J Orthop Spine Trauma. 2025 March; 11(1): 32-4. DOI: 10.18502/jost.v11i1.18011

Research Article

The Results of Management of Distal End Radius Fractures by Various Modalities

Mansi J Patel[1], Dhyey Baldha[2], Aakash Koladiya[3,*], Lalit Bhambhaniya[3], Utkarsh Panchal[3], Tejas Jogi[3], Ishani Patel[4], Neel Bhavsar[5]

[1] Assistant Professor, Department of Orthopedics, Smt NHL Medical College, Ahmedabad, India
[2] Senior Resident, Department of Orthopedics, Smt NHL Medical College, Ahmedabad, India
[3] Resident, Department of Orthopedics, Smt NHL Medical College, Ahmedabad, India
[4] Associate Professor, Department of Orthopedics, NHL Medical College, Ahmedabad, India
[5] Professor, Department of Orthopedics, Smt NHL Medical College, Ahmedabad, India

[*]Corresponding author: Aakash Koladiya; Department of Orthopedics, Smt NHL Medical College, Ahmedabad, India. Tel: +91-9601659652; Email: aakashnko@gmail.com

Received: 10 September 2024; **Revised:** 02 December 2024; **Accepted:** 14 January 2025

Abstract

Background: Distal end radius fractures constitute 16%-20% of all fractures. Extra-articular fractures are managed with closed reduction and casting, while intraarticular fractures require more invasive treatment due to instability and conservative treatment complications. Despite extensive research, the optimal treatment for distal end radius fractures remains unclear, prompting ongoing comparative studies.

Methods: 40 patients were treated and followed up for 3 to 14 months. Each patient underwent detailed clinical and radiological examinations of the affected wrist using the Arbeitsgemeinschaft für Osteosynthesefragen (AO) classification. Radiographs were routinely taken to evaluate extra-articular deformities and articular incongruences. Treatment decisions –plating, external fixation, or conservative management –were based on fracture type and patient physiology. Follow-ups occurred at various intervals, with assessments including hand grip strength comparison, radiographic measurements, and clinical evaluation of fracture union using Green and O'Brien scoring and Sarmiento radiological criteria.

Results: 40 patients with distal end radius fractures, averaging 40.62 years old, were included in the study. Treatment distribution was eight patients with reduction cast/slab, 18 with external fixators, and 14 with plating. Plating showed 57.28% excellent, 28.57% good, and 14.28% fair outcomes. External fixators had 33.33% excellent, 33.33% good, 16.67% fair, and 16.67% poor outcomes. Conservative management had 25% excellent, 37.5% good, 25% fair, and 12.5% poor outcomes.

Conclusion: Conservative management with a reduction pop slab/cast is suitable for extra-articular fractures in elderlies. External fixation is effective for osteoporotic or comminuted fractures. Plating is recommended for intra-articular fractures in young patients.

Keywords: Distal Radius Fractures; External Fixators; Volar Plate; Conservative Management

Citation: Patel MJ, Baldha D, Koladiya A, Bhambhaniya L, Panchal U, Jogi T, et al. **The Results of Management of Distal End Radius Fractures by Various Modalities.** *J Orthop Spine Trauma* 2025; 11(1): 32-4.

Background

Fractures of the distal end radius account for almost 16-20 percent of all fractures treated in the emergency room and are the most common fractures occurring in the upper extremity (1, 2).

As life expectancy increases, the incidence of falls and osteoporosis continue to increase, and the incidence of distal end radius fractures will inevitably increase. Extra-articular fractures of the distal end radius are most commonly treated by closed reduction and casting, as ligamentotaxis helps achieve a satisfactory reduction in most cases. Intraarticular fractures are inherently unstable, do not achieve satisfactory reduction, and have a high rate of complication by conservative treatment (3, 4).

Universal cast treatment gave way to neutralization with a bridging external fixator which, in turn, was replaced by buttress plating. The primary goal of the treatment of these fractures is the restoration of wrist function (5, 6).

External fixators assist the surgeon in obtaining fracture stabilization and help in fracture healing through gradual and controlled distraction by working on the principle of ligamentotaxis (7, 8). Open reduction and internal fixation (ORIF) is indicated for unstable distal radius fractures and those with articular incongruity, as long as there is sufficient bone stock to permit an early range of motion (ROM).

While many studies have compared distal end radius fixation by various modalities, the protocol for which modality to choose remains a grey area. Therefore, we present the results of distal end radius fractures treated by various modalities at in Sardar Vallabhbhai Patel Institute of Medical Sciences and Research (SVPIMSR) Center in Ahmedabad, India.

Methods

This is a prospective study of 40 distal end-of-radius fracture cases presented at our institute. We treated 40 consecutive cases of distal end-of-radius fracture, 39 of which were treated with either modality. One patient was treated for a bilateral distal end radius fracture. The results were examined at a mean follow-up of 5.7 months.

Participants: Both male and female adults over 18 years of age with isolated distal end-of-radius fractures were included. Patients with old fractures (more than 15 days last), compound fractures associated with vascular injuries, any other fracture in the ipsilateral limb, pathological fractures, and pre-existing severe degenerative changes of wrist joints were excluded.

A total of 40 patients satisfying the above criteria were treated and followed up regularly. The minimum follow-up

was 3 months and a maximum of 14 months.

Assessments: All selected patients were subjected to a detailed clinical and radiological examination of the affected wrist, and the findings were documented. All cases were assessed for symptoms of nerve compression. Routine posteroanterior and lateral radiographs were taken and assessed to determine the extent of extra-articular deformity and articular incongruence. The fracture pattern was classified using the Arbeitsgemeinschaft für Osteosynthesefragen (AO) classification system (9). Various measurements were taken, including radial tilt, radial length, shortening, intra-articular extension, distal radio-ulnar joint space, and articular congruity.

The decision as to whether to undertake plating, external fixator, or conservative management was taken based on the type of fractures and physiology of the patient.

Patients were followed up at seven days, 15 days, two months, six months, and thereafter. At each follow-up, the hand grip of the affected side was taken and compared with the normal side using a digital hand-grip dynamometer. A roentgenogram of the wrist with radius and ulna was obtained. Different radiological parameters were measured using a goniometer. The fracture union was assessed clinically and radiologically on follow-up in the sixth week.

Functional outcomes were assessed using Green and O'Brien's clinical scoring system (10). Radiological assessment was performed using the Sarmiento radiological score (modified Lidstrom criteria) (11).

Results

In the present study, 40 patients with distal end radius fractures, with a mean age of 40.62 years, were included. Of these, 8 patients were managed conservatively with reduction cast/slab, 18 patients were treated with an external fixator, and 14 patients underwent plating. We compared the results obtained from this study with similar studies by Vargaonkar (11), Anant et al. (12), and Leung et al. (13) (Table 1).

Table 1. Comparison of the study with other studies with respect to mean age, number of cases, and sex and side distribution

Study	Mean age (year)	No. of cases	Sex (%)		Side (%)	
			Men	Women	Right	Left
Present study	40.62	40	75.0	25.0	52.5	47.5
Vargaonkar (11)	46.45	60	42.0	58.0	-	-
Anant et al. (12)	36.10	30	82.3	17.7	53.3	46.7
Leung et al. (13)	42.00	144	50.0	50.0	50.0	50.0

Of the studies compared, Leung et al. study had the largest sample size (144) (13), while the study populations of Anant et al. (12) and Vargaonkar (11) were 30 and 60 cases, respectively. The mean age of cases in this study was 40.62, which is similar to other studies, with the mean age in Anant et al. (12) being 36.1, in Leung et al. (13) being 42, and in Vargaonkar (11) being 46.45. The sex distribution in this study had a male to female ratio of 3:1, while in Anant et al. (12), it was 4.6:1, and in Vargaonkar (11), it was 1:1.3.

The Leung et al. (13) study had an equal male-to-female distribution. As for side distribution, the present study and the study by Anant et al. (12) showed almost equal distribution, with a slight propensity towards the right side, while the Leung et al. study (13) had an equal side distribution. Anatomical and functional evaluation was done using Sarmiento's modification of Lindstrom criteria and Green and O'Brien scoring method. According to the Green and O'Brien score and Sarmiento radiological score, the plating group had 57.28% "excellent", 28.57% "good", and 14.28% "fair" outcomes. The external fixator group had 33.33% "excellent", 33.33% "good", 16.67% "fair", and 16.67% "poor" outcomes, while the conservatively managed group had 25% "excellent", 37.5% "good", 25% "fair", and 12.5% "poor" outcomes (Table 2).

Discussion

In the present study, we observed worse outcomes in the external fixator group compared to other studies. This may be due to more high-velocity trauma injuries and greater comminution in this study population that underwent external fixation. For patients with extra-articular, undisplaced or minimally displaced fractures, or those not fit for surgery, conservative management with reduction and cast was used. These patients were followed up regularly for 4-6 weeks.

Indications for operative management for conservatively managed patients included post-reduction articular step > 2 mm, radial shortening > 5 mm, or > 15 degrees of sagittal plane angulation. Patients with extra-articular irreducible fractures or intra-articular fractures with excessive comminution were treated with an external fixator. Ligamentotaxis, which reduces the fragments through traction, led to acceptable axial alignment in these cases. After distraction, the fixator could be augmented with a Kirschner wire (K-wire), yielding good results. For patients with intra-articular fractures, particularly volar Barton fractures, minimal swelling, and good local conditions, volar plating provided excellent to good results. Locked plates showed success, especially for treating unstable intra-articular fractures of the distal radius. This method offers effective anatomical realignment and allows early joint motion due to the fixation strength. The biomechanical advantages of this technique include close placement to the joint interface and screw placement in different orientations. The volar approach, with minimal surgical trauma and better adaptation to surrounding tissues, resulted in good anatomical alignment in this study, regardless of the direction of fracture angulation. Most young patients were able to return to their daily activities with good recovery. Early rehabilitation enabled quick regaining of independence in daily activities, enhancing the overall outcome.

Limitations of this study are relatively small sample size and not having long-term follow-up.

Conclusion

From this study, we conclude that distal end radius fractures are common in both older osteoporotic patients and younger individuals who experience high-velocity trauma. The most frequent mechanism of injury is a fall on an outstretched hand.

Table 2. Comparison of outcomes between different studies

Study	Plating outcomes (%)				External fixator outcomes (%)				Reduction cast/slab (conservative) outcomes (%)			
	Excellent	Good	Fair	Poor	Excellent	Good	Fair	Poor	Excellent	Good	Fair	Poor
Present study	57.14	28.57	14.28	0	33.33	33.33	16.67	16.67	25.00	37.50	25.00	12.50
Vargaonkar (11)	67.00	33.00	0	0	27.00	67.00	6.00	0	60.00	34.00	6.00	0
Anant et al. (12)	80.00	6.00	12.00	2.00	60.00	13.30	26.60	0	-	-	-	-
Leung et al. (13)	54.00	15.00	27.00	4.00	29.00	31.00	37.00	3.00	-	-	-	-

The primary treatment goal for fractures of the distal end of the radius is to achieve a fully functional recovery of the wrist, which requires the restoration of anatomy and early mobilization. For extra-articular fractures in older patients, conservative management through reduction and application of a pop slab or cast can yield acceptable results. In cases of open or comminuted fractures in older osteoporotic patients, the use of an external fixator can also produce favorable outcomes. For intra-articular fractures in younger patients, plating tends to provide good results. While there are various treatment modalities available for distal end radius fractures, the choice of management should take into account factors such as the surgeon's experience, bone quality, the patient's age, and the type of fracture.

Conflict of Interest

The authors declare no conflict of interest in this study.

Acknowledgements

None.

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