

Original Research Article

Comparative functional outcomes of distal radius fractures treated with Joshi's external stabilization system versus volar locking plate fixation: a prospective cohort study

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ABSTRACT

Background: Distal radius fractures are among the most common orthopedic injuries. Joshi's external stabilization system (JESS) and volar locking plate fixation are widely used surgical options with differing biomechanical principles.

Methods: A prospective cohort study of 94 patients with distal radius fractures was conducted. Patients underwent either JESS or volar locking plate fixation. Functional outcomes were assessed using DASH scores at 6 and 12 months and modified Mayo wrist score (MMWS) at 12 months.

Results: Volar plating demonstrated superior functional outcomes, with significantly better early recovery and consistently improved scores at final follow-up. Patients treated with volar plating achieved better range of motion and grip strength. The JESS group showed gradual improvement over time but did not match the overall functional outcomes of the plating group. Pin tract infections were more common in the JESS group, whereas hardware-related complications were observed in the plating group.

Conclusions: Volar locking plate fixation provides superior functional outcomes in distal radius fractures, both in early recovery and at final follow-up. While JESS remains a viable option in selected cases, volar plating should be preferred where feasible.

Keywords: DASH score, Distal radius fracture, JESS, Volar plating, Wrist outcomes

INTRODUCTION

Distal radius fractures are among the most frequently encountered injuries in orthopaedic practice, affecting both young individuals following high-energy trauma and elderly patients with osteoporotic bone. Restoration of anatomical alignment and function is essential to prevent long-term disability and ensure optimal wrist function.^{1,2}

Various surgical techniques have been described for the management of these fractures. External fixation using Joshi's external stabilization system (JESS) is a minimally invasive method based on the principle of ligamentotaxis, whereas volar locking plate fixation permits direct anatomical reduction with stable internal fixation.^{1,3,4}

Despite widespread use of both techniques, controversy persists regarding the optimal treatment modality. Volar plating has been associated with improved early functional recovery and restoration of anatomical parameters, whereas JESS remains a valuable option in comminuted fractures, cases with compromised soft tissues, and resource-limited settings.^{5,6} Long-term functional outcomes have been reported to vary according to fracture pattern, rehabilitation protocol, and fixation technique.⁷⁻¹²

This study aimed to compare the functional outcomes, radiological results, and complications associated with JESS and volar locking plate fixation in distal radius fractures.

METHODS

This comparative, non-randomized prospective cohort study was conducted in the department of orthopedics, Vedantaa Institute of Medical Sciences, Dahanu, Maharashtra, India, from January 2023 to June 2024. A total of 94 patients with distal radius fractures were included in the study.

Patients aged 18-80 years presenting with closed distal radius fractures within four weeks of injury were included. Patients with open fractures, pathological fractures, neuromuscular disorders, or delayed presentation beyond four weeks were excluded.

Patients were managed either with Joshi's external stabilization system (group J) or volar locking plate fixation (group V). Functional outcomes were assessed using the disabilities of the arm, shoulder and hand (DASH) score at 6 and 12 months and the modified Mayo wrist score (MMWS) at 12 months. Additional outcome measures included range of motion, grip strength, radiological parameters, time to union, and complications.

Statistical analysis was performed using Student's t-test, Mann-Whitney U test, and Chi-square test where appropriate. A p value of less than 0.05 was considered statistically significant.

Ethical considerations

The study protocol was approved by the institutional ethics committee (approval number: EC//2023). Written informed consent was obtained from all participants before inclusion in the study. The study adhered to the ethical principles of the Declaration of Helsinki.

RESULTS

Functional outcomes

DASH score

Volar plating demonstrated superior functional outcomes at both 6 months and 12 months, with consistently lower DASH scores compared to JESS.

Modified Mayo wrist score (MMWS)

A higher proportion of patients in the volar plating group achieved excellent outcomes. JESS patients showed improvement over time but had comparatively lower overall scores.

Range of motion and grip strength

Patients treated with volar plating showed significantly better recovery of wrist motion and grip strength throughout the follow-up period.

Table 1: Demographic distribution.

Parameters	Value
Total patients	94
Male	53 (56.4%)
Female	41 (43.6%)
Most common age group	31-40 years (26.6%)
Left side	52.1%
Right side	47.9%

Table 2: Outcome comparison.

Parameters	JESS	Volar plating
Early recovery	Slower	Faster
Final outcome	Inferior	Superior functional outcomes
ROM recovery	Delayed	Early and improved
Grip strength	Delayed	Early and better restoration

Time to union

Radiological evidence of union was observed in 90% of cases at one month and in 95.7% by three months. The mean time to complete union was 12.2 weeks.

Table 3: Complication profile.

Complication	JESS	Volar Plating
Pin tract infection	Higher	Nil
Joint stiffness	Moderate	Mild
Tendon irritation	Rare	Present
Hardware issues	Nil	Occasional
CRPS	Nil	Nil

DISCUSSION

The present study compared the functional outcomes of distal radius fractures managed with JESS and volar locking plate fixation. Both treatment modalities achieved satisfactory fracture union; however, patients treated with volar locking plates demonstrated superior functional outcomes, earlier recovery of wrist motion, and better restoration of grip strength.

Functional assessment using DASH and MMWS showed better overall outcomes in the volar plating group. Similar findings have been reported by Dixit et al, who observed superior functional recovery in patients managed with volar locking plates compared with external fixation.⁹ Joo et al also reported favourable outcomes following volar locking plate fixation, attributing these results to stable internal fixation and early mobilization.⁸

In the present study, patients treated with volar plating demonstrated better recovery of wrist range of motion and grip strength throughout the follow-up period. These findings are consistent with the observations of Rozental

et al and Walenkamp et al, who reported improved functional outcomes and earlier return to daily activities following volar plate fixation.^{3,6}

Although patients treated with JESS showed gradual improvement over time, their overall functional outcomes remained inferior to those observed in the plating group. Similar observations have been reported by Dubey and Kumaran and Chauhan, who demonstrated satisfactory outcomes with JESS fixation but noted limitations related to prolonged immobilization and delayed rehabilitation.^{7,11}

The mean time to union in the present study was 12.2 weeks, with radiological union observed in the majority of patients by three months. These findings are comparable to those reported by Kapoor et al and Garg et al, who demonstrated satisfactory fracture healing with external fixation techniques in distal radius fractures.^{1,10}

With respect to complications, pin tract infection was more frequently encountered in the JESS group, whereas hardware-related complications such as tendon irritation were observed in the volar plating group. Similar complication patterns have been reported by Arora et al and Tailor and Jasoliya.^{2,12} Despite these complications, the overall functional superiority of volar plating was maintained.

The findings of the present study support the growing body of evidence favouring volar locking plate fixation for distal radius fractures. Stable internal fixation permits early mobilization, improved wrist function, and superior patient-reported outcomes. Nevertheless, JESS remains a useful treatment option in selected fracture patterns, particularly where soft tissue conditions, fracture comminution, or resource constraints limit the use of internal fixation.

Limitations of this study are: non-randomized design, potential selection bias, follow-up limited to 12 months.

CONCLUSION

Volar locking plate fixation provides superior functional outcomes in distal radius fractures, with better early recovery and improved results at final follow-up. Although JESS remains a useful alternative in selected cases, particularly in resource-limited settings or specific fracture patterns, volar plating should be considered the preferred treatment modality when feasible.

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