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## Management of intra articular fractures of distal radius with variable angled locking compression plate - midterm outcome analysis

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### Abstract

**Introduction:** Fractures of distal radius remains one of the most challenging fractures treated by orthopaedic surgeons. The aim of this study is to analyse the functional outcome in intra articular distal radius fractures treated with variable angled volar locking plate.

**Aim of the Study:** The aim of this study is to analyse the functional outcome in intra articular distal radius fractures treated with variable angled volar locking plate.

**Materials and Methods:** From May 2016 to November 2017, consecutive patients with intra articular distal radius fractures were included in the study. All subjects were recruited, operated, and assessed at Department of Orthopaedic Surgery, RMMCH, Annamalai University, Chidambaram, Tamilnadu. The patients were followed up for a minimum of 6 months. The results were evaluated using Gartland and Werley scoring system for wrist.

**Results:** Of the forty wrists operated, according to demerit system of Gartland and Werley, 25 cases were males and 15 cases were females of which 28 cases were right and 12 cases were left wrists, the most common mode of injury being fall on out stretched hand accounting for 80% of cases, the average time for surgery was 5 days from the date of admission, a below elbow slab was applied on the day of admission till surgery. Excellent to Good results were obtained in 38 wrists i.e. 95%. Fair results were obtained in two wrists (5%). None of the patient showed poor results. Two patients showing fair results had wrist stiffness mainly attributable to patient's noncompliance to Physiotherapy. No major complication was noted in our study.

**Conclusion:** Variable angled volar locking plate is the implant of choice in Comminuted Intraarticular distal radius Fractures. Use of locked variable angled plate predictably yields better patient reported outcome as per Gartland and Werley scoring system and allows earlier range of wrist motion which yields accelerated return of function necessary for our Indian population.

**Keywords:** Variable angled locking plate, volar plate, wrist and fracture fixation

### Introduction

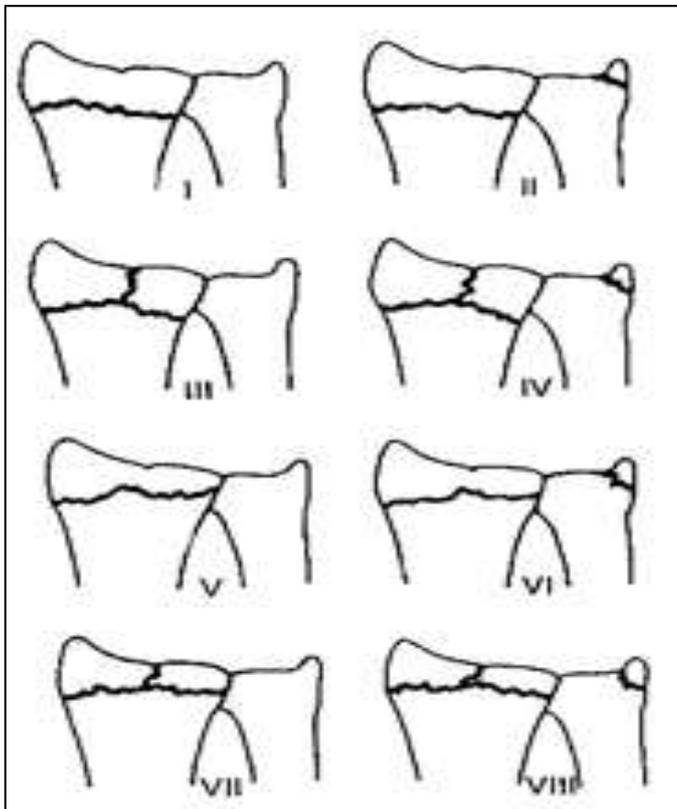
Distal radius fractures account for 6% of all extremity fractures and 17% of all the fractures treated in emergency department. As life expectancy increases, the incidence of distal radius fractures can be expected to increase as well. There appears to be a bimodal distribution of distal radius fractures consisting of a younger group who sustains relatively high energy trauma to the upper extremity and an elderly group who sustains both high energy and low energy injuries. In older age groups, women are more affected than men. The majority of fractures in older population are due to fall on an outstretched hand, while in younger these fractures are due to motor vehicle accidents.

### Common Classifications

1. Gartland & Werley
2. Frykman (radiocarpal & radioulnar)
3. AO
4. Melone (impaction of lunate)
5. Fernandez (mechanism)

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- I. Extra-articular
- II. With ulnar styloid fracture
- III. Radio-carpal joint
- IV. With ulnar styloid fracture
- V. Radio-ulnar joint
- VI. With ulnar styloid fracture
- VII. Both joints ulnar
- VIII. With styloid fracture

**Materials and Methods**

From May 2016 to November 2017, consecutive patients with intra articular distal radius fractures were included in the study. All subjects were recruited, operated, and assessed at Department of Orthopedic Surgery, RMMCH, Annamalai University, Chidambaram, Tamilnadu. The patients were followed up for a minimum of 6 months. The results were evaluated using Gartland and Werley scoring system for wrist.

**Inclusion Criteria**

- Age <18 years and <70 years.
- Less than 5 days between the trauma and study enrollment
- No contraindications to regional anesthesia
- The patient’s agreement to participate and sign the written informed consent form.

**Exclusion Criteria**

- Patients with neuro vascular deficit.
- Compound fractures.
- Patients with cognitive impairment.

**Results**

Of the forty wrists operated, according to demerit system of Gartland and Werley

- Excellent to good results were obtained in 38 wrists i.e. 95 %.
- Fair results were obtained in 2 wrists (10%)
- None of the patient showed poor results
- Two patients showing fair results had wrist stiffness mainly attributable to patient’s noncompliance to Physiotherapy.
- No major complication was noted in our study.

**Table 1**

Results	Point
<b>Residual deformity (range 0 to 3 points)</b>	
Prominent ulnar styloid	1
Residual dorsal tilt	2
Radial deviation of hand	2 or 3
<b>Subjective evaluation (range 0 to 6 points)</b>	
Excellent no pain, disability, or limitation of motion	0
Good: occasional pain, slight limitation of motion, and no disability	2
Fair: occasional pain, some limitation of motion, feeling of weakness in wrist, no particular disability if careful, and activities slightly restricted	4
Poor: pain, limitation of motion, disability, and activities more or less markedly restricted	6
<b>Objective evaluation (range 0 to 5 points)</b>	
Loss extension	5
Loss of ulnar deviation	3
Loss of supination	2
Loss of flexion	1
Loss of radial deviation	1
Loss of circumduction	1
Pain in distal radio-ulnar joint	1
Grip strength 60% or less than on the opposite side	1
Loss of pronation	2
<b>Complications (range 0 to 5 points)</b>	
<b>Arthritic change</b>	
Minimum	1
Minimum with pain	3
Moderate	2
Moderate with pain	4
Severe	3
Severe with pain	5
Nerve complications (median)	1-3
Poor finger function due to cast	1 to 2
<b>Final results (ranges of points)</b>	
Excellent	0-2
Good	3-8
Fair	9-20
Poor	≥21

**X ray And Clinical Pictures**

**Pre op**



**Post op**



### Follow-up at 1 year



### Clinical Pictures



### Discussion

The treatment of distal end radius fractures varies from closed reduction and casting in minimally displaced fractures to open reduction and internal fixation in more complex fractures. Open reduction and internal fixation restore the wrist's anatomy and help in faster rehabilitation with good clinical outcomes. Volar plating is currently favored for comminuted distal end radius fracture patterns and osteoporotic bones. The volar cortex of the distal end radius is often less comminuted than the dorsal cortex; therefore, anatomical reduction of the palmar cortex restores the radial shortening. Moreover, the palmar cortex is better contoured with respect to the dorsal cortex in terms of plate application. There had been a shift in focus from the use of non-locking volar plates to locking volar plates as the latter provides secure and reliable fixation of complex fractures due to angular stability. Kanabar *et al.* reported that early mobilization in fractures treated with volar fixed locking plates does not lead to a decrease in the radiological parameters achieved at the final follow-up. However, in their case series of comminuted distal end radius fractures, Gruber *et al.* noticed a statically significant loss in parameters like radial inclination and volar tilt with the use of volar fixed-angle plates. A few other studies have also reported a reduction in the radiological parameters during the follow-up period with the use of volar fixed-angle plates. The most significant change in parameters was seen in cases with comminuted distal end radius fractures (AO types C2 and C3). The introduction of variable angle plates addressed this problem in many such cases. There were concerns regarding the biomechanical rigidity of variable angle locking plates in comparison to fixed-angle plates. Stanbury *et al.* showed that the volar fixed and variable angle locking plates were similar in terms of the mean load to failure on cyclical loading. The

physiological compressive loads during movement of the wrist can easily be tolerated with VALPs. VALP allow subchondral purchase in the articular fragments due to the flexible plate positioning and so possibly maintain the reduction. In their case series on VALP, Figl *et al.* found no cases of a significant loss of radiological parameters in the follow-up period following fixation. Similarly, in our case series, the average loss in radial length, radial inclination, and volar angle, as well as the change in ulnar variance, were not significant at final follow-up in comparison to the immediate post-operative period despite the early and aggressive rehabilitation. Comminuted intra-articular radius fractures may require the placement of the volar plate distal near to the watershed line in order to capture the articular fragments; however, this could result in late flexor tendon rupture. A variable angle locking plate can be placed proximal to the watershed line and it is still able to engage those fragments. The bicortical purchase is another critical point in the management of complex fracture patterns and it can be achieved with flexible plate positioning in variable angle plates. The various fracture lines (proximal/distal and medial/lateral) are accommodated due to the flexibility offered by the variable angle system. Various authors reported the use of additional methods like Kirschner wire and/or dorsal plating in a few comminuted fracture patterns (AO type C3). With the introduction of variable angle locking plates, there has been a decrease in the use of these additional methods of fixation. The adaptation of screw direction helps in engaging specific fracture fragments and avoiding intraarticular penetration. Stanbury *et al.* reported the superiority of variable angle volar locking plates over fixed-angle locking plates in capturing the distal radial styloid. The evaluation of our results according to Gartland and Werley's

demerit scoring system revealed that 95% patients had excellent results, while 5% fell into the fair results mainly attributed to poor compliance. The minimum duration of follow-up in the present study was six months. MacDermid *et al.* reported that patients with distal end radius fractures achieve the majority of their grip strength and movement in six months. In their large series of 170 patients with distal end radius fractures, Kanabar *et al.* noticed that parameters such as range of motion and grip strength were regained by up to 94% in the three months after volar plating.

disability reported in the year following a distal radius fracture: a cohort study. *BMC Musculoskelet Disord.* 2003; 4:24.



### Conclusion

Comminuted intra articular fractures of the distal radius remains one of the most challenging fractures treated by orthopaedic surgeons. Variable angled Locking compression plate is the implant of choice in Comminuted Intra articular distal radius Fractures. Use of variable angle locking plate predictably yields better patient reported outcome as per Gartland and Werley scoring system and allows earlier range of wrist motion which yields accelerated return of function necessary for our Indian population. The use of such plates helps in early rehabilitation without the fear of a decrease in radiographic indices and hence functional results. It could thus be a useful modality for managing unstable distal end radial fractures. Despite the small sample size, the present series should provide the basis for a future prospective study involving variable volar locking plates.

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