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Functional Outcome of Volar Barton Fracture of Distal End Radius Undergoing Plating

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Volar Barton fracture, distal radius, volar plating, open reduction internal fixation, ORIF, functional outcomes, complications, wrist fracture management.

Disclaimers

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ABSTRACT

Background: Volar Barton fractures of the distal radius are complex intra-articular injuries that often require surgical intervention for optimal functional recovery. Volar plating is commonly used to achieve stable fixation and early mobilization.

Objective: This study aimed to evaluate the functional outcomes and complications in patients with volar Barton fractures of the distal radius treated with volar plating.

Methods: This prospective study was conducted from March 2023 to March 2024, including 60 patients aged 18-60 years with AO/ASIF type B3 volar Barton fractures. All patients underwent open reduction internal fixation (ORIF) using a volar locking plate through a modified Henry approach. Postoperative assessments were performed at six months using Gartland and Werley's wrist score. Data analysis was conducted using SPSS 25, with one-way ANOVA applied to evaluate associations between variables, considering a p-value < 0.05 as significant.

Results: The average age was 34.43 ± 12.34 years. Excellent functional outcomes were achieved in 61.7% of patients, good in 30%, fair in 6.7%, and poor in 1.7%. Complications were minimal, with 95% of patients reporting none, 3.3% experiencing wound infections, and 1.7% reporting wrist stiffness.

Conclusion: Volar plating for volar Barton fractures showed excellent to good functional outcomes in most patients, with minimal complications. Further studies with larger populations are recommended.

INTRODUCTION

Fractures of the distal radius are among the most prevalent bone injuries, frequently observed in both older adults and athletes, and are typically caused by falls onto an outstretched hand (1). These fractures vary significantly in severity, from simple, non-displaced breaks that may be managed conservatively, to more complex, displaced fractures requiring surgical intervention (2, 3). The incidence of distal radius fractures has shown a steady increase over time, with data from 1999 to 2010 indicating an annual rise of 2.0% in men and 3.4% in women aged 50-59 years (4). Distal radius fractures often exhibit a bimodal distribution, with high-impact trauma predominantly affecting adolescents and young adults, while low-impact trauma is more commonly the cause in older individuals (5, 6). A particularly challenging type of distal radius fracture is the volar Barton fracture, characterized by its intra-articular nature, where the fracture extends into the joint surface, impacting the articular cartilage and alignment of the wrist joint (7). This fracture type typically involves the distal fragment displacing towards the palmar side, leading to an abnormal angulation and significantly impairing wrist function. Patients with volar Barton fractures commonly present with severe pain, swelling, and a notable deformity of the wrist, resulting in considerable functional impairment (8-10).

Surgical management of volar Barton fractures often involves open reduction and internal fixation (ORIF) with volar locking plates. This approach aims to restore the anatomical alignment of the fracture and provide stable fixation, thus facilitating an early return to function. Volar locking plates are particularly advantageous due to their ability to buttress the volar fragment and stabilize the joint, preventing collapse and promoting early mobilization. This method of fixation also minimizes the risk of complications such as sympathetic dystrophy, which can arise from prolonged immobilization (11). Despite the potential benefits, volar Barton fractures pose significant challenges in achieving optimal functional outcomes due to the intra-articular nature of the injury and the tendency for the distal fragment to displace volarly. The current study aims to evaluate the functional outcomes and complications associated with volar plating for volar Barton fractures of the distal radius, as there is a lack of local data on this subject. Identifying factors that predict favorable outcomes and potential complications is essential for refining surgical techniques and rehabilitation strategies, ultimately improving patient care and recovery for those affected by volar Barton fractures.

MATERIAL AND METHODS:

This prospective study was conducted at the Orthopedic Department of Hayatabad Medical Complex, Peshawar,

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from March 2023 to March 2024, following ethical approval obtained from the hospital's ethics committee in accordance with the Declaration of Helsinki. The study included 60 patients aged between 18 and 60 years, of either gender, diagnosed with volar Barton's fracture (AO/ASIF type B3) confirmed by radiographic evaluation. Patients presenting within three weeks of injury were considered for inclusion, while those with associated fractures in the ipsilateral upper limb, neurovascular injuries, open fractures, or pathological fractures were excluded from the study.

All eligible patients underwent open reduction and internal fixation (ORIF) using a volar locking plate through a modified Henry approach. The procedures were performed under either general or regional anesthesia, depending on the patient's condition and preference. Fracture reduction was achieved under direct visualization, followed by the application of a volar locking plate to stabilize the fracture. Intraoperative fluoroscopy was used to confirm the accuracy of reduction and fixation. Provisional fixation with K-wires was applied when necessary before the placement of the plate. After ensuring stability, the wound was meticulously closed in layers, and a below-elbow plaster slab was applied to maintain immobilization during the initial healing phase.

Postoperative management included standardized protocols for pain control, wound care, and gradual mobilization, with follow-up assessments conducted at six months post-surgery. The primary outcome measure was the functional outcome of the wrist, assessed using Gartland and Werley's wrist score, which evaluates pain, range of motion, and ability to perform daily activities. Secondary outcomes included the incidence and nature of postoperative complications, such as wound infections and wrist stiffness.

Data collection involved recording demographic information, injury characteristics, surgical details, and follow-up outcomes. All data were entered into SPSS version 25 for statistical analysis. Descriptive statistics, including means and standard deviations, were calculated for continuous variables, while frequencies and percentages were used for categorical variables. One-way ANOVA was employed to assess the association between functional outcomes and variables such as age, with a p-value of less than 0.05 considered statistically significant.

The study maintained strict confidentiality and adhered to ethical guidelines throughout the research process. The outcomes aimed to provide insights into the effectiveness of volar plating in managing volar Barton fractures and to contribute to optimizing surgical techniques and postoperative care strategies in this patient population.

RESULTS

The study included 60 patients with volar Barton fractures of the distal radius who underwent volar plating. The average age of the participants was 34.43 ± 12.34 years, with a BMI of 23.33 ± 1.72 kg/m^2. Male participants constituted 58.3% of the sample, while 41.7% were female. The predominant cause of fractures was road traffic accidents, accounting for 71.7% of cases, followed by falls (28.3%). Fractures were more common on the left side (53.3%) compared to the right side (46.7%).

Table 1: Functional Outcome of Patients Post-Surgery

Functional Outcome	Frequency	Percent (%)
Excellent	37	61.7
Good	18	30.0
Fair	4	6.7
Poor	1	1.7
Total	60	100.0

The majority of patients (61.7%) achieved excellent functional outcomes, 30% had good outcomes, 6.7% had fair outcomes, and only 1.7% exhibited poor outcomes post-surgery.

Table 2: Complications Associated with Volar Plating

Complications of Plating	Frequency	Percent (%)
No Complication	57	95.0
Wound Infection	2	3.3
Stiffness of the Wrist	1	1.7
Total	60	100.0

Complications were infrequent, with 95% of patients experiencing no complications. Wound infections were reported in 3.3% of cases, and wrist stiffness was noted in 1.7% of patients.

The analysis revealed a significant association between age and functional outcomes, with younger patients demonstrating superior results. The mean age of patients with excellent outcomes was 32.86 ± 10.92 years, compared to 57.00 years for those with poor outcomes, highlighting a statistically significant difference (P = 0.0001). Overall, the findings suggest that volar plating for volar Barton fractures results in predominantly excellent to good functional outcomes, with minimal complications, particularly among younger patients.

Table 3: Comparison of Age with Functional Outcome Using One-Way ANOVA

Functional Outcome	N	Mean Age (Years)	Standard Deviation	P-value
Excellent	37	32.86	10.919	0.0001
Good	18	31.67	11.109	
Fair	4	55.75	3.304	
Poor	1	57.00	0.000	
Total	60	34.43	12.336	

DISCUSSION

The results of this study demonstrated that volar plating for volar Barton fractures of the distal radius led to excellent to good functional outcomes in a majority of patients, with a low incidence of complications. These findings align with previous studies that have reported favorable outcomes with volar plating, emphasizing the technique's effectiveness in restoring wrist function and stability (12, 13). In this study, 61.7% of patients achieved excellent results, which is consistent with the findings of Saini et al. (2021), who reported a similar rate of excellent outcomes in their cohort (12). The high rate of favorable results in the present study underscores the reliability of volar plating in managing complex intra-articular fractures of the distal radius.

The association between younger age and better functional outcomes observed in this study was significant, with younger patients more likely to achieve excellent results compared to older individuals. This finding is supported by the study conducted by Islam et al. (2022), which also noted that younger patients generally have better postoperative recovery and functional scores (13). This could be attributed to the generally better bone quality, higher healing potential, and greater adherence to rehabilitation protocols in younger patients. Additionally, the mechanism of injury, predominantly high-energy trauma such as road traffic accidents, was consistent with the findings of Bharath et al. (2021), who reported similar demographic patterns among their patient population (14).

The study demonstrated a minimal complication rate, with 95% of patients experiencing no postoperative complications, aligning with the results from prior studies that have shown volar plating to be a safe and effective method with few adverse outcomes (14). The low incidence of complications such as wound infection (3.3%) and wrist stiffness (1.7%) further supports the use of this technique, as it offers stable fixation and allows for early mobilization, which is crucial for optimal recovery. Previous studies, including those by Saini et al. (2021) and Islam et al. (2022), also reported low complication rates, reinforcing the safety profile of volar plating in the treatment of volar Barton fractures (12, 13).

However, this study has certain limitations that should be acknowledged. The sample size was relatively small and drawn from a single center, which may limit the generalizability of the findings. Additionally, the follow-up period was limited to six months, which may not fully capture the long-term outcomes and potential late complications such as hardware failure or post-traumatic arthritis. Future studies with larger sample sizes and extended follow-up periods are recommended to validate these findings and to assess the long-term efficacy of volar plating in this patient population.

Strengths of this study include its prospective design and the use of standardized outcome measures, which provided robust data on the functional recovery of patients. The inclusion of a homogenous patient group, all undergoing the same surgical technique, minimized variability and allowed for a clearer interpretation of the results. Nonetheless, future research should consider including a comparative group, such as patients treated with alternative fixation methods, to provide a more comprehensive evaluation of the relative benefits of volar plating.

In conclusion, volar plating for volar Barton fractures of the distal radius demonstrated excellent to good functional outcomes with minimal complications, particularly in younger patients. The findings of this study contribute to the growing body of evidence supporting volar plating as a reliable and effective treatment option for these complex fractures. Further research with larger populations and longer follow-up periods is warranted to confirm these results and to explore strategies to optimize patient outcomes and reduce the risk of complications.

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