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Lateral versus posterior fibular plating: A Comparative study in patients with external rotation ankle injuries

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Abstract

Introduction: Lateral malleoli fractures are one of the most commonly encountered injuries. Conventionally lateral fibula plating was done for fibula fracture but several studies have come up showing advantages of posterior antiglide plating for fibula. In this study, we aim at comparing the functional and radiological outcome in patients treated with conventional lateral fibula plating and posterior antiglide plating.

Materials and methods: 30 patients with external rotation lateral malleoli fractures were studied prospectively. Lauge-hansen's classification was used to classify these injuries. Patients were randomly divided into 2 groups. Group 1 was operated by lateral fibula plating and Group 2 by posterior antiglide plating. Comparison of the outcome between the 2 groups was done using Weber's criteria.

Result: The most common age group was 40-59 years with male dominance. Majority were supination-external rotation injuries. Both groups showed 33% excellent, 60% good and 7% poor outcomes. Lateral plating group exhibited few technical disadvantages like more hardware use, implant prominence and patient discomfort. But both groups were comparable in terms of surgical time, complications and final functional and radiological outcome.

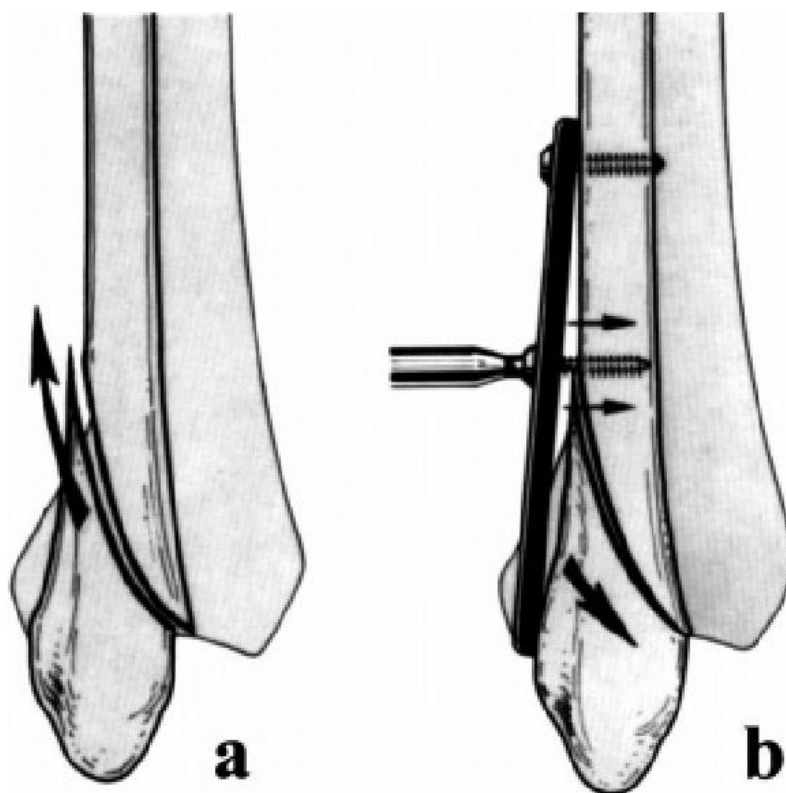
Conclusion: The outcome of the surgical management of a displaced lateral malleolus fracture is comparable with both techniques. Although few studies have reported some advantages using the antiglide technique, our data do not support one technique over the other.

Keywords: Lateral malleoli fracture, Lauge Hansen's, antiglide plate, weber's criteria

Introduction

Ankle fractures are the most common type of fractures treated by orthopaedic surgeons worldwide accounting for around 10% of all the fractures^[1]. Of late, there has been an increase in the prevalence of ankle fractures both in the young patients as well as in the elderly^[2, 3]. Most ankle fractures are complex injuries encompassing both ligamentous and bony components that are difficult to manage. These injuries gain utmost importance owing to the fact that the whole body weight is transmitted through the ankle and locomotion depends upon the stability of the ankle joint. They have the potential to produce significant long-term disability and complications in the form of pain, instability and early degenerative arthritis^[4]. As a result of a better understanding of the biomechanics of the ankle, improvements in fixation techniques and findings of outcome studies performed worldwide, there has been a gradual evolution in the effective strategies for the treatment of ankle fractures. Historically, lateral malleolus fracture has been managed with anatomic reduction, lag screw fixation, and a lateral neutralization plate with bicortical screws proximally and unicortical screws distally^[5, 6]. More recently, however, potential disadvantages of this technique have been countered, including intra-articular screw placement distally, prominent or symptomatic lateral screws, inadequate distal fixation, loss of fixation, and wound complications^[6, 7]. To overcome these potential complications, the use of a posterior antiglide plate as a method of fibular fixation was proposed in 1982 by Brunner and Weber. Proponents of this technique postulated that posterior plating was biomechanically superior and avoided many complications of lateral plating^[8].

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In external rotation injuries, obliquity of fracture is such that there is a tendency toward posterior and proximal displacement of the distal fragment. The application of a posterior antiglide plate will assist in the reduction of this fracture as well as provide a buttress to prevent redisplacement [8].

Our study aims at comparing lateral fibula plating and posterior fibula plating in external rotation injuries of the ankle using Weber criteria of functional and radiological outcome. We also have aimed to find out difference between the two groups in terms of technical difficulty, surgery time and osteosynthesis material used. We have studied the causes, modes of injury and sex predilection of external rotation injury of ankle and assessed the post-operative complications and their management associated with this injury.

Materials and methods

This was a prospective study in which patients who sustained lateral malleolus fracture due to external rotation injuries between May 2017 to June 2019, admitted in the department of Orthopaedics at Civil hospital, Ahmedabad were included. A total of 30 patients were included. All the patients were first assessed and managed according to ATLS protocol and once the patient's general condition was fit, relevant X-rays were taken. Fractures were classified according to Lauge-Hansen classification [9] and the injured limb was immobilized by below knee slab. Patients with severe swelling managed by axial traction by calcaneal Steinmann pin on bohler splint with application of ice and glycerine and magnesium sulfate at local part and taken in operative procedure when swelling reduced or subsided. Open injuries and abduction and adduction injuries were excluded from the study. 30 patients were randomly divided into 2 groups. One group was operated by lateral fibula plating and one was operated with posterior antiglide plating. We performed both the surgeries with the patient in a decubitus lateral position which made it easier to place the plate and with less surgery time. In the lateral plating group (group 1), a lateral skin incision was

made directly over the fibular fracture, and deep dissection was carried out to expose the fracture with care being taken to avoid injury to the superficial peroneal nerve. An anatomic reduction was attempted. An interfragmental screw was placed if at all possible. A lateral one-third tubular plate was then applied. Five- and six-hole plates were most commonly used. All the holes in the plates were filled with screws except those directly overlying the fracture or those obstructed by the interfragmental screws. In the antiglide group (group 2), the incision was slightly more posterior, over the posterior edge of the fibula. After careful dissection the fracture was reduced anatomically. An interfragmentary screw was placed whenever possible. A slightly under contoured plate was then applied on the posterior surface of the fibula. The average plate length was a five-hole plate (range 4–7 holes). The majority of this group had screw fixation in the plate only proximal to the fracture. Patients who had stable rigid fixation were started mobilization of next day. Patients with unstable fixation were given cast or brace for 7-10 days for support and Range of motion exercises were done daily under careful supervision and splint reapplied. Serial follow up and assessment was done at 15 days, 1.5 months, 3 months and 6 months. The outcome was assessed according to the Weber's criteria.

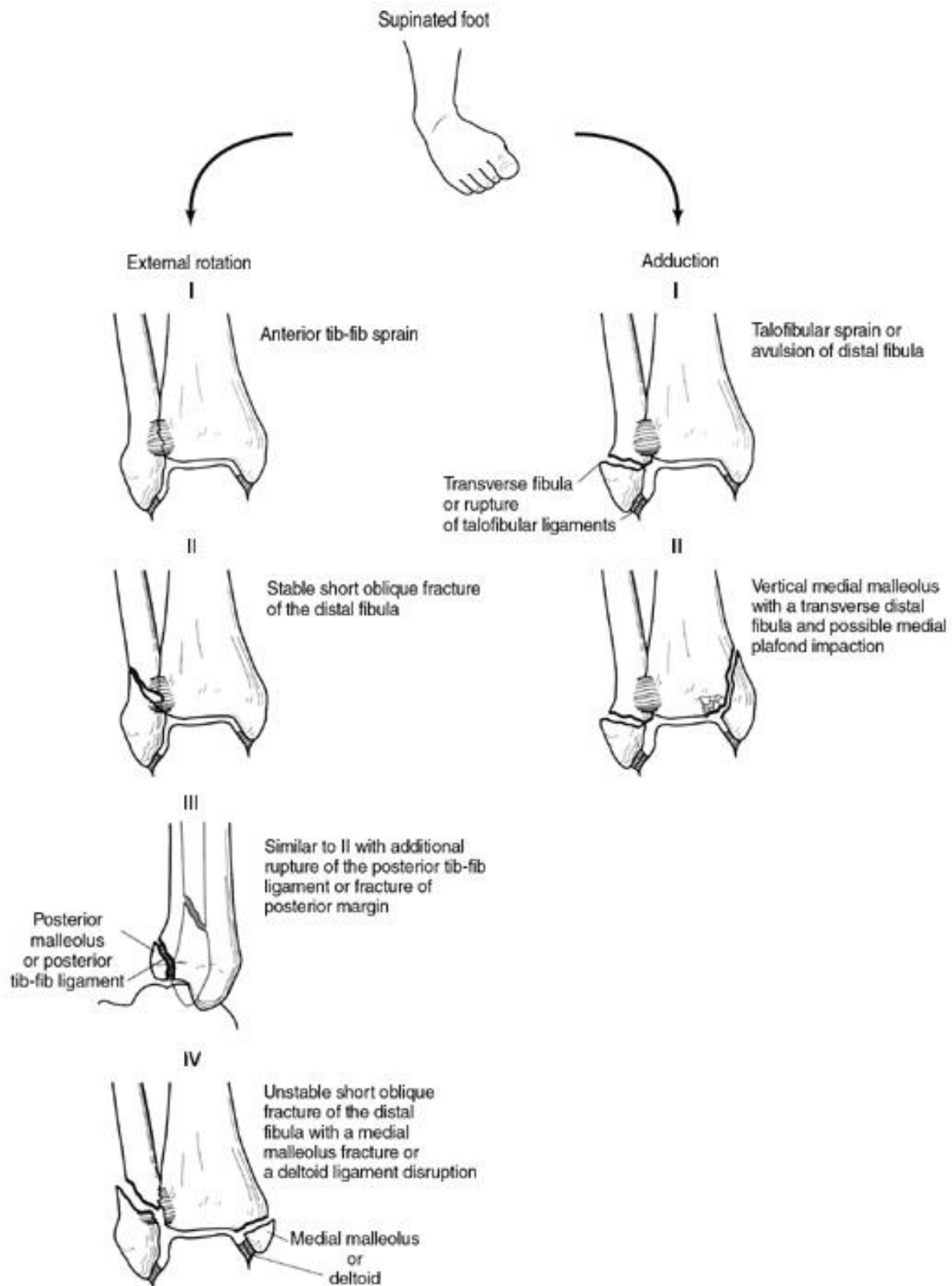
Lauge-Hansen's Classification

Supination-Adduction (SA)

- Transverse avulsion-type fracture of the fibula below level of the joint or tear of the lateral collateral ligaments.
- Vertical fracture of the medial malleolus.

Supination-Eversion (External Rotation) (SER)

- Disruption of the anterior tibiofibular ligament.
- Spiral oblique fracture of the distal fibula.
- Disruption of the posterior tibiofibular ligament or fracture of the posterior malleolus.
- Fracture of the medial malleolus or rupture of the deltoid ligament.

**Pronation-Abduction (PA)**

- Transverse fracture of the medial malleolus or rupture of the deltoid ligament.
- Rupture of the syndesmotic ligaments or avulsion fracture of their insertions.
- Short, horizontal, oblique fracture of the fibula above level of the joint.

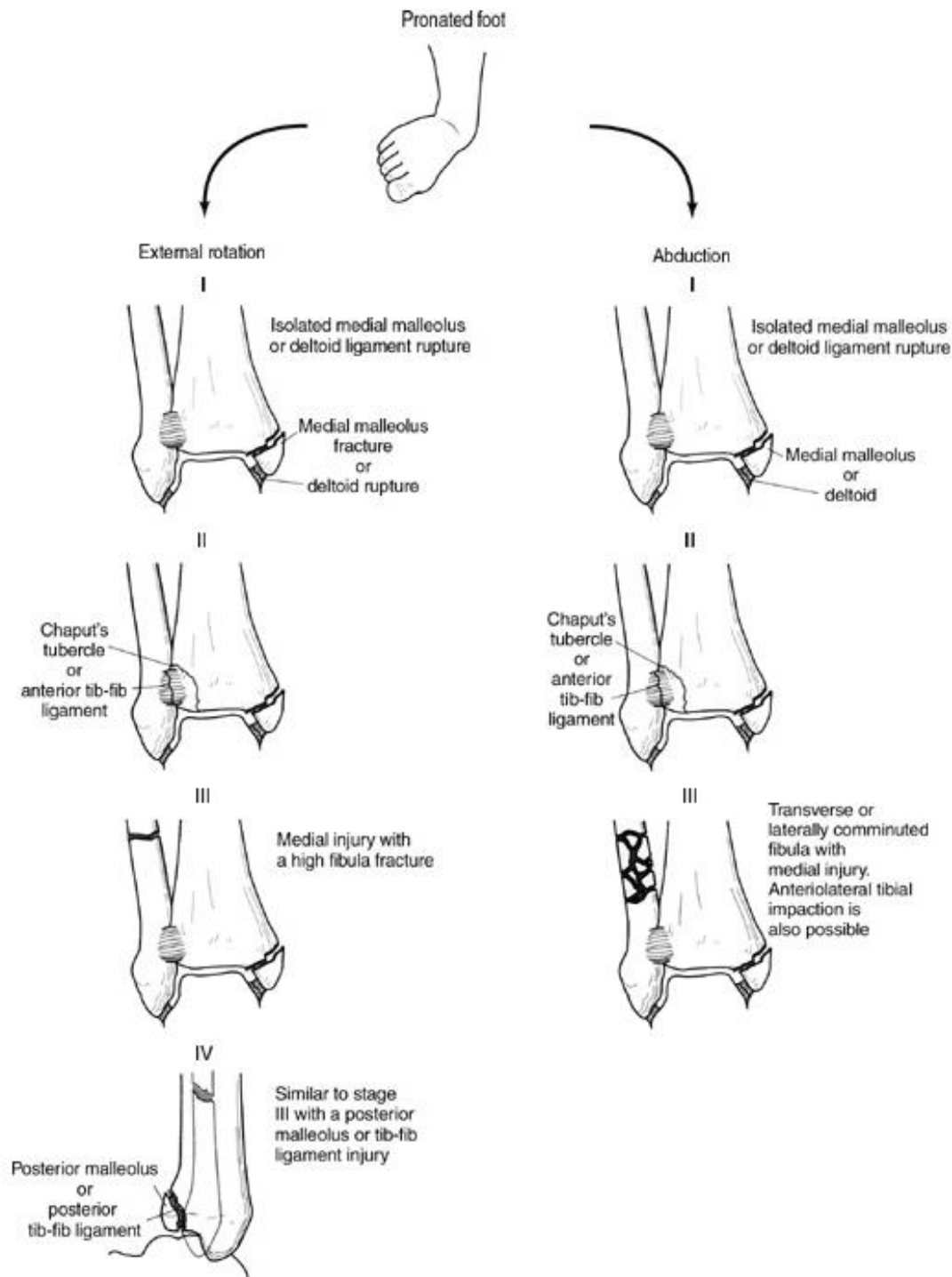
Pronation-Eversion (External Rotation) (PER)

- Transverse fracture of the medial malleolus or disruption of the deltoid ligament.

- Disruption of the anterior tibiofibular ligament.
- Short oblique fracture of the fibula above the level of the joint.
- Rupture of posterior tibiofibular ligament or avulsion fracture of the posterolateral tibia.

Pronation-Dorsiflexion (PD)

- Fracture of the medial malleolus.
- Fracture of the anterior margin of the tibia.
- Supra-malleolar fracture of the fibula.
- Transverse fracture of the posterior tibial surface.

**Table 1:** Weber's criteria ^[10]

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
4. Ankle joint function	Change of profession	4

	Complete, symmetrical ankle motion	0
	Reduced motion (dorsiflexion) < 10°	1
	Reduced motion (dorsi-flexion) > 10°, not equines	2
	5° equinus, good plantar flexion	3
	Ankle rigidity, more than 5° equines	4
5. Subtalar joint function	Full or equal to the other side	0
	Slight diminution	1
	Limitation less than 50% compared to the other side	2
	Limitation more than 50% compared to the other side	3
	No motion	4
6. Radiograph	Anatomically perfect with no arthritis	0
	Anatomically perfect with light calcification in the ligaments but not arthritis	1
	Anatomical disruption on the medial side	2
	Anatomical disruption on the lateral side with arthritis	3
	Step off in the joint with arthritis	4

Outcome:

Excellent: 0 points

Good: 1-2 points

Poor: 3-4 points

Results

Of the 30 cases, the most common age group found was 40-59 years (53%). Males predominated our study with male to female ratio being 5:1. Road traffic accident was the most common mode of trauma. Out of 30 cases there were 25 cases

of external rotation-supination and 5 cases of external rotation-pronation injury as per Lauge-hansen's classification. There was infection in 5 cases. There was 1 case of early loss of reduction, 1 case of hardware failure, 2 cases of osteoarthritis and 1 case of non-union.

Table 2: Patient Demographics

Number of Cases	Age (Years)				Sex		
	20-39	40-59	40-59	Total	Male	Female	Total
	11	16	03	30	25	5	30
Percentage	37%	53%	10%	100%	83%	17%	100%

The outcome measurement according to weber's criteria in both groups are as follow

Table 3: Weber functional and radiological assessment of group 1 and group 2

Group 1 (Lateral Plating)			Group 2 (Posterior Plating)		
Outcome	Number of cases	Percentage	Outcome	Number of cases	Percentage
Excellent	5	33%	Excellent	5	33%
Good	9	60%	Good	9	60%
Poor	1	7%	Poor	1	07%

Lateral plating with good outcome

**Posterior antiglide plate with good outcome**



Discussion

Our study was aimed at comparing the outcome results of lateral malleoli fracture treated with conventional lateral plating and posterior anti-glide plating. We found out that these injuries are common in young and middle aged population with male predominance. Supination-external rotation type of fracture is the most common pattern of ankle fractures. In our study we found out several 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 pain. In comparison, we found few advantages of antiglide plating. It requires a smaller dissection, minimum plate molding, prevents penetration of the joint, and does not show under the skin. In our research, with the lateral plate the osteosynthesis material caused discomfort for seven patients (31.81%) 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 which was seen as a complication in case of posterior plating in some studies ^[12, 13]. Although some research papers reported that the posterior antiglide plate requires less surgery time than the lateral plate ^[11], this is nothing more than a value judgment because none analyses thoroughly that parameter. We kept very detailed records on the surgery time and saw no differences between either technique. The results of our study according to the Weber functional assessment were excellent in 33% of cases, good in 60% of cases and poor in 07% of cases in both groups. Thus there were no difference in the functional outcome and radiological outcome in both the groups. The results of this study was comparable to few other similar studies ^[13, 14].

Study	Excellent	Good	Poor
Winkler and Weber	63%	30.4%	6.5%
Treadwell and Fallat	97.18%	-	2.82%
Our study	33%	60%	7%

Conclusion

The outcome of the surgical management of displaced lateral malleolar fractures is generally good. The posterior antiglide plating technique has some advantages over conventional lateral plating in terms of smaller incision, less implant hardware, less implant prominence and less patient discomfort. But we could find no difference in the clinical outcome when compared with the traditional lateral plate. In our experience, there is no evidence to support one surgical technique over the other. Because of the overall good results with both techniques and a lack of any significant differences in outcome, a prospective comparison seems to be unwarranted.

Limitation of study

The follow up period in this study was 6 months so it was a short term outcome study. A longer follow up might help in better understanding of these approaches.

Pediatric age group was not included in this study so finding may differ in this age group.

Since the cases were not of isolated fibula fracture, the associated other ankle injuries might have affected the final outcome which needs to be studied.

Conflict of interest: none

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