

Original Article

Comminuted medial malleolar fractures – a series of 5 cases

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Abstract

Objective: To demonstrate fixation options for comminuted fractures of the medial malleolus.

Methods: We retrospectively analyzed patients operated on for ankle fractures who had comminuted fractures of the medial malleolus between 2014 and 2018. Five patients were included in the study, 3 women and 2 men aged 19 to 37 years. Four cases were fixed with a tension-band wiring technique using Kirschner wires and cerclage, and 1 case with lag screws and buttress plate.

Results: Four cases progressed satisfactorily (AOFAS >70), and 1 case progressed to ankle arthrodesis.

Conclusion: Fixation with a tension-band wiring technique using Kirschner wires and cerclage may be an alternative to osteosynthesis in comminuted fractures of the medial malleolus with small fragments. Fixation with lag screws and buttress plate may be used in cases with larger fragments.

Level of Evidence IV; Therapeutic Studies; Cases Series.

Keywords: Ankle fractures; Ankle; Fractures, comminuted.

Introduction

Fractures of the medial malleolus can occur alone or in association with lateral malleolus or posterior pilon fractures, with an incidence of 187 per 100,000 person-years⁽¹⁾. Several methods have been used for fixation of medial malleolar fractures, but the technique traditionally used is osteosynthesis with 2 partially threaded screws perpendicular to the fracture line⁽²⁾.

The AO group recommends the use of lag screws or tension-band wiring for transverse fractures of the medial malleolus, while a buttress plate or lag screws should be used for oblique fractures. However, there are no clear recommendations for the fixation of comminuted fractures of the medial malleolus⁽³⁾.

The aim of this study is to present a case series demonstrating fixation options for comminuted fractures of the medial malleolus.

Methods

This study was approved by the Research Ethics Committee (approval number: CAAE 37116020.9.0000.0033).

We retrospectively analyzed patients operated on for ankle fractures who had comminuted fractures of the medial malleolus between 2014 and 2018. Patients with a follow-up <18 months, patients without preoperative and postoperative radiographs and those aged <18 years were excluded.

Of 12 patients evaluated, 7 were excluded: 2 for follow-up <18 months, 4 for absence of radiographs, and 1 patient younger than 18 years.

Results

Five patients were included in the study, 3 women and 2 men aged 19 to 37 years (Table 1).

Study performed at the Hospital de Urgências de Aparecida de Goiânia, Aparecida de Goiânia, GO, Brazil.

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Case 1

A female patient presented with an open bimalleolar ankle fracture with comminution of the medial malleolus. For treatment of the medial malleolar fracture, a tension-band wiring technique was used, with Kirschner wires and cerclage, in addition to mini- and microplates for distal fibular fixation (Figure 1). The patient had an American Orthopaedic Foot and Ankle Society (AOFAS) score of 92.

Case 2

A male patient had a motorcycle accident resulting in a bimalleolar ankle fracture. The medial malleolus showed comminution with displacement. Emergency treatment included a temporary external fixator until definitive surgery. In the second procedure, tension-band wire fixation was chosen for the medial and lateral malleoli. After 14 months, the patient developed post-traumatic arthritis (AOFAS 56) and underwent ankle arthrodesis.

Case 3

A male patient presented with an injury in the medial malleolar region due to a gunshot wound, with a comminuted fracture and loss of bone mass. The fragments were fixed using a tension-band wiring technique and cancellous bone grafting. The patient had an AOFAS score of 75.

Case 4

A female patient presented with a bimalleolar ankle fracture, with comminution of the medial malleolus and oblique frac-

ture of the fibula. For treatment of the comminuted fracture of the medial malleolus, a tension-band wiring technique was used, with Kirschner wires and cerclage, and a T-plate was placed to fix the fibula. After 1 year, the patient required hardware removal due to medial discomfort. She had an AOFAS score of 88.

Case 5

A female patient presented with a bimalleolar ankle fracture with a shear line in the medial malleolus and comminution. The medial malleolus was fixed with lag screws and buttress plate (Figure 2). She had an AOFAS score of 94.

Discussion

Ankle fractures are common and can be classified as unimalleolar, bimalleolar, or trimalleolar. Approximately 87% of these fractures require surgical treatment. In this setting, isolated fractures of the medial malleolus are less common than other ankle fractures and present greater stability due to the deltoid ligament complex. Therefore, they can be treated conservatively when not displaced⁽¹⁾.

Displaced fractures require surgical treatment. Osteosynthesis can be performed using several fixation methods described in the literature, such as cortical or cancellous screws, plates, and Kirschner tension-band wiring, among others. The fixation method recommended by the AO group for medial malleolar fractures is the use of a 4-mm partially threaded cancellous screw. This screw should have an average length of 40mm in order to reach the dense part of the cancellous bone in the metaphyseal region of the distal tibia⁽³⁾.

For comminuted fractures of the medial malleolus, there are no studies in the literature showing a better method than osteosynthesis. A comparative study between tension-band fixation and lag screws in comminuted fractures of the medial malleolus showed a higher rate of union, better AOFAS score, and lower rate of revision surgery for fractures treated with lag screws, but the difference was not statistically significant due to the small sample size. According to the authors, comminuted fractures have poor outcomes regardless of the fixation

Table 1. Cases evaluated in this study

Patient	AOFAS	Fixation method	Complications
Case 1	92	Tension band	None
Case 2	56	Tension band	Post-traumatic arthritis
Case 3	75	Tension band	None
Case 4	88	Plate and screws	Plate-related discomfort
Case 5	94	Plate and screws	None

AOFAS, American Orthopaedic Foot and Ankle Society.

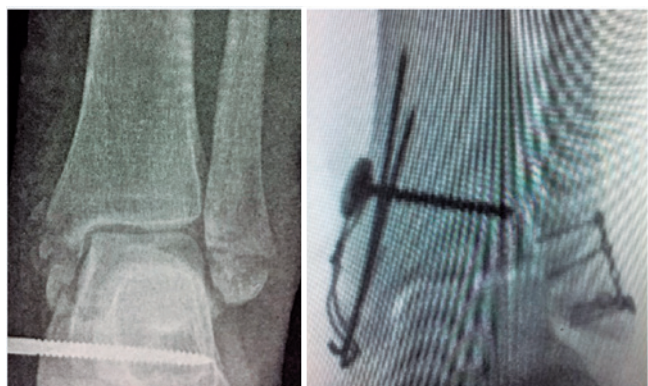


Figure 1. Preoperative and postoperative radiographs.

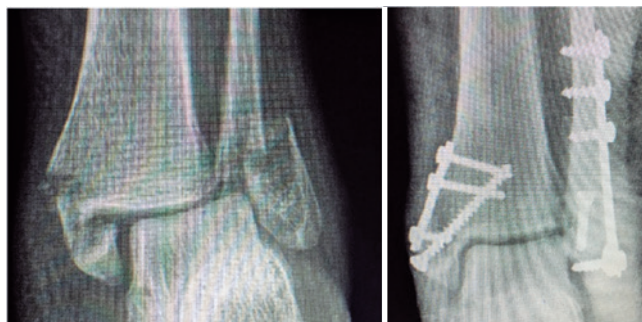


Figure 2. Preoperative and postoperative radiographs.

method⁽⁴⁾. In our case series, fixation methods were not compared, but all cases achieved union, with only 1 case associated with an unfavorable outcome requiring revision surgery. This poor outcome may be explained by the fact that it was an open fracture, with joint bone healing failure after reduction.

Of the 5 cases presented here, 4 were fixed from the medial malleolus using the 8-fold tension-band wiring technique with 2 Kirschner wires and stainless-steel cerclage wire. A tension-band wiring technique was used in 4 of our cases because they showed great comminution with very small fragments for screw osteosynthesis. Fixation with Kirschner wires and cerclage allowed anatomic reduction and fixation of the fragments.

A study comparing cancellous bone screw fixation vs tension-band fixation of medial malleolar fractures with 2-mm and 4-mm fragments in cadavers concluded that cancellous screws showed only 47.16% (60.98 N) of the strength of tension-band fixation (129.30 N), indicating that tension-band fixation provides greater resistance against displacement and local fracture protection⁽⁵⁾. It is possible that the resistance and strength generated by tension-band fixation provide better stability to comminuted fractures, thus reducing the likelihood of loss of reduction and allowing early rehabilitation.

All cases presented here exhibited a marked degree of comminution, only Case 5 showed a larger distal fragment despite


comminution of the medial wall. This was the only case in which fixation was possible with lag screws and buttress plating.

Fracture union was achieved in all of our cases. Only 1 patient had postoperative wound infection, treated with oral antibiotics and subsequent hardware removal. This patient developed early post-traumatic arthritis and, therefore, underwent ankle arthrodesis. This unfavorable outcome may be explained by the joint bone healing failure after reduction and postoperative infection.

A limitation of this study is that it is a case series with a small sample size. Also, we did not compare the fixation methods used for comminuted fractures of the medial malleolus.

Conclusion

Fixation with a tension-band wiring technique using Kirschner wires and cerclage may be an alternative to osteosynthesis in comminuted fractures of the medial malleolus with small fragments, but it has shown less favorable outcomes in previous published studies and also in the present case series (only 1 tension-band patient had an AOFAS score of 92), most probably due to the nature of the fracture rather than the internal fixation method. Fixation with lag screws and buttress plate may be used in cases with larger fragments.

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