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## ORIGINAL RESEARCH

# A study of external fixation of distal end radius fractures

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**Abstract**

**Background & Objectives:** Preservation of the articular congruity is the principle prerequisite for successful recovery following distal radius fractures. The best method of obtaining and maintaining an accurate restoration of articular anatomy however, remains a topic of considerable controversy. External fixation as a method of treatment for distal end of radius fracture has more than 60 years of documented clinical experience. The main aim of this study is to evaluate the results obtained by treatment of distal end radius fractures by external fixation.

**Methods:** In a prospective controlled study, 30 cases of unstable distal end radius fractures with intra-articular extension were treated with uniplanar bridging type of external fixation using the principle of ligamentotaxis and augmentation by Kwires. Mean age of the patients was 39.03 years, External fixator was applied for a mean duration of 6.06 weeks and cases were followed up for an average of 36.8 weeks post operatively.

**Results:** Assessed as per De merit point system of Gartland and Werley (modified by Sarmiento 1975) for functional results at the end of 6 months of follow up. Excellent to good functional result was noted in 80%.

**Conclusion:** External fixation and ligamentotaxis provides better functional and anatomical results in comminuted intra-articular and unstable extra-articular wrist injuries. The successful use of external fixator for distal end radial fracturesrequires careful assessment of fracture pattern, appropriate patient selecting, meticulous surgical techniques appropriate choice of fixation, judicious augmentation with internal fixation and bone grafting, careful post operative monitoring and aggressive early institution of rehabilitation. The final functional result of treatment of distal radius fractures not only depends on the anatomical restoration of the articular surface but also on the associated soft tissue injuries and articular damage.

**Keywords:** Distal radius fracture, External fixation, Ligamentotaxis, Intra- articular fractures, Distal end radius.

## Introduction

Fractures of the distal radius continue to be the most common skeletal injuries treated by the orthopedic surgeon. In fact these injuries are the most common fractures of the upper extremity and account for approximately 1/6th (16%) of all fractures seen and treated in emergency rooms [1- 3]. Distal radius fractures crush the mechanical foundation of the man's most elegant tool, the hand. No other fracture has a greater potential to devastate hand function, and no other metaphysis of bone is embraced by more soft tissues. The same ligaments, retinaculae, tendons and the periosteum that envelop the fracture which are the surgical barrier for open reduction of the fracture fragments, help to achieve reduction of the fracture by ligamentotaxis[4].

In majority of cases prompt detection of articular fragments displacement, stability, and reducibility provides a rational basis of optimal management of these complex distal end

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radius fractures. Many fractures of the distal aspect of the radius are relatively uncomplicated and are effectively treated by closed reduction and immobilization in cast. However unstable / intra-articular fractures can jeopardize the integrity of the articular congruence and /or kinematics of these articulations[5]. A consensus prevails that vast majority (nearly 90%) of distal radius fractures are articular injuries resulting in disruption of both the radiocarpal and radioulnar joints [6,7]. About 50% of the metaphyseal fractures have intra-articular extension to radiocarpal or distal radioulnar joint[5]. Intra-articular fractures are inherently unstable, difficult to reduce anatomically and immobilize in closed POP support and are associated with high rate of complications[8].

With the changing mode of injury, fracture of the distal end radius occurring in younger patients, increasing functional demands of the patients, better understanding of the fracture pattern, advances in biomechanics of the wrist and availability of treatment oriented classification system, it seems we have to look beyond the conventional teaching that theyall do well ultimately. Distal radius fractures especially the high energy fractures are often associated with poor results and high complication rates[5, 6].Preservation of the articular congruity is the principle prerequisite for successful recovery[7]. The best method of obtaining and maintaining an accurate restoration of articular anatomy however, remains a topic of considerable controversy[7].External fixation is generally accepted as superior to plaster immobilization in young patients with intra-articular comminuted displaced distal radius fracture.[9- 11]

The successful use of external fixation in the management of unstable intra-articular fractures necessitates careful assessment of the fracture pattern, appropriate patient selection, meticulous surgical technique, appropriate choice of fixation devices, judicious augmentation with internal fixation & bone grafting, careful post operative monitoring and aggressive early rehabilitation.[12] Hence; the present study was conducted for assessing the outcome of external fixation of distal end radius fractures.

**Materials & methods**

30 patients attending the out-patient and in-patient department of Orthopaedics at VIMS, Bellary with fracture of distal end radius fulfilling the inclusion criteria were enrolled.. Inclusion criteria for the present study included unstable intra-articular distal end radius fractures.Assessment of fractures of distal end radius was done with reference to skin condition (closed / open fracture), peripheral circulation, neurologic examination especially median nerve, flexor & extensor tendon function, distal radioulnar joint stability, compartment syndrome and associated injuries.In the pre operative period splintage with POP slab and elevation was Carried out which facilitate fracture reduction and precision of pins while applying external fixator. Fractures were classified according to Frykman classification. Instability was recognized based upon initial displacement: >20 dorsal angulation, marked dorsal metaphyseal comminution, radial shortening >10mm. Secondary instability is said to be present when closed reduction & cast immobilization fails to maintain initial reduction and is found if residual dorsal angulation >100, residual radial shortening>5mm, >2mm step-off or displacement of articular fragments, intra articular fractures,loss of radial inclination>20, metaphyseal comminution of > 50% diameter of radius, associated ulnar fracture, significant osteoporosis.Immediate post-operative check x-rays were taken in both AP and lateral views. Active exercises of all the fingers, Elbow and shoulder were carried out. The patient was discharged on the 2nd post-operative day after the first dressing change.The patient was called for inspection and dressing change at the interval of one week for the next 6 weeks. The patient was assessed subjectively for pain at the fracture site; clinically fortenderness and loosening of the pins.The external fixator was removed on the 6th week without any anaesthesia. Check X-ray was taken in both AP and lateral view. The range of motion at the

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wrist was recorded and anydeformity was assessed Physiotherapy was carried out regularly for 2 weeks.All the cases were followed at an interval of 6 weeks, 3 months & 6 months. The follow-up ranged from 1 month to 6 month with an average of 3 months.There was loosening of pins in two case during the 4th week for which the fixator was removed on the 5th week. Following removal no displacement was noted. Final results were assessed as excellent, good, fair and poor.Quantitative data was expressed in terms of Mean and Standard deviation Association between two qualitative variables was seen by using Chi square/ Fischer's exact test.

**Results**

Majority of our patients were in the age group of 21-40 years. Youngest person was 22 years old and oldest was 60 years. Mean age was 39.03 years. In 73.3% of our cases Right hand was found to be involved. Out of 30 patients, 18 (60%) were males and 12 (40%) were females.Duration of the external fixator in situ was for 5-6 weeks in 85% & in 15% of cases external fixator was left in place for 7-8 weeks. Mean duration of external fixator application was 6.17 week.Most of our cases were followed up for a minimum period of 6 months. Average duration of follow up was 36.8 weeks.At the end of follow up the average range of movement achieved was 62.5° dorsiflexion,54.6° palmar flexion, 16.5° radial deviation, 25.5° ulnar deviation, 75.2° supination and 71° pronation.In our study we noticed 5 cases of residual wrist pain which was mild to moderate and was treated by analgesics alone. 4 cases had dorsal angulation. Pin tract infection was not seen. Restricted wrist movements was present in cases of metaphysical communition and in patients who were not compliant for physiotherapy. One case had mild Sudeck's dystrophy which responded to aggressive physiotherapy.Results were assessed as per De merit point system of Gartland and Werley for functional results at the end of 6 months of follow up. Excellent results were seen in 26.6 percent of the patients while good results were seen in 53.3 percent of the patients.

**Table 1: Average Range of Movement achieved after 6 months:**

| Movements | Average movement |
|---|---|
| Dorsiflexion | 62.5° |
| Palmar flexion | 54.6° |
| Radial deviation | 16.5° |
| Ulnar deviation | 25.5° |
| Supination | 75.2° |
| Pronation | 71° |

**Table 2: Outcome**

| Outcome | Number (Percentage) |
|---|---|
| Excellent | 8 [26.6%] |
| Good | 16 [53.3%] |
| Fair | 5 [16.6%] |
| Poor | 1 [3.3%] |

**Discussion**

It must be emphasized that this study is only short term follow up with average of 36.8 weeks and the discussion that follows is essentially a preliminary assessment.The aim of this study is to evaluate the results of external fixator for distal end radius in particular for open fractures, intra-articular fractures and unstable fractures. Most distal radial fractures are treated with closed reduction and cast applications. We treated distal end radius fractures which fulfilled inclusion criteria by external fixation. From December 2020 to November

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2022. We treated 30 patients with distal radius fractures by wrist spanning external fixation.Patients ranged from 22-60 years and the mean age was 39.03years. The table below shows the mean age group of various studies. It shows that the incidence of unstable distal radius fracture was common in 4th decade.Higher incidence in this age group probably is due to active life style which is prone for accidents and resulting in high velocity injuries.

The incidence of fractures in our study was more common in males 18/30(60%) which can be attributed to the risk of injury due to occupational and ambulant life led by them, another reason for high incidence of cases in males may be due to high susceptibility to injury and easy accessibility to health facilities. In our study it was noted that right hand was more commonly involved(73.3%). This maybe attributed to tendency of stretching the right hand as a reflex while RTA or fall so as to avoid injury to face and head.

In our study 3(10%) of fractures were open fractures. This aspect is important in our study as it has bearing on planning for secondary procedure like split thickness skin grafting and final outcome of treatment. There was poor outcome in cases with open fractures with associated tendon injuries.As far as distribution of fractures according to Frykman classification our indications for fracture of distal radius for external fixation are comparable to that of other standard studies. Most of our cases had a higher Frykman type with Type III constituting 40%.

The average period of immobilization in our study was shorter (6.06weeks) as advised by Nagi ON et al[2] compared to that of Gunaki RB et al[13] wherein it was 7.2weeks. It was peculiarly noted that severely comminuted fractures and Frykman type VIII required longer duration of immobilization than Frykman type I to VII. In our institution though we planned for external fixation of distal end radius fracture on emergency basis usually on the day of admission, delay had occurred in few of the because of associated injuries, late presentation of patients and delay in consenting for surgery.The fixator was removed after radiological and clinical union on out patient basis under sedation after 5-8 weeks and below elbow POP slab or splint was applied for 2 weeks with intermittent removal and exercises. Most of the cases were followed up for a minimum of 6 months. The mean follow up was 36.8 weeks.

The radial shortening due to loss of reduction was measured as the difference between initial post reduction and final X ray made for each patient as suggested by Cooney et al (1979)[14] In our series average loss of radial length was 3.12mm, slightly higher as compared to that of 2.13mm in David Eei et al (2009)[15]. It was also noted that loss of radial length increases with Type VII & VIII fractures.

Radial length is one of the crucial factors for regaining good wrist function. 4mm - 6mm shortening compromises DRUJ (Gunaki RB et al (1998)[16] series). The residual tilt depended upon extent of dorsal angulation before reduction and adequacy of restoration of palmar tilt after reduction.Excellent function of wrist is achieved even if normal 110 palmar tilt is not achieved because of biomechanics of wrist. Arora J et al[17]in a comparative study of comminuted intra-articular fractures of distal radius concluded that the external fixator is a versatile tool that is well established in the treatment of these fractures and it maintains the reduced position significantly better as compared to cast immobilization. They stated that comminuted intra-articular fractures of distal radius are common injuries that will not do well, unlesscertain treatment criteria are met and the result will be painful, stiff, dysfunctional wrist.Kreder HJ et al[18] in a 2 year follow up of 179 adult patients with displaced intra-articular fractures of the distal radius reported that who underwent indirect reduction and percutaneous fixation had a more rapid return of function and a better functional outcomethan those who underwent open reduction and internal fixation, provided that the intra- articular step and gap deformity were minimized.[18]

**Conclusion**

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Static external fixators were used in 30 intra – articular fractures of distal end of radius in a prospective study. Fixator was maintained for a duration of 6 weeks. We had 8 excellent, 16 good, 5 fair and 1 poor result. External fixation was maintained for6 weeks till the bony union is complete. It is important to have a tight purchase of the pin in the bone with minimal damage to surrounding tissue. For an optimal result, good anatomical reduction is necessary.This series concludes that in younger age group [<50], ligamentotaxis by external fixation consistently results in a favourable outcome in the management of intra- articular distal end of radius fractures.In conclusion external fixation is the effective method in treating the unstable intra- articular fractures of the distal end of radius.

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