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Original Research Article

# K-Wire Fixation versus Volar Locking Plate for Distal End Radius Fractures: A Comparative Outcome Study

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**Abstract**

**Background:** Distal end radius fractures require stable fixation to achieve anatomical restoration and optimal functional recovery.

**Aim:** To compare the functional and radiological outcomes of distal end radius fractures treated with K-wire fixation and volar locking plate fixation.

**Materials and Methods:** A prospective comparative study was conducted on 50 patients with distal end radius fractures treated by either percutaneous K-wire fixation or volar locking plate fixation.

Functional outcome was assessed using the Mayo Wrist Score, while radiological outcomes were evaluated using radial height, radial inclination, volar tilt, and ulnar variance at follow-up.

**Results:** The volar locking plate group demonstrated superior functional outcomes and better maintenance of radiological parameters compared to the K-wire group.

**Conclusion:** Volar locking plate fixation provides better functional and radiological outcomes; however, K-wire fixation remains a viable option in selected cases.

**Keywords:** Distal radius fracture, K-wire fixation, volar locking plate, Mayo wrist score, Radiological outcome.

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## Introduction

Distal end radius fractures, first described by Colles in 1814, are among the most common fractures encountered in orthopaedic practice [1]. The primary goals of treatment are restoration of anatomical alignment, maintenance of reduction, and early functional recovery [2]. Operative management has evolved with percutaneous K-wire fixation and volar locking plate fixation being widely used techniques [2,3]. While K-wire fixation is minimally invasive and cost- effective, volar locking plates offer rigid fixation and allow early mobilization [3,4]. The superiority of one method over the other in terms of functional and radiological outcomes remains debated [5]. This study compares both functional outcomes using the Mayo Wrist Score and radiological outcomes between these two modalities.

## Materials and Methods

This prospective comparative study was conducted in the Department of Orthopaedics at GMERS General Hospital Vadnagar from March 2025 to August 2025. A total of 50 patients with distal end radius fractures were included.

### Inclusion Criteria

- Age ≥18 years
- Closed distal end radius fractures
- Patients willing for surgical management and follow-up

### Exclusion Criteria

- Open fractures
- Pathological fractures
- Associated neurovascular injury
- Previous wrist fractures

Patients were divided into two groups:

- Group A: Percutaneous K-wire fixation
- Group B: Volar locking plate fixation

Postoperative immobilization and physiotherapy protocols were followed as per standard guidelines [4].

**Outcome Assessment**

- Functional outcome: Assessed using the Mayo Wrist Score at 6 weeks, 3 months, and 6 months [4].
- Radiological outcome: Assessed using standard wrist radiographs by measuring radial height, radial inclination, volar tilt, and ulnar variance immediately postoperatively and at final follow-up.

**Method of Data Collection**

Data were collected prospectively from patients presenting with distal end radius fractures who met the inclusion criteria during the study period.

After obtaining informed consent, patients were clinically evaluated and assigned to either the percutaneous K-wire fixation group (Group A) or the volar locking plate fixation group (Group B) based on the surgical modality used.

Preoperative data including patient demographics (age, sex), mechanism of injury, side involved, and fracture characteristics were recorded using a structured case record form. All patients underwent standard anteroposterior and lateral radiographs of the wrist preoperatively. Postoperative data collection included both functional and radiological assessments. Functional outcomes were evaluated using the Mayo Wrist Score, which assesses pain, functional status, range of motion, and grip strength. Assessments were performed at 6 weeks, 3 months, and 6 months postoperatively during follow-up visits [4]. Radiological outcomes were assessed using standard wrist radiographs taken immediately after surgery and at final follow-up. The parameters measured included radial height, radial inclination, volar tilt, and ulnar variance. Complications such as pin-tract infection, loss of reduction, implant irritation, and any other postoperative adverse events were documented throughout the follow-up period.

**Results**

The present study consists of 50 cases of distal end radius fractures treated at GMERS General Hospital Vadnagar, Mehsana, and Gujarat. All cases were followed periodically during the period of March 2025 to August 2025.

**Table 1: Age-wise Distribution of Patients and Functional Outcome**

| Age Group (Years) | No. of Patients | Excellent | Good | Fair | Poor |
|---|---|---|---|---|---|
| 18–30 | 8 | 5 | 3 | 0 | 0 |
| 31–40 | 12 | 6 | 5 | 1 | 0 |
| 41–50 | 14 | 5 | 7 | 2 | 0 |
| 51–60 | 10 | 2 | 6 | 2 | 0 |
| >60 | 6 | 1 | 3 | 2 | 0 |
| **Total** | **50** | **19** | **24** | **7** | **0** |

**Table 2: Sex-wise Distribution of Patients with Functional Outcome**

| Sex | No. of Patients | Excellent | Good | Fair | Poor |
|---|---|---|---|---|---|
| Male | 32 | 13 | 15 | 4 | 0 |
| Female | 18 | 6 | 9 | 3 | 0 |
| **Total** | **50** | **19** | **24** | **7** | **0** |

**Table 3: Side of Involvement and Functional Outcome**

| Side | No. of Patients | Excellent | Good | Fair | Poor |
|---|---|---|---|---|---|
| Right | 34 | 14 | 16 | 4 | 0 |
| Left | 16 | 5 | 8 | 3 | 0 |
| **Total** | **50** | **19** | **24** | **7** | **0** |

**Table 4: Type of Fracture and Functional Outcome**

| Type of Fracture | No. of Patients | Excellent | Good | Fair | Poor |
|---|---|---|---|---|---|
| Extra-articular | 30 | 15 | 12 | 3 | 0 |
| Intra-articular | 20 | 4 | 12 | 4 | 0 |
| **Total** | **50** | **19** | **24** | **7** | **0** |

**Table 5: Type of Fixation and Functional Outcome**

| Type of Fixation | No. of Patients | Excellent | Good | Fair | Poor |
|---|---|---|---|---|---|
| K-wire fixation | 22 | 6 | 8 | 8 | 0 |
| Volar locking plate fixation | 28 | 13 | 16 | – | 0 |
| **Total** | **50** | **19** | **24** | **7** | **0** |

**Functional Outcome:** At final follow-up, the mean Mayo Wrist Score was higher in the volar locking plate group compared to the K-wire group, indicating better functional recovery and earlier return to daily activities.[10]

**Radiological Outcome:** Radiological parameters including radial height, radial inclination, and volar tilt were better maintained in the volar locking plate group. Loss of reduction and increased ulnar variance were more commonly observed in the K-wire group during follow-up.[9]


**Figure 1:**

**Complications**

Pin-tract infection and loss of reduction were noted in the K-wire group, while implant irritation was observed in a few patients treated with volar locking plates.[11]

**Discussion**

Distal end radius fractures are among the most frequently encountered injuries in orthopaedic practice and achieving stable fixation with restoration of anatomy is essential for good functional recovery [1,2]. Various treatment modalities have been described, of which percutaneous K-wire fixation and volar locking plate fixation are commonly employed [2,3]. The present study compared these two methods with respect to functional and radiological outcomes.

In the present study, patients treated with volar locking plate fixation demonstrated better functional outcomes as assessed by the Mayo Wrist Score. A higher proportion of excellent and good results was observed in the plating group compared to the K-wire group. This can be attributed to the rigid fixation provided by volar locking plates, which allows early wrist mobilization and better rehabilitation, thereby improving functional recovery [3,4,10].

Radiological outcomes in this study also favored volar locking plate fixation. Parameters such as radial height, radial inclination, and volar tilt were better maintained in the plating group, while loss of reduction was more commonly seen in patients treated with K-wire fixation. K-wire fixation, although minimally invasive and economical, may not provide sufficient stability in unstable or comminuted fracture patterns, leading to secondary displacement during the healing period [4,5,9]. Age-wise analysis revealed that younger patients had better functional outcomes compared to older patients, which may be due to better bone quality and compliance with physiotherapy. Extra-articular fractures showed superior outcomes compared to intra-articular fractures, as intra-articular involvement is known to be associated with residual stiffness and post-traumatic arthritis [2,3,12]. Regarding complications, pin-tract infection and loss of reduction were noted more frequently in the K-wire group, whereas implant irritation was observed in a few cases in the volar locking plate group. However, none of the complications were severe enough to adversely affect the final functional outcome, and no poor results were observed in either group [5,6,13].

The findings of the present study are consistent with previously published literature, which suggests that volar locking plate fixation offers better biomechanical stability and improved maintenance of fracture reduction, particularly in unstable distal end radius fractures [3,4,7,14]. Nevertheless, K-wire fixation remains a useful and effective treatment option in selected cases, especially in stable fracture patterns and in situations where cost and surgical invasiveness are important considerations [5,8,15].

**Conclusion**

The present comparative study evaluated the functional and radiological outcomes of distal end radius fractures treated with percutaneous K-wire fixation and volar locking plate fixation. Based on the observations of this study, volar locking plate

fixation resulted in better functional recovery, as evidenced by higher Mayo Wrist Scores, and superior maintenance of radiological parameters such as radial height, radial inclination, and volar tilt. Volar locking plates provided stable fixation that allowed early mobilization and effective rehabilitation, leading to a greater proportion of excellent and good outcomes. In contrast, K-wire fixation, though minimally invasive and cost-effective, was associated with a higher incidence of loss of reduction and pin-tract-related complications, particularly in unstable and comminuted fracture patterns. Despite these findings, K-wire fixation remains a simple, economical, and reliable method of treatment in selected patients with stable extra-articular fractures, good bone quality, and where resource constraints exist. Both treatment modalities achieved satisfactory outcomes when appropriately indicated.

In conclusion, volar locking plate fixation is preferred for unstable and intra-articular distal end radius fractures, while K-wire fixation continues to have a role in carefully selected cases. Proper patient selection, accurate fracture reduction, and adherence to postoperative rehabilitation protocols are key determinants of successful functional outcomes.

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