Original Article

Functional and Radiological Outcomes of Dorsal Distraction Plating in Comminuted Distal Radius Fractures: A Prospective Study from a Tertiary Care Centre

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Abstract

Background: Distal radius fractures constitute a substantial proportion of upper limb injuries, accounting for approximately 10–15% of all adult fractures. Management of comminuted intra-articular fractures remains challenging due to instability, metaphyseal comminution, and difficulty in achieving anatomical reduction. **Material and Methods:** This prospective observational study was conducted between January 2023 and January 2026 at a tertiary care centre in Jaipur, India. A total of 25 adult patients with AO type 23-C2 and 23-C3 distal radius fractures were included. All patients were managed using dorsal distraction plating. Functional outcomes were assessed using wrist range of motion and the Mayo Wrist Score over a follow-up period of 36 weeks. Radiological parameters, including ulnar variance, radial inclination, and volar tilt, were evaluated. Statistical analysis was performed using SPSS version 25.0, with $p < 0.05$ considered statistically significant. **Results:** A statistically significant improvement in wrist mobility was observed over the follow-up period ($p < 0.001$). Mean wrist flexion improved from 36° at 4 weeks to 65° at final follow-up. Supination improved from 38° to 68°, while pronation increased from 27° to 58°. Based on the Mayo Wrist Score, 72% of patients achieved good to excellent functional outcomes. Radiological parameters were maintained within acceptable limits in the majority of cases. No major complications such as infection, implant failure, or neurovascular injury were encountered. **Conclusion:** Dorsal distraction plating is a reliable and effective technique for the management of comminuted distal radius fractures, providing stable fixation, satisfactory functional recovery, and acceptable radiological alignment with a low complication rate.

Keywords: Dorsal angulation, Distal radius, Plating, Dorsal Distraction.

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Introduction

Fractures of the distal radius constitute a substantial proportion of orthopaedic injuries, accounting for approximately one-sixth of all fractures encountered in adults.[11] These injuries demonstrate a characteristic bimodal age distribution, affecting elderly individuals following low-energy falls due to osteoporotic bone, as well as younger patients sustaining high-energy trauma such as road traffic accidents.[12] Owing to their frequency and functional importance, distal radius fractures continue to be a significant focus of orthopaedic research and clinical management.

Comminuted intra-articular distal radius fractures represent a particularly challenging subset. These injuries are often associated with metaphyseal comminution, articular surface disruption, and varying degrees of instability, making restoration of anatomical alignment difficult.[13] Inadequate reduction or loss of alignment may lead to poor functional outcomes, including decreased range of motion, chronic pain, and early post-traumatic arthritis. Conventional treatment options such as closed reduction and casting, external fixation, and volar locking plate fixation have shown variable success, especially in cases with severe comminution, osteoporotic bone, or compromised distal fragments.[15]

In this context, dorsal distraction plating has emerged as a useful surgical alternative for managing complex distal radius fractures. This technique functions as an internal spanning fixator, relying on the principle of ligamentotaxis to restore radial height, alignment, and articular congruity.[1,4] By maintaining fracture reduction through indirect means, it allows for biological healing while minimizing further disruption of soft tissues. Previous studies have demonstrated encouraging functional and radiological outcomes with this technique, particularly in highly comminuted fracture patterns where conventional fixation methods may be insufficient.[5,6]

Despite its increasing clinical application, there remains a relative paucity of prospective studies from Indian tertiary care

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centres evaluating the outcomes of dorsal distraction plating.[2] Most available literature originates from Western populations, and regional data reflecting patient demographics, injury patterns, and functional outcomes are limited. Therefore, the present study was undertaken to evaluate both the functional recovery and radiological alignment following dorsal distraction plating in comminuted intra-articular distal radius fractures.

Materials and Methods

This prospective observational study was conducted in the Department of Orthopaedics at Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India, over a period of three years from January 2023 to January 2026. The study included patients admitted to both male and female orthopaedic wards who satisfied the eligibility criteria.

A total of 25 adult patients with comminuted intra-articular distal radius fractures were enrolled. All fractures were classified according to the AO/OTA classification system, and only type 23-C2 and 23-C3 fractures were included.

Inclusion Criteria

- Patients aged ≥18 years
- AO type 23-C2 and 23-C3 distal radius fractures
- Injury duration less than 2 weeks
- Patients willing to participate and provide informed consent

Exclusion Criteria

- Patients aged <18 years
- Open fractures with active infection
- Associated neurovascular injury
- Ipsilateral upper limb injuries interfering with functional assessment

Written informed consent was obtained from all participants prior to inclusion.

Surgical Technique: All procedures were performed under regional or general anaesthesia under aseptic conditions. A standard dorsal approach to the wrist was utilized. A dorsal spanning plate was applied from the distal radius to the metacarpal, typically the third metacarpal, acting as an internal fixator.

Fracture reduction was achieved indirectly using the principle of ligamentotaxis. Additional manual manipulation was performed where required to optimize alignment. Care was taken to restore radial length, inclination, and articular congruity intraoperatively.

Postoperative Protocol

- Early mobilization of shoulder and elbow joints was encouraged
- Wrist mobilization was initiated following implant removal
- All patients underwent a supervised physiotherapy program

Follow-up Schedule

Patients were evaluated at regular intervals:

- 4 weeks
- 12 weeks
- 24 weeks
- 36 weeks

Outcome Measures

Functional Assessment

- Wrist range of motion: flexion, extension, pronation, and supination
- Mayo Wrist Score
- Radiological Assessment
- Ulnar variance
- Radial inclination
- Volar tilt

Statistical Analysis: Data were analysed using SPSS software (version 25.0; IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation. Changes in functional parameters over time were analysed using repeated measures ANOVA. A p-value <0.05 was considered statistically significant.

Demographic Profile: A total of 25 patients were included in the study. Based on AO classification, 14 patients (56%) had type C2 fractures, while 11 patients (44%) had type C3 fractures.

Functional Outcomes: A progressive and statistically significant improvement in wrist range of motion was observed over the follow-up period ($p < 0.001$).

- Mean wrist flexion improved from 36° at 4 weeks to 65° at final follow-up
- Mean supination improved from 38° to 68°
- Mean pronation improved from 27° to 58°

Results

Based on the Mayo Wrist Score, 72% of patients achieved good to excellent functional outcomes at final follow-up. [Table 1]

Table 1: Range of Motion Improvement

Movement	4 weeks	Final
Flexion	36°	65°
Supination	38°	68°
Pronation	27°	58°

Radiological Outcomes

Radiological evaluation demonstrated satisfactory maintenance of fracture reduction parameters in the majority of patients:

- Ulnar variance remained within acceptable limits
- Radial inclination was maintained between 10° and 20°
- Volar tilt was restored close to neutral alignment

Complications

- Difficulty in achieving adequate intraoperative reduction was encountered in 6 cases (24%)
- No cases of postoperative infection, implant failure, or neurovascular injury were observed

Discussion

The present study demonstrates that dorsal distraction plating is an effective technique for managing comminuted intra-articular

distal radius fractures, providing stable fixation and facilitating progressive functional recovery. The observed improvement in wrist range of motion and the high proportion of good to excellent outcomes based on the Mayo Wrist Score support the clinical utility of this method in complex fracture patterns.

The progressive improvement in wrist mobility noted over the follow-up period reflects the ability of dorsal distraction plating to maintain fracture alignment while allowing biological healing. By functioning as an internal spanning fixator, this technique utilizes the principle of ligamentotaxis to restore radial length, alignment, and articular congruity without the need for extensive soft tissue dissection.[1,4] This is particularly advantageous in fractures with severe metaphyseal comminution or poor bone quality, where conventional fixation methods such as volar plating or external fixation may be inadequate.[15]

Our findings are consistent with previous studies by Wolf et al., Dahl et al., and Lewis et al., who reported satisfactory functional and radiological outcomes with dorsal spanning plate fixation in complex distal radius fractures.[1,5,6] Similarly, studies by Ruch et al. and Harness et al. have demonstrated favourable outcomes with this technique, particularly in cases where traditional fixation strategies are limited.[16,17] The functional outcomes observed in the present study, with 72% of patients achieving good to excellent results, are comparable to those reported in the existing literature. This technique may reduce the need for external fixation in highly comminuted fractures.

Radiological assessment in our study revealed maintenance of key parameters such as ulnar variance, radial inclination, and volar tilt within acceptable limits in the majority of cases. This further reinforces the effectiveness of ligamentotaxis in preserving anatomical alignment during fracture healing. The absence of major complications such as infection, implant failure, or neurovascular injury in our series highlights the safety profile of this technique when performed with appropriate surgical expertise.

However, certain limitations of the present study must be acknowledged. The sample size was relatively small, and the study was conducted at a single tertiary care centre, which may limit the generalizability of the findings. Additionally, the follow-up duration, although adequate to assess early functional outcomes, may not fully capture long-term complications such as post-traumatic arthritis. Future studies with larger sample sizes, multicentric data, and longer follow-up are recommended to further validate these findings.

Conclusion

Dorsal distraction plating is a reliable and effective surgical option for the management of comminuted intra-articular distal radius fractures. It provides stable fixation, facilitates satisfactory functional recovery, and maintains acceptable radiological alignment with a low complication rate. This technique is particularly valuable in complex fracture patterns where conventional fixation methods may be inadequate.

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Conflicts of interest

There are no conflicts of interest.

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