

Surgical Outcomes of Distal Radius Fracture Fixation using Locking Plate at the 108 Military Central Hospital

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ABSTRACT

Objective: To describe patients' clinical and paraclinical characteristics with closed distal radius fractures and evaluate the surgical outcomes of distal radius fracture fixation using locking plates at the 108 Military Central Hospital. **Methods:** A retrospective cross-sectional study was conducted with 38 patients between January 2020 and December 2023. **Results:** The mean age of the patients was 45.7 ± 13.28 years. The AO fracture distribution was as follows: type A, 5.3%; type B, 28.9%; and type C, 65.8%. The mean postoperative radiographic indices were UA $22.16 \text{ degrees} \pm 1.98$, UV $-0.52 \text{ mm} \pm 0.68$, and VA $13.17 \text{ degrees} \pm 2.63$. Based on the Green and O'Brien criteria, functional outcomes showed that 86.8% of patients had good-to-excellent results and 13.2% had fair results. **Conclusion:** Surgical treatment of distal radius fractures using locking plates effectively provides satisfactory anatomical and functional recovery.

Keywords: Distal radius fracture, locking plate, outcome.

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INTRODUCTION

Distal radius fractures are among the most common types of fractures in the United States, second only to hip fractures in the elderly, with an estimated 643,000 cases annually, accompanied by a significant financial burden on patients and their families.

Historically, distal radius fractures have been primarily treated using noninvasive methods, including closed reduction and casting. Since the advent of locking plates in the early 2000s, the rate of surgical interventions for distal radial fractures has steadily increased. The choice of treatment method depends on the fracture classification, systemic factors, patient expectations post-intervention, financial capacity, available medical equipment, and

experience of the treating physician. With the development of transportation, the pattern of radius fractures has evolved. Previously, these fractures were predominantly observed in the elderly owing to low-energy household accidents. However, in recent years, the incidence of high-energy accidents has increased among younger working-age individuals. Surgical fixation is indicated in cases of complex distal radial fractures with multiple fragments, where closed reduction and casting do not yield satisfactory results. Locking plates offer advantages such as minimizing screw loosening, preventing joint surface collapse, reducing secondary displacement post-surgery, and facilitating early mobilization of patients. This study aimed to describe the clinical and subclinical characteristics and treatment outcomes of

closed distal radius fractures managed with locking plate fixation at the 108 Military Central Hospital. These findings provide insights and help to improve the quality of care in local healthcare facilities.

PATIENTS AND METHODS

Patients

This study included 38 patients with closed distal radius fractures who underwent open reduction and internal fixation using a locking plate between January 2020 and December 2023 at the Department of Upper Extremity Trauma and Microsurgery, 108 Military Central Hospital. The study was approved by the ethics committee of 108 Military Central Hospital. All patient information was kept confidential.

Inclusion Criteria

Patients were diagnosed with closed distal radius fractures.

Patients who consented to participate in the study met the following inclusion criteria.

- Age over 18 years.
- Indications for surgery and treatment with locking plate fixation.
- Complete medical records.

Exclusion Criteria

Patients with closed distal radius fractures were treated conservatively or using other surgical methods.

Patients with pathological fractures.

Patients with incomplete medical records or declined participation in the study.

Indications for Locking Plate Fixation of the Distal Radius: When conservative treatment or closed reduction is inadequate or if there is progressive displacement at the following levels:

Angulation displacement in the anterior-posterior plane $> 5^\circ$

Joint surface displacement > 2 mm.

Shortening radius > 5 mm.

Methods

A retrospective cross-sectional descriptive study using a total sampling method was performed. Data were collected from patient records, including medical records and pre- and post-operative X-rays. Fractures were classified according to the AO classification and measurements of radial ulnar variance, ulnar angulation, and volar angulation were obtained using a goniometer. The research records were maintained based on the created data forms.

Postoperative Assessment

Clinical Outcomes: Results were evaluated based on standard medical records, including anatomical recovery based on X-ray indicators measured with a goniometer: ulnar variance (UV), volar angulation (VA), and ulnar angulation (UA). Anatomical recovery was assessed using Hass JL and JLde la Caffinière criteria. Functional recovery was evaluated using the functional scoring system for distal radius fracture treatment, according to Green and O'Brien, as modified by Cooney.

Data were analyzed using statistical algorithms in SPSS 21.0.

RESULTS

Clinical and Radiographic Characteristics

The mean age of the study patients was 45.7 ± 13.28 years, with the youngest being 24 years and the oldest being 71. The most prevalent age group was 18–40 years (52.6 %), while the group older than 60 years was the least prevalent (10.5 %). In this study, the proportion of male

patients was 65.8%, which was higher than that of female patients (34.2 %) with a male-to-female ratio of 2:1.

The primary cause of injury was traffic accidents, which accounted for 44.7% of the injuries. Household accidents accounted for 36.8% of the total, whereas work-related accidents accounted for 18.5%.

According to the AO classification, Type C fractures were the most common (65.8 %), followed by Type B fractures (28.9 %). Only two patients (5.3 %) had Type A fractures.

Postoperative radiographic indicators showed good recovery: the mean volar angulation was 13.17 °, the mean ulnar angulation was 22.16 °, and the mean ulnar variance was -0.52 mm. (Table 1)

Table 1. Postoperative Radiographic Recovery in the Study Group

Measurement	Preoperative Mean	Preoperative Standard Deviation	Postoperative Mean	Postoperative Standard Deviation
UA	13.65	5.67	22.16	1.98
UV	1.24	0.749	-0.52	0.68
VA	3.57	19.62	13.17	2.63

Treatment Outcome Evaluation

The study included 38 patients with a minimum follow-up period of 6 months after surgery. The wound healing rate was 100%, and no screws penetrated the wrist joint.

Postoperative radiographic indicators showed good to excellent recovery, with none of the patients rated fair or poor. (Table 2)

Table 2. Postoperative Anatomical Recovery According to JL Hass and JY de la Caffinière

Recovery Level	Volar angulation		Ulnar Variance		Ulnar Angulation	
	Number of Patients	%	Number of Patients	%	Number of Patients	%
Very Good	35	92.1%	36	94.7%	29	76,3%
Good	3	7.9%	2	5.3%	7	23,7
Fair	0	0%	0	0%	0	0
Poor	0	0%	0	0%	0	0
Total	38	100%	38	100%	38	100

Functional assessment of distal radius fractures according to Green and O'Brien at 6 months post-surgery showed that 86.8% of patients achieved good-to-excellent results, while 13.2% had fair results. None of the patients had poor outcomes. (Table 3)

The rate of bone healing after surgery was 100%, with no cases of non-union or refracture after fixation.

Table 3. Functional Assessment of Distal Radius Fracture Treatment According to Green and O'Brien, Modified by Cooney (6 Months Post-Surgery)

Functional Rating	Number of Patients	Percentage (%)
Very Good	28	73.6%
Good	5	13.2%
Fair	5	13.2%

Poor	0	0%
Total	38	100%

DISCUSSIONS

The mean age of the study patients was 45.7 ± 13.28 years, with the youngest being 24 years and the oldest being 71. The most prevalent age group was 18–40 years, accounting for 52.6%. The group aged 41–60 years represented 34.2% of the sample, and the group aged > 60 years had the lowest representation at 10.5%. This indicates that patients with distal radius fractures who require surgical intervention are predominantly in the working-age group and engage in physically demanding activities. This result is consistent with Vũ Xuân Hoàng's 2023 study, which found that 48.9% of patients with distal radius fractures requiring surgery were in the 18-40 age group, 35.5% were in the 41-60 age group, and only 13.6% were over 60 years old.

The most common cause of fractures was traffic accidents (44.7 %) followed by household accidents (36.8 %). These injuries predominantly affected males, with a male-to-female ratio of 2:1.

This result aligns with the current situation in Vietnam, where traffic accidents are prevalent and predominantly affect working-age males. This finding is similar to that of Vu Xuan Hoang's 2023 study, which reported that traffic accidents were the leading cause of accidents (44.4 %), followed by household accidents (40 %). This contrasts with Hoàng Minh Thắng's 2013 study, which found that household accidents were the most common cause (65.6 %), followed by traffic accidents (15.6 %). This discrepancy may be due to the use of convenience sampling in these studies, which

may not fully represent the overall pattern of injuries.

We used the AO classification for fracture types to assess the complexity of the fractures and joint damage. In our study, Type C1 fractures were the most common (36.8 %), followed by Type B2 (23.7 %), and Type A (5.3 %). The latter category included two older patients with failed closed reduction and casting. This result differs from Vu Xuan Hoang's 2023 report, which found that Type C2 fractures were the most common (37.8 %), followed by Type B2 (24.4 %) and Type C3 (4.4 %).

Based on the JL Hass and JY de la Caffinière scoring systems, the proportion of patients rated as having good to very good anatomical recovery was very high, with no patients rated as fair or poor. This result is consistent with that of Vu Xuan Hoang's 2023 study, which also found that no cases were rated as fair or poor. Benjamin M. Mauck and colleagues (2012) conducted a study on 50 patients with unstable distal radius fractures treated with locking plate fixation, observing excellent results in 32 patients and good results in 18 patients, with no poor outcomes reported.

According to the Green and O'Brien scoring system modified by Cooney, at six months post-surgery, 73.6% of patients reported no pain and 13.2% experienced mild or occasional pain, which did not affect daily activities. Overall, 86.8% of the patients achieved good to very good functional outcomes, while 13.2% achieved fair results. None of the patients had poor outcomes. The five patients rated as having fair functional recovery were all over 50 years old, with

three having Type C2 fractures and two having Type C3 fractures.

Locking plates offer significant advantages over conventional plates, such as providing stable fracture fixation, ensuring adequate blood supply to the bone, preventing secondary displacement, and allowing early mobilization. Unlike conventional plates, locking plates do not require compression of the bone surface to increase friction, thereby avoiding damage to the periosteum and reducing the risk of bone resorption under the plate. According to Qualbauer et al. (2012), who studied 28 patients with distal radius fractures treated with locking plates, the use of locking plates resulted in significantly better postoperative outcomes in terms of volar angulation and ulnar angulation recovery. The study also highlighted the benefits and comfort provided by locking plates, including improved support for the joint (especially in osteoporotic bones) and reduced need for additional bone grafting.

CONCLUSIONS

Surgical treatment of distal radius fractures using locking plates is an effective method that provides satisfactory anatomical and functional recovery.

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CONFLICT OF INTERESTS

The authors declare no conflicts of interest regarding the publication of this article.

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None.

CONSENT

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the

written consent is available for review by the Editor-in-Chief of this journal upon request.

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