

The results of treatment closed lateral third clavicle fractures with locking plate at Viet Tiep Friendship Hospital

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ABSTRACT

Objectives: Review the results of surgical treatment for closed lateral third clavicle fracture with locking plate at Viet Tiep Friendship Hospital. **Methods:** Retrospective and prospective study with 40 patients who were diagnosed closed lateral third clavicle fractures and treated using locking plate at Viet Tiep Friendship Hospital from January 2022 to January 2024. **Result:** The average age of the study subjects was 38.55 ± 16.22 , male/female ratio was 3/2. Traffic accidents, which are the cause of injury, accounted for the highest rate and the damage was mainly type 15.3A (80%) according to the AO/OTA standard classification. Evaluate the results according to Constant - Murley: very good 6.90%, good 68.97% and pretty good with 24.13%. **Conclusion:** Surgical treatment using locking plate with small surgical incision, restores anatomical, fixes the fracture firmly, creates conditions for early rehabilitation after surgery and gives good function to the patients.

Keywords: closed lateral third clavicle fracture, distal clavicle fracture, locking plate

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INTRODUCTION

Lateral third clavicle fractures represent the second largest group (15%) of clavicle fractures, followed by middle third (80%) and medial third (5%) fractures. The most common cause is traffic accidents. The main mechanism of injury in these cases is indirect force, such as falling onto the lateral shoulder or outstretched hand on hard ground [1].

There are two main methods for treating lateral third clavicle fractures: conservative treatment and surgical treatment [1]. Currently, surgical treatment for fractures of the lateral third clavicle is widely applied due to its many advantages. These advantages include the ability to adjust the broken bone to a normal anatomical

position, handling complex injuries, causing less damage from displacement, maintaining aesthetics, and creating conditions for early post-surgical rehabilitation for patients.

In the surgical treatment for closed lateral third clavicle fractures, the fracture fixation method using a locking plate shows many advantages such as firmly immobilizing the fracture, allowing for early rehabilitation, achieving a high bone healing rate, and preventing complications associated with other fracture fixation methods, such as Kirschner-wire migration and wire breakage [2].

At Viet Tiep Friendship Hospital, surgical treatment for closed clavicle fractures with locking plate has been applied since 2015 with many positive results. However, there has been no comprehensive

and systematic study on the treatment of lateral third clavicle fractures with locking plate to date. Therefore, we conducted a study on the topic:

“The results of surgical treatment for closed lateral third clavicle fractures with locking plate at Viet Tiep Friendship hospital” with two objectives:

1. Description of clinical, radiographic characteristics of patients with closed lateral third clavicle fractures at Viet Tiep Friendship Hospital from January 2022 to January 2024.

2. Review the results of surgical treatment for closed lateral third clavicle fracture with locking plate of these patients.

MATERIALS AND METHOD

Materials

The study included 40 patients who were diagnosed closed lateral third clavicle fractures and treated using locking plate at Viet Tiep Friendship Hospital from January 2022 to January 2024 with selection criterias:

- Patient of 16 years and older.
- Patients diagnosed with closed isolated lateral third clavicle fractures and treated using locking plates at Viet Tiep Friendship Hospital.
- Availability of complete medical records.
- Written informed consent to participate in the study.

In addition, the study employed the following exclusion criteria:

- Medial or middle third clavicle fractures.

- Open fractures of the lateral third clavicle.
- Closed lateral third clavicle fractures treated with other surgical methods or at other medical facilities.
- Closed lateral third clavicle fractures with associated injuries.
- Pathological fractures: Osteoporosis, osteoarthritis, bone cancer...
- Patients who did not consent to participate, lacked complete medical records, or could not be monitored and evaluated.

Research Methods: This was a retrospective and prospective study.

Research sample size: A sample size of 40 patients was conveniently recruited.

Research targets:

- Clinical and radiographic characteristics: Age, gender, medical history, fracture location, clinical symptoms, time from injury to surgery, classification of lateral third clavicle fractures according to AO/OTA (2018).

Surgical results:

- Intra-operative results: Length of incision, type of locking plate used, surgical time and intra-operative complications.
- Short-term outcomes: Incision condition, radiographic result after fracture fixation according to Larson – Bostman classification, hospital duration.
- Long-term outcomes: Surgical scars, result of union on radiographs, evaluating function of glenohumeral joint on Constant - Murley score, general results.
- Data processing: SPSS 22.0 statistical software.

RESULTS

Characteristics of patients

Table 1. Characteristics of patients

Characteristics	Results
The average age	38.55 ± 16.22 (18-72)
Male/Female	1.5 (24/16)

Right/left	1.86 (26/14)
Comorbidities	52.5%
Time from accident to surgery	1.24 ± 1.01 (3 hours – 6 days)

Assessment: The average age was 38.55 ± 16.22, male patients account for more with a male/female ratio of 1.5, right/left was 1.86, 52.5% of patients have comorbidities such as cardiovascular, diabetes, respiratory, etc... Time from fracture to surgery was 1.24 ± 1.01 days.

Clinical symptoms, X-rays

Table 2.1. Clinical symptoms(n=40)

Clinical symptoms	Quantity of patients	Percentage (%)
Sharp pain	40	100
Swelling	25	62.50
Skin bruising	28	70
Deformity of fracture	37	92.5
The absolute length of the clavicle is shorter than the normal side	29	72.5
Limitation of glenohumeral joint movement	40	100

Assessment: 40/40 patients(100%) had clinical symptoms such as: sharp pain, limitation of glenohumeral joint movement, 28/40 patients have skin bruising at the fracture site (70%), 25/40 patients had swelling symptoms (62.5%), 37/40 patients had deformity of fracture(92.5%), 29/40 patients the absolute length of the clavicle is shorter than the normal side(72.5%).

Table 2.2. X-rays symptoms

Classification		Quantity of patients	Percentage(%)
15.3A	Extraarticular fracture	32	80
15.3B	Partial articular fracture	7	17.5
15.3C	Complete articular fracture	1	2.5
Total		40	100

Assessment: The main type of fracture was 15.3A with 32/40 patients account for 80%, type 15.3B has 7/40 patients accounting for 17.5%, type 15.3C has 1/40 patients accounting for 2.5%.

Surgical results

Table 3. Surgical results

Characteristics		Results	
Intra-operative results	The average length of incision	9 ± 2.11 (8 - 13) cm	
	Type of locking plate used	Hook plate	82.50%
		S-shaped plate	15%
		C-shaped plate	2.5%
	Surgical time	51±10.2 (35-75) min	
Complications	0%		
Short-term outcomes(n=40)	Hospital duration	8.7 ± 2.5 (5 - 16) days	
	Incision condition	Very good	87.5%
		Good	10%
		Average	2.5%
	X – rays post-operative	Very good	82.5%
		Good	12.5%
		Average	5%
	Union on X-rays	Union	100%
	Surgical scars	Good scar	83.33%
		Bad scar	16.67%
Long-term outcomes after 12 months (n=29)	Function of glenohumeral joint on Constant - Murley score	Very good	6.9%
		Good	68.97%
		Pretty good	24.13%
	General results	Good	79.31%
		Pretty good	20.69%

Assessment: All patients had bone healing. Only 16.67% of patients had bad surgical scars, the majority of patients had good and very good post-operative rehabilitation, 75.87%. The general results mostly reached a good level of 79.31%.

DISCUSSION

A study was conducted on 40 patients with closed lateral third clavicle fractures treated using locking plates at the Traumaorthopedics Department of Viet Tiep Friendship Hospital from January 2022 to January 2024. As a result, the quantity of patients from 21 - 30 years old accounts for the largest proportion, with 17/40 patients

(42.5%), the average age is 38.55 ± 16.22 , the male-to-female ratio was 1.5:1. Research results by author Luu Danh Huy (2023) [1], the average age is 41 and the male/female ratio was 1.5. This can explain that this is the age that participates in the most activities from studying, working to entertainment activities. At this age, they often participate in traffic and are often the main laborers in the family, so there is a greater risk of injury

than other ages. The ratio of men is higher than that of women, possibly because men often perform more complex and heavy activities, can drive vehicles at faster speeds, and often use alcohol and stimulants while participating traffic.

In terms of clinical symptoms, 100% of patients have symptoms of sharp pain and limited movement of the shoulder joint. These are typical symptoms associated with limb fractures, exacerbated in lateral third clavicle fractures due to bone displacement causing irritation and pain, leading patients to restrict movement to alleviate discomfort. In the study, 100% patients have clinical symptoms such as: sharp pain, limitation of glenohumeral joint movement, 37/40 patients have deformity of fracture(92.5%), 28/40 patients have skin bruising at the fracture site (70%), 25/40 patients have swelling symptoms (62.5%), 29/40 patients have the absolute length of the clavicle is shorter than the normal side(72.5%). These symptoms are the main and secondary symptoms of bone fractures in general. Although not all patients have them, they account for a fairly high proportion. Specific symptoms also depend on the cause of the accident, mechanism of injury and complications after injury. According to research by My Duy Tien (2016) [3], 100% of patients had symptoms of sharp pain, swelling and limited movement of the shoulder joint on the fractured side compared to the unaffected side.

According to the AO/OTA 2018 classification, the majority of lateral third clavicle fractures in our study were type 15.3A, with 32/40 patients, accounting for 80%. Type 15.3B comprised 7 patients (17.5%), while type 15.3C represented 1 patient (1.25%). Type 15.3A fractures were most common at 80%, likely due to their association with mild, low-energy injuries,

typically involving falling on the shoulder's lateral side or leaning on the hand on hard ground. Our findings align closely with those of My Duy Tien (2016) [3], where type A fractures constituted 81.5%, with types B and C totaling 18.5%.

Regarding intra-operative outcomes, all 40 patients in our study underwent clavicle fracture fixation surgery via an incision on the upper lateral third of the clavicle, with the plate consistently positioned on the superior surface. This placement resists pulling forces from the sternocleidomastoid muscle and leverages the flat nature of the lateral clavicle to ensure the plate adheres closely to the bone, minimizing secondary displacement risks. The incision lengths ranged from 8 to 13 cm, averaging 9 ± 2.11 cm, with 31 out of 40 patients (77.5%) having incisions between 8 and 10 cm. The use of locking plates with smaller incisions limits soft tissue and periosteal damage, reducing infection risks, promoting better bone healing, and ensuring aesthetic outcomes. These results are consistent with those reported by Raju Vaishya, Vipul Vijay, and Vikram Khanna (2017) [4], who also found an average incision length of 8.8 ± 1.89 cm.

In our study, 33/40 patients (82.5%) underwent surgery using a hook plate, while 6/40 patients (15%) received a S-shaped plate, and 1 patient (2.5%) was treated with a C-shaped plate. The type of locking plate used depends on the fracture classification on X-ray, the location of the fracture, the number of fragments and the length of the fracture. In the surgical treatment for lateral third clavicle fractures, using a hook plate shows many advantages. Hook plate are often used in intra joint fracture cases, or small fragments at the distal clavicle, too close to the end of the bone and not having enough

area to screw on. The hook is placed in the space under the acromion, creating force to fix the fracture according to the principle of leverage, without needing to comply with the principle of least 2 screws on both sides of the fracture. Dong-Wan Kim et al (2020) [2], showed that bone fixation in lateral clavicle fractures using hook plate has a high bone healing rate of about 95%.

Our study recorded an average surgical time of 51 ± 10.2 minutes. Most of patients (87.5%) had surgical time in 40-60 minutes, 4 patients had surgical time under 40 minutes (10%) and only 3 cases lasted more than 60 minutes (7.5%). This result is also equivalent to the result of author My Duy Tien (2016) [3] with the average surgical time of 46.91 ± 6.49 minutes.

All patients in our study experienced no complications during surgery, consistent with the findings of Dong-Wan Kim et al (2020) [2].

In our study, 60% (24/40) patients stayed in the hospital for less than 10 days, of which the shortest hospital duration was 5 days. There was one case with the longest hospital duration of 16 days. The average hospital duration is 9 days. Results of author My Duy Tien (2016) [3] with average hospital duration of 7.86 days.

Regarding wound healing progress, 35/40 patients (87.5%) showed excellent progress, 4/40 patients (10%) showed good progress, and 1 patient (2.5%) exhibited average progress due to superficial incision infection likely stemming from severe diabetes and poor nutritional intake, similar to findings by Nguyen Van Binh (2015) [5] with initial wound healing at 97.78% and superficial bacterial infection at 2.27%.

After surgery, X-rays of the clavicle were taken for all 40 patients to evaluate the results of fixation. The results showed that:

38 patients had all their displacement corrected (95%), 2 patients still had a little displacement (5%). These are cases of fractures of lateral third clavicle with complex fractures, so restoring the correct anatomical shape is still difficult. Our results are similar to Nguyen Van Binh's (2015) [5] study on 44 patients with distal clavicle fractures who had surgical treatment using hook locking plate, showing that all cases had bone healing. Of which 95.46% of patients have no displacement, 4.54% of patients have little displacement.

After 12 months, 29/40 patients came back for examination. Of these, 26/29 (89.66%) patients had good surgical scars healing; 3/29 patients (10.34%) had keloid or concave scars. During all time points, no patient had fistula inflammation. The condition of keloid and concave scars in patients without complications at the incision may be due to physical condition, shoulder joint movement, and subcutaneous plate. This result is similar to the results of author Sophie J Uittenbogaard and colleagues (2023) [6], the proportion of patients with good surgical scars is 91%, the remaining 9% of patients have keloid or concave scars.

After 12 months, the X-ray results following surgery showed that among the patients who returned for re-examination, 100% (29/29) achieved union, with no cases of plate breakage, slow healing, or pseudoarthrosis recorded. The locking plate demonstrated effective fracture fixation and minimal periosteal damage, yielding positive outcomes comparable to Nguyen Van Binh's findings in 2015 [5], where 100% union was reported.

After 12 months, the results of shoulder rehabilitation according to the Constant - Murley score were: Very good in 2/29 patients (6.9%), good in 20/29 patients

(68.97%) and pretty good in 7/29 patients (24.13%), there were no average or poor results. This shows the advantages of locking plate in restoring shoulder joint mobility. According to the results of Dong-Wan Kim et al (2020) [2], using hook locking plate gave good and very good results, accounting for 73.3%.

Evaluating the general results of 29 patients who returned for re-examination after 12 months, the good rate was 23/29 patients accounting for 79.31%, pretty good rate was 6/29 patients accounting for 20.69%, with no average or poor results observed. This result is similar to the result of author Nguyen Hai Dang (2018) [7] with 82% good, 16.5% pretty good, 1.5% average.

CONCLUSIONS

Through the above results, we see that the surgical treatment for closed fractures of the lateral third of clavicle with locking plate brings positive results, with a short hospital duration (9 days), a low complication rate (2.5%), good fixation (95%) and good general results after surgery (79.31%).

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