Clinical and functional outcomes of ulnar shaft fracture fixation using locking plates at Military Central Hospital 108

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ABSTRACT

Objective: This study aims to describe the clinical and paraclinical characteristics of patients with ulnar shaft fractures and evaluate the outcomes of locked plating as a surgical treatment at Military Central Hospital 108. ***Methods:*** A retrospective descriptive cross-sectional study was conducted on 39 patients who underwent locked plating for ulnar shaft fractures from January 2019 to July 2023. Clinical, radiographic, and functional recovery outcomes were assessed using Leung et al.'s classification for radiographic evaluation, Anderson et al.'s criteria for elbow range of motion, and the QuickDASH questionnaire for functional assessment. ***Results:*** The mean age of patients was 35.7 ± 11.28 years, with a male-to-female ratio of 2:1. Traffic accidents were the leading cause of injury (46.1%). Fractures were classified according to the AO/OTA system, with type B being the most common (64.1%). Postoperative radiographic outcomes were rated as excellent in 64.1% of cases and good in 35.9%. Functional recovery assessment showed that 61.5% of patients achieved excellent results, while 38.5% had satisfactory outcomes. The mean QuickDASH score was 18.2 ± 7.8, and the mean pain score (VAS) was 2.3 ± 1.1. No cases of infection, nonunion, or implant failure were recorded. ***Conclusion:*** Locked plating is an effective surgical method for treating ulnar shaft fractures, providing high rates of anatomical and functional recovery. These findings support the use of locked plates as a preferred treatment for displaced ulnar shaft fractures, allowing early rehabilitation and improved patient outcomes.

Keywords: *locking plate, ulnar shaft fracture*

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INTRODUCTION

The treatment of ulnar shaft fractures was traditionally managed non-invasively through closed reduction and casting. However, since the early 2000s, the adoption of locked plating has led to a gradual increase in surgical fixation for these fractures. The choice of treatment depends on various factors, including fracture classification, patient-specific conditions, financial considerations, available medical resources, and the surgeon's expertise [1].

For significantly displaced ulnar shaft fractures where closed reduction and casting fail to yield satisfactory outcomes, surgical fixation is the preferred approach. Locked plating offers several advantages, such as enhanced biomechanical stability, reduced risk of screw loosening, prevention of secondary displacement, and early mobilization [2-5].

This study aims to evaluate the clinical and paraclinical characteristics of patients with ulnar shaft fractures treated with locked plating at 108 Military Central Hospital. By analyzing treatment outcomes, we seek to

provide valuable insights that can contribute to improving management strategies and enhancing the quality of care in primary healthcare facilities.

MATERIALS AND METHODS

Study subjects and design

This retrospective cross-sectional study was approved by the ethics review board of 108 Military Central Hospital, ensuring patient confidentiality and ethical compliance. Informed consent was obtained from all 39 patients with ulnar shaft fractures who underwent locked plating surgery at the hospital's Upper Limb Trauma and Microsurgery Department between January 2019 and July 2023. Using a convenience sampling method, the study included all eligible patients meeting the inclusion and exclusion criteria.

Inclusion Criteria

- Age over 18 years
- Diagnosed with an ulnar shaft fracture requiring surgical fixation with a locked plate
- Availability of complete medical records

Exclusion Criteria

- Patients were excluded if they:
- Underwent conservative treatment or surgical fixation using alternative methods
- Had open fractures or pathological fractures
- Lacked complete medical records or declined participation in the study

Indications for Locked Plating of Ulnar Shaft Fractures

Surgical fixation with locked plating was indicated when conservative treatment or closed reduction failed, or if progressive displacement occurred, including:

- Displacement exceeding 50% of the fracture cross-sectional area
- Angulation greater than 10°
- Absolute shortening of more than 2 mm

Procedures

A retrospective review was conducted using patient records from the medical archive of 108 Military Central Hospital, covering the period from January 2019 to July 2023. The collected data included medical records, preoperative and postoperative X-ray images, fracture classification based on the AO/OTA system, mechanism of injury, and study-specific patient records documented according to a standardized research template.

Postoperative outcomes were assessed through multiple parameters. Anatomical recovery was evaluated using radiographic parameters, while elbow joint range of motion was assessed based on the modified Anderson et al. classification. Functional recovery was measured using the QuickDASH (Disabilities of the Arm, Shoulder, and Hand) scoring system, and pain levels were evaluated using the Visual Analog Scale (VAS).

Data analysis

The collected data were analyzed using medical statistical methods with SPSS 21.0 software.

RESULTS

Patient characteristics

The study followed 39 patients for a minimum of six months postoperatively. The primary wound healing rate was 100%, and no cases of surgical site infection were recorded. The average age of patients in the study was 35.7 ± 11.28 years, ranging from 20 to 63 years. The most common age group was 18–40 years, accounting for 58.9%, while patients over 60 years

old had the lowest proportion at 10.3%. Male patients comprised 66.7% of the study population, while female patients accounted for 33.3%, resulting in a male-to-female ratio of 2:1. Fractures were more common in the right arm (53.8%) than in the left arm (46.2%). Additionally, injuries involving the dominant hand were observed in 69.2% of cases. The leading cause of injury was traffic accidents (46.1%), followed by domestic accidents (35.9%) and occupational injuries (18%). Most fractures occurred in the proximal third of the ulna (56.4%), followed by the middle third (30.8%), while only five patients sustained fractures in the distal third. According to the AO/OTA classification, type B fractures were the most common (64.1%), followed by type C (28.2%), while only two patients (7.7%) had type A fractures.

Postoperative anatomical recovery

Postoperative anatomical recovery was evaluated using Leung et al.'s assessment criteria. Among the 39 patients, 25 (64.1%) achieved excellent recovery with complete anatomical structure restoration. Fourteen patients (35.9%) had a good outcome, characterized by angular deviation less than 10°, bone shortening less than 2 mm, and displacement under 25%. Notably, no patients (0%) experienced a poor outcome, defined as angular deviation greater than 10°, bone shortening over 2 mm, and displacement exceeding 25% (Table 1).

Table 1. *Postoperative Anatomical Recovery on X-ray Based on Leung et al.'s Assessment*

	No.	**%**
Excellent: Complete anatomical structure restoration.	25	64.1
Good: Angular deviation less than 10°, bone shortening less than 2 mm, and displacement less than 25%.	14	35.9
Poor: Angular deviation greater than 10°, bone shortening over 2 mm, and displacement over 25%.	0	0

Elbow range of motion assessment 6 months postoperatively

At the 6-month postoperative follow-up, functional outcomes assessed using Anderson's classification showed that 61.5% of patients achieved excellent results, while 30.8% had satisfactory outcomes. Notably, no patients experienced poor outcomes. Upper limb disability was evaluated using the QuickDASH questionnaire, with an average score of 18.2 ± 7.8, while pain levels, assessed through the Visual Analog Scale (VAS), had an average score of 2.3 ± 1.1. The bone union rate was 100%, with no cases of nonunion or refracture after fixation (Table 2).

Table 2. *Elbow range of motion assessment 6 months postoperatively*

Function asessment	**No.**	**%**
Excellent: Loss of flexion-extension <10%, loss of pronation-supination <25%.	24	61.5
Satisfactory: Loss of flexion-extension <20%, loss of pronation-supination <50%.	15	38.5
Unsatisfactory: Loss of flexion-extension >30%, loss of pronation-supination >50%.	0	0

DISCUSSION

Patient demographics and injury characteristics

The average age of patients in the study was 35.7 ± 11.28 years, ranging from 20 to 63 years. The most common age group was 18–40 years (58.9%), while the least common was over 60 years (10.3%). This finding suggests that surgical intervention for ulnar shaft fractures is predominantly required in individuals of working age, who are more engaged in physically demanding activities. These results align with Vũ Xuân Hoàng's 2023 study, which found that among patients undergoing surgery for distal radius fractures, 48.9% were aged 18–40 years, 35.5% were 41–60 years, and only 13.6% were over 60 years.

Traffic accidents were the leading cause of fractures (46.1%), followed by domestic accidents (35.9%). The injury predominantly affected males, with a male-to-female ratio of 2:1. This trend is consistent with Vietnam's current situation, where traffic accidents remain a significant issue, particularly among working-age men. Similar findings were reported in Zhao L's 2017 study, in which traffic accidents accounted for 45.4% of cases, followed by domestic accidents at 39%. However, this differs from Zhang XF's 2016 study, which reported domestic accidents as the leading cause (65.6%), while traffic accidents accounted for only 15.6%. This discrepancy may be attributed to differences in sample sizes and the use of convenience sampling, which limits representativeness in many studies.

Fracture classification and anatomical recovery

Fracture complexity was assessed using the AO/OTA 2018 classification. The most common fracture type in our study was B2 (33.3%), followed by B3 (30.8%), while A-type fractures were the least common (7.7%). Notably, the two patients with A-type fractures were elderly individuals for whom closed reduction and casting had failed.

Our findings differ from P.S. Marcheix's 2016 study, which reported C2 fractures as the most common (36.8%), followed by B2 (22.4%), with C3 fractures being the least common (3.4%).

Postoperative radiographic assessment based on Leung et al.'s criteria showed a high proportion of excellent and good outcomes, with no cases classified as poor [1]. This result is consistent with P.S. Marcheix's 2016 study, which also found no patients classified as fair or poor [6]. Similarly, Sauder D et al. (2007) evaluated 64 patients with closed ulna fractures treated with locking plate fixation over a minimum follow-up of one year. Their findings showed that 40 patients achieved excellent outcomes, while 24 had good outcomes, with no poor cases reported [7].

Functional recovery and advantages of locking plates

At six months postoperatively, functional recovery based on Anderson's criteria showed that 61.5% of patients achieved excellent results, while 38.5% had satisfactory outcomes, with less than 20% loss of flexion-extension and less than 50% loss of pronation-supination [3]. Locking plates offer several advantages over conventional plating, including rigid fracture fixation, preservation of blood supply, prevention of secondary displacement, and early mobilization. Unlike traditional compression plates, locking plates do not require direct contact with the bone surface to enhance friction, thereby reducing periosteal damage and minimizing the risk of subplate osteolysis. According to Patel A et al. (2017), a study involving 38 patients with ulna fractures treated with locking plates

demonstrated significantly better postoperative pronation-supination recovery. The study also emphasized that locking plates reduce the need for bone grafting and provide greater technical ease during surgery, further supporting their advantages in fracture management [8].

CONCLUSION

Locked plating is an effective surgical method for treating ulnar shaft fractures, providing high rates of anatomical and functional recovery. These findings support the use of locked plates as a preferred treatment for displaced ulnar shaft fractures, allowing early rehabilitation and improved patient outcomes.

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