

Evaluating the Efficacy: Lag Screw vs. Buttress Plate Fixation in Posterior Malleolar Fractures

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Abstract:

Background: Effective surgical management is crucial for optimal outcomes in posterior malleolar fractures. This study compares the efficacy of lag screw versus buttress plate fixation techniques in treating these fractures.

Aim and Objective: To compare the efficacy of lag screw versus buttress plate fixation in treating these fractures.

Methods and Methods: In this prospective randomized controlled trial, 40 patients with posterior malleolar fractures were assigned to either lag screw fixation (n=20) or buttress plate fixation (n=20). Clinical outcomes were assessed using the American Orthopaedic Foot and Ankle Society (AOFAS) scores, range of motion (ROM), and radiographic evaluations over a mean follow-up period of 38.2 months.

Results: At 1 year, the AOFAS scores for the lag screw group averaged 94.1 ± 5.4 , and for the buttress plate group, 93.8 ± 5.6 . ROM improved to 60.3 ± 6.4 degrees in the lag screw group and 60.0 ± 6.6 degrees in the buttress plate group. Complete union was achieved in 19 patients in each group, with minor step-off discrepancies noted in one patient per group. Complication rates were low, with superficial infections occurring in 1 patient from the lag screw group and 2 from the buttress plate group.

Conclusion: Lag screw and buttress plate fixations provide comparable and satisfactory outcomes for posterior malleolar fracture management. Both techniques are effective, allowing surgeons to choose based on specific fracture characteristics and personal expertise.

Keywords: Posterior malleolar fracture, lag screw fixation, buttress plate fixation, AOFAS scores, range of motion, radiographic outcomes.

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Introduction

Posterior malleolar fractures are a significant concern in orthopedic trauma, frequently occurring in conjunction with other ankle injuries. [1] These fractures involve the posterior aspect of the tibial plafond and can compromise the stability and function of the ankle joint if not properly addressed. [2] Proper fixation is crucial to ensure optimal healing and to prevent post-traumatic arthritis and other complications. [1, 3]

Two commonly employed surgical techniques for these fractures are lag screw fixation and buttress plate fixation. [4] Lag screws are designed to provide interfragmentary compression, promoting primary bone healing by stabilizing the fracture fragments directly. [5] In contrast, buttress plates are applied to support the posterior fragment, counteracting shear forces and providing a stable environment for bone healing, especially in cases

with larger fracture fragments or significant comminution. [1, 6]

Despite the widespread use of these techniques, there is ongoing debate regarding the optimal method for posterior malleolar fracture fixation. Some studies suggest that lag screw fixation offers superior functional outcomes due to its minimally invasive nature and effective compression. [5] Others argue that buttress plate fixation provides better stabilization, particularly in fractures involving substantial posterior tibial plafond involvement. [7, 8]

This study aims to directly compare the clinical and radiographic outcomes of lag screw versus buttress plate fixation in patients with posterior malleolar fractures. By evaluating key metrics such as the American Orthopaedic Foot and Ankle Society (AOFAS) scores, ankle range of motion (ROM), and

radiographic outcomes, we seek to determine which technique offers superior results in terms of stability, functionality, and overall patient satisfaction. The findings of this study will provide valuable insights to guide orthopedic surgeons in selecting the most appropriate fixation method for posterior malleolar fractures.

Materials and Methods

Study Design and Setting

This study was designed as a prospective randomized controlled trial and was conducted at a Department of Orthopedic center of Gandhi Medical College and Hamidia Hospital, Bhopal, Madhya Pradesh from January 2021 to December 2023. Institutional review board approval was obtained, and all participants provided informed consent prior to their inclusion in the study.

Patient Selection

A total of 40 patients with posterior malleolar fractures were included in the study. Eligible patients were adults aged 18-65 years with isolated posterior malleolar fractures or fractures associated with other ankle injuries. Patients with open fractures, fractures older than 2 weeks, significant comorbidities affecting healing, or those unwilling to comply with follow-up protocols were excluded from the study.

Randomization and Group Allocation

Participants were randomly assigned to one of two groups using a computer-generated randomization list. Group A, consisting of 20 patients, received lag screw fixation, while Group B, also with 20 patients, underwent buttress plate fixation. This randomization ensured an equal number of participants in each group, thereby minimizing selection bias.

Surgical Techniques

All surgeries were performed by experienced orthopedic surgeons specialized in ankle trauma. For the

lag screw fixation group, patients were placed in a prone position under general or spinal anesthesia. A standard posterolateral approach was used to expose the fracture site, and after reducing the fracture, one or two lag screws were inserted to achieve interfragmentary compression. For the buttress plate fixation group, the same posterolateral approach was used. Fracture reduction was achieved, and a pre-contoured buttress plate was placed along the posterior tibia, secured with screws to provide stability against shear forces.

Postoperative Care

Postoperative protocols were identical for both groups. Patients were immobilized in a short leg cast for six weeks and remained non-weight bearing during this period. Gradual weight-bearing was allowed as tolerated after six weeks. Physiotherapy was initiated following cast removal to restore range of motion and strength.

Outcome Measures

Patients were evaluated at 6 weeks, 3 months, 6 months, and 1 year postoperatively. The primary outcome measures included the American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score, which assessed pain, function, and alignment. Range of motion (ROM) was measured using a goniometer, and radiographic assessments were performed through X-rays to evaluate fracture healing, alignment, and any complications.

Results

Demographic and Baseline Characteristics

A total of 40 patients were included in the study, with 20 patients in each group. The demographic and baseline characteristics of the patients, including age, gender, and type of fracture, were comparable between the two groups, as shown in Table 1.

Table 1: Demographic and Baseline Characteristics

Characteristic	Lag Screw Fixation (n=20)	Buttress Plate Fixation (n=20)
Age (years)	42.3 ± 12.4	40.8 ± 11.9
Gender (Male/Female)	12/8	11/9
Type of Fracture	Isolated/Associated	13/7

Clinical Outcomes

The American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Scores were recorded at 6 weeks, 3 months, 6 months, and 1 year

postoperatively. Both groups demonstrated significant improvement in AOFAS scores over time, with no significant difference between the groups at any follow-up point.

Table 2: AOFAS Ankle-Hindfoot Scores

Time Point	Lag Screw Fixation (Mean ± SD)	Buttress Plate Fixation (Mean ± SD)
6 weeks	65.4 ± 8.2	64.8 ± 7.9
3 months	78.1 ± 9.5	77.6 ± 8.7
6 months	89.3 ± 7.2	88.9 ± 7.5
1 year	94.1 ± 5.4	93.8 ± 5.6

Range of Motion (ROM)

Range of motion (ROM) was assessed using a goniometer at the same follow-up intervals. Both groups showed similar improvements in ROM, with no statistically significant differences observed.

Table 3: Range of Motion (ROM)

Time Point	Lag Screw Fixation (Mean ± SD)	Buttress Plate Fixation (Mean ± SD)
6 weeks	35.2 ± 7.3	34.7 ± 7.1
3 months	45.6 ± 8.1	45.2 ± 7.8
6 months	54.8 ± 6.9	54.5 ± 7.2
1 year	60.3 ± 6.4	60.0 ± 6.6

Radiographic Outcomes

Radiographic evaluations showed complete union without loss of reduction in 38 out of 40 patients. One patient from each group experienced minor step-off discrepancies, which did not affect the overall outcomes.

Table 4: Radiographic Outcomes

Outcome	Lag Screw Fixation (n=20)	Buttress Plate Fixation (n=20)
Complete Union	19	19
Loss of Reduction	0	0
Step-off Discrepancies	1	1

Complications

The complication rates were low and comparable between the two groups. Minor complications included superficial wound infections, which were successfully treated with antibiotics.

Table 5: Complications

Complication	Lag Screw Fixation (n=20)	Buttress Plate Fixation (n=20)
Superficial Infections	1	2
Deep Infections	0	0
Hardware-related Issues	0	0

Discussion

This study aimed to compare the clinical and radiographic outcomes of lag screw versus buttress plate fixation in the management of posterior malleolar fractures. The findings indicate that both techniques offer comparable results in terms of union rates, AOFAS scores, range of motion, and complication rates. These results align with previous studies, although some discrepancies are noted in specific aspects of fixation techniques and outcomes.

Previous literature has explored the effectiveness of various fixation methods for posterior malleolar fractures. Haraguchi et al. [2] emphasized the importance of anatomical reduction and stable fixation in preventing post-traumatic arthritis and ensuring optimal functional recovery. The present study corroborates these findings, demonstrating high union rates and satisfactory functional outcomes with both lag screw and buttress plate fixations.

Lag screw fixation, known for its ability to provide interfragmentary compression, has been associated with favorable outcomes in several studies. Meyer et al. [6] reported that lag screw fixation offers excellent stability and promotes primary bone healing, particularly in fractures with minimal comminution.

Our study supports this, showing significant improvements in AOFAS scores and range of motion in the lag screw group. However, the results also indicate that the buttress plate fixation group achieved similar outcomes, suggesting that this method is equally effective for stabilizing posterior malleolar fractures, especially in cases with larger fracture fragments or comminution.

The use of buttress plates for posterior malleolar fractures has been advocated due to their ability to provide stability against shear forces. [4] highlighted that buttress plates are particularly beneficial in fractures involving significant posterior tibial plafond involvement. Our study found no significant difference in clinical or radiographic outcomes between the two groups, indicating that both techniques are viable options. This finding is consistent with the study by Gardner et al. [9], which suggested that the choice of fixation method should be tailored to the specific fracture pattern and surgeon's preference.

Complication rates in our study were low and comparable between the two groups, with only minor superficial infections reported. This is consistent with the findings of Smeeing et al. [10], who noted that both fixation methods have similar safety profiles when

proper surgical techniques and postoperative care protocols are followed.

Conclusion

Overall, the present study demonstrates that both lag screw and buttress plate fixations are effective in managing posterior malleolar fractures, with no significant differences in clinical or radiographic outcomes. These findings provide valuable insights for orthopedic surgeons, suggesting that the choice of fixation method can be based on individual fracture characteristics and surgeon expertise. Further research with larger sample sizes and longer follow-up periods is recommended to validate these results and explore potential differences in long-term outcomes.

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