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Management of Distal Radius Fractures in a Bangladeshi Public Hospital: Outcomes of External Fixation vs. Plate Fixation

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Abstract **Original Research Article**

Introduction: Distal radius fractures are common upper limb injuries with diverse treatment options, including external fixation and volar locking plate (VLP) fixation. This study compares their effectiveness in achieving functional and radiological outcomes in a resource-limited Bangladeshi public hospital setting. ***Objectives:*** To compare functional and radiological outcomes of external fixation versus VLP fixation in managing distal radius fractures. ***Method and Materials:*** This prospective study was conducted on 38 patients with distal radius fractures at Dhaka Medical College Hospital from June 2019 to May 2020. Patients underwent external or plate fixation based on clinical assessment. Data collection included demographics, AO/OTA fracture classification, and postoperative outcomes (DASH scores, union rates). Statistical analysis was performed using SPSS version 25.0, and ethical approval was obtained prior to study initiation. ***Results:*** The study involved 38 patients with distal radius fractures, with a mean age of 43.2 years. The most common causes were falls from height (39.5%) and road traffic accidents (28.9%). External fixation was used in 52.6%, and plate fixation in 47.4%. Functional outcomes showed excellent recovery in 57.9%, while complications, including joint stiffness and infections, affected 47.4%. Radiological union was achieved in 92.1%, with high patient satisfaction (92.1%). ***Conclusion:*** This study highlights the effectiveness of external fixation and plate fixation in managing distal radius fractures in a Bangladeshi public hospital setting.

Keywords: Distal radius fractures, External fixation, Plate fixation, Infections.

INTRODUCTION

Distal radius fractures represent a significant proportion of upper limb injuries, contributing to substantial morbidity and healthcare costs worldwide [1,2]. These fractures are often caused by falls on an outstretched hand, with high-energy trauma being a common etiology in younger patients, whereas osteoporotic fractures dominate in older populations [3]. Management options for distal radius fractures vary based on fracture type, patient demographics, and resource availability. Among the surgical options, external fixation and volar locking plate (VLP) fixation are widely practiced techniques with distinct advantages and challenges [4]. External fixation is known for its minimal invasiveness and reliance on ligamentotaxis to restore alignment. This method is particularly beneficial in scenarios with severe soft tissue damage or limited access to advanced surgical equipment [5]. On the other hand, VLP fixation facilitates direct fracture reduction and provides rigid internal fixation, thereby allowing early postoperative mobilization and quicker recovery [6]. Both methods have shown favorable outcomes in terms of union rates, yet their comparative effectiveness remains a topic of debate, especially in resource-limited settings [7,8]. The choice of treatment also depends on patient-specific factors. Younger patients, typically involved in high-energy trauma, may benefit from external fixation due to its simplicity and lower cost. Meanwhile, VLP fixation is often preferred for older patients with osteoporotic bones, as it ensures anatomical reduction and enhances early function [9,10]. Studies suggest that while VLP fixation may offer superior early functional outcomes, external fixation is equally effective for long-term results in appropriate cases [11,12]. In the context of Bangladesh, the burden of distal radius fractures is amplified by a lack of specialized trauma care and socioeconomic barriers to

advanced surgical techniques [13]. Public hospitals, which cater to the majority of the population, often rely on cost-effective treatment modalities like external fixation. However, the increasing availability of VLP fixation in urban centers offers an opportunity to explore its utility in this setting [14,15].

OBJECTIVES

General objectives: This study aims to evaluate the outcomes of external fixation versus VLP fixation for distal radius fractures in a Bangladeshi public hospital. By comparing functional and radiological outcomes, the study seeks to provide evidence-based recommendations to optimize treatment strategies for diverse patient groups.

METHOD AND MATERIALS

Study Design: This study was a prospective comparative study conducted to evaluate the outcomes of external fixation versus plate fixation in the management of distal radius fractures. The study was conducted over a period of one year, from June 2019 to May 2020. The study population included 38 patients diagnosed with distal radius fractures, who were treated either with external fixation or plate fixation. The study was conducted at the Department of Orthopedic Surgery, Dhaka Medical College Hospital, a tertiary-level hospital providing treatment for a wide range of orthopedic conditions. Data were collected through clinical and radiological assessments during follow-up visits.

Sampling formula: The sample size was calculated using the following formula for comparative studies:

$$n=\frac{2\times(Z_\alpha+Z_\beta)^2\times\sigma^2}{(\mu_1-\mu_2)^2}$$

Where:
Z_α= standard normal deviate corresponding to a 95% confidence level (1.96)
Z_β= standard normal deviate corresponding to 80% power (0.84)
σ^2= pooled variance of outcome measures (assumed from previous studies)
μ_1 *and* μ_2= mean outcomes of the two groups being compared

Data Collection Procedure: Patients presenting to the orthopedic outpatient department or emergency room with a diagnosis of distal radius fractures were assessed for eligibility. Detailed demographic and clinical information, including age, gender, occupation, and mechanism of injury, was collected using a structured questionnaire. Radiographs were obtained to confirm the diagnosis and classify the fractures according to the AO/OTA classification. Eligible patients were allocated to one of the two treatment groups—external fixation or plate fixation—based on the surgeon's discretion and patient preferences. Postoperative evaluations were conducted at regular intervals (4 weeks, 8 weeks, and 12 weeks). Functional outcomes were assessed using the Disabilities of the Arm, Shoulder, and Hand (DASH) score, while radiological assessments focused on fracture union and alignment.

Inclusion Criteria

- Adult patients aged 18 years or older with radiologically confirmed distal radius fractures.
- Patients deemed suitable for surgical management with external fixation or plate fixation.
- Participants willing to provide written informed consent and adhere to the follow-up protocol.

Exclusion Criteria

- Open fractures or those associated with significant soft tissue injury.
- Pathological fractures or those associated with underlying bone diseases.
- Patients with previous fractures, deformities, or surgical interventions in the same limb.

Statistical Analysis: Data were analyzed using SPSS version 25.0. Continuous variables, such as age, fracture healing time, and DASH scores, were summarized as means and standard deviations. Categorical variables, such as gender distribution, fracture types, and postoperative complications, were presented as frequencies and percentages.

Ethical Consideration: Ethical approval was obtained from the Institutional Review Board of Dhaka Medical College Hospital before initiating the study. Written informed consent was obtained from all participants after providing detailed information about the study objectives, procedures, and potential risks. The confidentiality of patient data was strictly maintained throughout the study, and all participants were assured that their care would not be affected by their decision to participate.

RESULT

Table 1: Demographic Characteristics of the Study Population. (n=38)

Characteristics	Frequency (n)	Percentage (%)
Age Group (years)		
18–30	8	21.1
31–45	15	39.5
46–60	12	31.6

>60	3	7.8
Gender		
Male	25	65.8
Female	13	34.2
Mean Age ± SD	43.2 ± 12.5	
Occupations		
Manual Labor	14	36.8
Office Workers	10	26.3
Homemakers	9	23.7
Others	5	13.2

Table 1 demonstrates the distribution of age, gender, and occupations among the 38 patients. The mean age is 43.2 years (SD ±12.5). Most participants are aged 31–45 years (39.5%). Male patients (65.8%) outnumber females (34.2%). Regarding occupations, manual laborers comprise the largest group (36.8%), followed by office workers (26.3%).

Table 2: Mechanism of Injury. (n=38)

Mechanism of Injury	**Frequency (n)**	**Percentage (%)**
Fall from Height	15	39.5
Road Traffic Accident	11	28.9
Sports Injury	7	18.4
Others	5	13.2

Table 2 highlights the common causes of fractures, with falls from height being the leading cause (39.5%). Road traffic accidents account for 28.9%, and sports injuries contribute to 18.4%.

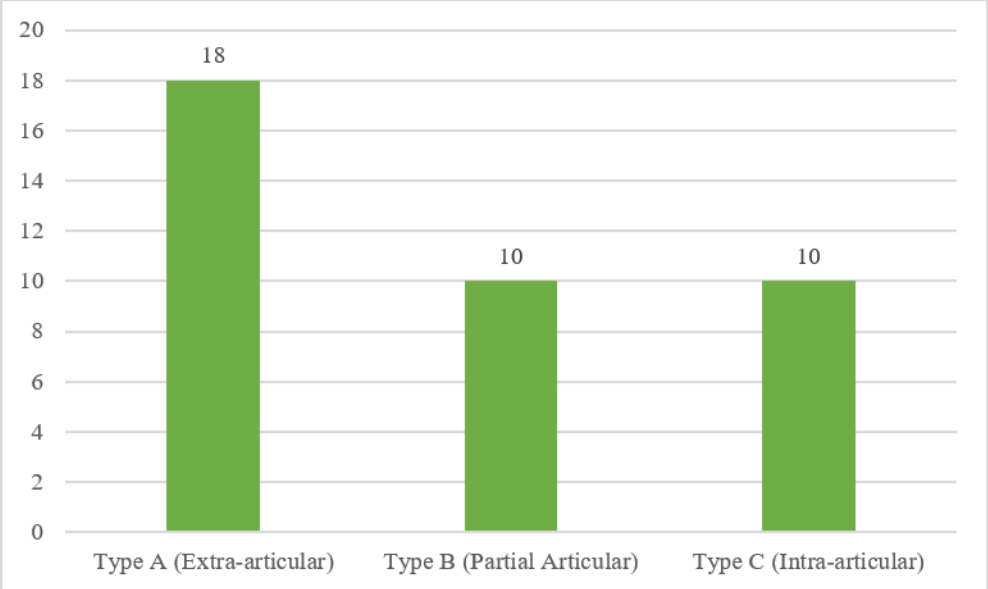

Figure 1: Distribution of Fracture Types (AO Classification)

Figure 1 shows the fractures were predominantly extra-articular (Type A), affecting 47.4% of the patients. This type indicates fractures not involving the joint surface, often managed effectively with external fixation. Intra-articular fractures (Type C) and partial articular fractures (Type B) each accounted for 26.3%. These types are more complex and often require plate fixation for optimal outcomes, reflecting the diversity in fracture presentations in the study population.

Table 3: Surgical Procedures Performed

Procedure	**Frequency (n)**	**Percentage (%)**
External Fixation	20	52.6
Plate Fixation	18	47.4

Table 3 shows, 52.6% underwent external fixation, while 47.4% received plate fixation. External fixation was slightly more commonly performed, possibly due to its cost-effectiveness and shorter operative time, especially in resource-limited settings like public hospitals. Plate fixation, though slightly less common, provides superior anatomical reduction, particularly in intra-articular and complex fractures, highlighting the tailored approach taken based on the type and severity of fractures.

Table 4: Postoperative Complications

Complication	Frequency (n)	Percentage (%)
Infection	6	15.8
Hardware Loosening	4	10.5
Joint Stiffness	8	21.1
None	20	52.6

Table 4 shows the Postoperative complications were observed in less than half of the patients (47.4%). Joint stiffness was the most frequently reported issue (21.1%), likely due to prolonged immobilization or inadequate physiotherapy. Infections occurred in 15.8% of cases, predominantly in those with external fixation. Hardware loosening was noted in 10.5%, requiring further follow-up or adjustments. Encouragingly, more than half (52.6%) of the patients reported no complications, indicating overall satisfactory surgical outcomes.

Table 5: Functional Outcomes (Based on DASH Score)

DASH Score	Frequency (n)	Percentage (%)
Excellent (0–20)	22	57.9
Good (21–40)	10	26.3
Fair (41–60)	4	10.5
Poor (>60)	2	5.3

Table 5 shows the Functional outcomes measured by the DASH score revealed excellent recovery in 57.9% of patients, with minimal disability and pain. Good outcomes were achieved in 26.3%, indicating minor limitations. A smaller proportion experienced fair (10.5%) or poor outcomes (5.3%), likely due to pre-existing conditions, severe fractures, or complications.

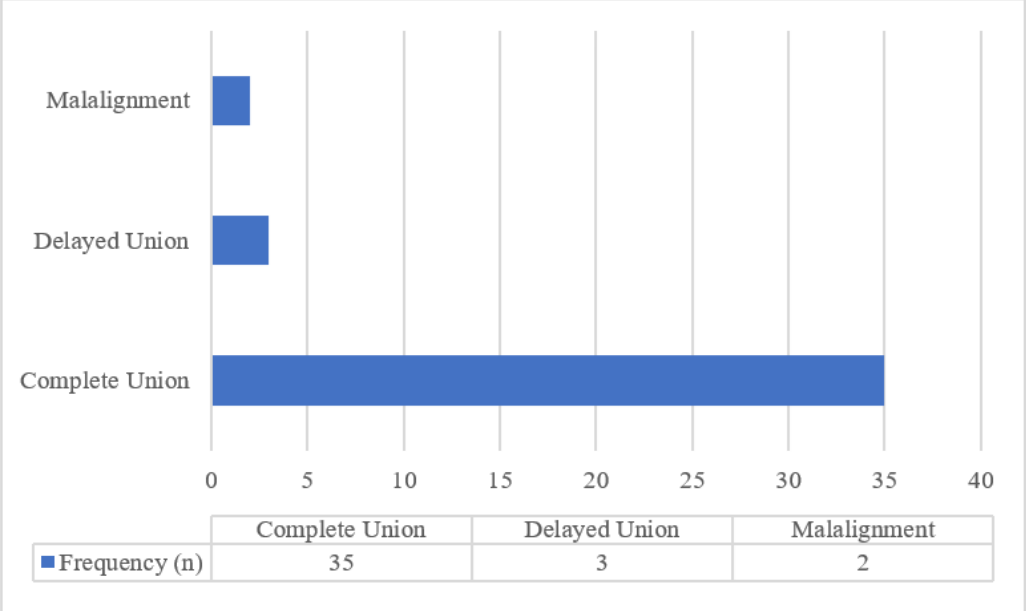

Figure 2: Radiological Outcomes (Union and Alignment)

Figure 2 shows the Radiological evaluation showed a high rate of complete union (92.1%), reflecting the success of both fixation techniques. Delayed union occurred in 7.9%, possibly due to poor bone quality or non-compliance with postoperative instructions. Malalignment was observed in 5.3%, underscoring the importance of precise surgical intervention and postoperative care to ensure optimal anatomical restoration.

Table 6: Patient Satisfaction Levels

Satisfaction Level	Frequency (n)	Percentage (%)
Very Satisfied	25	65.8
Satisfied	10	26.3
Neutral	2	5.3
Dissatisfied	1	2.6

Table 6 shows the Patient satisfaction was predominantly positive, with 65.8% of participants reporting being very satisfied and 26.3% satisfied with the surgical outcomes. Only 5.3% remained neutral, and a mere 2.6% were dissatisfied, possibly due to complications or limited functional recovery.

DISCUSSION

This study evaluated the management outcomes of distal radius fractures using external fixation and plate fixation in a Bangladeshi public hospital. The majority of fractures were caused by falls from height (39.5%) and road traffic accidents (28.9%). These findings align with similar studies that identified falls as the leading cause of distal radius fractures due to decreased bone density in middle-aged individuals and the rising incidence of accidents in urban areas [16,17]. In terms of fracture classification, extra-articular fractures (Type A) were most common (47.4%), followed by intra-articular (Type C) and partial articular fractures (Type B). This pattern reflects the predominance of less complex fractures in low-resource settings where patients often delay seeking medical care [18]. Surgical management showed external fixation being more frequently used (52.6%) compared to plate fixation (47.4%). External fixation was preferred for its cost-effectiveness and quicker procedures, making it a favorable choice in resource-limited settings. Similarly, studies have reported external fixation as a widely used method for extra-articular fractures, owing to its accessibility and minimal invasiveness [19,20]. Plate fixation, however, was more suited for complex fractures requiring anatomical reduction and stability, as highlighted in prior research comparing fixation techniques [21]. Complication rates were recorded at 47.4%, with joint stiffness (21.1%) and infections (15.8%) being the most common issues. These rates are comparable to studies that highlight joint stiffness as a common complication, especially in cases of prolonged immobilization or inadequate physiotherapy post-surgery [22]. Infections, predominantly seen in external fixation, align with reports citing pin site infections as a recurring challenge [23]. Hardware loosening (10.5%) and malalignment (5.3%) were less frequent but emphasize the importance of follow-up care and surgical precision. Functional outcomes, as assessed by DASH scores, showed excellent recovery in 57.9% of patients. This is consistent with research indicating favorable functional results for distal radius fractures managed surgically [24]. Radiological outcomes supported these findings, with 92.1% achieving complete union and a minimal rate of delayed union (7.9%), mirroring outcomes reported in other studies with similar surgical approaches [25,26]. Patient satisfaction was predominantly positive, with 65.8% reporting being very satisfied with their surgical outcomes. This high satisfaction rate is comparable to studies that emphasize the importance of functional recovery and minimal postoperative complications in influencing patient perspectives [27].

CONCLUSION

This study highlights the effectiveness of external fixation and plate fixation in managing distal radius fractures in a Bangladeshi public hospital setting. External fixation was slightly more commonly used, reflecting its cost-effectiveness and utility in resource-limited environments. However, plate fixation demonstrated superior outcomes in complex fractures, particularly intra-articular ones, due to its ability to achieve anatomical alignment.

Limitations of the Study: The short follow-up period primarily assessed immediate and short-term outcomes, leaving long-term complications and functional recovery unexplored. Additionally, the lack of randomization in selecting surgical techniques introduces potential bias, as the choice of external or plate fixation depended on surgeon preference and patient factors.

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