



# Comparison of the Lateral Malleolus Fracture Treating Method With Close Pinning With Open Reduction and Plating

Ali Sadighi<sup>1</sup>, Hossein Aslani<sup>1</sup>, Vahid Sadighi<sup>1\*</sup>

## Abstract

**Objectives:** The fracture of the ankle is one of the most common fractures that is treated by an orthopedic surgeon. Different surgical methods have been described for treating the lateral alveolus fracture open reduction and plating is considered as the most commonly used surgical procedure. Therefore, the purpose of this study was to compare the closed reduction and pinning with the open surgical method with plating.

**Materials and Methods:** To this end, 60 patients by the lateral malleolus or bimalleolar fracture were selected, who were referred to the emergency room of Shohada hospital of Tabriz. Then, half of the patients were treated by closed reduction and pinning and the remaining 30 patients received open reduction with plating. Finally, the two groups were compared for the infection rate, union, and skin necrosis.

**Results:** In terms of union, all patients in both groups were completely union and there was no significant relationship in this regard. There was only one case in open surgery with a plate in terms of the infection rate, which was also significantly correlated with close pinning.

**Conclusions:** In general, the rates of union and infection were the same in both groups. Thus, it is recommended to use close pinning to the lateral malleolus fracture since it has less complications and easier surgical procedures.

**Keywords:** Syndesmosis, Lateral Malleolus, Fracture

## Introduction

Restituting the lateral malleolus in the normal anatomical position has been identified as the key to the operative treatment of ankle fractures (1,2). An ankle fracture is one of the most common fractures that is treated by an orthopedic surgeon. In addition, these fractures account for about 10% of total fractures and are regarded as the second most common fracture in the lower limb after the hip fracture (3).

The ankle fracture epidemiology is changing. Enhancement longevity has resulted in the highest age-specific occurrence of ankle fractures in women between 75 and 84 years of age (4). Further, the mean age at injury is 45 years, with the peak incidence of the ankle fracture in younger men and older women. Furthermore, obesity causes a more severe injury to these fractures, and alcohol use is represented as a risk factor for fractures as well. In general, this fracture is considered a fracture from osteoporosis (3). The incidence of fractures is increasing rapidly and is expected to increase by 3 times its current value by 2030 (5).

Various surgical methods have been identified for the treatment of the lateral malleolus fracture, including retrograde intramedullary nailing, implantation of a

screw or nail inside the medullary, the tension band, implantation of a screw in the lag position or plating with the minimal invasive method (6).

A routine procedure for the lateral malleolus fracture is an open surgery with plating, that is, the lateral incision in the ankle and exposing the fibula. The superficial peroneal nerve is the principal structure at risk. The patient is placed supine with a bolster under the ipsilateral hip in order to allow the foot to lie vertically. After the reduction is performed, a 3.5 dynamic compression plate or a 1.3 tubular plate is used to fix the fracture (3).

In the close pinning method, 2 or 2.5 pins are used to fix the distal segment of the fibula fracture to the tibia. The advantages of the open surgical procedure include the direct observation of the bone and the establishment of a normal lining for the bone. Despite these benefits, like other open surgical procedures, complications such as soft tissue damage and long duration of the surgery increase the infection rate and the risk of skin necrosis (4).

Considering that both open surgical procedures with the plate and the closed surgery with the pin are the common methods for treating fractures in the lateral malleolus fracture and due to the lower complications of the closed surgical technique, the present study compared these two



methods and the success rate of the surgery, along with the side effects of each surgery (7).

### Materials and Methods

The target population of this study included individuals who were referred to the Emergency Department of Shohada hospital of Tabriz due to ankle trauma and fracture during 2014-2017. In this study, 60 patients with an ankle fracture from 2014 to 2017, including the lateral malleolus or bimalleolus fracture, were selected by the inclusion criteria. Then, they were divided into two equal groups in terms of gender and age. In this study, 60 patients underwent an open reduction and plating surgery and the other 60 patients received surgical procedures with closed reduction and pinning.

**Inclusion criteria:** All patients with a lateral malleolus or bimalleolus fracture.

**Excluding criteria:** Fractures in osteoporosis patients, the posterior malleolus fracture, and the fractures of lateral malleolus above the syndesmosis.

All patients with an ankle fracture were hospitalized and received primary care including icepack, elevation, and oral pain killers. Moreover, the surgery was performed in 1-2 day(s) in all cases. In the surgical procedure, patients were placed in a supine position and with a lateral approach under fluoroscopy after general anesthesia. Then, 30 patients with a lateral malleolus fracture were openly reduced and fixation was performed with a plate and the other 30 fractures were treated by closed reduction and percutaneous pinning.

Patients were discharged 2 days after the surgery and returned in two weeks to remove sutures and have a preliminary examination. After the initial surgery, patients were referred to the clinic under the examination in terms of infection union and skin necrosis. The studied variables included age and gender, along with the union rate of the fracture, the infection rate, and skin necrosis

All data were analyzed by SPSS software, version 24. Descriptive statistics (i.e., frequency, percentage, mean, and standard deviation) were used for statistical analysis. Additionally, the chi-square test was applied to compare qualitative findings between the two groups, and then an independent t-test was used to compare the findings. In this study, *P* value of less than 0.05 was considered statistically significant.

### Results

In this study, 60 patients with a lateral or bimalleolar fracture were evaluated, including 30 patients who were fixed by a pin (group A) and 30 patients who were treated by a plate (group B). Table 1 presents demographic findings among the two groups. Based on the data, there was no statistically significant difference between the two groups in terms of the patient's age.

It is noteworthy that there was one superficial infection in the group that was treated with open reduction and

**Table 1.** Demographic Information

	Group A	Group B	P-value
Age (year)	45	55	0.06
Gender			0.12
Male	18	17	
Female	12	13	

plating, and treated with oral antibiotics and did not require any surgical intervention for treatment. The mean device removal time in group A was 2.7 months while the removal of the device in group B was not compulsory and not recommended.

The second criterion was welding, which was evaluated by serial X-rays. In all patients of the first group who underwent a pin surgery, all cases showed signs of welding. All patients underwent outpatient pins after two months of receiving radiographs and observing fusion symptoms.

In the second group, all patients underwent an open plating surgery although symptoms appeared significantly later compared to the PIN technique, considering the percentage of joint wounds in both groups. It was impossible to calculate *P* statistically.

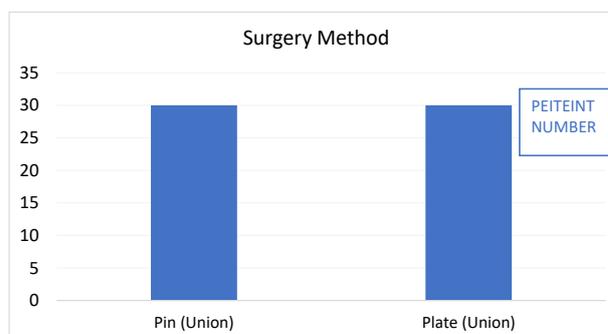
Union in both groups was complete and no statistically significant difference was observed between the two groups in this regard (Figure 1).

Based on the results, the rate of the infection in the treated patients was confirmed by the removal of purulent discharge and laboratory symptoms. Nonetheless, the surface infection was reported in a 65-year-old diabetic patient who was treated on an outpatient oral antibiotic and completely recovered within a week.

The next criterion was the rate of skin necrosis in patients that was detected in none of the patients, but the rate of skin irritation due to the prominent implant was significantly higher in patients undergoing a plating surgery compared to the group undergoing a pin surgery, and patients had no complaints.

### Discussion

Ankle fracture is one of the most common fractures which is treated by an orthopedic surgeon, and different surgical



**Figure 1.** How to Explain the Amount of Welding.

methods have been presented for treating this fracture (8). The main goal of the treatment is a fracture union with minimal complication (8). In this study, two surgical methods were compared, including closed reduction and pinning with open reduction and plating. Each of the two therapies has some advantages and disadvantages (9). The advantage of open reduction is the patient's anatomical fracture reduction although this method is more invasive and causes a large scar. No study has succeeded in making closed reduction and fixing the distal fragment of the fibula fracture to the tibia. Therefore, the current study sought to compare the results of two surgical methods of fixation with plate and pin (9, 10).

Several methods of lateral malleolar fixation have been utilized, all of which have yielded acceptable results. Buttress plating is perhaps the most usual method of fracture fixation in "lateral malleolar". It provides stable fixation and maintains the length of the malleolus. In addition, this method of fixation is carried out in cases where the malleolus is comminuted, as the length could not be reliably maintained with an intermedullar screw. The problems with the plate fixation of the lateral malleolus lie in the fact that the plate is placed in a subcutaneous position (11).

According to the results of 60 patients with a lateral malleolus or bimalleolus fracture, there was no significant difference between the two groups regarding the union of the fracture and all fractures were eventually union, but the union time in open reduction was longer. Although no infection was reported in the group treated with a pin, one superficial infection was reported in the group treated with open reduction. The findings revealed no significant difference between the two groups in terms of the infection and the *P*-value was 1.01. Eventually, there was no device failure in both groups.

The closed-pin surgery is the preferred method for the treatment of lateral malleolus fractures for the following reasons.

1. It is a less invasive procedure and needs less time for anesthesia.
2. Given that it is a less invasive method, the patient's recovery time is faster and the range of motion is earlier.
3. The removal of the pin requires no hospitalization and anesthesia and can be done outpatient.
4. Considering that the hematoma is not manipulated, bone union in the closed reduction and pinning is earlier.

## Conclusions

Regarding the results of the present study, union in the fracture and the complication rate were equal in the close pinning method with open reduction and plating. However, closed reduction and pinning is recommended as the best method for lateral malleolus fracture treatment since it is a less invasive method.

## Conflict of Interests

Authors have no conflict of interests.

## Ethical Issues

The study was approved by the ethical committee of Tabriz University of Medical Sciences (IR.TBZED.REC.1397.242).

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## References

1. Mifsud RP, Batten RL. External rotation and abduction fractures around the ankle joint treated by internal fixing using AO instrumentation. *Injury*. 1979;11(1):33-38. doi:10.1016/s0020-1383(79)80121-7
2. Pankovich AM. Fractures of the fibula at the distal tibiofibular syndesmosis. *Clin Orthop Relat Res*. 1979(143):138-147.
3. Green DP. *Rockwood and Green's Fractures in Adults*. Lippincott Williams & Wilkins; 2010.
4. Court-Brown CM, McBirnie J, Wilson G. Adult ankle fractures—an increasing problem? *Acta Orthop Scand*. 1998;69(1):43-47. doi:10.3109/17453679809002355
5. Daly PJ, Fitzgerald RH Jr, Melton LJ, Ilstrup DM. Epidemiology of ankle fractures in Rochester, Minnesota. *Acta Orthop Scand*. 1987;58(5):539-544. doi:10.3109/17453678709146395
6. Azar FM, Canale ST, Beaty JH. *Campbell's Operative Orthopaedics E-Book*. Elsevier Health Sciences; 2016.
7. Canale ST, Beaty JH. *Campbell's Operative Orthopaedics E-Book*. Elsevier Health Sciences; 2012.
8. Lemon M, Somayaji HS, Khaleel A, Elliott DS. Fragility fractures of the ankle: stabilisation with an expandable calcaneotibial nail. *J Bone Joint Surg Br*. 2005;87(6):809-813. doi:10.1302/0301-620x.87b6.16146
9. Bacon A, Amirfeyz R, Blom A, Harries W. Fixation of ankle fractures by minimally invasive tibiotalar canal fusion. *Orthro Proc*. 2006;88-B(SUPP\_III):431-431. doi:10.1302/0301-620x.88bsupp\_iii.0880431
10. Bauer M, Jonsson K, Nilsson B. Thirty-year follow-up of ankle fractures. *Acta Orthop Scand*. 1985;56(2):103-106. doi:10.3109/17453678508994329
11. Schaffer JJ, Manoli A, 2nd. The antiglide plate for distal fibular fixation. A biomechanical comparison with fixation with a lateral plate. *J Bone Joint Surg Am*. 1987;69(4):596-604.

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