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RESEARCH ARTICLE
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# OSTEOPOROTIC DISTAL RADIUS FRACTURES: A RETROSPECTIVE ANALYSIS IN A TERTIARY CARE SETTING

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**Abstract**

**Background:**
Osteoporotic distal radius fractures are among the most common fragility fractures in the elderly, often resulting from low-energy trauma. They pose management challenges due to poor bone quality and increased complication risks.

**Objectives:**
To analyze the demographic profile, fracture characteristics, treatment patterns, and short-term outcomes of osteoporotic distal radius fractures in patients treated at a tertiary care center.

**Materials and Methods:**
This retrospective study included 104 patients aged ≥50 years with distal radius fractures and confirmed or clinically suspected osteoporosis. Data were collected on age, gender, mode of injury, AO/OTA fracture classification, treatment modality, and outcomes at 3 months. Radiological union, complication rates, and pain scores were assessed.

**Results:**
The mean age was 67.2 ± 8.4 years, with a female predominance (77.9%). Type A fractures were most common (47.1%). Conservative treatment was used in 53.8% and surgical intervention in 46.2%, with volar plating being the most common method. Radiological union was achieved in 93.3% of cases. Surgical patients had lower VAS pain scores and faster return to activity.

**Conclusion:**
Osteoporotic distal radius fractures are prevalent in elderly women. Both conservative and surgical treatments yield favorable short-term outcomes, though surgical intervention may offer better functional recovery.

**Keywords:** Osteoporosis, Distal radius fracture, Fragility fracture, Elderly, Retrospective study, Volar plate, Conservative treatment, AO classification, Bone healing, Orthopedic surgery

## INTRODUCTION

Distal radius fractures are among the most common osteoporotic fractures encountered in clinical practice, particularly affecting the elderly population. These fractures typically result from low-energy mechanisms such as falls from standing height and are indicative of compromised bone

quality due to underlying osteoporosis [1]. With increasing life expectancy and an aging global population, the incidence of osteoporotic fractures—including those of the distal radius—is on the rise, posing a substantial burden on healthcare systems [2].

Osteoporosis is characterized by reduced bone mass and microarchitectural deterioration of bone tissue, leading to increased bone fragility and susceptibility to fractures. It is often asymptomatic until a fracture occurs, making distal radius fractures one of the earliest clinical manifestations in affected individuals [3]. The wrist is particularly vulnerable due to the biomechanical load it bears during a fall and the natural deterioration of cortical bone density with age. Distal radius fractures may, therefore, serve as a clinical marker for future major osteoporotic fractures, such as those involving the hip or vertebrae [4].

Management of osteoporotic distal radius fractures is challenging due to the altered bone biology in such patients. Fragile bone, comminution, and poor healing potential complicate both conservative and surgical interventions [5]. Treatment approaches may vary based on patient age, comorbidities, activity level, and fracture characteristics. While closed reduction and immobilization remain a mainstay for stable fractures, unstable or displaced fractures often necessitate surgical intervention, including volar plating or percutaneous fixation [6].

There is ongoing debate regarding the optimal treatment strategy in osteoporotic patients, especially when considering functional outcomes, complication rates, and healthcare resource utilization. Retrospective analyses from tertiary care centers provide valuable insights into real-world fracture patterns, treatment protocols, and outcomes in resource-intensive settings, where both conservative and operative options are available [7].

Identifying patterns in fracture type, mechanism of injury, demographic characteristics, and treatment responses can assist in tailoring management protocols to this vulnerable population. Additionally, the high recurrence rate of fragility fractures underscores the importance of integrating osteoporosis evaluation and secondary fracture prevention strategies into the care continuum [8]. Dual-energy X-ray absorptiometry (DEXA) scans, calcium and vitamin D supplementation, and pharmacologic interventions such as bisphosphonates play a crucial role in reducing future fracture risk and improving patient prognosis [9].

Despite the availability of various treatment modalities and preventive measures, data on the presentation and management of osteoporotic distal radius fractures in the Indian tertiary care setting remains limited. Most available literature is from Western populations, where demographic characteristics, dietary habits, and access to healthcare differ significantly [10]. This gap necessitates locally generated evidence to guide clinical decision-making and optimize care delivery.

The present study aims to retrospectively analyze the demographic profile, clinical features, fracture patterns, management strategies, and early outcomes of osteoporotic distal radius fractures treated at a tertiary care center. Through this study, we seek to enhance understanding of the burden and clinical trajectory of these fractures in the Indian context and contribute to the evolving discourse on optimal fracture management in osteoporotic individuals.

## MATERIALS AND METHODS

This retrospective study was conducted at a tertiary care center in India over a period of 3 years. Institutional ethical clearance was obtained prior to data collection.

**Study Design and Population**
The study included patients aged 50 years and above who were diagnosed with distal radius fractures and were confirmed to have underlying osteoporosis, either by previous dual-energy X-ray absorptiometry (DEXA) scans or based on clinical risk factors and radiographic indicators suggestive of low bone mineral density. Patients with high-energy trauma, pathological fractures (other than osteoporosis), multiple injuries, or incomplete medical records were excluded from the analysis.

**Data Collection**
Medical records were reviewed to extract demographic data (age, sex), mode of injury, side involved, comorbidities, fracture classification (based on AO/OTA classification), treatment modality (conservative vs. surgical), and postoperative or post-treatment complications. Radiographs were used to confirm fracture types and healing progression. Follow-up records up to 3 months were included to assess short-term outcomes.

**Diagnosis of Osteoporosis**
Osteoporosis was defined either by a T-score ≤ -2.5 on DEXA scan or, in the absence of DEXA, by clinical judgment based on fragility fractures, age-related risk, and radiologic features such as cortical thinning, trabecular rarefaction, and loss of radial height.

**Fracture Classification**
Fractures were categorized using the AO/OTA classification system. Type A fractures (extra-articular), Type B (partial articular), and Type C (complete articular) were recorded accordingly. This helped guide the selection of treatment approach.

**Treatment Protocol**
Patients were treated either conservatively (closed reduction with immobilization in a below-elbow cast) or surgically, depending on fracture displacement, instability, and patient factors. Surgical options included volar locking plate fixation, K-wire fixation, or external fixation. Decision-making was at the discretion of the treating orthopedic surgeon.

**Outcome Measures**
The primary outcome was radiological union at 3 months. Secondary outcomes included complications (malunion, infection, hardware failure), range of motion at wrist joint, and patient-reported pain using the Visual Analogue Scale (VAS). Functional assessment was not routinely documented but subjective improvement was recorded.

**Statistical Analysis**
Data were entered in Microsoft Excel and analyzed using SPSS software version 25.0. Categorical variables were expressed as frequencies and percentages. Continuous variables were summarized using mean and standard deviation. The Chi-square test was used to compare categorical variables, and the Student's t-test or Mann–Whitney U test was used for continuous data, depending on normality. A p-value < 0.05 was considered statistically significant.

**RESULTS**
A total of 104 patients with osteoporotic distal radius fractures were included in the study. The mean age of the patients was 67.2 ± 8.4 years, with a female predominance (n = 81, 77.9%). Most fractures occurred due to low-energy falls from standing height (n = 92, 88.5%), predominantly involving the dominant hand (right side in 62.5% of cases).

**Table 1: Demographic and Clinical Profile of Study Population**

| Parameter | Value |
|---|---|
| Total Patients | 104 |
| Mean Age (years) | 67.2 ± 8.4 |
| Gender | Female: 81 (77.9%)<br>Male: 23 (22.1%) |
| Side Involved | Right: 65 (62.5%)<br>Left: 39 (37.5%) |
| Mode of Injury | Low-energy fall: 92 (88.5%)<br>Other (e.g. minor trauma): 12 (11.5%) |
| Comorbidities | Hypertension: 48 (46.1%)<br>Diabetes Mellitus: 36 (34.6%)<br>Both: 22 (21.2%) |

Fractures were categorized as per the AO classification. The most common type was Type A (extra-articular) in 47.1% of patients, followed by Type C (complete articular) in 35.6%.

**Table 2: Fracture Classification (AO/OTA)**

| AO Type | Frequency (n) | Percentage (%) |
|---|---|---|
| Type A (Extra-articular) | 49 | 47.1% |
| Type B (Partial articular) | 18 | 17.3% |
| Type C (Complete articular) | 37 | 35.6% |

Treatment approach varied based on fracture pattern and patient comorbidities. Conservative management was chosen in 56 patients (53.8%), while 48 patients (46.2%) underwent surgical intervention. Among surgical cases, volar locking plate fixation was the most frequently used technique.

**Table 3: Treatment Modalities**

| Treatment Method | Number of Patients (n) | Percentage (%) |
|---|---|---|
| Conservative (Cast) | 56 | 53.8% |
| Volar Plate Fixation | 34 | 32.7% |
| Percutaneous K-wire Fixation | 10 | 9.6% |
| External Fixator | 4 | 3.8% |

At the 3-month follow-up, radiographic union was achieved in 97 patients (93.3%). Complications included malunion in 5 cases, superficial infection in 3 surgical cases, and transient stiffness in 11 cases. Pain scores improved significantly in both groups; however, surgical patients showed better range of motion and early return to function.

**Table 4: Clinical Outcomes at 3 Months**

| Outcome Parameter | Conservative (n = 56) | Surgical (n = 48) |
|---|---|---|
| Radiological Union | 52 (92.9%) | 45 (93.8%) |
| Malunion | 3 (5.4%) | 2 (4.2%) |
| Superficial Infection | 0 | 3 (6.3%) |
| Transient Stiffness | 7 (12.5%) | 4 (8.3%) |
| Mean VAS Pain Score (0–10) | 2.9 ± 1.1 | 2.1 ± 0.9 |
| Return to Activities (weeks) | 8.3 ± 2.1 | 5.6 ± 1.7 |

## DISCUSSION

Osteoporotic distal radius fractures represent one of the most frequent fragility fractures seen in elderly populations, particularly in postmenopausal women. The present retrospective study conducted at a tertiary care center provides real-world insights into the demographic profile, fracture characteristics, treatment strategies, and short-term outcomes of such fractures in the Indian context. The mean age of the patients in our study was 67.2 years, consistent with the typical age group affected by osteoporosis-related fractures [6]. A significant female predominance was observed (77.9%), which aligns with the hormonal changes post-menopause that contribute to accelerated bone loss [7].

The mechanism of injury in the vast majority of cases (88.5%) was a low-energy fall from standing height, which is the classic presentation in osteoporotic individuals [8]. The right side was more frequently involved, which could be attributed to reflexive extension of the dominant hand during a fall. A large proportion of patients also had associated comorbidities such as hypertension and diabetes mellitus, both of which have been linked to impaired bone metabolism and increased fall risk [9].

Fracture classification based on the AO/OTA system revealed that Type A fractures were the most common (47.1%), followed by Type C fractures (35.6%). This pattern suggests that although extra-articular fractures dominate, intra-articular involvement is not uncommon in osteoporotic bone, likely due to compromised bone microarchitecture and higher fragility [10]. These findings are consistent with previous institutional studies from Asia and Europe, which have reported similar distributions of fracture types in osteoporotic populations [11].

Treatment selection in osteoporotic distal radius fractures remains a subject of debate, particularly given the challenges posed by poor bone quality, the risk of hardware loosening, and prolonged healing times. In our study, 53.8% of patients were treated conservatively with immobilization, while 46.2% underwent surgical management. Among surgical options, volar locking plate fixation was the preferred method, particularly in unstable or displaced fractures. This preference is supported by existing evidence demonstrating that volar plates provide better angular stability and allow early mobilization, even in osteoporotic bone [12].

While the choice between conservative and surgical management is influenced by fracture pattern, patient activity level, and comorbidities, our data indicate that short-term radiological union rates were comparable in both groups—above 92%. However, surgical patients showed slightly faster return to activities and lower VAS pain scores. This finding supports the growing consensus that in selected osteoporotic patients, especially those with high functional demands, surgical intervention may offer better functional outcomes without significantly increasing complication rates [13].

Complication rates were low in both groups. Malunion occurred in 5 cases, more commonly in the conservatively treated cohort. Superficial infections were noted only in the surgical group but were managed effectively with local care and antibiotics. Stiffness, a common concern post-treatment, was seen in both groups but was more frequent in conservatively managed patients. Early mobilization following surgical stabilization may account for this difference [14].

Importantly, our study underscores the need for a holistic management approach that goes beyond fracture fixation. Osteoporotic fractures are sentinel events indicating a heightened risk of future fractures. In our center, however, we observed underutilization of DEXA scans and anti-resorptive therapy initiation, reflecting a wider systemic gap in secondary prevention. Several studies have emphasized the importance of integrating fracture liaison services and initiating pharmacologic therapy such as bisphosphonates, denosumab, or teriparatide in appropriate cases [15].

The limitations of this study must be acknowledged. As a retrospective analysis, it is subject to biases in documentation and follow-up. Functional outcomes were not assessed using validated scoring systems such as DASH or PRWE, which may limit comparability with other studies. Furthermore, long-term outcomes including refracture rates and sustained mobility were not evaluated due to the short follow-up period.

## CONCLUSION

Osteoporotic distal radius fractures are a common injury among elderly patients, especially women, following low-energy trauma. Our retrospective analysis highlights that both conservative and surgical management yield high radiological union rates, with surgical intervention offering superior early functional recovery in selected cases. The AO/OTA classification remains a valuable tool for guiding treatment decisions. Importantly, the study underscores the necessity of incorporating osteoporosis evaluation and treatment into fracture care to prevent future fractures. A comprehensive, multidisciplinary approach is crucial to improving long-term outcomes and reducing the healthcare burden associated with fragility fractures.

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