

Functional Outcome Of Intraarticular Distal Radius Fractures Managed By Volar Locking Compression Plate – A Prospective Study

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Abstract: Background: Distal end radius fracture is one of the most common upper extremity fracture. Intraarticular distal end of radius fracture is a therapeutic challenge. They can be managed by various treatment modalities. The function outcome of a particular treatment modality needs to be further studied. **Objectives:** To evaluate the functional outcome and complications of intraarticular distal radius fracture treated by volar locking plate fixation. **Methods:** Prospective study involving Adults (18-60years) with intraarticular distal radius fracture admitted to a Tertiary care center in Kerala, India in the period from February 2016 to July 2017. In this study 35 patients with intraarticular distal radius fracture selected by consecutive sampling were treated with volar locking plate. Serial follow up was done at 4, 8, 12, 24 weeks using QuickDASH, PRWE questionnaire and xrays to assess radiological union and complications. **Results:** At 24 weeks follow up mean QuickDASH score was 6.82 ± 7.84 and mean PRWE score was 14.56 ± 6.77 with good functional outcome. Radiological union was noted in majority (28 cases) by 8 weeks. Wrist stiffness was noted in 5 cases. There were no cases of Intra articular screw penetration, Screw loosening, Non-union, Implant failure, Shoulder hand syndrome or neuropathies. **Conclusion:** Volar locked plating may be recommended for intraarticular distal radius fractures requiring operative intervention with early mobilization of wrist joint.

Keywords: Intraarticular distal radius fracture, Volar locking plate, Functional outcome, prospective study.

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I. Introduction

Distal end radius fractures is one of the most common upper extremity fracture. Elderly population is affected by low energy trauma such as fall on outstretched hand [1] whereas young adults are mainly affected in high energy trauma such as road traffic accidents.

Fractures of distal end of radius is a therapeutic challenge. Improper reduction and malalignment can lead to many complications like post-traumatic osteoarthritis, stiffness, carpal instability and reduced grip strength.

Internal fixation of metaphyseal bending fractures has definite advantages over external fixation (i) directly control and maintain physiologic palmar tilt, (ii) prevent collapse with external fixation, and (iii) avoid bridging the radiocarpal joint. The distal fragment typically has sufficient size and integrity to provide adequate purchase and may be approached from either a dorsal or a volar approach. Volar plating is preferred, as the screws directly buttress against collapse. The advantage of volar plating also include faster functional recovery with lower complication rates including extensor tendon irritation and rupture [2,3].

Volar plates for fractures of distal radius can be (a) Conventional plates and (b) Locking compression plates. When using conventional plates comminution must be less. They poorly hold the cancellous bone fragments hence screws can toggle in the distal holes of the plate leading to loss of reduction and collapse during axial loading.

With locking plates the locking screws support subchondral bone, resist axial loading forces and prevents collapse and maintains reduction especially in intraarticular fractures [4]. Compression of plate to bone is not necessary and thus preserves periosteal blood supply. Locking plate also provides additional strength by transferring the load from the intact subchondral bone across the compromised metaphysis to the intact diaphysis, which would theoretically permit early range of motion postoperatively [5].

The development of fixed angular stable fixation techniques theoretically improves stability to maintain the reduction of fractures in osteoporotic bones and fractures especially in elderly which is usually unstable [6].

II. Materials And Methods

Thirty five patients with intraarticular distal radius fractures treated at Orthopaedics department of a Tertiary care center in Kerala, India between February 2016 and July 2017 were included in this study. Patients included in the study were in the age group of 18-60 years of age, having closed injuries, with radiological findings confirming intraarticular fracture of distal radius, Frykman classification III, IV, V, VI, VII&VIII, undisplaced fracture and displaced fracture. Exclusion criteria was patients with open fracture, fracture more than three weeks old and severely comminuted fracture.

2.1 Pre-operative evaluation and planning:

Routine examination of blood was done for hemoglobin percentage, total and differential WBC counts, fasting blood sugar, blood urea, serum creatinine, bleeding and clotting time, screening. Preparation of the part was done on the day of surgery. Tetanus toxoid injection and intravenous antibiotic were given to all patients pre-operatively. Consent for surgery was taken and patients were operated after a pre-anaesthetic checkup. Standard radiographs in PA and lateral views were taken. Oblique views were also taken in a few patients who had complex comminuted fractures. The fracture were classified according to the Frykman's and AO classification. The operations were performed under general anaesthesia in twenty six cases and Regional block in nine cases.

2.2 Technique:

After positioning painting and draping, the distal radius was exposed using volar Henry approach. An incision is made between the flexor carpi radialis (FCR) tendon and the radial artery. This interval is developed, revealing the flexor pollicis longus (FPL) muscle at the proximal extent of the wound and the pronator quadratus muscle more distally. The radial artery is carefully retracted laterally, while the tendons of the FCR and FPL are retracted medially. The pronator quadratus is divided at its most radial aspect. After the pronator quadratus has been divided and elevated, the fracture is readily visualized, and reduction maneuvers can be accomplished under direct vision. After exposure and debridement of the fracture site, the fracture is reduced and provisionally fixed with K-wires or reduction forceps. The appropriate plate is selected following fracture reduction.

First, a standard cortical screw was applied to the most distal oval hole of the vertical limb of the plate in order to temporarily secure the plate to the proximal fragment. This allowed concomitant proximal and distal plate adjustment. After fixing the distal fragment with subchondral screws, radial length was gained, when necessary, by pushing the plate distally. The first standard screw were either left in situ or exchanged with another locking screw.

The optimal placement of the distal screws is important. They must be inserted at the radial styloid, beneath the lunate facet, and near the sigmoid notch. The distal screws can be of either monocortical or bicortical engagement. The final position of the plate was confirmed using fluoroscopy.

Pronator quadratus muscle was not closed in any of the patients. The wound was closed in layers and sterile compression dressing was applied. The operated limb was supported with an anterior below elbow POP slab with the wrist in neutral position.

Postoperatively appropriate antibiotics and analgesics were used. Immediate post-operative radiographs were taken to determine the bone alignment. Post-operative wound inspection was done on 2nd day and suture removal was done on 10th day.

2.3 Follow up and assessment:

Patients were reviewed on 4th,8th,12th and 24th week and were asked to answer the Patient Rated Wrist Evaluation (PRWE)[7,8] and Disabilities of the Arm, Shoulder and Hand(Quick DASH) score questionnaire[9,10,11]. X-rays were also taken to assess the radiological union.

2.4 Statistical Methods:

Numerical variables were expressed as mean and standard deviation. Categorical variables were expressed as frequency and percentages. To test the statistical significance in mean values of QuickDASH and PRWE score at 4, 8, 12, 24 weeks repeated measures of ANOVA (Analysis of variance) was used.

III. Results

The mean follow up period was 13 months. In the study the patients were in the age group of 21-58 years with mean of 36.37 years. A male preponderance was noted that is, of the 35 cases studied, 28 (80%) of the patients were males and 7 (20%) were females. Majority that is 26 (74.28%) patients had right side involvement (dominant wrist) and 9 (25.71%) had left side involvement of the patients. Of the 35 cases, injury

occurred due to road traffic accident in 22 (62.85%) patients and fall on the out stretched hand in 13(37.14%) patients. Based on AO classification there were 1(2.86%) case of AO B1, 4(11.43%) B2, 15(42.86%) B3, 10(28.57%) C1 and 5(14.3%) C2 cases. We encountered a complication rate of 14.3%, with stiffness of the wrist and was mainly due to lack of mobilization by patient and they all improved gradually by physiotherapy and mobilization. There were no complication like median nerve compression or carpal tunnel syndrome, other neuropathies, Shoulder hand syndrome, tendon ruptures. The mean QuickDASH score calculated was 6.82 ± 7.84 and mean PRWE score calculated was 14.56 ± 6.77 .

IV. Figures And Tables

Table 1. Complications.

Complication	Number of Cases	Percentage
Stiffness	5	14.3
Total	5	14.3

14.3% of cases had complication in the form of wrist stiffness.

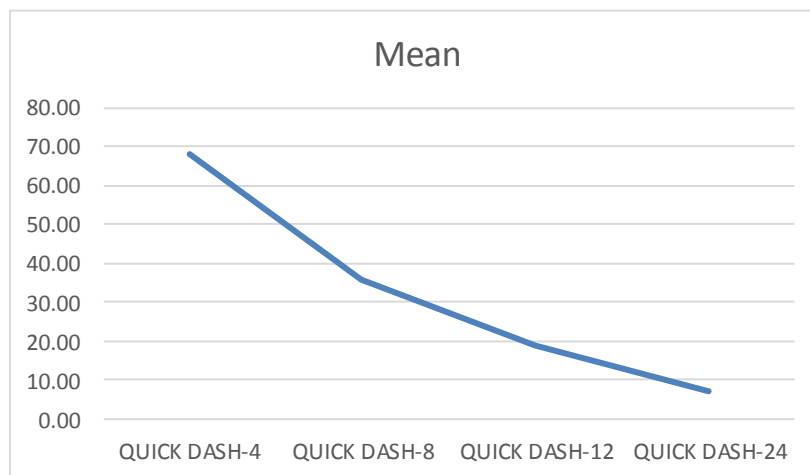


Figure 1 QuickDASH mean.

Table 2. Comparison of quick dash scores at 4,8,12,24 weeks

QUICK DASH	N	Mean	SD	p Value
QUICK DASH-4 Weeks	35	68.31	4.49	<0.001
QUICK DASH-8 Weeks	35	35.91	11.14	
QUICK DASH-12 Weeks	35	18.56	9.89	
QUICK DASH-24 Weeks	35	6.82	7.84	

Mean and standard deviation of QuickDASH scores calculated at 4, 8, 12, 24 weeks. p Value is < 0.001 ; statistically significant. There was progressive improvement in QuickDASH score calculated at timely interval showing improvement in functional outcome.

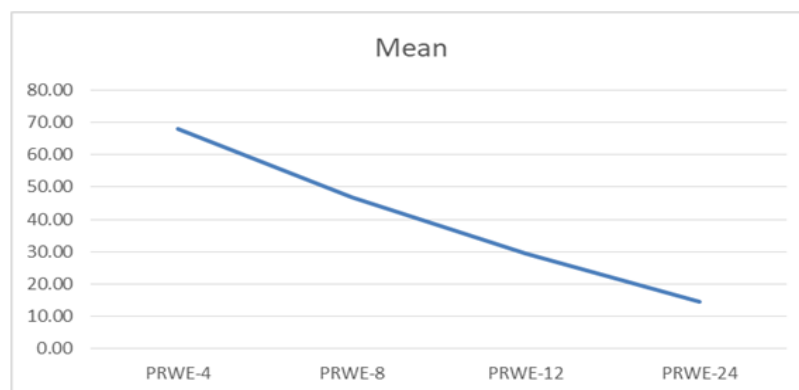


Figure 2. PWRE Mean.

Table 3. Comparison of prwe scores at 4,8,12,24 weeks

PRWE	N	Mean	SD	p Value
PRWE-4 Weeks	35	67.86	7.38	<0.001
PRWE-8 Weeks	35	46.96	7.91	
PRWE-12 Weeks	35	29.37	7.33	
PRWE-24 Weeks	35	14.56	6.77	

Mean and standard deviation of PRWE scores calculated at 4,8,12,24 weeks . p Value is < 0.001 ; statistically significant. There was progressive improvement in PRWE score calculated at timely interval showing improvement in functional outcome



Figure no 3. Preoperative Xrays.

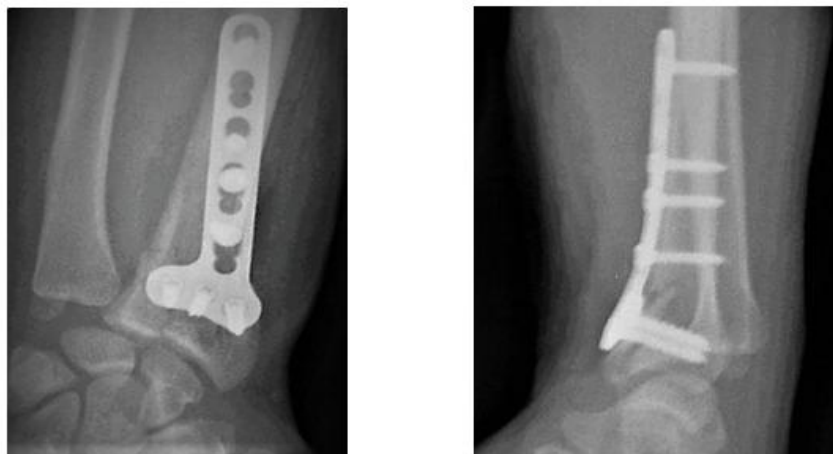


Figure no 4. Immediate Post-operative xrays.

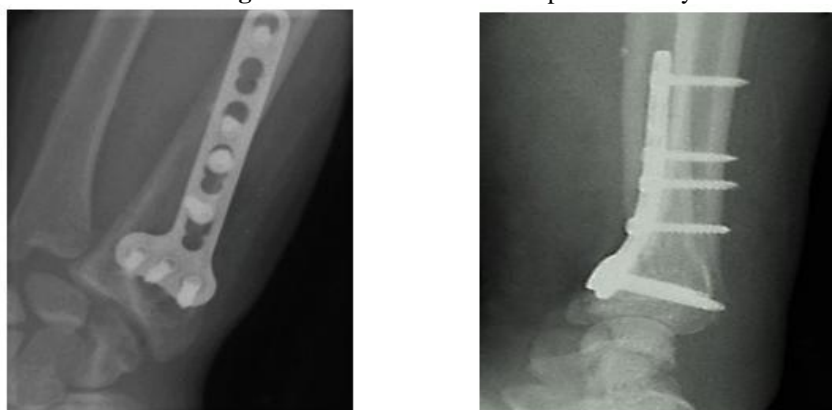


Figure no 5. X ray at 24 weeks follow up



Supination

Pronation

Figure no 6.1 Wrist movements at 8 weeks



Dorsiflexion

Palmarflexion

Figure no 6.2 Wrist movements at 8 weeks

V. Discussion

We encountered a complication rate of 14.3%, with stiffness of the wrist and was mainly due to lack of mobilization by patient. All of them improved gradually by physiotherapy and mobilization. There were no complications like median nerve compression or carpal tunnel syndrome, other neuropathies, shoulder hand syndrome, tendon ruptures etc. Kilic et al. reported a complication rate of 11.1% [12], Chung et al. reported 9.1% [13], and Anakwe et al. reported 4.8% [14].

The mean QuickDASH score calculated at fourth follow up was 6.82 ± 7.84 . Khan et al. in his study had a mean QuickDASH score of 17.2 ± 8.8 with good functional outcome [15]. Mean QuickDASH of 5.98 ± 10.94 was calculated by Quaddlbauer et al with good and excellent functional outcome in his study of 30 patients [16]. Our study showed a progressive decrease in the mean QuickDASH scores calculated at 4 weeks (Mean 68.31), 8 weeks (Mean 35.91), 12 weeks (Mean 18.56), 24 weeks (Mean 6.82) which was statistically significant (p Value < 0.001) and reflects improvement in functional outcome over time. According to Kwok et al. [17] in assessing results after distal radius fracture treatment there was strong correlation between Green and O'Brien scoring system and DASH score. Green and O'Brien scoring system's Excellent outcome had a mean DASH score of 0-8.2, Good outcome had a mean DASH score of 8.2-16.9, Fair outcome had a mean DASH score of 16.9-20.7 and a mean DASH score of 20.7 and above was considered poor. At 24 weeks the our study had a mean score of 6.82 with twenty three patient's score between 0-8.2, seven patients between 8.2-16.9, one patient with score between 16.9-20.7 and four patient with score more than 20.7 score.

The mean PRWE score of our study was 14.56 ± 6.77 . The PWRE score was 14 in a study conducted by Jupiter et al [18] with good functional outcome. In our study there was progressive decrease in the PRWE mean at 4 weeks (Mean 67.86), 8 weeks (Mean 46.96), 12 weeks (Mean 29.37), and 24 weeks (Mean 14.56) which is statistically significant (p Value is < 0.001) and shows improvement in functional outcome over time.

80 % (28 cases) had radiological fracture union at 8 weeks follow up and remaining 20% (7 cases) had union at third (12 weeks) follow up. Four cases had articular step off of less than 2mm and it had no association with the functional outcome. There were no intraarticular screw penetration, screw loosening, non-union, or implant failure.

VI. Conclusion

Stiffness of the operated wrist was the main complication observed and it improved by good physiotherapy and mobilisation. We did not encounter any implant related complications, neuropathies, shoulder hand syndrome or tendon ruptures. The study demonstrates mean QuickDASH score of 6.82 ± 7.84 and PRWE score of 14.56 ± 6.77 with good functional outcome. Hence volar locked plating is recommended for intraarticular distal radius fractures requiring operative intervention with early mobilization of wrist joint.

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