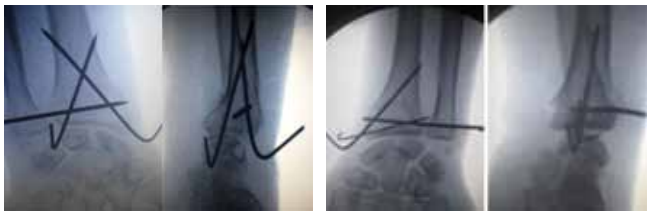
One patient had k wire loosening , one patient had skin necrosis around DRUJ wire site(indicating minor supination and pronation occurring despite DRUJ stabilization ) .one patient had causalgia which improved over nine months, One patient had shoulder stiffness ,one patient had numbness around anatomical snuff box and dorsum of thumb.

Radiologically average loss of radial length was 1.2 mm, radial angle 2.3 degree, palmar tilt 4.4 degree and 0.3mm loss in negative ulnar variance.

Radiologically 12 Patients (40%) had excellent results, 16(53.3%) had good results, 2 (6.6%)had fair results as per Stewart et al[4] radiological criteria. Functionally we used Sarmientos[5] objective plus subjective criteria. 16 patients (53.3%) had excellent results, 12 (40%) had the good, 1(3.3%) had fair and one (3.3%) had poor functional result. [Pie chart 1] (Table 1).



**X ray-1:** Raft k wire with extra articular fixation; **X ray-**2: Extra articular fracture with DRUJ k wire



**X ray-**3: Extra articular cross k wire with DRUJ k wire ; **X ray-4:** Intra articular fracture with raft k wire and DRUJ k wire

## DISCUSSION

The goal of treatment for displaced distal radius fracture like any other fracture is to restore the functional and anatomical originality ,with full restoration of wrist and hand function. Four methods that are usually followed in treating distal radial fractures are 1) closed manipulation and casting. 2) Percutaneous k wiring. 3) External fixation. 4) Open reduction and internal fixation. However there is no universal consensus regarding indications, merits and demerits of each of these modalities. Percutaneous k wire fixation is simple, accepted treatment for both unstable intra articular and extra articular fractures, except for fractures with shearing force and severe bone loss. Closed reduction and cast stabilisation has got higher rate of loss of reduction especially between 7 to 14 days ,hence needs multiple radiographs in initial weeks and need of remanupulation. External fixation is a good option for intra articular fracture but maintaining alignment of meta-diaphyseal fragment is difficult in both planes with unilateral frames. As it is a rigid fixation, over distraction can lead to a) triangular fibrocartilage complex related problems, b) severe stiffness of wrist and hand, c) collapse of fragments once fixator removed.[6] Open reduction and internal fixation is a good choice and helps in early mobilization, but needs good technique and different types of plates are required for different fracture patterns. Intra articular placement of distal screws can lead to restriction

of mobility and degeneration of joints, even 2mm longer screws can irritate the extensor tendons, chronic attrition even rupture of tendons.[7] Good fixation of the fracture can maintain radial angle but may not maintain negative ulnar variance if DRUJ is unstable. Removal of implant needs one more surgery unlike removal of k wire which is an OPD procedure.

Percutaneous K wire fixation is well accepted treatment technique for displaced distal end radius fracture. Many techniques have been described; kapandji[8] intrafocal k wires, modified kapandji k wires[9], conventional willenegger radial styloid k wires[10] and cross pinning technique. Many comparative studies between modified kapandji technique and willenegger technique done in the past by many authors[9] showed that maintenance of radial tilt was difficult in both techniques[11],also maintenance of articular step or maintenance of DRUJ or negative ulnar variance is a problem. In our technique we addressed all these issues; intra articular step and radial tilt stabilized by raft or subchondral k wire(s); radial length and palmar tilt were stabilized by multiple k wires as explained in extra articular technique and DRUJ and negative ulnar variance is stabilized by DRUJ k wire. One patient had poor functional outcome in our series, despite good radiological outcome due to causalgia; 93% had satisfactory (excellent and good) radiological and functional outcome. Most studies are done comparing kapandji and willenegger k wire fixation, or modified kapandji with willenegger techniques.[9] Modified kapandji technique had better outcome in most studies, Kapandji technique had good results but with more complications. Our results were comparable to modified Kapandji technique complications side effects even though we have used more K wires.[3,9,11] In our technique radial styloid k wires maintains the radial length and radial angle, raft k wire maintain intra articular congruency and radial angle, dorsal k wire from lunate fossa maintains palmar tilt and DRUJ k wire maintains negative ulnar variance and DRUJ.

### Limitation of study

Even though it is a prospective study sample size was small. Bigger sample size is needed to further validate our findings. We did not get any case of die punch fracture during the course of our study. Our technique needs to be compared with other techniques and the study needs to be widely reproduced by other authors before it is considered for wide acceptance as a standard technique of fixation.

## CONCLUSION

Our study shows that fragment specific fixation with multiple percutaneous k wiring for displaced distal radial fractures is a reliable technique yielding good functional and radiological outcomes. However further larger sample size studies are required to validate our findings.

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