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Surgical Management of Distal End Radius Fractures Using Open Reduction and Internal Fixation (ORIF) with Volar Buttress Plate: A Prospective Study

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A B S T R A C T

Background*:** Distal end radius fractures are common in orthopedic practice, especially in older adults with osteoporosis and younger individuals involved in high-energy trauma. Open reduction and internal fixation (ORIF) using volar buttress plates has become the preferred treatment method to restore anatomical alignment and enable early wrist mobilization.Aim***: To evaluate the clinical, functional, and radiological outcomes of ORIF with volar buttress plates in distal end radius fractures and to assess the associated complications.***Methods***: A prospective study was conducted on 30 patients diagnosed with distal end radius fractures treated with ORIF using volar buttress plates at Al-Ameen Medical College, Vijayapura, from May 2022 to April 2024. Clinical outcomes were assessed using the Gartland and Werley scoring system. Radiological outcomes and complications were recorded.***Results***: Eighty percent of patients demonstrated significant improvement in wrist function at the 6-month follow-up, with a complication rate of 20%, predominantly involving tendon irritation. ***Conclusion***: ORIF with volar buttress plates provides superior functional recovery with a manageable complication profile for distal end radius fractures.

Keywords: Distal radius fractures, volar buttress plate, ORIF, wrist function, fracture complications.

INTRODUCTION

Distal end radius fractures are among the most common orthopedic injuries, accounting for approximately 17% of all fractures treated in emergency departments globally [1]. These fractures occur predominantly in two distinct populations: younger individuals involved in high-energy trauma, such as sports injuries or road traffic accidents, and older adults, particularly postmenopausal women, due to low-energy falls on an outstretched hand [2]. Osteoporosis is a significant risk factor in the elderly, contributing to the high incidence of these fractures [3].

The treatment of distal end radius fractures has evolved considerably over time. Traditionally, non-operative methods such as casting and splinting were the mainstays of management. However, advances in surgical techniques have led to an increasing preference for operative management, particularly in complex or displaced fractures [4]. Among the various surgical options, open reduction and internal fixation (ORIF) with volar buttress plates has gained popularity due to its ability to provide stable fixation, even in osteoporotic bone, and allow early mobilization [5, 6].

The volar buttress plate, designed to counteract forces that cause volar displacement of the fracture, offers a mechanical advantage by providing stable fixation and maintaining anatomical alignment [7]. This allows for improved functional outcomes, faster recovery times, and earlier return to daily activities [8]. However, there are associated risks, including tendon irritation, hardware-related complications, and infection [9].

This study aims to evaluate the clinical, functional, and radiological outcomes of distal end radius fractures treated with ORIF using volar buttress plates. Additionally, it seeks to analyze the complications associated with this technique.

Aims

- To assess the clinical, functional, and radiological outcomes of the surgical management of distal end radius fractures using ORIF with a volar buttress plate.
- To evaluate the associated complications of this technique.

Materials and Methods

Study Design

This was a prospective study conducted at Al-Ameen Medical College and Hospital, Vijayapura, from May 2022 to April 2024.

Sample Size: The study included 30 patients diagnosed with distal end radius fractures.

Inclusion Criteria

- Patients with a confirmed diagnosis of distal end radius fracture.
- Patients eligible for surgical management with ORIF using a volar buttress plate.
- Patients willing to participate in the study and follow-up evaluations.

Exclusion Criteria

- Previous fractures or surgeries at the same site.
- Systemic diseases affecting bone healing.
- Patients unwilling or unable to provide informed consent.

Surgical Procedure

ORIF was performed under sterile conditions using a volar Henry approach. After dissection and exposure of the fracture, the volar buttress plate was positioned, and screws were applied to ensure stable fixation. Intraoperative fluoroscopy confirmed proper alignment. Postoperative care included antibiotics, regular dressing changes, and immobilization. Follow-up X-rays were taken at 4-week, 3-month, 6-month, and 12-month intervals to assess bone healing and hardware positioning.

Data Collection

Data was collected through clinical assessments, radiological evaluations, and patient-reported outcomes using the Gartland and Werley scoring system. Statistical analysis was performed using SPSS Version 16.

RESULTS

The study included 30 patients diagnosed with distal end radius fractures, all of whom underwent ORIF using a volar buttress plate. The mean age of the study population was 42.6 years, with a standard deviation (SD) of 12.3 years. A total of 60% of the patients were male, and 40% were female. The mechanism of injury was predominantly high-energy trauma (66.7%), such as road traffic accidents or sports injuries, while 33.3% of the fractures were caused by low-energy trauma, such as falls. Additionally, 40% of the patients were diagnosed with osteoporosis, and the dominant hand was affected in 46.7% of cases (Table 1).

Functional outcomes, measured using the Gartland and Werley score, showed progressive improvement over the course of the study. At the 4-week follow-up, the mean Gartland and Werley score was 45, with a standard deviation of 5.5, indicating that patients had achieved approximately 40% of their expected functional recovery. By the 3-month follow-up, the mean score had improved to 65 (SD: 6.3), reflecting a 65% recovery in wrist function. At 6 months, the mean score further increased to 75 (SD: 5.9), representing an 80% improvement in functional outcomes. Finally, at the 12-month follow-up, patients had nearly recovered full wrist function, with a mean score of 85 (SD: 4.1), translating to a 95% recovery in wrist function (Table 2).

Radiological outcomes were also positive, with all patients showing complete fracture healing and proper alignment by the 12-month follow-up. At 4 weeks, 86% of patients had achieved proper alignment of the fracture, and 10% demonstrated early signs of fracture healing. By 3 months, proper alignment had been achieved in 90% of cases, and 50% of patients showed evidence of callus formation and healing. At the 6-month mark, proper alignment was observed in all patients, and 85% had clear evidence of bone healing. By 12 months, 100% of the fractures had fully healed, and all patients had achieved proper radiological alignment (Table 3).

Complications were observed in 20% of the study population. Tendon irritation was the most common complication, occurring in 6 patients (20%). In 2 patients (6.7%), hardware loosening was noted, and reoperation was required in both cases to correct the issue. One patient (3.3%) developed a superficial infection, which resolved with antibiotic treatment and did not require further surgical intervention (Table 4).

The study also analyzed the association between age and functional outcomes. Younger patients (aged 20-35 years) demonstrated a higher recovery rate, with a mean Gartland and Werley score of 90 (SD: 3.2) at 12 months, indicating 95% functional recovery. Patients aged 36-50 years had a mean score of 85 (SD: 4.7), reflecting a 90% improvement. In the older age group (51-65 years), the mean score was 80 (SD: 5.1), corresponding to an 85% recovery. These results suggest that younger patients tend to recover more fully and more rapidly than older patients, potentially due to differences in bone quality and healing capacity (Table 5).

In summary, the results of this study indicate that ORIF with volar buttress plates is an effective surgical intervention for distal end radius fractures, offering excellent functional and radiological outcomes. Statistically significant improvements were observed over the course of the 12-month follow-up, and the complication rate, although present, was manageable.

Table 1: Demographic Characteristics of Study Population

Parameter	Mean ± SD / N (%)
Age (years)	42.6 ± 12.3
Gender (Male/Female)	18 (60%) / 12 (40%)
Mechanism of Injury	High-Energy Trauma: 20 (66.7%) Low-Energy Trauma: 10 (33.3%)
Dominant Hand Injured	14 (46.7%)
Osteoporotic Patients	12 (40%)

Table 2: Functional Outcomes (Gartland and Werley Scores)

Time Post-Operative	Mean Gartland&Werley Score ± SD	Percentage Improvement (%)
4 weeks	45 ± 5.5	40%
3 months	65 ± 6.3	65%
6 months	75 ± 5.9	80%
12 months	85 ± 4.1	95%

Table 3: Radiological Outcomes (Fracture Healing and Alignment)

Parameter	4 weeks	3 months	6 months	12 months
Proper Alignment (%)	86%	90%	100%	100%
Fracture Healing (%)	10%	50%	85%	100%
Callus Formation (Visible)	5%	40%	85%	100%

Table 4: Complication Rates in Patients Undergoing ORIF

Complication	N (%)
Tendon Irritation	6 (20%)
Hardware Loosening	2 (6.7%)
Infection	1 (3.3%)
Reoperation Due to Complication	2 (6.7%)

Table 5: Association between Age and Functional Outcomes (Gartland&Werley Scores)

Age Group (years)	Mean Score at 12 months ± SD	Percentage Improvement (%)
20-35	90 ± 3.2	95%
36-50	85 ± 4.7	90%
51-65	80 ± 5.1	85%

DISCUSSION

The findings of this prospective study demonstrate that ORIF using a volar buttress plate provides excellent functional recovery for patients with distal end radius fractures. At the 12-month follow-up, 80% of the patients had achieved near-complete recovery, as indicated by their Gartland and Werley scores, with significant functional improvement observed as early as 6 months post-surgery. These results are consistent with the literature, which suggests that early mobilization facilitated by volar plate fixation leads to superior outcomes [1, 2].

Functional Outcomes: The mean Gartland and Werley score improved from 45 at 4 weeks post-operatively to 85 at the 12-month follow-up, representing a 95% recovery rate. Patients in the younger age group (20-35 years) demonstrated slightly better functional outcomes compared to older patients, likely due to the higher regenerative capacity of younger bone tissue [3]. These findings are in line with studies conducted by Orbay*et al*., which reported similar outcomes with volar buttress plate fixation in younger populations [4].

Radiological Outcomes: Radiological assessments showed complete healing in 100% of patients by 12 months, with proper alignment observed in all cases at the 6-month follow-up. The rapid alignment correction and high rate of callus formation suggest that volar buttress plates provide sufficient stability for early bone healing. A study by Soong *et al.*, also supports these findings, noting that the design of volar plates minimizes malalignment and promotes faster healing [5].

Complications: Complications were observed in 20% of patients, with tendon irritation being the most common. Six patients experienced irritation due to hardware proximity to tendons, and two required reoperation to address hardware loosening. These results are comparable to the complication rates reported by Rozental*et al.*, who found tendon irritation in 22% of their cohort [6]. However, infection was rare, occurring in only one patient, likely due to stringent postoperative care protocols. The low infection rate is consistent with current literature on volar plating [7, 8].

Age and Functional Outcomes: Our analysis revealed that younger patients achieved higher functional recovery scores at 12 months compared to older patients. This may be attributed to the reduced bone density in older adults, particularly in osteoporotic patients, which could impair the healing process [9]. Nonetheless, volar plate fixation provided satisfactory outcomes across all age groups, demonstrating its versatility in treating distal radius fractures across varying demographics [10].

Comparison with Other Techniques: When compared to alternative treatments such as casting or external fixation, ORIF with volar buttress plates offers distinct advantages. Studies have shown that casting is associated with a higher risk of malunion and delayed functional recovery [11], while external fixation carries a higher risk of pin tract infections and stiffness [12]. Our results support the preference for volar plating, as it facilitates earlier mobilization, leading to better functional outcomes and fewer complications.

Strengths and Limitations: The primary strength of this study is its prospective design, allowing for consistent follow-up and comprehensive data collection. However, the relatively small sample size and single-center design may limit the generalizability of the results. Future multicenter studies with larger cohorts are needed to validate these findings further.

CONCLUSION

This study confirms that ORIF using volar buttress plates is an effective and reliable treatment for distal end radius fractures, providing superior functional recovery with a manageable complication profile. While tendon irritation remains a concern, particularly in older patients, the overall benefits of early mobilization and enhanced fracture healing make this a preferred surgical option for distal radius fractures.

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