

# Evaluation of Results of Volar Plating in Distal End Radius Fractures: A Prospective Study

Akella Suryanarayana Rao

Associate Professor, Department of Orthopaedics,  
Meenakshi Medical College Hospital & Research Institute, Enathur, Kanchipuram, Tamilnadu, India.

## ABSTRACT

**Background:** Fracture of the distal radius continues to be one of the most common skeletal injuries treated by Orthopaedic or trauma surgeons. Distal radius fractures that are caused by severe high energy trauma, results in intra-articular involvement and comminution. These fractures often are unstable, are difficult to reduce anatomically, and are associated with a high rate of complication. This study evaluates the anatomical and functional outcome of open reduction and plate fixation in the management of fracture distal end radius in thirty patients.

**Material & Methods:** This is a prospective study carried out on the patients with fractures of the distal end radius, attending the outdoor and the emergency services of Meenakshi Medical College Hospital & Research Institute, Enathur, Kanchipuram, Tamilnadu, (India), who gave their consent to undergo the procedure. Thirty patients with fractures of the distal radius were included in the study.

**Results:** The mean age of the patients taken up for the study was 42.6 years, there were 20 male patients (67%) and 10 female patients (33%). The mode of injury was fall in 14 cases (46.66%), road traffic accident in 16 cases (53.33%). 6 fractures were classified as AO type A, 8 fractures as AO type B and 16 fractures as AO type C. Subjectively, out of 30 patients, 21 patients (70%) had excellent, 7 patients (23%) had

good, & 2 patients had fair (7%) results and functionally 22 patients (73%) had excellent, 5 good (17%) and 3 patients had fair (10%) restoration of functions. Poor function correlated with residual displacement and poor patient compliance.

**Conclusion:** The technique emphasises that open reduction and internal fixation with volar plating has excellent functional outcome with minimal complications thus proving that it is the prime modality of treatment for distal radius fractures.

**Keywords:** Volar Plate, Fracture in Distal End Radius, Functional Outcome, Subjective Outcome, AO Classification.

## \*Correspondence to:

**Dr. Akella Suryanarayana Rao**

Associate Professor, Department of Orthopaedics,  
Meenakshi Medical College Hospital & Research Institute,  
Enathur, Kanchipuram, Tamilnadu, India.

## Article History:

Received: 27-10-2016, Revised: 08-11-2016, Accepted: 29-11-2016

Access this article online	
Website: www.ijmrp.com	Quick Response code 
DOI: 10.21276/ijmrp.2016.2.6.064	

## INTRODUCTION

Fractures of lower end radius are most common fractures of the upper extremity, encountered in practice and constitute 17 % of all fractures and 75% of all forearm fractures.<sup>1</sup> Close reduction and cast immobilization has been the mainstay of treatment of these fractures but malunion of fracture and subluxation /dislocation of distal radioulnar joint resulting in poor functional and cosmetic results is the usual outcome.<sup>2</sup> It may cause pain, limitation of forearm motion, and decreased grip strength as a result of arthrosis of the radiocarpal and distal radio-ulnar joints.<sup>3</sup> Distal radial fractures have a bimodal age distribution, consisting of a younger group who sustains relatively high-energy trauma to the upper extremity and an elderly group who sustains both high-energy injuries and insufficiency fractures.<sup>4</sup>

As open reduction and volar plating ensures more consistent correction of displacement and maintenance of reduction, this study evaluates the anatomical and functional outcome of open

reduction and plate fixation in the management of fracture distal end radius in thirty patients. The aim of this study to assess the role of open reduction and plate fixation followed by early mobilization of wrist joint in the management of fracture distal end radius.

## MATERIALS & METHODS

This is a prospective study carried out on the patients with fractures of the distal end radius, attending the outdoor and the emergency services of Meenakshi Medical College Hospital & Research Institute, Kanchipuram, Tamilnadu, (India), who gave their consent to undergo the procedure. Thirty patients with fractures of the distal radius were included in the study.

## Exclusion Criteria

1. Patients with comorbid conditions preventing surgical intervention

2. Patients with more than 3 weeks duration of injury
3. Patients with immature skeleton
4. Patients with local tissue condition making the surgery inadvisable

All the patients were subjected to clinical examination. Radiographic evaluation of the affected & the normal side was done at the time of injury with the antero-posterior and lateral views. The radiographs were assessed in terms of loss of palmar tilt or presence of dorsal tilt, radial shortening and loss of radial inclination. Fractures were classified as according to the AO Classification into type A (extra-articular), type B (partial articular) or type C (complete articular). After pre-anaesthetic evaluation patients were taken up for surgery.

#### Surgical Technique

All procedures were performed under general or regional anaesthesia. Our standard practice was preoperative prophylactic intravenous ceftriaxone and usage of tourniquet and bipolar diathermy for homeostasis. The standard volar approach was undertaken to fix the fragments.

In cases initially approaching the radial styloid fragment, dissection between the flexor carpi radialis tendon and radial artery were used. For the die-punch volar fragment, dissection between the median nerve and flexor carpi radialis tendon was used. The distal and radial borders of pronator quadratus were lifted and retracted ulnarly.

Open reduction was performed with the aid of intrafocal leverage, traction by an assistant/distractor, and provisional fixation by temporary Kirschner wires followed by definitive volar buttress or locking plate and screws. Image intensifier was used in theatre to assist the evaluation of fracture reduction and fixation. The patients were followed up for minimum of 1 year. Clinical, radiological and functional reviews were performed at periodic intervals.

Functional evaluation of the patients was done at the last follow up according to the demerit point system of Gartland and Werley with Sarmiento et al's modification.

#### RESULTS

The present study showed the mean age of the patients taken up for the study was 42.6 years with the youngest patient being 20 years and the oldest being 70 years.

There were 20 male patients (67%) and 10 female patients (33%) (Table 1). The mode of injury was fall in 14 cases (46.66%), road traffic accident in 16 cases (53.33%). 6 fractures were classified as AO type A, 8 fractures as AO type B and 16 fractures as AO type C (Table 2).

Subjectively, out of 30 patients, 21 patients (70%) had excellent, 7 patients (23%) had good, and 2 patients had fair (7%) results (Table 3).

**Table 1: Age & Sex Distribution**

Age (yrs)	Male	Female	Total
20-30	3	2	5
31-40	3	3	6
41-50	7	3	10
51-60	3	2	5
61-70	4	0	4
<b>Total</b>	20	10	

**Table 2: Mode of Trauma & Type of Fracture (AO Classification)**

	Type A	Type B	Type C	Total
FALL	2	4	8	14
RTA	4	4	8	16
<b>Total</b>	6	8	16	

**Table 3: Subjective Evaluation**

Subjective Evaluation	Number of Patients
Excellent	21
Good	7
Fair	2
Poor	0
<b>Total</b>	30

**Table 4: Objective Evaluation**

Objective Evaluation	Number of Patients
Loss Of Dorsiflexion (<45 degrees)	0
Loss Of Palmar Flexion (<30 degrees)	3
Loss Of Ulnar Deviation (< 15 degrees)	1
Loss Of Radial Deviation (< 15 degrees)	2
Loss Of Supination (< 50 degrees)	1
Loss Of Pronation (< 50 degrees)	1
Loss Of Circumduction	1
Pain at DRUJ	0
Grip Strength $\leq$ 60% of opp. side	1

**Table 5: Complication**

Complication	Number of Patients
Reflex Sympathetic Dystrophy	nil
Joint stiffness	3
Paraesthesia in the distribution of radial nerve	1
Impingement of tendons	nil
Median Nerve Complications	nil

**Table 6: Functional Outcome**

Functional Evaluation	Number of Patients
Excellent	22
Good	5
Fair	3
Poor	0
<b>Total</b>	30

The scoring of healed fracture was done as according to the demerit point system of Gartland and Werley with Sarmiento et al modification. Functionally 22 patients (73%) had excellent, 5 good (17%) and 3 patients had fair (10%) restoration of functions. Poor function correlated with residual displacement and poor patient compliance.

**DISCUSSION**

The present study showed the mean age of the patients taken up for the study was 42.6 years with the youngest patient being 20 years and the oldest being 70 years. There were 20 male patients (67%) and 10 female patients (33%). Factors such as patient age, activity level, co morbidities, and functional demands are considered. For young, active patients, acceptable reduction is generally considered to be less than 10° dorsal tilt, less than 3 to 5 mm of radial shortening, and less than 2 mm of articular displacement. Younger patients have stronger bone, and thus, more energy is required to create a fracture in these individuals. Motorcycle accidents, falls from a height, and similar situations are common causes of a DRF. Trauma is the leading cause of death in the 15- to 24-year-old age group, and this is also reflected in the incidence of lesser traumas. Older patients have much weaker bones and can sustain a DRF from simply falling on an outstretched hand in a ground-level fall. An increasing awareness of osteoporosis has led to these injuries being termed fragility fractures, with the implication that a workup for osteoporosis should be a standard part of treatment. As the population lives longer, the frequency of this type of fracture will increase. Kevin C. Chung et al (2008)<sup>5</sup> reported that the VLPS is successful in managing DRFs in older patients without increased complications compared to younger patients. For older patients without prohibitive surgical risks, internal fixation using the VLPS yields comparable outcomes to younger patients.

The maximum percentage of complete articular (type C) fracture (53.3%) followed by partial fracture (type B) (26.66%), extra articular (type A) (20%) in this study. Extra-articular fractures require avoidance of malunion with angulation and shortening. Malalignment results in limitation of movement (Fernandez 1993)<sup>6</sup>, changes in load distribution (Short et al 1987)<sup>7</sup>, midcarpal instability (Taleisnik and Watson 1984)<sup>8</sup> and an increased risk of osteoarthritis of the radiocarpal joint. Intra-articular fractures with a step of over 2 mm in the radiocarpal joint inevitably result in osteoarthritis and functional impairment (Knirk and Jupiter 1986).<sup>9</sup> Knirk & Jupiter (1986)<sup>9</sup> in a study on intra particular fractures found that supination is limited more commonly than any other movement. Dorsi-flexion is the second most common movement to be restricted. Symptoms include restricted painful pronation and supination, weakness of grip, persistent pain on compressing and DRUJ protruding distal ulna and laxity of DRUJ (Lidstrom 1959<sup>10</sup>, Frykman 1967<sup>11</sup>). Frykman 1967<sup>11</sup> found an incidence of 19% and regard it an important cause of unsatisfactory functions results. For most authors resection of the distal ulna (Darrach procedure) is the treatment of choice for complaints resulting from loss of DRUJ integrity. Good results painless motion and improved cosmetic appearance have been reported after this procedure (Conney 1980<sup>12</sup>). Persistent pain and other symptoms associated with DRUJ disruption made many surgeons to feel that the DRUJ remains the low back pain of wrist.

Several studies have suggested that restoration of the articular anatomy is the most critical factor in obtaining a good functional result and preventing late post traumatic arthritis. The operative management of these fractures is difficult and is associated with a high rate of early and late morbidity. Preoperative planning, including anteroposterior and lateral tomography, is exceptionally helpful. Before the incision is made, distraction and the temporary application of an external fixator will make it easier to manipulate

the small articular fragments and minimize soft tissue dissection. The anterior approach is useful for fractures with anterior displacement or rotation of the articular fragments. When the radius is approached ulnarly to the flexor tendons, trauma to the median nerve and its palmar cutaneous branch is minimized. When exposing the articular fragments anteriorly, the surgeon must be aware of the critical anterior radio carpal ligaments. Disruption of these ligaments can result in subsequent inter carpal instability. When the fracture involves multiple small articular fragments, the use of a not be possible; definitive fixation is then accomplished with Kirschner wires and external skeletal fixation. The severity of these injuries is reflected by the fact that most patients will have some residual limitation of mobility of the wrist as well as of grip strength.

Hanae Minegishi et al (2011)<sup>13</sup> reported volar plate fixation is a valuable method because of the decreased risk of inducing dorsal soft-tissue complications. In volar approach, the volar anatomy of the wrist presents an advantage over the dorsal aspect because of there more space between volar cortex and flexor tendons.

Wake field (2000)<sup>14</sup> has identified the "at risk" group for poor outcome, includes a patient > 55 year age with malunion at 6 week after a displaced fracture, history of functional impairment before the injury, high level of pain, reduced rotation of forearm and reluctance to use the wrist and hand for functional activities. For these patients he recommended physiotherapy.

**CONCLUSION**

We concluded that excellent to good results, suggests that stabilizing the fracture fragments with volar plate and screws in the management of the fractures of distal radius, is an effective method to maintain the reduction till union and prevent collapse of the fracture fragments, even when the fracture is grossly comminuted/intra-articular/unstable and/or the bone is osteoporosed.

The technique emphasises that open reduction and internal fixation with volar plating has excellent functional outcome with minimal complications thus proving that it is the prime modality of treatment for distal radius fractures.

**REFERENCES**

1. Colles A. On the fracture of the carpal extremity of the radius. *Edinburgh Med Surg* 1814;10:182-6.
2. Bacorn RW, Kurtzke JF: Colles' Fracture: A study of two thousand cases from the New York states Compensation Board. *J Bone Joint Surg* 1953; 35A: 643-658.
3. Zemel NP: The prevention and treatment of complications from fractures of the distal radius and ulna. *Hand Clin.* 1987;3:1 – 11
4. Neal C. Chen, MD; Jupiter JB, MD: Current Concepts Review, Management Of Distal radial fractures. *J Bone Joint Surg Am.* 2007;89:2051-62.
5. Kevin C. Chung et al; Comparative outcome study using the volar locking plate system for the distal radius fracture in both young adults and adults older than 60 years; *The Journal of hand surgery.* July- Aug 2008; Vol. 33: page .no 32-38.
6. Fernandez DL. Fractures of the distal radius: Operative treatment. *Instr Course Lect.* 1993;42:73-88.
7. Short WH, Palmer AK, Werner FW, Murphy DJ. A biomechanical study of distal radial fractures. *J Hand Surg [Am]* 1987;12-A: 529-34.

8. Bartosh RA, Saldana MJ. Intra-articular fractures of the distal radius: a cadaveric study to determine if ligamentotaxis restores radiopalmar tilt. *J Hand Surg [Am]* 1990;15(1):18-21
9. Knirk J L, Jupiter J B. Intra-articular fractures of the distal end of the radius in young adults. *J Bone Joint Surg* 1986; 68A: 647-659.
10. Lidstrom A., Fractures of the distal end radius a clinical and statistical study of end result. *Acta scand* 1959; Suppl 41.
11. Frykman G. Fractures of the distal radius including sequale shoulder hand finger syndrome, disturbance in the distal radioulnar joint and impairment of nerve function : a clinical and experimental study. *Acta orthop scand* 1967; Suppl 108:1-55.
12. Conney W P, Linschied R L, Dobyys J H. Complications of colles fractures. *J Bone joint surg* 1980; 62A: 613-619.
13. Hanae minegishi, Osamu dohi, Soukan an & Hidetsugu sato ; Treatment of unstable distal radius fractures with the volar locking plate; *Upsala Journal of Medical Sciences*. 2011; 116: 280–284.
14. Wakefield A B, Mc Queen MM. The role of physiotherapy and clinical predictors of outcome after fracture of the distal radius. *J Bone Joint surg* 2000;82 B: 972-976.

**Source of Support:** Nil.

**Conflict of Interest:** None Declared.

**Copyright:** © the author(s) and publisher. IJMRP is an official publication of Ibn Sina Academy of Medieval Medicine & Sciences, registered in 2001 under Indian Trusts Act, 1882. This is an open access article distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

**Cite this article as:** Akella Suryanarayana Rao. Evaluation of Results of Volar Plating in Distal End Radius Fractures: A Prospective Study. *Int J Med Res Prof*. 2016; 2(6):307-10. DOI:10.21276/ijmrp.2016.2.6.064