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Efficacy of DCP Radius Fixation in the Management of Distal Radius Fractures

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Abstract **Original Research Article**

Background: Distal radius fractures (DRFs) are among the most common skeletal injuries in orthopedic practice, often leading to significant morbidity and requiring precise management to restore functionality and prevent complications. The purpose of this study was to assess the efficacy of Dynamic Compression Plate (DCP) radius fixation in the management and outcomes of distal radius fractures. ***Aim of the study:*** The aim of the study was to evaluate the efficacy of Dynamic Compression Plate (DCP) radius fixation in the management and outcomes of distal radius fractures. ***Methods:*** This prospective study was conducted in the Department of Orthopaedics at Monowara Sikder Medical College & Hospital, Shariatpur, from June 2023 to May 2024, involving 100 patients with distal radius fractures. Inclusion criteria were adults ≥18 years requiring surgical intervention, excluding pathological fractures, severe comorbidities, or prior wrist surgeries. Patients underwent DCP fixation, with follow-up assessing healing, functional outcomes (Gartland and Werley score), complications, and satisfaction. Data were analyzed using SPSS version 22.0. ***Results:*** The study of 100 patients (mean age 35.25 years, 75% male) found DCP radius fixation effective for distal radius fractures, with 92% achieving union and 65% excellent functional outcomes. Complications were minimal (5% superficial infections), and patient satisfaction was high (92% satisfied or very satisfied), demonstrating the procedure's efficacy and patient acceptance. ***Conclusion:*** DCP radius fixation proves to be a reliable and effective treatment for distal radius fractures, offering high union rates, excellent functional outcomes, minimal complications, and high patient satisfaction.

Keywords: Distal Radius Fractures, Dynamic Compression Plate, Fracture Fixation, Functional Outcomes, Surgical Management.

INTRODUCTION

Distal radius fractures (DRFs) are among the most frequently encountered skeletal injuries in orthopedic practice, [1] accounting for approximately 10% to 20% of fractures treated in emergency settings [2]. These injuries are particularly common after the fourth decade of life, [1] forming a significant proportion of upper limb fractures and contributing notably to global morbidity and healthcare expenses [3,4]. Improper reduction of DRFs can result in subtle but serious complications, including midcarpal instability, distal radioulnar joint incongruity, post-traumatic arthritis, and chronic wrist pain, often linked to slight radial malalignment or ligament damage [5]. Successful management focuses on achieving accurate fracture reduction and maintaining stability to restore functionality and avoid long-term complications.

Over the last two decades, the approach to managing distal radius fractures (DRFs) has undergone substantial advancements, moving from traditional cast immobilization to Kirschner wire fixation and, more recently, to internal fixation using various plates [6]. While casting remains effective for stable fractures, surgical methods like plate fixation are essential for managing unstable fractures to restore proper alignment and function [7]. Among surgical options, internal fixation with the Dynamic Compression Plate (DCP) has become increasingly favored due to its ability to provide precise fracture reduction, secure stabilization, and facilitate early postoperative mobility [8]. This method is

now widely used, delivering superior outcomes in terms of fracture healing and functional recovery.

The treatment of distal radius fractures (DRFs) remains a complex task, particularly in selecting the optimal fixation technique for various types of fractures. Ensuring correct reduction and stable fixation while minimizing complications, such as loss of reduction or impaired hand function, is crucial for successful outcomes [9]. Over time, a range of techniques has emerged, including external fixation, percutaneous pinning, and internal fixation, each with its advantages and drawbacks [10]. Ongoing debates surround the effectiveness of these methods in preventing complications and achieving long-term functional recovery. A key challenge in managing DRFs lies in choosing a technique that restores anatomical alignment, supports early functional recovery, and avoids muscle imbalance or disability. Additionally, complications such as vascular issues at the bone-plate interface, particularly with conventional plating, underscore the need for more advanced and refined fixation methods [11,12]. The purpose of the study was to assess the efficacy of Dynamic Compression Plate (DCP) radius fixation in the management and outcomes of distal radius fractures.

Objective

- The aim of the study was to evaluate the efficacy of Dynamic Compression Plate (DCP) radius fixation in the management and outcomes of distal radius fractures.

METHODOLOGY & MATERIALS

This prospective observational study was conducted in the Department of Orthopaedics at Monowara Sikder Medical College & Hospital, Shariatpur, Bangladesh, from June 2023 to May 2024. A total of 100 patients with distal radius fractures were enrolled in the study.

Inclusion Criteria:

- Adults aged 18 years and older.
- Patients with acute distal radius fractures requiring surgical intervention.
- Individuals who provided written informed consent for participation in the study.

Exclusion Criteria:

- Patients with pathological fractures.
- Individuals with severe comorbidities or previous surgeries on the affected wrist.
- Patients unable to comply with follow-up protocols.

Written informed consent was obtained from all participants to ensure confidentiality and voluntary participation. Upon enrollment, detailed demographic data, including age, gender, and dominant hand involvement, were collected. Fracture characteristics, such as type (classified according to the AO classification) and mechanism of injury, were documented. All patients underwent Dynamic Compression Plate (DCP) radius fixation performed by experienced orthopedic surgeons. Postoperative follow-up was conducted at regular intervals to monitor healing progress and functional recovery. Radiological assessments were performed using standard X-rays to evaluate fracture union, alignment, and any signs of complications. Functional outcomes were assessed using the Gartland and Werley score, categorizing results into excellent, good, fair, and poor based on range of motion, pain, and functional ability. Patient satisfaction was recorded through a standardized questionnaire to gauge their overall experience and satisfaction with the surgical outcome. Data were compiled and analyzed using appropriate statistical methods. Descriptive statistics, including frequencies and percentages, were used to summarize demographic characteristics, clinical outcomes, and satisfaction levels of participants. The primary outcomes measured included rates of complete union, functional recovery, complication rates, and patient satisfaction levels. Statistical analysis was performed using SPSS version 22.0.

RESULTS

Table 1: Demographic Characteristics of Study Participants (n=100)

Variable		Frequency (n)	Percentage (%)
Age (In years)	18 – 30	50	50.0%
	31 – 40	15	15.0%
	41 – 50	20	20.0%
	51 – 60	10	10.0%
	61 – 70	5	5.0%
	Mean±SD (years)	35.25±12.86	
Gender	Male	75	75.0%
	Female	25	25.0%
Dominant hand involved	Yes	65	65.0%
	No	35	35.0%

Table 1 provides an overview of the demographic and clinical characteristics of the 100 participants included in this study. The age distribution showed that the majority of patients (50, 50.0%) were

aged 18–30 years, followed by 20 (20.0%) in the 41–50 years age group, 15 (15.0%) in the 31–40 years age group, 10 (10.0%) in the 51–60 years age group, and 5 (5.0%) in the 61–70 years age group. The mean age of the participants was 35.25 ± 12.86 years. Regarding gender, 75 (75.0%) participants were male, while 25 (25.0%) were female. A higher proportion of fractures involved the dominant hand (65, 65.0%) compared to the non-dominant hand 35 (35.0%).

Table 2: Fracture Type and Mechanism of Injury in Distal Radius Fractures (n=100)

Variable		Frequency (n)	Percentage (%)
Fracture Type (AO Classification)	A	80	80.0%
	B	5	5.0%
	C	15	15.0%
Mechanism of Injury	Fall from height	45	45.0%
	Road traffic accidents	30	30.0%
	Sports injuries	15	15.0%
	Other	10	10.0%

Table 2 provides an overview of the fracture type and mechanism of injury for the 100 participants in this study. The distribution of fracture types, according to the AO classification, revealed that the majority of fractures were of Type A (80, 80.0%), followed by Type C (15, 15.0%) and Type B (5, 5.0%). In terms of injury mechanisms, fall from height was the most common cause of injury (45, 45.0%), followed by road traffic accidents (30, 30.0%), sports injuries (15, 15.0%), and other causes (10, 10.0%).

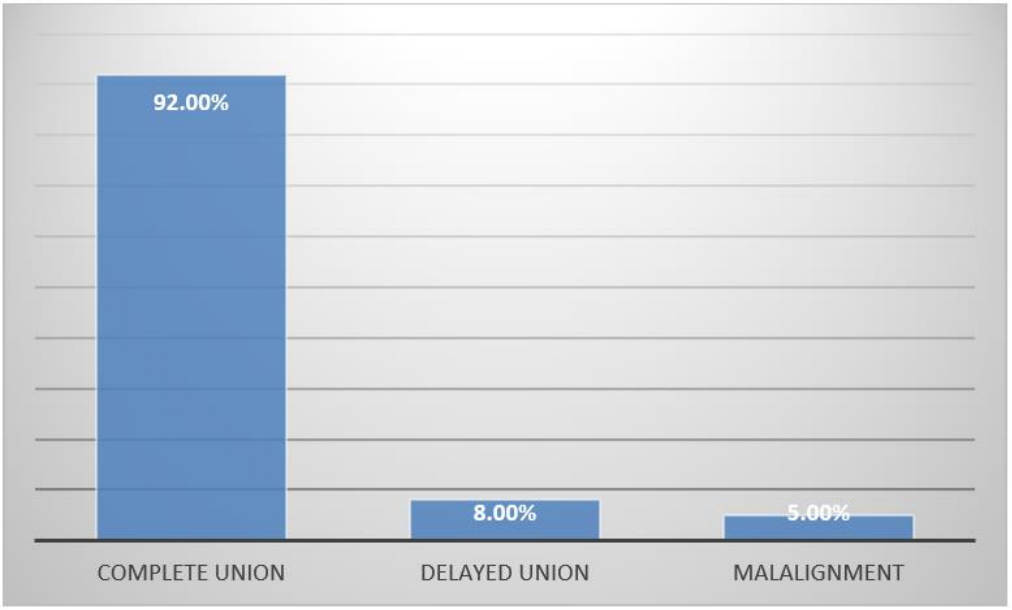

Figure 1: Radiological Outcomes of Distal Radius Fractures Post-DCP Fixation

Figure 1 presents the radiological outcomes of 100 patients following DCP radius fixation. The majority of patients (92%) experienced complete union of the fracture, reflecting the high success rate of the fixation method. Delayed union occurred in 8% of cases, potentially due to factors such as compromised bone quality or postoperative non-compliance. Malalignment was observed in 5% of patients, emphasizing the importance of precise surgical technique to ensure optimal anatomical restoration.

Table 3: Functional Outcome of Distal Radius Fracture Patients (n=100)

Functional Outcome (Gartland and Werley Score)	Frequency (n)	Percentage (%)
Excellent	65	65.0%
Good	30	30.0%
Fair	5	5.0%
Poor	0	0.0%
Total	100	100.0%

Table 3 presents the functional outcomes based on the Gartland and Werley score for the 100 participants in this study. The majority of patients (65, 65.0%) achieved an excellent functional outcome, followed by

30 (30.0%) with a good outcome. A smaller proportion (5, 5.0%) had a fair outcome, while no patients reported a poor outcome. These findings suggest that the DCP radius fixation procedure provided satisfactory results in terms of functionality, with most patients regaining excellent or good functional status post-surgery.

Table 4: Complications Following DCP Radius Fixation (n=100)

Complication	Frequency (n)	Percentage (%)
Superficial Infection	5	5.0%
Tendon Irritation	3	3.0%
Malunion	2	2.0%
Hardware Loosening	1	1.0%
Total	100	100.0%

Table 4 presents the complications observed in the study cohort after DCP radius fixation. The most common complication was superficial infection, reported in 5 (5.0%) of cases, followed by tendon irritation in 3 (3.0%) of patients. Malunion occurred in 2 (2,0%) of the cases, while hardware loosening was the least frequent complication, seen in 1 (1.0%) of the patients.

Table 5: Patient Satisfaction Following DCP Radius Fixation (n=100)

Satisfaction Level	Frequency (n)	Percentage (%)
Very Satisfied	66	66.0%
Satisfied	26	26.0%
Neutral	5	5.0%
Dissatisfied	3	3.0%
Total	100	100.0%

Table 5 presents the patient satisfaction levels following DCP radius fixation. The majority of patients were very satisfied (66.0%), followed by those who were satisfied (26.0%). A smaller proportion of patients reported neutral (5%) or dissatisfied (3.0%) outcomes.

DISCUSSION

This study highlights the clinical outcomes and patient satisfaction associated with Dynamic Compression Plate (DCP) fixation in the management of distal radius fractures at a tertiary care hospital in Bangladesh. Distal radius fractures, one of the most common orthopedic injuries, often require surgical intervention to restore wrist function and prevent long-term disability. The findings emphasize the effectiveness of DCP fixation in achieving high union rates, favorable functional recovery, and patient satisfaction, while also shedding light on the associated complications. These results underscore the importance of timely surgical intervention and comprehensive postoperative care in optimizing outcomes for patients with distal radius fractures.

In our study, the mean age of participants was 35.25 ± 12.86 years, with the majority falling in the 18–30-year age group (50%). This aligns with findings by Bharam *et al.*, [13], who observed a higher incidence of distal radius fractures in younger adults. A male predominance (75%) was noted, reflecting gender trends in fracture rates as seen in Jain *et al.*, [14], where males were more frequently affected due to greater involvement in high-risk activities such as sports and manual labor. Additionally, dominant hand involvement was observed in 65% of cases, consistent with Sable *et al.*'s findings, [15] which emphasized that fractures of the dominant hand result in greater functional impairment, thereby underscoring the importance of surgical intervention for optimal functional recovery. These demographic trends highlight the need for personalized treatment strategies, particularly for younger, active male patients and those with fractures of the dominant hand, as they are likely to benefit most from DCP radius fixation.

Regarding fracture type (AO classification), 80% of cases in our study were classified as Type A, indicating less complex fractures. This is consistent with Shukla *et al.*'s findings, [16] which also reported a predominance of Type A fractures. In terms of injury mechanism, fall from height was the most common cause (45%), aligning with Mahmud *et al.*'s observations [17]. However, our study also found that 30% of fractures resulted from road traffic accidents, mirroring Jain *et al.*'s report [14]. This suggests that while falls remain a significant cause, road traffic accidents also play a notable role in distal radius fractures, especially in high-risk populations. These findings highlight the importance of addressing different injury mechanisms, as both fall-related and accident-related fractures require prompt intervention and careful management, with DCP radius fixation playing a key role.

In terms of radiological outcomes, 92% of patients in our study achieved complete union, which is consistent with Mahmud *et al.*'s findings of high union rates following distal radius fixation.[17] Delayed union occurred in 8% of cases, which aligns with Mahmud *et al.*'s observations that poor bone quality or inadequate postoperative care may contribute to delayed healing

[17]. Additionally, malalignment was observed in 5% of cases, emphasizing the need for meticulous surgical technique and vigilant postoperative monitoring to minimize complications and optimize long-term outcomes. These results reinforce the efficacy of DCP radius fixation while highlighting areas for improvement in technique and postoperative care to reduce complications.

The functional outcomes in our study were also highly positive, with 65% of patients achieving excellent results. This is consistent with Shukla *et al.*, [16], who similarly reported high rates of excellent outcomes following DCP fixation for distal radius fractures. Another 30% of patients achieved good functional recovery. The absence of poor outcomes in our cohort underscores the reliability of DCP fixation in restoring functionality and highlights its positive impact on patients' quality of life.

In terms of complications, superficial infection (5%) was the most common, consistent with findings by Sable *et al.*, [15] and Bharam *et al.*, [13], who also identified infection as a frequent complication following distal radius fixation. These results emphasize the importance of effective postoperative care, including wound management and early intervention, to mitigate infection risks. While other complications such as tendon irritation, malunion, and hardware loosening were less common, they still underscore the need for careful surgical technique and ongoing follow-up to ensure optimal recovery. Although complications are infrequent, their management remains critical to maximizing functional outcomes.

Lastly, patient satisfaction in our study was high, with 66% reporting being very satisfied and 26% satisfied. These findings align with Mahmud *et al.*, [17], who also reported high satisfaction rates following similar surgical interventions. The low percentage of dissatisfied (3%) or neutral (5%) patients further suggests that DCP fixation generally leads to favorable outcomes. While a small proportion of patients expressed dissatisfaction, these cases could potentially be attributed to complications or residual functional limitations, as suggested in the literature. Overall, the high satisfaction levels reinforce the notion that DCP fixation is an effective and well-received treatment for distal radius fractures.

Limitations of the Study

This study had some limitations:

- The study was conducted in a selected tertiary-level hospital.
- The sample was not randomly selected.
- The study's limited geographic scope may introduce sample bias, potentially affecting the broader applicability of the findings.

CONCLUSION

This study underscores the efficacy of Dynamic Compression Plate (DCP) radius fixation in the management of distal radius fractures, revealing high rates of fracture union and excellent functional recovery among patients. The majority of participants achieved satisfactory outcomes, with minimal complications such as superficial infections. Patient satisfaction was notably high, reflecting the procedure's success in restoring functionality and reducing postoperative issues. These results affirm the reliability of DCP fixation as an effective treatment for distal radius fractures, highlighting its clinical importance in ensuring positive patient outcomes and recovery.

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