International Journal of Orthopaedics Sciences

**ISSN:** 2395-1958
IJOS 2017; 3(4): 109-113

www.orthopaper.com
Received: 18-08-2017
Accepted: 19-09-2017

**Dr. Ashish Suthar**
MS Ortho. Assistant Professor. B.J. Medical College and Civil Hospital Ahmedabad, Gujarat, India

**Dr. Hiren M Patel**
MS Ortho. Ex Assistant Professor. B.J. Medical College and Civil Hospital Ahmedabad, Gujarat, India

**Correspondence**
**Dr. Ashish Suthar**
MS Ortho. Assistant Professor. B.J. Medical College and Civil Hospital Ahmedabad, Utter Pradesh, India

# Volar locking plate in intra-articular fracture lower end radius

**Dr. Ashish Suthar and Dr. Hiren M Patel**

**DOI:** https://doi.org/10.22271/ortho.2017.v3.i4b.18

**Abstract**
**Introduction:** Fractures of the distal radius recently have become the focus of an intense resurgence in interest regarding optimal management. The overly optimistic attitude that a favourable outcome will eventuate, despite residual deformity must be tempered by the realization that the common factor predisposing to a suboptimal recovery is malunion. Moreover for the most frequently occurring intra-articular fractures, an increasing consensus exists that preservation of distal radial articular contours, that in many cases can be achieved only be open treatment, is an absolute prerequisite for successful recovery.
**Aim:** To evaluate the outcome of volar plating using locked plates in intra articular fractures of lower end radius.
Materials and Methods: This is prospective all inclusive study for outcomes of intra articular fracture lower end radius using locked plates as a type of implant for open reduction and internal fixation of the fracture fragments. All patients included for this study sustained distal radius fracture grade III to grade VIII according to Frykmann classification. At the final follow up patients were assessed using Gartland and Werley's Demerit Scoring System[6] for the result of plating of intra articular fracture of lower end radius.
**Results and Discussion:** The results of present study were assessed using using Gartland and Werley's Demerit Scoring System. We observed that 60.47% patients showed excellent result, 34.89% patients showed good and 4.65% patients showed fair results. These results were quite comparable with other studies performed in the past.
**Conclusion:** Based on our study, we conclude that plating in unstable intra articular fracture of distal end radius using locked plates had become an effective tool in the management of difficult injuries. With the development of volar fixed angle locking plates, this technique is advantageous in intra articular lower end radius fractures.

**Keywords:** Volar locking plate, intra-articular fracture, radius

## Introduction
Having been recognized for nearly two centuries, fractures of the distal radius recently have become the focus of an intense resurgence in interest regarding optimal management [1]. Formerly considered relatively innocuous injuries incurred principally by the elderly, these fractures are now acknowledged as serious disruptions of wrist anatomy, with a considerable incidence of complications that affect a much larger segment of the populations. Heightened awareness of the widening scope of distal radius fractures has led to the emergence of substantial change in concepts that rational treatment should incorporate [2].
Prominent among these concepts is that functional recovery closely parallels the accuracy of skeletal restoration. The overly optimistic attitude that a favourable outcome will eventuate, despite residual deformity must be tempered by the realization that the common factor predisposing to a suboptimal recovery is malunion. Moreover for the most frequently occurring intra-articular fractures, an increasing consensus exists that preservation of distal radial articular contours, that in many cases can be achieved only be open treatment, is an absolute prerequisite for successful recovery.
Residual joint incongruity of seemingly minimal extent is prone to the inevitable development of disabling arthritis. Furthermore it is increasingly evident that well-conceived treatment for the diverse spectrum of distal radius fractures is contingent upon strict definition of specific

fracture configuration. The extent to displacement, the degree of articular disruption, the stability and reducibility of each fracture, as well as any concurrent injury to the adjacent nerves. Tendons or carpal structures must be assessed carefully in the planning of logical treatment. Clearly optimal management requires an accurate recognition and repair of concomitant injuries and rehabilitation supervised by highly skilled therapists [1, 2].

The present study is intended to find out and assess both conceptual and practical guidelines for precision treatment with an expectant favourable result.

**Aims and Objectives:** To evaluate the outcome of volar plating using locked plates in intra articular fractures of lower end radius

**Materials and Methods:** This is prospective all inclusive study for outcomes of intra articular fracture lower end radius using locked plates as a type of implant for open reduction and internal fixation of the fracture fragments. All patients included for this study sustained distal radius fracture grade III to grade VIII according to Frykmann classification[3].

These were intraarticular fractures that involved the distal radiocarpal and radioulanr joint with or without ulnar styloid fracture with varying comminution.

The prospective study was conducted in the Guru Gobind Singh Hospital Jamnagar in the Department of Orthopaedics between 2008 to 2011.

**Materials**

It included a study of 43 cases of intra articular fracture lower end radius coming to G G Hospital Jamnagar for treatment between 2008 to 2011. Patients falling in the inclusion criteria were included in the study. All adequate radiographs required for the diagnosis of the fracture type and morphology and to classify them further and to rule out trauma in other parts of the body were taken. Patients were given immobilization in the form of cock up slab and elevation to reduce edema caused due to trauma. Adequate analgesics were provided to the patient. Necessary investigations required for the pre operative profile were carried out and an anaesthetic assessment was done for the administration of the anaesthesia prior to surgery.

**Methods**

We operated patients under brachial block or general anaesthesia.

**Approach:** Following approaches for Volar Plating were used

- Volar approach of Henry for distal radius[4]
- The volar approach for distal radius along carpal tunnel[5]

**Rehabilitation**

During the fracture immobilization using a cock up slab rehabilitation included:-

- Immediate exercise of uninvolved joints, finger, elbow and shoulder
- Resistive exercise
- Reduction of post operative oedema
- Ablation of pain prevents complex regional pain syndrome

Following suture removal at two weeks and plaster slab removal at three weeks it included:

- Scar management
- Immediate joint mobilization
- Active and passive exercises
- Muscle strengthening exercises

Radiographs taken at three weeks interval for three months.

At the final follow up patients were assessed using Gartland and Werley's Demerit Scoring System[6] for the result of plating of intra articular fracture of lower end radius.

**Observations and Results**

The present study is a prospective study of 43 cases of intraarticular fracture of distal end radius carried out in the Department of Orthopaedics Guru Gobind Singh Hospital, Jamnagar between May 2008 to May 2011.

The data collected used for comparison with the data of studies mentioned below were obtained by regular follow up of the patients with minimum duration of follow up being 4 months.

It is the study to know the outcome of volar locking plates in intraarticular fracture lower end radius.

**Age**

The patients included in this present study belonged to age group of 20 to 70 years. Percentage of patients belonging to different age groups are shown in the table mentioned below:

| Age | <20 YRS | 20-40 YRS | 41-60 YRS | >60 YRS | Average Age |
|---|---|---|---|---|---|
| Incidence | 1 (2.33%) | 24 (55.81%) | 15 (34.88%) | 3 (6.98%) | 45 |

**Sex**

| Sex | Male | Female |
|---|---|---|
| **Incidence** | 33 (76.74%) | 10 (23.26%) |

**Mode of Injury**

| | Velocity of trauma | |
|---|---|---|
| | High velocity | Low velocity |
| Present series | 28 (65.12%) | 15 (34.88%) |

**Fracture Classification**

| Frykmann Classification | No of cases | Percentage |
|---|---|---|
| Type III | 17 | 39.53% |
| Type IV | 5 | 11.63% |
| Type V | - | - |
| Type VI | - | - |
| Type VII | 13 | 30.24% |
| Type VIII | 8 | 18.60% |

**Incidence of side in relation to distal end radius fracture**

| | Dominant hand | Non-dominant hand |
|---|---|---|
| Present Series | 19 (44.19%) | 24 (55.81%) |

**Incidence of Typre of injury**

| | Open | Closed |
|---|---|---|
| **Present series** | 1 (2.33%) | 42 (97.67%) |

**Type of locked plate used in surgery**

| | Locked Plates | |
|---|---|---|
| | **AO** | **NON AO** |
| No of patients (%) | 3 (6.98%) | 40 (93.02%) |

**Type of locked plate used in surgery**

| | Locked Plates | |
|---|---|---|
| | **AO** | **NON AO** |
| No of patients (%) | 3 (6.98%) | 40 (93.02%) |

**The duration of followup of intraarticular fracture of distal end radius treated with volar locked plates**

| Duration | Plating |
|---|---|
| <6 MONTHS | 7 (16.28%) |
| 6 TO 12 MONTHS | 27 (62.79%) |
| 13 TO 18 MONTHS | 9 (20.93%) |

**The incidence of patients who underwent physiotherapy and the mean duration**

| Duration | Physiotherapy in department | Physiotherapy at home |
|---|---|---|
| Upto 10 Days | 26 (60.47%) | - |
| 11-30 Days | 16 (37.21%) | 26 (60.47%) |
| >30 Days | 1 (2.32%) | 17 (39.53%) |

Almost all the patients in this series underwent adequate supervised physiotherapy.

**The incidence of complications in relation to distal end radius fracture**

| Complication | Present Series |
|---|---|
| Pain | 9 (20.93%) |
| Deformity | 5 (11.63%) |
| Finger stiffness | 10 (23.26%) |
| Osteoarthritis | - |
| Complex regional pain syndrome | 5 (11.63%) |
| Nerve injury | - |
| Tendon rupture | - |
| Malunion/ Nonunion | - |
| Hardware related complications (Implant loosening, backout) | - |

**The range of movement**

| Degrees | 0-30 | 31-60 | 61-90 | 91-120 | >120 |
|---|---|---|---|---|---|
| Arc of dorsiflexion to plantarflexion | | | 2 (4.65%) | 13 (30.23%) | 28 (65.12%) |
| Degrees | 0-5 | 6-10 | 11-15 | 16-20 | >20 |
| Ulnar deviation | - | 4 (9.30%) | 12 (27.91%) | 14 (32.56%) | 13 (30.23%) |
| Radial deviation | - | 7 (16.28%) | 21 (48.84%) | 13 (30.23%) | 2 (4.65%) |
| Degrees | 0-50 | 51-75 | 76-100 | >100 | |
| Arc of supination to pronation | - | 1 (2.33%) | 4 (9.30%) | 38 (88.37%) | |

**The incidence of radial shortening with relation to intraarticular fracture of distal radius**

| Shortening In Mm | 0-3 | 4-6 | 7-9 | >9 |
|---|---|---|---|---|
| No of patients | 37 | 6 | - | - |
| Percentage | 86.05% | 13.95% | | |

**The degree of volar tilt at final followup**

| | Degrees of tilt | | |
|---|---|---|---|
| | **10 to 6 degree volar tilt** | **5 to 0 degree volar tilt** | **dorsal tilt** |
| No of patients | 23 | 19 | 1 |
| Percentage | 53.49% | 44.19% | 2.32% |

**The degree of radial angulation achieved at final followup**

| | Degrees | | |
|---|---|---|---|
| | <20 | 20-25 | >25 |
| No of patients | - | 38 | 5 |
| Percentage | - | 88.37% | 11.63% |

**The results of the patients following intraarticular fracture of distal end radius treated with volar locked plates**

| | Results | | | |
|---|---|---|---|---|
| | **Excellent** | **Good** | **Fair** | **Poor** |
| Present Series (ORIF with 3.5 mm locking plate) | 26 (60.47%) | 15 (34.89%) | 2 (4.65%) | - |

**The result of present study with regards to frykmann classification**

| Frykmann classification | No of type | Results | | | |
|---|---|---|---|---|---|
| | | **Excellent** | **Good** | **Fair** | **Poor** |
| III | 17 | 16 (94.12%) | 1 (5.88%) | - | - |
| IV | 5 | 1 (20%) | 4 (80%) | - | - |
| V | - | - | - | - | - |
| VI | - | - | - | - | - |
| VII | 13 | 9 (69.23%) | 4 (30.77%) | - | - |
| VIII | 8 | - | 6 (75%) | 2 (25%) | - |

## Discussion

### Age

The classical Colles' fracture occurs in old age for aging causes osteoporosis and the cancellous metaphysis becomes weak through which the fracture occurs. In contrast the intraarticular fracture of distal end radius occurs in young and middle aged physically active individual with good bone stock and are related more with high velocity trauma.

**Table 1**

| Series | Age range in years |
|---|---|
| Present series | 20 to 70 |
| Jupiter and fernandez[7] | 16 to 76 |
| Shetty and kiran[8] | 20 to 65 |

**Table 2:** Shows the age incidence of our study in comparison with other studies

| Series | <20 YRS | 20-40 YRS | 41-60 YRS | >60 YRS | AVERAGE AGE |
|---|---|---|---|---|---|
| Present series | 1 (2.33%) | 24 (55.81%) | 15 (34.88%) | 3 (6.98%) | 45 |
| Jupiter and Fernandez series [7] | 3 (6.12%) | 20 (40.82%) | 14 (28.57%) | 12 (24.49%) | 43 |

**Table 3:** Shows the sex incidence and its relation to intraraticular distal end fracture of radius

| Sex | Male | Female |
|---|---|---|
| Present series | 33 (76.74%) | 10 (23.26%) |
| Jupiter & Fernandez series[7] | 29 (59.18%) | 20 (40.82%) |

**Table 4:** Shows the mode of injury resulting in intraarticular lower end radius

| | Velocity of Trauma | |
|---|---|---|
| | High velocity | Low velocity |
| Present series | 28 (65.12%) | 15 (34.88%) |
| Jupiter and Fernandez series[7] | 37 (75.51%) | 12 (24.49%) |
| Shetty and Kiran series [8] | 16 (69.57%) | 7 (30.43%) |

**Table 5:** Shows the incidence of side in relation to distal end radius fracture

| | Dominant hand | Non- dominant hand |
|---|---|---|
| Present series | 19 (44.19%) | 24 (55.81%) |
| Jupiter & Fernandez series [7] | 30 (61.22%) | 19 (38.78%) |

**Table 6:** Shows the incidence of type of injury

| | Open | Closed |
|---|---|---|
| Present series | 1 (2.33%) | 42 (97.67%) |
| Jupiter & Fernandez series[7] | 8 (16.33%) | 41 (83.67%) |

**Table 7:** Shows the incidence of complications in relation to distal end radius fracture

| Complication | Present series | Jupiter & fernandez series[7] |
|---|---|---|
| Pain | 9 (20.93%) | 5 (10.20%) |
| Deformity | 5 (11.63%) | 4 (8.16%) |
| Finger stiffness | 10 (23.26%) | 5 (10.20%) |
| Osteoarthritis | - | 2 (4.08%) |
| Complex regional pain syndrome | 5 (11.63%) | 1 (2.04%) |
| Nerve injury | - | 3 (6.12%) (Carpal tunnel syndrome) |
| Tendon rupture | - | 1 (2.04%) (Extensor pollicis longus) |
| Malunion/ Nonunion | - | - |
| Hardware related complications (Implant loosening, backout) | - | - |

**Table 8:** Shows the results of the patients following intraarticular fracture of distal end radius treated with volar locked plates

| | Results | | | |
|---|---|---|---|---|
| | Excellent | Good | Fair | Poor |
| Present Series (ORIF with 3.5 mm locking plate) | 26 (60.47%) | 15 (34.89%) | 2 (4.65%) | - |
| Jupiter & Fernandez series [7] (47- ORIF with 3.5mm locking plate, 1-ORIF with 4 mm cancellous screws 1-ORIF with 2.7 mm locking plate) | 31 (63.27%) | (20.41%) | 8 (16.32%) | - |
| Shetty And Kiran Series [8] (ORIF with 2.4 mm volar locking plate) | 4 (17. 39%) | 18 (78.26%) | 1 (4.35%) | |

Although distal radius fracture is the commonest of fracture and represents 20% of all fractures there is a surprising disagreement about classification treatment and the correlation between radiographic and functional outcome. Nevertheless a consensus has developed on a treatment protocol which takes into consideration the fracture type and advocate differential treatment with additional fixation for unstable fracture.

These fractures as a rule are easily reduced by traction and manipulation. Frequently however, maintenance of reduction is not possible because there is significant metaphyseal comminution in these fractures which can heal only after collapse and therefore deformity recurs. The logical interference is that the reduction can be maintained by some form of fixation at the fracture site improving the end result.

On analyzing the result and comparing with other study interesting factors were unraveled. It also helps us to know the feasibility of such treatment in our setup and brings to focus the problems caused by it.

Volar locking plate in distal radius intra articular fractures has the following advantages:-

1) It can be applied to different patterns of apex volar and dorsal fractures
2) Stable subchondral support to the intact radial shaft affords excellent fracture stability and prevents settling
3) It allows early active wrist motion so there is less stiffness of fingers and wrist joint

## Conclusion

We have arrived at the following conclusion:-

- Intra articular fractures are more common in young and middle aged males who had sustained high velocity trauma
- Fracture pattern in most of the patients was unstable with varying degree of combination and displacements.
- Anatomical restoration of articular congruency along with restoration of radial length and reduction of the dorsal tilt are of great importance with regards to long term outcomes.
- Patients with Frykmann type VII and VIII fractures have less favourable outcomes.

Based on our study, we conclude that plating in unstable intra articular fracture of distal end radius using locked plates had become an effective tool in the management of difficult injuries. With the development of volar fixed angle locking plates, this technique is advantageous in intra articular lower end radius fractures.

## References


1. Raval H, Vyas K. Long term outcome of lower end radius fractures treated with locking plates, IJOS. 2017; 3(1):515-519.
2. Rajput Y. A Comparative Study of Different Methods of Treatment for Fractures of the Distal End of Radius with Volar Locking Compression Plate System, International Journal of Current Medical and Applied Sciences. 2016; 13(1):65-69.
3. Frykman G. Fracture of the Distal Radius Including Sequelae-Shoulder-Handfinger Syndrome, Disturbance in the Distal Radio-Ulnar Joint and Impairment of Nerve Function: A Clinical and Experimental Study. Acta Orthopaedica Scandinavica. 1967; 38(108):1-61.
4. Ilyas AM. Surgical approaches to the distal radius. Hand (New York, NY.). 6(1):8-17. http://doi.org/10.1007/s11552-010-9281-9
5. Orbay JL. The treatment of unstable distal radius fractures with volar fixation. Hand surgery. 2000; 5(02):103-112.
6. Kwok IHY, Leung F, Yuen G. Assessing Results after Distal Radius Fracture Treatment: A Comparison of Objective and Subjective Tools. Geriatric Orthopaedic Surgery & Rehabilitation. 2011; 2(4):155-160. http://doi.org/10.1177/2151458511422701
7. Jupiter JB, Fernandez MD. Choon-laui Toh *et al*. operative treatment of volar intraarticular fractures of the distal end radius. J Bone joint surgery am. 78:1817-1828, 1996.
8. Shetty MS, Kumar MA, Kiran GK, Kini AR. Department of orthopaedics and traumatology, Tejasvini hospital, SSIOT Kadri, Mangalore India.