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Does the Conventional Lateral Plate Still have Its Place in the Management of Weber B Fractures on Osteoporosis? Assessment of the Results of a Series of 56 Cases

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Abstract **Original Research Article**

***Background*:** Weber B fractures occur at the syndesmosis and are very common. They pose a problem of fixation due to the short available length of the distal fragment, in addition if the quality of the bone is poor as in the case of osteoporosis. ***Objectives*:** to assess the outcomes of the surgical management of Weber B fractures in osteoporosis by conventional lateral plate. ***Methodology*:** This is a retrospective study of 56 osteoporotic patients treated for trans-syndesmotic bimalleolar fracture in the Department of Orthopedic and Trauma Surgery at the Ibn Sina University Hospital. The study was conducted over a period of two years. ***Results*:** The mean age was 61 years with a sex ratio of 2.5. 43 patients were followed for osteoporosis. Intraoperative evaluation of radiographs and bone quality confirmed the poor quality of the bone in our patients. Falls were the most frequent mechanism. All patients were operated on within 8 hours. Consolidation was obtained after an average of 4 months. Distal screw setback was reported in 5 cases requiring removal of the material. All of our patients were satisfied with the results. ***Conclusion*:** Although other studies report the superiority of locked plates or antiglide plates in osteoporosis, our data show no complications related to the use of conventional lateral plates with an advantage of low cost.

Keywords: Weber B, osteoporosis, conventional plate.

INTRODUCTION

Ankle fractures are one of the most frequent pathologies in traumatology. In fact, bimalleolar fractures rank 3rd after wrist fractures and proximal femur fractures [1]. Weber [2] had developed an anatomical classification subdividing each type according to the localization of the fibular line in relation to the syndesmosis. The Weber B fracture occurs at the level of the syndesmosis and represents up to 50% of these injuries [3]. They occur by supination-external rotation mechanism as defined by the Lauge-Hansen classification [4].

Osteoporosis is characterized by the reduction of bone quality and bone mass with a deterioration of the micro- architecture of the bone tissue [5].

In Weber B fractures occurring in osteoporosis, the surgeon is exposed to multiple challenges including the length of the distal fragment available for osteosynthesis, the placement of distal unicortical screws, and the bone quality. Several authors recommend the use of locked plates for this type of fracture, particularly in cases of osteoporosis, because of their biomechanical rigidity acting as a single beam construct. Other authors recommend the use of posterior antiglide plates to avoid joint effusion and the setback of unicortical screws and to ensure resistance to shearing forces.

The aim of this work is to report the results of the management of trans-syndesmotic fractures on osteoporosis managed with a lateral conventional plate and to reconsider the choice of some authors of locked plates or antiglide plates which could increase the cost for this type of patient. This work could also serve as a pilot study before conducting comparative studies.

MATERIAL AND METHODS

This is a retrospective study of 56 cases of Weber B fracture on osteoporotic bone, regardless of the traumatic mechanism, sex or terrain over a period

from June 2018 to January 2021, collected in the Department of Orthopedic and Traumatological Surgery of the Ibn Sina University Hospital of Rabat.

We excluded from our study Weber B fractures occurring on normal bone quality, other types of ankle fractures (fractures involving the posterior malleolus or anterior rim, bimalleolar equivalents), and fractures treated with antiglide plates or locked plates. We also excluded incomplete records and patients lost to follow-up.

Our study was conducted in accordance with medical ethics standards.

The study of the records was based on an exploitation form using the patients medical records, the operating reports and the consultation registers. The epidemiological study was based on a percentage study.

The anatomopathological aspects of bimalleolar fractures were studied on the basis of a descriptive radiological analysis and using the most relevant classifications: Weber and Danis classification; Lauge Hansen classification.

Functional outcomes were assessed by the Vidal functional score evaluation sheet. Data were entered on an Excel spreadsheet.

Surgical Technique

All our patients were placed in dorsal position, with an operating table cushion under the homolateral buttock. A tourniquet was placed on the upper thigh on the homolateral side of the fracture. After washing the limb with chlorhexidine, it was scrubbed then covered with a universal drape.

The approach to the lateral malleolus was lateral without dissection of subcutaneous tissues; fibular muscles were pulled posteriorly to expose the fracture site. The fracture hematoma was evacuated, and the muscle insertions and periosteum were exposed, sparingly, with a rugine. After a wash out to improve visualization of the site, the bone quality was evaluated, as it was poor in all our patients. Once reduction was obtained, controlled by C-arm, a one third tubular plate was fixed to the bone by forceps; a bicortical drilling was made using a 2.7-mm drill upstream of the fracture, at the closest hole to the fracture site, followed by the placement of a 3.5-mm bicortical nonlocked screw. Another path was drilled into the distal fragment in a unicortical pattern avoiding intra-articular penetration; a second unicortical screw was added. The drilling and screwing of the other holes were completed afterwards, in such a way as to have two distal unicortical screws and three or four proximal bicortical screws.

After the lateral malleolus, the medial malleolus was reached by a medial approach, respecting the saphenous vein. A reduction was made and secured with a pin; then a parallel drilling with screwing with 4.0 mm cancellous screws was performed in accordance with AO rules. For fractures with a small fragment, a tension-band wiring was performed.

Syndesmosis was evaluated by a forced external rotation test.

A Redon drain was placed on the lateral malleolus side, followed by sealing of both incisions.

A cast immobilization for 45 days was applied to all our patients. Weight-bearing was delayed and a rehabilitation plan was established.

The average follow-up was 9 months. Monthly follow-up was recommended for the first 6 months, followed by long-term follow-up every 6 months.

Clinical evaluation focused on joint mobility, particularly dorsiflexion and plantar flexion. Radiographic control evaluated bone healing and the state of the osteosynthesis (figure 1 and 2).

Figure 1: Weber B bimalleolar fracture in a 53-year-old patient who underwent surgery

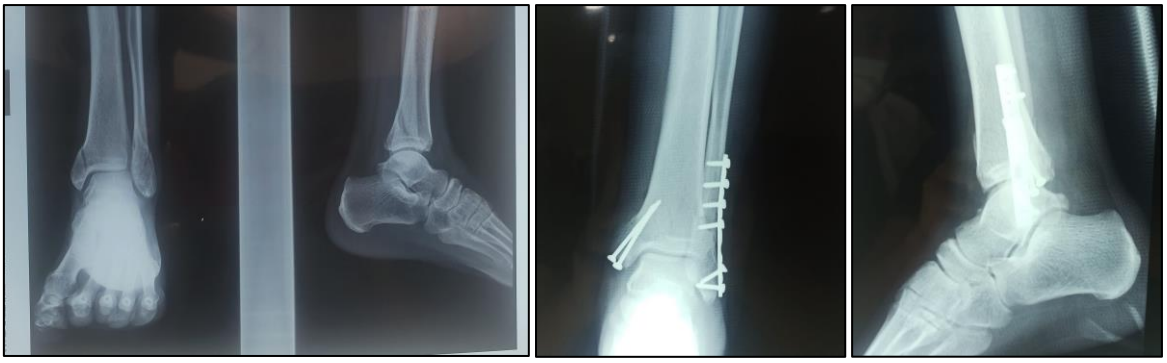

Figure 2: Pre- and post-operative radiological evaluation of a 56-year-old patient

RESULTS

The sample consisted of 56 patients. The average age of our patients was 61 years (between 47 and 65 years). Men ranged in age from 57 to 65 and women from 47 to 63 (Table 1).

Table 1: Distribution of patients by age

Age range	Number of cases	Percentage
<50 yo	3	5,36%
50-60 yo	29	51,79%
>60 yo	24	42,86%

The distribution of patients according to sex showed a significant female predominance with a sex ratio of 2.5. 16 of our patients were men and 40 were women (Table 2).

Table 2: Distribution of patients by sex

Sex	Number of cases	Percentage
Male	16	28,57%
Female	40	71,43%
Total	**56**	**100%**

The right side was affected in 43 cases with a percentage of 76.79%, while the left side was affected in 13 cases with a percentage of 23.21%. No case of bilateral fracture was reported in our series (Table 3).

Table 3: Distribution of patients according to the affected side

Affected side	Number of cases	Percentage
Right	43	76.79%
Left	13	23.21%
Bilateral	0	0%

43 patients were initially followed for osteoporosis in the rheumatology department. 38 patients were put on calcium+vitamin D and the other 5 were on bisphosphonates. The osteoporosis was diagnosed by bone densitometry in 8 patients, and on standard radiographs in 35 patients. 14 patients were being treated for type 2 diabetes; 16 other patients were being treated for hypertension. It should be noted that 13 patients were not known to have osteoporosis. Preoperative radiographic evaluation of bone density and intraoperative bone quality assessment confirmed that these patients had porotic bone (Table 4).

Table 4: Distribution of patients according to medical history

Medical history	Number of cases
Osteoporosis	43
Diabetes	14
Hypertension	16
Osteoporosis not known initially	13

Falls were the main etiology in 32 cases; road traffic accidents were confirmed in 19 cases; and 5 cases were victims of a misstep (Table 5). Falls and missteps placed the affected ankle in external rotation-supination.

The clinical evaluation found a painful ankle, edematous, an impossibility of passive and active mobilization of the ankle with no cutaneous complications. No neurovascular injuries were reported.

All patients underwent two orthogonal radiographic views to confirm the diagnosis and to analyze the bone quality. In our study, concerning the lateral malleolus, the oblique pattern was the most frequent (43% of cases); the horizontal pattern was observed in 27%; a fracture with a third fragment was observed in 19% of cases; and a comminuted fracture in 11% of cases. The horizontal line at the level of the medial malleolus was widely noted (83% of cases); in 17% of cases the fracture was oblique. No tibiotalar dislocation was noted. The posterior malleolus was not involved in all our patients.

Table 5 : Distribution of patients according to mechanism injury

Mechanism	Number of cases
Accident on public highway	19
Fall	32
Misstep	5

Patients presented to the emergency room after a mean delay of 8 hours (between 3 and 24 hours), following a low-energy trauma in external rotation and supination.

The bone healing time was approximately 4 months on average. After specific rehabilitation, no passive or active limitation of joint mobility was noted. No pseudoarthrosis was reported; in 5 cases, the distal unicortical screw was set back, requiring removal of the material. To evaluate our results, we used the modified radio clinical rating of VIDAL.

Table 6: Modified radio clinical rating of VIDAL.

Pain:	
Appreciation	**Rating**
Normal	5
Barometric pain	4
Pain on effort	3
Spontaneous pain	2
Nocturnal spontaneous pain	1
Mobility:	
Appreciation	**Rating**
Normal	5
Dorsal flexion between 10° and 20°	4
Dorsal flexion between 0° and 10°	3
No dorsal flexion	2
Residual equinus	1
Walk :	
Appreciation	**Rating**
Normal	5
Functional discomfort on rough ground	4
Discomfort on stairs	3
Limping without cane	2
Walking with cane	1
Radiology:	
Appreciation	**Rating**
Normal	5
Algodystrophy	4
Necrosis of the talus	3
Tibio-diastasis osteoarthritis	2
Axis defect (vicious callus, flat foot)	1

Results

- Good: 17 to 20.
- Acceptable: from 13 to 16.
- Poor: 8 to 12.
- Catastrophic: from 4 to 7.

According to the Vidal criteria, the results evaluated for the patients in our series are summarized in the underlying table.

Table 7: Table summarizing the results evaluated in our patients.

Results	**Number of cases**	**Percentage**
Good	51	91,07%
Acceptable	5	8,93%
Poor	0	0%
Catastrophic	0	0%

DISCUSSION

The surgical management of Weber B fractures in osteoporotic bone is a challenge for every surgeon because of the distal location of the fibular fracture and the poor bone quality that can lead to failure of the osteosynthesis [6]. Several techniques have been developed to repair this type of fracture [7-9], while others have focused on improving fixation in cases of osteoporosis [10]. Usually, distal fibular fractures have been treated by lateral neutralization plate offering direct exposure of the fracture [11]. However, the number and short "working length" of screws to fix the distal fragment [12] is a limitation to the use of conventional lateral plates, which rely on high plate bone friction to achieve maximum stability [13]. Brunner and Weber [14] suggested the use of antiglide plates to avoid some of the complications of the lateral approach (skin defect, fibular nerve injury, intra-articular screw penetration) while providing a biomechanically strong construct [15]. With the advent

of locked plates, these plates have dominated the indications for comminuted fractures or fractures in poor quality bone because of their greater stability and stiffness [16, 17]. However, despite the increasing popularity of these plates, no study has covered the distal malleolar region.

Herrera-Perez *et al.,* [18] conducted a comparative study between conventional and locked plates in the management of distal fibular fractures in osteoporosis and found no advantage to the use of locked plates. His results were similar to studies conducted by Dingeman *et al.*, [19] and Tsukada *et al.*, [20]. Another study was conducted on cadavers with this type of fracture by Kim *et al.*, [21], asserting a biomechanical similarity between a standard plate and locked plate construct. Furthermore, in a comparison of conventional lateral plates and posterior antiglide plates, Yi Deng *et al.*, [22] found an increased revision rate for the antiglide plate group due to the poor tolerance and discomfort generated by these plates. This is consistent with the results of Treadwell *et al.*, [23] who reported two cases of tendinitis that forced removal of the implant.

The limitation of the study was the reduced number of patients, as our study only included osteoporotic subjects with Weber B fractures.

CONCLUSION

Our results show that osteosynthesis with a conventional lateral plate allowed bone healing with no vicious callus and no skin damage caused by the screw setback, and prevented the risk of fibular tendinitis. This calls for not omitting these plates despite the poor quality of the bone, as well as lifting the problem of the optimal indication for the management of these fractures in the presence of numerous comparative studies with different results.

AVAILABILITY OF DATA AND MATERIALS

The datadets used and analysed during the study are available from the corresponding author.

DECLARATION OF CONFLICTING INTEREST

The authors declare that there is no conflict of interest.

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Author Contributions

All authors participated in the data collection. All authors have read and approved the final manuscript.

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