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# Osteosynthesis by Pinning of Bimalleolar Fractures with Syndesmosis Involvement in a Resource-Limited Country

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### ABSTRACT

Bimalleolar fractures are common injuries that have a favorable outcome if treated properly. Weber type C fractures require osteosynthesis of the malleoli and stabilization of the tibiofibular syndesmosis. The aim of this study is to evaluate the treatment of these injuries using a less expensive technique involving pins and steel wire for pinning. Over a period of two years, 15 patients were treated for bimalleolar fractures with syndesmosis involvement. The average age was 34.2 years. The surgical technique was performed with an open approach, involving pinning of the lateral malleolus, syndesmosis, and medial malleolus cerclage. The functional assessment at six months showed an excellent outcome with an average Karlson and Peterson score of 90.13 (range: 85 to 97). The use of simple and less expensive techniques improves the prognosis of bimalleolar fractures in developing countries.

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### Introduction

Bimalleolar fractures are common injuries that have a favorable outcome when treated properly. These are articular fractures, and their surgical treatment must adhere to the principles of osteosynthesis [1]. Bimalleolar fractures involving distal tibiofibular syndesmosis require malleoli, including temporary osteosynthesis of the syndesmosis fixation [2]. Several osteosynthesis techniques and materials have been proposed. The most cost-effective osteosynthesis methods are preferred in hospitals in resourcelimited countries. Kirschner wires are among these options [3-5].

The aim of this study was to evaluate the surgical treatment of malleolar fractures using only pins and steel wire.

## **Materials and Methods**

### **Patients**

We conducted a prospective study from July 2021 to June 2023 at CHU-YO. We included 15 patients with 15 bimalleolar fractures involving the syndesmosis. There were 11 men and 4 women, with a mean age of 34.2 years (range: 21 to 45 years). The average consultation delay was 5 hours (range: 2 to 24 hours). Six patients had a Weber type B injury, and nine had a type C injury, including two fracturedislocations.

The left side was affected nine times, and the right side six times. The mechanism of injury was indirect in all cases. Five patients had sustained sports accidents, seven had domestic accidents, and three had road traffic accidents.

**Therapeutic Protocol** 

The radiographic assessment always included anteroposterior and lateral views of the ankle. The preoperative delay was 16 hours (range: 10 to 48 hours). All surgical procedures were performed by the same team under spinal anesthesia. The patients were positioned in the dorsal decubitus position on a regular table, and a pneumatic tourniquet was applied at the root of the ipsilateral thigh. Fracture reduction and osteosynthesis were performed with an open approach.

For the lateral malleolus, a double pinning technique was used: After reduction and fracture fixation with a bone lever, two intramedullary pins were inserted, one intramedullary and the other at a  $45^\circ$  angle to fix the syndesmosis (Figure 1A). The reduction of the syndesmosis was confirmed using a fluoroscope.

The osteosynthesis of the medial malleolus was performed using cerclage. A plaster cast was applied for immobilization for a period of 45 days. Protected weightbearing with the assistance of crutches was allowed after removal of the syndesmosis pin under local anesthesia at Day 45 (Figure 1C). Postoperative care included routine prophylaxis for thromboembolic disease using enoxaparin sodium (4000 IU/day). A prophylactic antibiotic regimen with 2 g of ceftriaxone per day for 48 hours was systematically administered. The pain management protocol consisted of 1000 mg of injectable paracetamol combined with 20 mg of nefopam, administered four times a day. The removal of the osteosynthesis material was performed 12 months postoperatively (Figure 1D).



**Figure1:**Ankle fracture-dislocation (**A**). Reduction and osteosynthesis with pins and cerclage (**B**). Removal of the syndesmosis screw at Day 45 postoperatively (**C**). Removal of the osteosynthesis material after bone consolidation (**D**).

### Method of Evaluation of Results

We evaluated our results in three phases:

The first phase was the postoperative hospitalization period of the patient. During this period, immediate postoperative complications were monitored. The quality of the reduction was evaluated using immediate postoperative radiographs. The evaluation was performed according to the criteria of Lecestre and Ramadier [7] (Table I).

The second phase covered the period from hospital discharge until the removal of the syndesmosis pin and the resumption of weight-bearing at Day 45. During this period, patients were reviewed on Day 21, Day 30, and Day 45. Secondary complications were monitored.

Table I: Eva	luation of the	e quality o	f reduction	n according to
the	criteria of Le	ecestre and	l Ramadie	r [7]

Results	Criteria				
Good	Anatomical reduction				
	Moderate displacement (less				
	than4mm) Widening of the				
Fair	bimalleolar clamp				
	Absence of transverse tilting				
	Absence of posterior subluxation				
	displacement greater than 4 mm				
Poor	Transverse tilting				
	Posterior subluxation				

The third phase covered the period from the resumption of weight-bearing and removal of the pin at Day 45 until the 18th month. During this phase, patients were reviewed on Day 90, Day 180, and at 18 months. Late complications were monitored. Bone consolidation was assessed. The ankle function was evaluated at 18 months for all patients according to the Karlsson and Peterson score [1].

#### **Results**

No immediate postoperative complications were encountered. The reduction was good in 14 patients and fair in 1 patient. One patient, who initially had a good reduction, experienced secondary displacement and had a fair reduction at the Day 45 follow-up. No patient had syndesmosis destabilization after the removal of the syndesmosis pin. Bone consolidation was achieved in 90 days in all cases. The functional evaluation at 18 months showed an average Karlsson and Peterson score of 90.13, with a range from 85 to 97 (Table II).

Among the 15 patients, 10 no longer experienced any pain, and 13 had regained a stable ankle. Ankle swelling occurred with exertion in three patients. Stair climbing was possible for 11 patients, and running for nine. All had resumed their professional activities with the same capacity. **Discussion** 

In this study, osteosynthesis was performed using cerclage of the medial malleolus and pinning of the lateral malleolus. This method is inexpensive and reliable [8].

Pinning of the lateral malleolus has already been described, but it remains a less robust method of osteosynthesis compared to the use of a screw plate [9].

Fixation of the distal tibiofibular syndesmosis is necessary in Weber type B and C bimalleolar fractures. Several techniques for reduction and fixation of the distal tibiofibular syndesmosis have been described in the literature, including screws, endo-buttons, and pins. Fixation of the syndesmosis using an endo-button reportedly has a low failure rate and reduced need for surgical revision. This technique has the advantage of resulting in fewer malunions of the lateral malleolus and provides better functional outcomes, without the need for removal [2], [10].

Among the other methods of syndesmosis immobilization, cerclage using a titanium cable has been described by Jia [11] with good results.

The osteosynthesis of the lateral malleolus fracture described in this series is of the intramedullary type. This same type of internal fixation has been described using a fibular nail [12]. In cases of Weber type B or C bimalleolar fractures, the locked fibular nail, along with a long locking screw, helps to stabilize the syndesmosis [13].

All the bimalleolar fractures in our series were managed as emergencies. The reduction of the syndesmosis in these cases was achieved without difficulty. Older fractures may require other reduction methods. The use of an external fixator with a tensioned olive pin placed through the hole in the malleolar plate allows for reduction and maintenance of the syndesmosis [14].

In the postoperative follow-up, plaster immobilization and weight-bearing restriction were prescribed for six weeks. These recommendations are also applied by other authors [15].

There is no consensus in the literature regarding the timing of syndesmosis osteosynthesis removal. We systematically performed the removal of the syndesmosis pin at Day 45, as this procedure, carried out under local anesthesia, poses no risk [16]. According to Pogliacomi [17], removal of the syndesmosis screws is not necessary. He reports a rupture of screws that were not removed, but finds no functional difference between patients who had their screws removed and those who had broken screws. The number, position, or rupture of the screw would have no

impact on ankle function [18], [19]. However, in cases of unsatisfactory reduction of the syndesmosis, removal of the screw is recommended [20].

The reduction of the syndesmosis in our series was controlled using a fluoroscope. Postoperative CT scans were not requested to assess the quality of the reduction. Such imaging would have allowed for a better evaluation of the syndesmosis and lateral malleolus [20].

Conclusion

The use of simple, cost-effective techniques allows for the effective treatment of bimalleolar fractures in developing countries.

Patients	Pain	swelling	Instability	Stiffness	Walking	Running	Work	Support	Total
	/20	/10	/25	/5	/10	/10	/15	/5	/100
1	15	10	25	5	10	10	15	5	95
2	20	10	25	5	5	5	15	5	90
3	20	10	25	2	10	10	15	5	97
4	15	10	20	5	10	5	15	5	85
5	20	10	25	2	10	10	15	5	97
6	20	10	20	5	5	10	15	2	87
7	15	5	20	2	10	5	15	5	77
8	20	10	25	2	5	10	15	2	89
9	20	10	25	5	10	5	15	5	95
10	20	5	20	5	5	10	15	5	85
11	15	5	20	5	10	10	15	5	85
12	20	10	25	2	10	5	15	5	92
13	15	10	25	5	10	10	15	5	95
14	20	10	25	2	10	10	15	2	94
15	20	10	25	2	10	5	15	2	89
									90,13333

Table II: Functional outcome after treatment of bimalleolar fractures according to the Karlsson and Peterson score [1]

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