RESULTS OF TREATMENT OF CLOSED MIDDLE THIRD CLAVICLE FRACTURE BY LOCKING PLATE AT MILITARY HOSPITAL 175

Tran Quoc Doanh[1], Hoang Manh Linh[1], Nguyen Vo Sy Trung[1], Dang Hoang Anh[2], Nguyen Anh Sang[1,2]

ABSTRACT

Objectives: Evaluating the results of treating closed middle third clavicle fracture by locking plate at Military Hospital 175. ***Subjects and methods:*** A prospective study from May 2022 to November 2023 at Military Hospital 175 on 38 adult patients with closed middle third clavicle fracture with separate fragments, treated by open reduction and internal fixation with locking plate method. ***Results:*** The initial wound healing rate reached 100%. On X-ray, the results of fracture reduction with complete displacement reached 36/38 patients, reaching 94.74%. Scars healed well and were soft in 32/38 patients, 84.21%. The rate of bone healing in patients reached 100%. The average Constant score is 85.35 ± 8.37 points. Postoperative rehabilitation results were 100% good and excellent, with 65.79% achieving very good results. No complications were encountered in the study. ***Conclusion:*** The method of clavicle fracture fixation using locking plates ensures stable fixation of the fracture without the need for external immobilization after surgery. This approach minimizes the impact on patients' daily activities, allows for early mobilization, and achieves optimal treatment outcomes.

Keywords: upper limb, clavicle fracture, locking plate

I. INTRODUCTION

Clavicle fractures are among the most common types of fractures, accounting for approximately 10% of upper limb fractures and around 5% of all fractures [1]. Among these, about 80% of clavicle fractures occur in the middle third of the clavicle [2]. The surgical method of internal fixation using locking plate and screws is now widely applied in the treatment of fractures in the middle third of the clavicle shaft. This method offers significant advantages, such as the ability to handle complex fractures, realign the fracture to near-anatomical positions, provide stable fixation, and minimize secondary displacement and complications. dditionally, this technique ensures patient comfort during daily activities, enables quicker recovery of movement, and facilitates an earlier return to work. At Military Hospital 175, the locking plate and screw internal fixation surgery has been implemented for many years to treat closed fractures in the middle third of the clavicle shaft. However, no detailed report has yet been published to evaluate the outcomes of this method. Based on clinical observations, we conducted a study with the objective: "Evaluating the results of treating closed middle third clavicle fracture by locking plate at Military Hospital 175".

II. SUBJECTS AND METHODS

2.1. Research subjects

* *Research subjects:* The study included 38 cases of closed middle-third clavicle shaft fractures with fragments, treated using surgical fixation with locking plate and screws. These cases were classified as Type

[1]*Military Hospital 175*
[2]*Vietnam Military Medical University*
Responsible person: Nguyen Anh Sang
Email: dr.anhsang@gmail.com
Date of receipt: 10/2/2025
Date of scientific judgment: 10/3/2025
Reviewed date: 17/3/2025

B or C according to the AO classification (Arbeitsgemeinschaft für Osteosynthesefragen).

As updated by AO in 2018 [3], clavicle shaft fractures are designated as 15.2 and divided into three types: Type A: Simple fractures; Type B: Fractures with fragments; Type C: Multi-fragmented fractures (Figure 1).

* *Inclusion criteria:* Patients aged 18 years or older, diagnosed with a closed middle-third clavicle shaft fracture classified as Type B or C according to AO, treated with locking plate and screw fixation surgery.

* *Exclusion criteria:* Patients who did not consent to participate in the study. Patients with open clavicle fractures, pathological fractures, pre-existing deformities, or loss of partial shoulder joint function.

* *Research location and duration:* Conducted at Military Hospital 175, from May 2022 to November 2023.

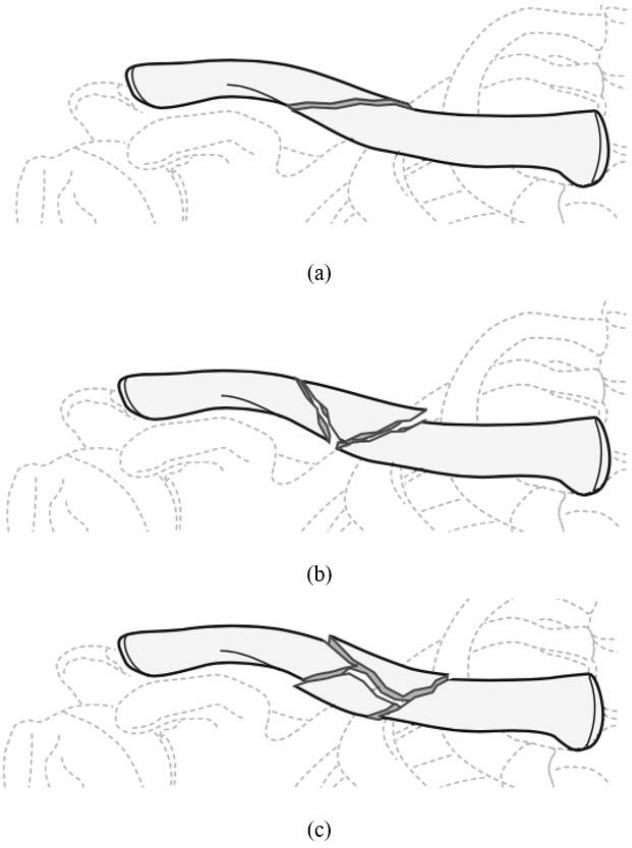

Figure 1: **Classification of clavicle fractures according to AO, (a): Type A, (b): Type B, (c): Type C** [3]

2.2. Research methods

* *Research design:* A prospective, longitudinal observational study without a control group.

* *Sample size and sampling:* The sample size was calculated using the formula:

$$n = Z^2_{1-\frac{\alpha}{2}} \times \frac{p \times (1-p)}{\Delta^2}$$

We selected p = 93,55%, the proportion of patients achieving excellent outcomes according to the Constant-Murley criteria reported by Yadav S. (2022) [4], to anticipate similar efficacy with this method. To ensure reliability and timely completion of the study, the absolute margin of error Δ was set at 8%; Substituting values into the formula yielded a minimum sample size of 37. The study collected data from 38 eligible patients.

* *Research tools and data collection techniques*

Tools: The Constant-Murley Score [5] and Shoulder function classification by Boehm, adjusted for age and gender using the Constant Score [6],[7].

Assessment Variables: Wound site progression; X-ray evaluation of post-fixation alignment; Condition of the surgical scar; Bone union status; Shoulder mobility assessed by the aforementioned tools; Complications.

Steps of the Study:

- Initial Data Collection: Conducted 30-minute patient interviews to gather baseline information. Performed clinical and paraclinical evaluations.
- Data Recording During Treatment: Recorded data related to treatment and hospital care.
- Follow-Up Assessments: Collected data during follow-up visits at 1 month, 3 months, and 12 months post-surgery at Military Hospital 175.
- Data Consolidation: Compiled all collected information for analysis.
- Data Analysis: Processed and analyzed the data using Stata 14.1 statistical software.

2.3. Research ethics

This report is part of a study approved by the Scientific Council of Military Hospital 175 under Decision No. 1848/QD-BV, issued on June 17, 2022. The research team affirms that there are no conflicts of interest related to this study.

III. RESULTS

Among the 38 patients included in the study, 11 were female (28.95%) and 27 were male (71.05%). The average age across both genders was 33.92 ± 12.5 years. The primary cause of fractures was traffic accidents (86.84%), followed by domestic accidents (13.16%). Regarding fracture classification, 52.63% were Type B, and 47.37% were Type C.

Table 1: **Wound status at suture removal and Fracture alignment results assessed by postoperative X-ray (n=38)**

Characteristic		Number of patients	Percentage (%)
Wound healing	First-intention healing	38	100
	Superficial infection	0	0
	Deep infection	0	0
Alignment results	No displacement	36	94.74
	Minor displacement	2	5.26
	Major displacement	0	0

Remarks: No patients experienced wound infections. Fracture alignment was achieved in 94.74% (36 patients), while 2 patients (5.26%; 1 Type B and 1 Type C) had minor displacement. These patients did not use steel wires for fixation. All patients achieved bone union.

Table 2: **Scar progression and Bone union results 12 months post-surgery (n=38)**

Characteristic		Number of patients	Percentage (%)
Scar status	Smooth scars	32	84.21
	Hypertrophic scars	6	15.79
Bone union on X-ray	Bone union	38	100
	Delayed union	0	0
	Non-union	0	0

Remarks: 84.21% of patients had smooth scars, while 15.79% exhibited hypertrophic scars. Bone union was achieved in 100% of cases, with no delayed union or non-union recorded.

Table 3: **Post-surgery hospitalization duration (n=38)**

Duration	Number of patients	Percentage (%)
Within 24 hours	25	65.79
2–7 days	13	34.21
Over 7 days	0	0
Average duration (days)	**Minimum**	**Maximum**
1.58 ± 1.0	1	5

Remarks: The average hospital stay was 1.58 ± 1.0 days. Notably, 65.79% of cases were discharged within 24 hours post-surgery.

Table 4: **Constant score and Shoulder function classification using Boehm's Constant score (n=38)**

Constant score	Minimum	Maximum
85.35 ± 8.37	58.18	94.62
Shoulder function classification using Boehm's Constant score	**Number of patients**	**Percentage (%)**
Very Good	25	65.79
Good	13	34.21
Fair	0	0
Average	0	0
Poor	0	0

Remarks: The average Constant score was 85.35 ± 8.37. Based on Boehm's classification, all patients achieved outcomes rated as "Very Good" or "Good". Among the 38 patients, 25 (65.79%) were rated "Very Good", and 13 (34.21%) were rated "Good".

No complications related to anesthesia, such as allergic reactions to local or general anesthetics, were observed. During surgery, there were no vascular or nerve injuries or fractures caused by drilling or fixation. Post-surgery, 100% of patients achieved recovery outcomes classified as "Good" or better, with no complications or sequelae.

IV. DISCUSSION

4.1. Short-term outcome evaluation

ccording to Table 1, all 38 patients in the study achieved primary wound healing at the time of suture removal, with no wound infections. This success can be attributed to thorough preoperative preparation, surgical techniques, and postoperative care. All patients underwent postoperative X-rays of the clavicle in an upright position to assess alignment. The results showed: 36 patients (94.74%) achieved good anatomical realignment, with no displacement; 2 patients (5.26%) exhibited minor displacement, associated with complex fractures involving

fragments, making perfect anatomical alignment challenging; No patients had major displacement.

As shown in Table 3, the average hospital stay post-surgery was 1.58 ± 1.0 days, with 65.79% of patients discharged on the first postoperative day. The short hospitalization period can be explained by the relatively simple nature of the clavicle fractures, enabling quick recovery. Postoperative X-rays confirmed proper axial alignment of the clavicle fractures, with no signs of bleeding requiring intervention. For patients requesting early discharge, arrangements were made for continued treatment and follow-up at home.

4.2. Long-term outcome evaluation

According to Table 2, at 12 months post-surgery, all patients achieved scar healing (100%), with 84.21% having smooth, well-formed scars, and 15.79% (6 patients) presenting hypertrophic scars. All patients also achieved bone union (100%).These positive outcomes can be attributed to several factors: Appropriate surgical indications and methods; Increasing expertise of the surgical team; Patients adhering to medical advice and postoperative care instructions. Our findings align with or even surpass previous studies using internal fixation with locking plates. For instance: Duong Duy Thanh (2023) reported a bone union rate of 97.1% [1]; Other authors, including Bui Duc Ngot (2023) [8], Nguyen Huu Thanh (2016) [9], Bekir Eray Kilinc (2020) [10] reported a 100% bone union rate.

Functional recovery results, presented in Table 4, show an average Constant score of 85.35 ± 8.37, with a maximum score of 94.62 and a minimum of 58.18. Based on Boehm's classification adjusted for age and gender [7] 100% of patients achieved “Good” or “Very Good” outcomes, with 65.79% rated as “Very Good”. Comparing with other studies: Nguyen Huu Thanh reported 86.3% “Good” and 13.7% “Fair” outcomes [9], Bekir Eray Kilinc (2020) reported an average Constant Score of 97.2 ± 1.8 [10]. Our study confirms that locking plate fixation for clavicle fractures provides excellent treatment outcomes, attributable to the following advantages: Bảo tồn màng xương và duy trì nguồn máu. Preservation of the periosteum and blood supply: This method avoids excessive periosteal stripping and maintains a gap between the plate and bone surface, promoting blood flow and bone healing; Maintaining fracture morphology: Locking plates act as an external fixation frame, preventing deformity during screw fixation; Stable fixation: The locking plate ensures fracture stability, enabling early postoperative mobilization. Although the cost of locking plates remains high, health insurance coverage has alleviated the financial burden for patients, improving accessibility and treatment efficacy.

V. CONCLUSION

The method of clavicle fracture fixation using locking plates ensures stable fixation of the fracture without the need for external immobilization after surgery. This approach minimizes the impact on patients' daily activities, allows for early mobilization, and achieves optimal treatment outcomes.

REFERENCES

1. **Duong Duy Thanh, Vu Truong Thinh, Ha Van Tuan (2023)** Evaluate the results of combined surgery with plate screws to treatment clavicle fractures in adults at Viet Duc university hospital. *Vietnam medical journal*. 524 (1A):303-308.

2. **Liu Y., Tang X., Ding Y., et al. (2024)** A novel surgical method for treating fractures of the middle third of the clavicle. *J Back Musculoskelet Rehabil*. 37 (3):611-616.
3. **AO Foundation (2018)** Fracture and dislocation classification compendium - 2018. *Journal of Orthopaedic trauma*. 32 (1)
4. **Yadav S. (2022)** Comparative study of postoperative outcomes of clavicle midshaft fracture treated by nailing vs. plating. *Cureus*. 14 (3):e22862.
5. **Constant C.R., Murley A. (1987**) A clinical method of functional assessment of the shoulder. *Clinical orthopaedics and related research*. 214:160-164.
6. **Boehm D. (2002)** Scores. *Orthopädie und Orthopädische Chirurgie: Schulter*.pp. 98-104.
7. Constant C.R. (2008) A review of the Constant score: modifications and guidelines for its use. *J Shoulder Elbow Surg*. 17 (2):355-361.
8. **Bui Duc Ngot, Hoang Manh Ninh, Tran Xuan Loc, et al. (2023)** Mid-term outcome of clavicle open reduction internal fixation surgery with superior titanium locking plate at Buu Dien hospital. *Journal of medical research*. 167 (6):70-78.
9. **Nguyen Huu Thanh, Nguyen Van Thai (2016)** Evaluation of operative treatment of multi-fragment clavicle fractures with plate fixation. *Vietnam medical journal*. 2:95-99.
10. **Kilinc B.E., Oc Y., Erturer R.E. (2020)** Treatment of midshaft clavicle fracture with superior plate placement. *Acta Ortop Bras*. 28 (2):88-91.