



COMPLICATIONS OF INTRA-ARTICULAR DISTAL RADIUS FRACTURES TREATED WITH DISTAL VOLAR RADIUS PLATE

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Abstract:

Background: Distal end radius fractures account for approximately 1/6th (16%) of all fractures and treated in emergency rooms. **Objective:** To enumerate the complications of intra-articular distal radius fractures treated with distal volar radius plate. **Methods:** The study was conducted among adult population coming to Department of Orthopaedics, Shaheed Hasan Khan Mewati Government Medical College, Nalhar, Nuh, Haryana SHKM, GMC with intra-articular distal end radius fracture. **Result:** The mean age of the study population was 42.98±8.31 (range = 25-59) years. There were 72.5% males and 27.5% females among study population. Left side was affected among 14 (35.0%) and Right side among 26 (65.0%) subjects. The mode of injury was Fall among 11 (27.5%) and Road traffic accident injury among 29 (72.5%) subjects. Associated injury occurred among 32.5% subjects. The complications reported were Stiffness among 20 (50%), Superficial infections among 2 (5.0%), Malunion and Non-union among 1 (2.5%) subject each.

Conclusion: The technique emphasizes 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: Complications, intra-articular distal radius fractures, distal volar radius plate

INTRODUCTION: Many surgeons are interested in the volar approach of distal radius because it minimizes the prominent hardware complications because pronator quadratus well pads the plate and avoids contact of the plate with flexor tendons. Also screw back out, loss of reduction and intraarticular screw migration are common in conventional plates rather than locking plates and screws. Further locking screws act as an indirect buttress in holding the dorsally comminuted fragments.

Volar locking plate is an increasingly popular choice for distal radial fractures, owing to its wider availability and reliability of the locking technology adapted to the wrist.¹ Variable angle locking screws facilitate column-specific fixation even in osteoporotic bones, and extend the application to a wider spectrum of fractures, with good outcome and few complications.¹

The Distal volar radius plate system is direct and easy to operate, allowing patients to quickly regain wrist movement.² The excellent biomechanical strength of the DVR plate is based on its ability to provide a three-dimensional scaffold structure and strong subchondral support for the articular surface of the distal radius. It locks the screw and screw structure by the fixed angle formed by the cross arrangement of two rows of screws at its far end. The role of these screws is to stabilize the subchondral bone and reduce disturbance to the dorsal tendon. The pull screw can fix the dorsally displaced fracture fragments and pull them to the radius, so as to resolve the fracture.^{3,4,5}

Numerous studies have confirmed the importance of restoring and maintaining anatomic alignment for optimal functional outcome^{5,6,7} and prevention of residual articular incongruence, which is associated with the development of posttraumatic arthritis.^[8,9] Volar locking plate fixation has been demonstrated to allow restoration of radiographic parameters within accepted standards.^[10,11,12]

Volar Plate Fixation has become the preferred method of internal fixation for distal radius fractures.¹³ Because of the correlation between anatomic reduction and functional outcome, locked plating systems were developed for distal radius fractures to assist with fixation in more difficult cases, such as in unstable osteoporotic bone and highly comminuted fractures.¹³

Hence this study was conducted to enumerate the complications of intra-articular distal radius fractures treated with distal volar radius plate.

Material and Methods: This prospective clinical study was conducted among adult population coming to Department of Orthopaedics, Shaheed Hasan Khan Mewati Government Medical College, Nalhar, Nuh, Haryana SHKM, GMC with intra-articular distal end radius fracture. Duration of study was 18 months. **Ethical** clearance was taken from Institutional Ethical committee Shaheed Hasan Khan Mewati Govt. Medical College, Nalhar, Nuh, Haryana.

Inclusion criteria

1. All intra-articular fracture distal end radius (Frykman type III to VIII).
2. Patient between 18-60 years of age.
3. Closed fractures.
4. Patients who are willing to participate in the study and give informed consent.

Exclusion criteria

1. Osteoporosis (>60 years old of age).
2. Extra-articular fracture.
3. Compound Fracture.
4. Associated forearm and hand injuries.
5. Patients lost to follow up

Sample Size:

Cases satisfying the inclusion criteria among the admitted patients in the department of Orthopaedics, SHKM GMC Nalhar, Nuh and who gave consent to participate in the study were included in the study. On the basis of previous trends of similar cases in our institute, the present study enrolled 40 patients.

PATIENT EVALUATION:

Patients were admitted both in Emergency department and as regular Outpatient Department of those suspected wrist injury. Elucidating history to assess the force and nature of violence, mode of injury, co-morbid illness history of previous surgeries and to rule out head injury or other system involvement. Thorough general examination and evaluation was done of the patient as a whole and the limb in specific survey was done.

In case of polytrauma due to road traffic accident, complete skeletal survey including the clavicle, chest, whole spine, pelvis and all long bones was done, otherwise wrist x-ray alone were ordered. Systemic examination of cardiac, respiratory, abdominal, and neurological functions was done.

The upper limb was surveyed for the injuries, to assess the skin condition, neurovascular status,

clinical signs of fracture and its displacement with deformity. Radial and ulnar artery pulses were checked and compared with other hand.

Peripheral Nerve Examination was carried out with particular importance to Median nerve considering its proximity to fracture in volar compartment of forearm. This explains its propensity to cause compartment syndrome. Those patients who belonged to our inclusion criteria were subjected to further radiological evaluation.

The involved extremity was immobilized in below elbow POP slab and kept elevated. Pain and inflammation were managed by using analgesics and NSAIDS.

Routine investigations were done to obtain anaesthetic fitness, in this Pandemic time, pre operative Covid-19 RTPCR test were done. All our patients were Covid-19 negative

METHOD OF TREATMENT:

Open reduction and internal fixation with volar buttress plate was done. Treatment modality was explained to the patients and family including procedure, expected outcome and complications.

Pre-anaesthetic check-up was done. Consent was taken for surgery. Preparation of the part was done a day before surgery. Intravenous antibiotics were given to all patients half hour prior to surgery.

SURGICAL TECHNIQUES

The standard volar approach named modified Henry Approach (FCR approach) was used to address the distal radius fragments. Longitudinal incision was made overlying the tendon of flexor carpi radialis. Plane is developed between radial artery radially and the flexor carpi radialis ulnarly to expose the pronator quadratus muscle. The pronator quadratus muscle was divided to expose the underlying volar aspect of distal radius.

At this point, fracture site was exposed and reduced. Appropriate distal volar plate was applied over the fracture site and fixed with the help of appropriate screw size. Implants used in all patients were of Indian manufacturers.

Statistical analysis

The data was entered into the Microsoft excel and the statistical analysis was performed by statistical software SPSS version 21.0. The Quantitative (Numerical variables) were present in the form of mean and SD and the Qualitative (Categorical variables) were present in the form of frequency and percentage.

The repeated measures ANOVA test was used for comparing the mean values between different time intervals. The p-value was considered to be significant when less than 0.05.



Position of Limb**Incision****Exposed Fracture Site****Fixed distal volar radius plate****Per-Operative Clinical photograph**

Results: In our present prospective study we have included 40 patients with intra-articular distal radius fractures treated in department of orthopaedics, Shaheed Hasan Khan Mewati Government Medical College Nalhar, Nuh.

Majority of the subjects belonged to 41-50 years (50.0%) followed by 31-40 years (27.5%), > 50 years (15.0%) and 21-30 years (7.5%). The mean age of the study population was 42.98 ± 8.31 (range = 25-59) years. There were 29 (72.5%) males and 11 (27.5%) females.

Left side was affected among 14 (35.0%) and Right side among 26 (65.0%) subjects.

Table 1: Distribution of study population according to side of injury

Side of Injury	Frequency	Percent
Left	14	35.0%
Right	26	65.0%
Total	40	100.0%

Table 2: Distribution of study population according to mode of injury.

Mode of Injury	Frequency	Percent
Fall	11	27.5%
RTA	29	72.5%
Total	40	100.0%

The mode of injury was Fall among 11 (27.5%) and Road traffic accident injury among 29 (72.5%) subjects.

Table 3: Distribution of study population according to presence or absence of associated injury.

Associated injury	Frequency	Percent
Absent	27	67.5%

Present	13	32.5%
Total	40	100.0%

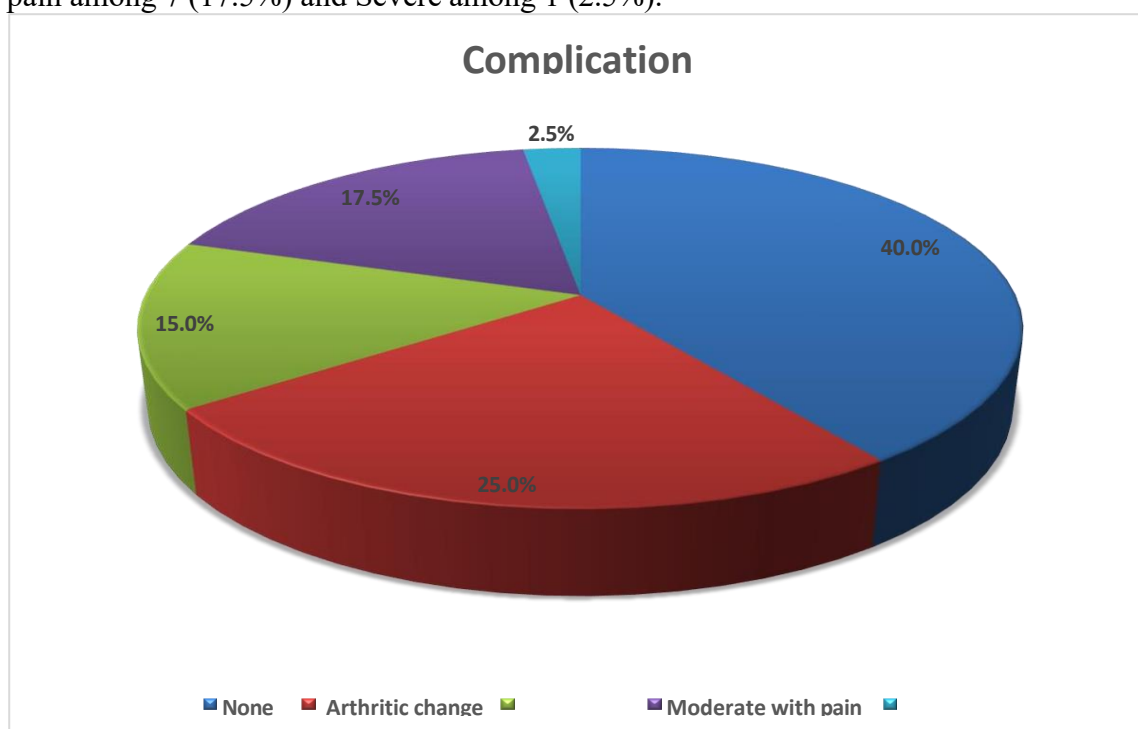
Associated injury occurred among 32.5% subjects. In our study 6 patients had metatarsal fractures, 3 patients had fracture both bone leg, 2 patients had femur fracture, 2 patients had patella fracture. Maximum subjects reported with Frykman type IV and VII (22.5% each).

Residual deformity showed that Prominent ulnar styloid among 18 (45.0%), Residual dorsal tilt among 8 (20.0%) and Radial deviation of hand among 2 (5.0%) subjects.

Subjective evaluation showed Excellent outcome 9 (22.5%), Good among 13 (32.5%), Fair among 12 (30.0%) and Poor among 6 (15.0%).

Objective evaluation showed Loss of Palmar flexion ($< 30^0$) and Loss of Radial deviation ($< 15^0$) among 4 each (10.0% each), Loss pronation ($< 50^0$) among 4 (10.0%), Loss of ulnar deviation ($< 15^0$) among 6 (15.0%) and Loss of dorsiflexion ($< 45^0$) among 2 (5.0%) subjects.

There was Arthritic change among 10 (25.0%), Moderate change 6 (15.0%), Moderate with pain among 7 (17.5%) and Severe among 1 (2.5%).

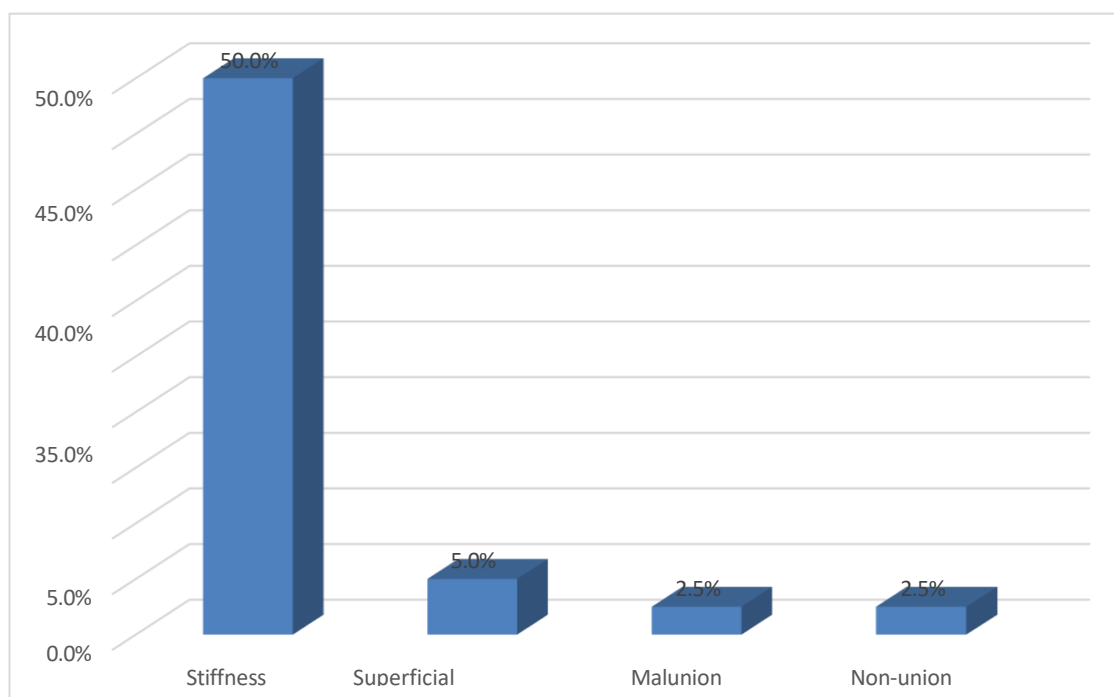


There was Excellent outcome among 13 (32.5%), Good among 18 (45.0%), Fair among 8 (20.0%) and Poor among 1 (2.5%) subject.

Table 4: Distribution of study population according to other complications

Complications	Frequency	Percentage
Stiffness	20	50.0%
Superficial infections	2	5.0%
Malunion	1	2.5%
Non-union	1	2.5%

The complications reported were Stiffness among 20 (50%), Superficial infections among 2 (5.0%), Malunion and Non-union among 1 (2.5%) subject each.



Discussion:

The mean age of the study population was 42.98 ± 8.31 with a range of 25-59 years. Similar to our study, In the study by *Kevin C, Chung et al.*¹⁴ the average age of the patients was 48.9 years with minimum age 18 years and maximum years 83 years. In the research by *Anakwe RE et al.*¹⁵ the average age of the patients was 48 years (22- 67 years).

In our study, there were 72.5% males and 27.5% females. The study done by *Hanae Minegishi et al.*¹⁶ included mostly females (80%) and males were 20%. *Tank Gyaneshwar* study had 65% females and 35% males.¹⁷

In present study, left side was affected among 35.0% and Right side among 65.0% subjects. In other studies,^{18,19} the right side was more predominantly involved but at the same time they have inferred that statistically there was no significance of side involvement in the study.

Mode of Injury

In current study, the mode of injury was Fall among 27.5% and Road traffic accident injury among 72.5% subjects. In the study of *Kilic et al.*²⁰ also found road traffic among 48.1% and fall among 51.9% patients.

Associated injury

There were associated injury among 32.5% subjects in our study. *Chavhan AN et al.*²¹ reported that 5.7% had an associated injury and *Khan et al.*²² reported that 6.66% patients had associated injuries.

Complications

Previous studies suggest that it is safe to mobilise wrists immediately after fixation with a volar locking plate which is due to the fact that the threaded locking screws and locking plate can provide an internal-external fixator, which acts as a single unit to support and hold the bone. This is particularly important in osteoporotic bone and in very comminuted fractures.²³

In current study, the complications reported were Stiffness among 20 (50%) but all had no functional disability in daily activities, Severe arthritis among 1 patient, Superficial infections among 2 (5.0%) which were managed by regular dressings and antibiotics. Infection healed within 15 days. Malunion and Non-union among 1 (2.5%) subject each. Mal-union was acceptable functionally. Re-operation was done by bone grafting and re-plating in patient with non-union. *Wong et al.*²³ reported only two complications in 35 patients treated with the variable-angle locking system. The frequency of ulnar styloid non-union has previously been found to be between 26%²⁴ and 63%,²⁵ and functional outcome scores for such patients were not worse than for patients with

healed fractures.^{26,27}

Fracture of distal end of radius with or without involvement of articular surface when treated with volar plate fixation have significantly better outcome over other methods. Our study had some limitations. The sample was not homogenous regarding the stages of classification system for comparison by different method of treatment and, therefore, the findings are inconclusive. The sample size of our study is limited to one centre and is small to conclude very effectively. Many patients who were planned for plate osteosynthesis were managed by cast or K-wire due to financial constraints.

Conclusion: The technique emphasizes 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.

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