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Original Research Article

Functional Outcome of Volar Barton Fractures of the Distal Radius Managed with Volar Plating

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Abstract: *Volar Barton fractures are unstable intra-articular injuries of the distal radius that commonly result from high-energy trauma. Anatomical reduction and stable fixation are essential to restore wrist function and prevent post-traumatic arthritis. Volar locking plates are widely used, yet local outcome data remain limited.* ***Objective:*** *To evaluate the functional outcomes of Volar Barton fractures of the distal radius managed with volar plating.* ***Methods:*** *This study involved 65 patients with a confirmed diagnosis of a volar Barton's fracture (AO/ASIF type B3). All patients underwent surgical fixation with a volar locking plate via the modified Henry approach. Guided physiotherapy was initiated two weeks after surgery. Functional outcomes were assessed using the Gartland and Werley scoring system at 6-month follow-up.* ***Results:*** *65 patients were selected for this study; the majority were male (70.8%). Road traffic accidents accounted for 72.3% of cases. Assessment of functional outcomes showed that 73.8% of patients achieved excellent outcomes, 16.9% good, and 9.2% fair. Post op complications were superficial infection (6.2%), wrist stiffness (4.6%), and carpal tunnel syndrome (3.1%).* ***Conclusion:*** *Volar locking plate is a highly successful and safe surgical strategy for managing volar Barton's fractures of the distal radius, with a higher proportion of excellent-to-good functional outcomes.*

Keywords: Volar Barton's Fracture, Distal Radius, Volar Locking Plate, Functional Outcomes, Gartland and Werley Score, Fracture Fixation

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Introduction

Distal radius fractures (DRF) are among the most prevalent bone injuries, frequently found in older adults as well as athletes. These injuries usually occur from falls. The extent of these fractures varies considerably from non-displaced injuries that might be managed conservatively to far more complex displaced fractures requiring surgical intervention (1, 2). A complex variant of DRF is called a volar Barton fracture. This type is characterized by its intra-articular nature, in which the fracture extends to the surface, influencing both the articular cartilage and the alignment of the wrist joint. Patients presenting with volar Barton fractures tend to demonstrate severe pain and a characteristic wrist deformity resulting in significant functional impairments (3, 4).

The surgical treatment of volar Barton fractures usually involves open reduction and internal fixation with volar locking plates. This method aims to restore the fracture's structural alignment while providing stable fixation, facilitating a swift return to function. Volar locking plates provide substantial benefits by supporting volar fragments, ensuring joint stability, and thereby avoiding collapse and encouraging early mobilization. This fixation procedure effectively minimizes the risk of complications such as sympathetic dystrophy, which can arise from prolonged immobilization (4,6). The functional outcome of correcting a fracture at the distal aspect of the radius is determined by anatomical reduction of the articular surface, along with the alignment of the distal portion of the radius outside the joint. Restoration of anatomy via plating facilitates secure internal fixation, thereby contributing to an expedited return of wrist function. Additionally, the anti-gliding effect of buttress plates contributes to the reduction and stabilization of intra-articular fractures. This innovative fixation approach addresses the rising incidence of sympathetic dystrophy associated with prolonged immobilization (7-9).

Volar Barton fractures of the distal radius are intra-articular injuries characterized by displacement of the volar rim, leading to instability of the radiocarpal joint and significant impairment of wrist function if inadequately treated. The advent of volar plating techniques, particularly with locking plates, has revolutionized the management of these fractures by providing stable fixation, maintaining reduction, and allowing early wrist rehabilitation. Assessing the functional outcomes of volar Barton fractures managed with volar plating is therefore essential to evaluate the efficacy of this surgical approach in restoring wrist motion, strength, and stability while minimizing complications and improving overall patient quality of life.

Methodology

This study was initiated as a descriptive study at Department of Orthopedic and Spine, Hayatabad Medical Complex. The duration was from April 2024 to October 2024. We obtained an ethical certificate from the hospital before carrying out the study.

We enrolled 65 patients who were 18 years or older with a confirmed volar Barton's fracture of the distal radius, which was classified as AO/ASIF type B3 sustained within three weeks of presentation. We excluded patients with open fractures, significant neurovascular compromise, pre-existing ipsilateral upper limb injuries, and pathological fractures.

All the patients gave their consent. Demographic information was recorded for all patients. All patients underwent open reduction and internal fixation using a volar locking plate performed by an experienced consultant surgeon. The surgical procedure employed the standard modified Henry's approach, which utilises the inter-nervous plane between the flexor carpi radialis and the radial artery. This approach provides excellent exposure of the volar distal radius. After achieving an anatomical reduction of the fracture fragments under direct visualization and fluoroscopic guidance, a pre-contoured volar locking plate was applied. The position and stability of the fixation were confirmed intraoperatively using image intensification.

Postoperatively, a below-elbow plaster slab was applied for comfort and support for the first 2 weeks. Upon suture removal at two weeks, a structured, supervised physiotherapy program was initiated. This rehabilitation program initially focused on active and passive range-of-

motion exercises for the digits, elbow, and shoulder, progressively incorporating specific wrist mobilization and strengthening exercises as tolerated by the patient.

Functional outcomes were evaluated at the six-month follow-up using the Gartland and Werley demerit scoring system. This well-established scoring system provides a composite score based on residual deformity, objective measurements of range of motion and grip strength, the presence of pain, and the patient's ability to return to their pre-injury activities. The resulting scores were then categorized into excellent, good, fair, or poor.

SPSS 27 was used to analyze the patients' data. We used the mean and standard deviation for age. Frequency and percentages were used for gender, cause of injury, side of injury, socioeconomic status, residence, functional outcomes, and complications.

Results

We analyzed data from 65 patients; their mean age was 35.29 ± 11.77 years. The study population was mostly men (46, 70.8%), while 19 patients (29.2%) were female (Table 1). The most common mechanism of injury was a road traffic accident, which was reported in 47 cases (72.3%). Fall was the cause in 13 patients (20.0%), with other mechanisms reported in 5 cases (7.7%). Regarding involvement, fractures occurred more frequently on the left side, affecting 40 patients (61.5%) (Table 2). Assessment of functional outcomes revealed that 48 patients (73.8%) achieved excellent outcomes, while 11 (16.9%) achieved good outcomes. A fair outcome was observed in the remaining six patients (9.2%) (Table 3). Post-operative complications were infrequent. The most common issue was superficial infection, which occurred in 4 patients (6.2%), followed by wrist stiffness in 3 (4.6%) and carpal tunnel syndrome in 2 (3.1%) (Figure 1).

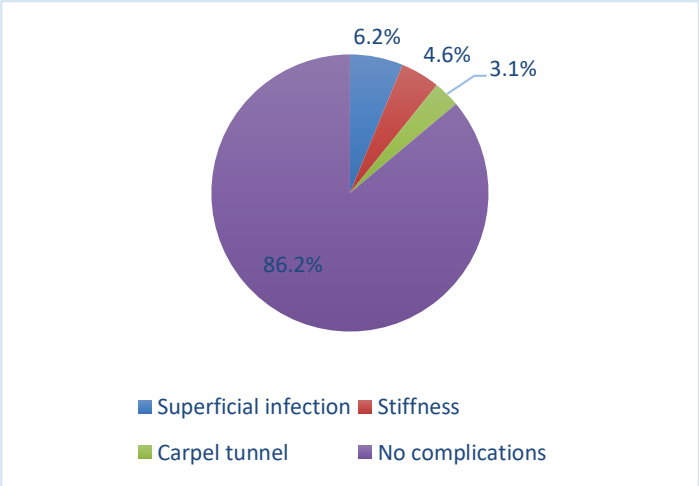

Figure 1: Complications.

Table 1: Demographics

Demographics		Frequency	Percentage
Gender	Male	46	70.8%
	Female	19	29.2%
Residence	Urban	41	63.1%
	Rural	24	36.9%
Socioeconomic status	Low	23	35.4%
	Middle	30	46.2%
	Higher	12	18.5%

Table 2: Clinical presentation

Clinical presentation		Frequency	Percentage
Cause of injury	RTA	47	72.3%
	Fall	13	20.0%
	Other	5	7.7%
Side of injury	Right	25	38.5%
	Left	40	61.5%

Table 3: Functional outcome

Functional outcome	Frequency	Percentage
Excellent	48	73.8%
Good	11	16.9%
Fair	6	9.2%

Discussion

This study was set out to evaluate the functional outcomes of 65 patients with volar Barton's fractures treated with volar plating, and the findings contribute positively to other studies. Beginning with a comparison of demographic profiles, our patient cohort had a mean age of 35.29 years, which aligns closely with those reported in similar studies. Saeed et al. and Islam et al. reported mean ages of 34.43 and 32 years, respectively, firmly placing the typical patient within the young-to-middle-aged adult demographic (5,11). This consistency across studies suggests that volar Barton's fractures, often resulting from high-energy trauma, disproportionately affect patients in their most productive years, thereby underscoring the importance of achieving a full functional recovery.

Our data showed that70.8% of our patients were male. This finding is remarkably similar to other studies, such as those by Bharath et al. and Saini et al., which reported male percentages of 90% and 80%, respectively (11, 13). A prominent observation in our study was the side of injury, with the left side being involved in 61.5% of cases. This left-sided preponderance was also noted by Islam et al. (63%) and Bharath et al. (53.3%) (10, 11).

Road traffic accidents were the leading cause of injury in 72.3% of cases, similar to reports by Saeed et al. (71.7%) and Bharath et al. (80%) (5,11). Falls were the second most common mechanism in our study, representing 20% of injuries, which is comparable to the 28.3% and 16% reported by Saeed et al. and Saini et al., respectively (5,12).

The assessment of functional outcomes showed that 73.8% of our patients achieved an excellent outcome, with a further 16.9% achieving a good

outcome. This success rate is consistent with the literature. Saeed et al. documented a 91.7% satisfactory outcome rate using the Gartland and Werley score, while Saini et al., employing the Mayo Wrist Score, reported a 96% excellent-to-good outcome (5,12). Haider et al. compared two plating techniques and reported excellent results of 93.3% and 96.7% for each method, respectively (13). The high rate of satisfactory outcomes can be attributed to the biomechanical advantages of volar locking plates, which act as an internal buttress, maintaining articular congruity, radial length, and volar tilt until bony union occurs.

Furthermore, the safety of the procedure is evidenced by our low complication rate. Around 86.2% of our patients had no complications. The most frequent issues were superficial infection (6.2%), wrist stiffness (4.6%), and carpal tunnel syndrome (3.1%). This profile is consistent with other studies. Saeed et al. reported wound infection and stiffness, each occurring in less than 4% of cases.[5] Similarly, Islam et al. noted superficial infection being the most common minor complication (10).

Based on our findings, we strongly support volar plating as the treatment of choice for volar Barton's fractures. The favorable outcomes support its routine use in clinical practice. The high incidence of these injuries among young males in road traffic accidents also suggests a potential area for public health intervention focused on road safety awareness.

Conclusion

In conclusion, this study affirms that a volar locking plate is a highly successful and safe surgical strategy for managing volar Barton's fractures of the distal radius, with a higher proportion of excellent-to-good functional outcomes. A very low complication rate was observed in our study.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-23)

Consent for publication
Approved

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Conflict of interest

The authors declared no conflict of interest.

Author Contribution

MS (Associate Professor)
Conception of Study, Manuscript drafting, Critical input, Review of manuscript and Study Design
MZK (Associate Professor)
Review of Literature, Data entry and Data analysis
MH (Trainee Medical Officer)
Development of Research Methodology Design,
SUH (Specialist Registrar)
Study Design, manuscript review, and critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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