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Original article

Posterior antiglide plate vs lateral plate to treat Weber type B ankle fractures

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SUMMARY. In ankle fractures a clinical evaluation based on the injury mechanism is necessary. It is also necessary to have X-ray imaging to decide on whether to use conservative or surgical treatment. A comparative, blind, experimental, ambispective, cross section study was designed for 60 patients beginning January 2000, involving patients older than 15 years of age and younger than 80 years, of both genders, with Danis-Weber Type B ankle fracture. Fractures involved one, two or three malleoli less than 15 days old. Two groups were made: one control group with patients operated and using a lateral plate and an experimental group with patients operated using a posterior antiglide plate. Patients were sequentially distributed. Sixteen patients were excluded from the study since they did not meet the follow up requirements. Weber's functional assessment reported 3 cases (13.63%) with excellent results, 18 (81.81%) with good results and one (4.5%) with a poor result for the lateral plate group. No differences were seen in the clinical outcome of both groups. The osteosynthesis material in the lateral plate group caused discomfort to 7 (31.81%) patients and in 2 cases, it had to be removed. In the posterior antiglide plate group two patients complained about it. No dehiscences, infections or pseudoarthrosis were seen in some of the groups. Our conclusions: we found no differences in terms of technical difficulty, duration of surgery or functional outcome. The posterior antiglide plate requires plates with a smaller number of holes. The posterior antiglide plate was less uncomfortable for the patient.

Key words: ankle, fracture, comparative study, osteosynthesis.

RESUMEN. En las fracturas del tobillo se necesita de una evaluación clínica basada en el mecanismo de lesión, así como estudios radiográficos para decidir un tratamiento conservador o quirúrgico. Se diseñó un estudio comparativo, ciego, experimental, ambispectivo y transversal en 60 pacientes a partir de enero del 2000, que incluyó pacientes mayores de 15 años y menores de 80, ambos sexos, con fractura de tobillo tipo B de Danis-Weber, unimaleolares, bimaleolares o trimaleolares, de menos de 15 días de evolución. Se formaron dos grupos, un grupo control con pacientes operados con placa lateral (PL) y un grupo experimental con pacientes operados con placa posterior antideslizante (PPA), asignados de manera secuencial. Se eliminaron del estudio 16 pacientes que no cumplieron con el seguimiento. La evaluación funcional de Weber reportó en el grupo de PL 3 casos con resultado excelente (13.63%), 18 con resultado bueno (81.81%) y uno con resultado pobre (4.5%). En el grupo de PPA, 3 casos con resultado excelente (13.63%), 18 con resultado bueno (81.81%) y 1 con resultado pobre (4.5%), observando que no existió diferencia en el resultado clínico en ambos grupos. El material de osteosíntesis en el grupo de PL molestó en 7 pacientes (31.81%), teniendo que ser retirado en dos casos. En el grupo de PPA molestó en 2 pacientes (9%). No se presentaron casos de dehiscencia, infección o pseudoartrosis en alguno de los grupos. Nuestras conclusiones: No encontramos diferencias en cuanto a la dificultad técnica, tiempo quirúrgico o resultado funcional. La técnica de placa posterior antideslizante requiere de placas con menor número de orificios. La placa posterior antideslizante ocasiona menos incomodidad al paciente.

Palabras clave: tobillo, fractura, estudio comparativo, osteosíntesis.

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Introduction

The goal of ankle fracture treatment is anatomical restoration and recovery of function of the injured limb. In 1929, Bohler claimed that every inconsistency, even the smallest displacement visible on the X-ray film, may cause permanent complications on the joint surface. Over time, displacements cause arthrosic changes leaving the ankle joint with permanent pain. With surgical treatment of displaced ankle fractures, anatomical reduction, especially of the lateral malleolus, is essential.¹²

Weber Type B fractures are one of the most common fractures.^{2-4,10} There are several alternatives to stabilize it: two or three direct interfragment screws, dual oblique screws on the lateral malleolus end, tension wire bands, neutralization with one third of the lateral cane combined with an interfragment screw, and the posterior antiglide, one third cane plate with an interfragment compression screw.^{2,5,9,10} This method was introduced by Brunner and Weber in 1982.¹ It involves putting the plate on the posterior face of the peroneal malleolus, the proximal screws in a postero-anterior direction and an optional screw that may be placed by crossing the fracture site in an oblique direction for compression (*Figure 1*).

The purpose of this paper is to assess posterior antiglide plate osteosynthesis, clinically and with the X-ray film, to compare it against a lateral plate osteosynthesis.

Material and methods

Beginning January 2000, a comparative, blind, experimental, ambispective, cross section study was designed in-



Figure 1. Posterior antiglide plate.

volving 60 patients. Inclusion criteria were patients older than 15 years and younger than 80 years of age, of both genders, with Danis-Weber type B ankle fractures involving one, two or three malleoli, less than 15 days old. Exclusion criteria were exposed fractures, patients with neuromuscular, vascular disorders or with an old injury of the ankle involved. Two groups were made: one control group with patients operated with a lateral plate, and an experimental group with patients operated with a posterior antiglide plate, sequentially distributed. Sixteen patients were excluded from the study for not meeting the follow up requirements.

The control group (lateral plate) was made by 22 fractures in 13 females and 9 males 19 to 70 years old, with an average 44.5 years of age. The experimental group (posterior antiglide plate) was also made by 22 fractures in 13 females and 9 males, 10 to 67 years old, with an average 43.5 years of age. There was no statistically significant difference in the universal variables of both groups thus eliminating biases about the characteristics of the study groups (*Table 1*).

Surgeries were performed by physicians and residents working at the Orthopedics Service.

The operating table position was decubitus dorsal for all 22 patients in the lateral plate group. For the posterior antiglide plate, 14 patients were operated on a decubitus dorsal position and 8 in decubitus lateral position to reduce the medial malleolus, in case of bimalleolar fracture. The situation screw was placed in a single patient in the posterior antiglide group and it was removed after six weeks postoperatively. In a patient in the lateral plate group, the deltoid ligament was revised. All patients were immobilized for 6 weeks.

Six months after surgery, patients were asked to come to the rehabilitation service at the hospital where the physician assigned to this service performed a Weber functional assessment (*Table 2*). The evaluator was blind to the technique used when operating each patient. Baseline, postoperative X-rays, and X-ray film at 6 months after surgery were analyzed. Data were taken from the medical history of patients, the clinical history review and the individual surgery registration sheet, as well as the X-ray files. Variables to be compared were: technical difficulty, amount of osteosynthesis material, time of surgery, discomfort caused

Table 1. Universal variables.

	Lateral plate	Posterior antiglide plate	
Right side	15	14	P = 1.00
Left side	7	8	
One malleolus involved	11	9	
Two malleoli involved	11	13	
Time lapsed since the fracture occurred (Days)	8.5 (2-5)	8 (1-15)	P = 0.85

Table 2. Evaluation criteria of outcome after ankle fractures (Weber).

Category	Assessment	Score
1. Pain	Painless	0
	Mild pain with high physical activity	1
	Mild pain with normal physical activity	2
	Pain when actively moving the ankle	3
	Pain at rest	4
2. Walking	Normal toe and heel waking, running and sit-ups	0
	Impaired gait, not limping	1
	Impaired gait, with mild limping	2
	Limping	3
	Limping massively or using crutches	4
3. Activity	Full (professional and recreational) activity	0
	Full professional activity, mild restriction of recreational activities	1
	Full professional activity, strong restriction of recreational activities	2
	Partially restricted professional activity	3
	Change of profession	4
4. X-Rays	Perfect anatomy	0
	Mild ligament calcification, no arthritis	1
	Medially impartial anatomy	2
	Impartial lateral anatomy plus arthritis	3
	Arthritis plus dystrophy	4
5. Ankle Joint	Complete, symmetrical ankle motion	0
	Reduced motion < 10°	1
	Reduced motion > 10°, not equinus	2
	5°equinus, good plantar flexion	3
	Ankle rigidity, more than 5° equinus	4
6. Subtalar Joint	Full mobility, symmetrical motion	0
	Mild restriction	1
	Function reduced by half	2
	Function reduced by more than half	3
	Rigidity of the subtalar joint	4
Outcome: Excellent 0 points, good 1-2 points, poor 3-4 points		

by the osteosynthesis material and outcome according to the Weber functional assessment.

Statistical analysis was conducted based on means, standard deviations, Chi² testing, and charts.

Results

The osteosynthesis material used was made of third cane plates. Sixteen plates with 6 holes, 5 plates with 7 holes, and 1 with 8 holes were used in the lateral plate group. On the other hand, 8 plates with 5 holes, 11 plates with 6 holes, and 3 plates with 7 holes were used in the posterior antiglide plate. For the medial malleolus, 4.0 mm cancellous bone screws and Kirschner pins were used (*Figures 2 and 3*). The amount of osteosynthesis material used (five plates with five or less holes against plates with six or more holes) was compared by the Chi² trend test resulting in 7.48 with a P value (Fisher's correction) of 0.004. The average number of holes used on patients using the posterior antiglide plate was 5.77 with a 0.68 standard deviation. Student's T test for averages resulted in 2.82 with a P value of 0.007.

The time of surgery in the lateral plate group was an average 97.5 minutes (between 45 and 150) and in the poste-

rior antiglide plate the average was 102.5 minutes (between 60 and 145) considering the time used both in uni-malleolar and bimalleolar fractures.

Weber functional assessment reported 3 cases (13.63%) with excellent results, 18 (81.81%) with good results, and one (4.5%) with poor results for the lateral plate group. For the posterior antiglide plate group, there were 3 cases (13.63%) with excellent results, 18 cases (81.81%) with good results, and 1 case (4.5%) with poor results. There were no differences in the clinical outcome for both groups.

The osteosynthesis material for the lateral plate group was uncomfortable to 7 patients (31.81%) and in two cases it was necessary to remove the plate at 14 and 16 months respectively. In the posterior antiglide plate, 2 patients (9%) were uncomfortable with the material. No dehiscences, infection or pseudoarthrosis were found in either group.

Discussion

Looking for a solution to the discomfort caused by subcutaneously placing the plate on the lateral face of the peroneal malleolus, Brunner and Weber described the antiglide posterior plate in 1982.¹ In a biomechanical study on



Figure 2. X-rays pre and postoperatively of the fracture treated with the lateral plate.

a cadaver, Schaffer and Manoli reported more stability and rigidity with the posterior antilide plate than with the lateral plate. They claimed certain limitations in using the lateral plate. Its application requires tilting and placing it with great precision while forcing it to be frequently turned along its longitudinal axis. Screws in the distal fragment should be unicortical to prevent them from penetrating the joint which might lead to poor fixation. The plate is subcutaneously placed so it may be felt under the skin and cause no pain. According to their clinical experience, the authors concluded that the posterior antilide plate seems to have clinical advantages. It requires a smaller dissection, less surgery time, minimum plate molding, prevents penetration of the joint, and does not show under the skin.⁷

We started by performing surgery with the patient in a decubitus dorsal position. This position makes it difficult to place the osteosynthesis material and prolongs the surgery time. As a result, and based on Wissing's work,¹² we placed the last eight patients in a decubitus lateral position which made it easier to place the plate and consequently decrease the surgery time. Although the authors recommend operating the patient in the decubitus lateral position for a uni-malleolar fracture and in decubitus dorsal position for bi-malleolar fractures, we preferred the decubitus lateral position to put the posterior antilide plate. Having to mobilize the patient to the decubitus dorsal position for bimalleolar fractures is no problem. This is a maneuver that takes no more than one minute.



Figure 3. X-rays pre and postoperatively of the fracture treated with the posterior antiglide plate.

In terms of the osteosynthesis material, the literature reports a majority use of plates with five and six holes for the posterior antiglide plate.^{6,8,11,12} In our research we saw the same trend with 86% of cases within this range. In the beginning we started using plates with 7 holes and then, when we were able to master the technique, we used plates with only 5 and 6 holes. When comparing this to the lateral plate cases, we saw there was indeed a statistically significant difference in terms of the amount of osteosynthesis material used. As for the size of the plates, with the anterior antiglide plate, we used smaller plates ($p: 0.004$). By average number of wholes, the posterior antiglide plate required the smaller plates ($0: 0.007$).

Although some research papers reported that the posterior antiglide plate requires less surgery time than the lateral plate,⁷ this is nothing more than a value judgment because none analyzes thoroughly that parameter. We kept very detailed records on the surgery time and saw no differences between either technique.

The osteosynthesis material may cause discomforts and complaints from patients. With the lateral plate, prominence under the skin was mentioned which might cause pain and even become exposed.⁷ With the posterior antiglide plate, Treadwell et al. reported delayed consolidation in 71 cases with two cases of peroneal tendonitis and two complaints leading to removal of the plate.⁸ In 32 patients, Ostrum reported peroneal tendonitis which subsided after

four to eight weeks and 12 complaints leading to removal of the plate.⁶ On the other hand, Winkler¹¹ and Wissing¹² in 93 and 48 cases respectively reported no discomforts. In our research, with the lateral plate the osteosynthesis material caused discomfort for seven patients (31.81%) leading to the removal of two of them unlike the posterior antiglide plate where the material caused discomfort for two patients (9.09%) but it was tolerable. In our research we saw no peroneal tendonitis.

The results of our study according to the Weber functional assessment were excellent in 13.63% of cases, good in 81.81% of cases and poor in 4.5% of cases in both groups. Ostrum conducted a subjective questionnaire one year after surgery where 90.5% of patients reported no pain and 9.5% reported being in pain; 62% of patients reported being satisfied, 33% were very satisfied and 5% were unsatisfied.⁶ Winkler and Weber reported their results related to gender and the Weber scale with 63.1% of women having excellent results, 30.4% of them with good results, and 6.5% with poor results. For males, 70.2% reported excellent results, 25.5% reported good results, and 4.3% reported poor results.¹¹ Treadwell and Fallat reported good results in 97.18% and poor results in 2.82% of cases.⁸ Notice that in all three reports patients were assessed subjectively while our research was a blind study where the evaluator was not working in the orthopedics service and was completely blind to the techniques used to operate every patient.

Conclusions

1. We found no differences in terms of technical difficulty, surgery time or functional results.

2. The posterior antiglide plate technique requires plates with a smaller number of holes.
3. The posterior antiglide plate causes less discomfort for patients.

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