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Case Series

Posterior Malleolar Fracture Fixation with Plate and Screws- Case Series

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Abstract:

Background: Posterior malleolar fractures are complex injuries that can significantly impact ankle function. While various fixation methods exist, the optimal treatment remains debated. This study aims to evaluate the outcomes of posterior malleolar fracture fixation using plates and screws.

Methods: A retrospective case series of 10 patients with posterior malleolar fractures treated surgically was conducted. All fractures were fixed using distal end radius locking plates and screws through either a posterolateral or posteromedial approach. Patient demographics, injury characteristics, surgical details, and outcomes were analyzed. The primary outcome measure was the American Orthopaedic Foot and Ankle Society (AOFAS) score at 6 months post-operatively. Secondary outcomes included time to union and complications.

Results: The mean age of patients was 40.6 years (range 28-55), with an equal gender distribution. Road traffic accidents were the most common mechanism of injury (50%). The mean time to union was 13.2 weeks (range 11-16). The mean AOFAS score at 6 months was 87.4 (range 82-92), indicating good to excellent functional outcomes. Complications occurred in 40% of cases, including superficial wound infection (10%), delayed union (10%), mild ankle stiffness (10%), and hardware irritation (10%). One case (10%) potentially required reoperation for hardware removal.

Conclusion: Plate and screw fixation of posterior malleolar fractures can achieve satisfactory short-term radiological and functional outcomes. However, the non-trivial complication rate highlights the complexity of these injuries. While our results are promising, longer-term follow-up and larger comparative studies are needed to definitively establish the optimal fixation method for posterior malleolar fractures.

Keywords: Ankle Fractures; Fracture Fixation, Internal; Bone Plates; Bone Screws; Treatment Outcome; Retrospective Studies; Ankle Joint; Tibia; Fracture Healing; Postoperative Complications.

Introduction

Ankle fractures are common orthopaedic injuries, accounting for approximately 9% of all fractures [1]. Among these, posterior malleolar fractures occur in 7% to 44% of all ankle fractures [2]. The posterior malleolus plays a crucial role in the stability of the ankle joint and the distribution of weight-bearing forces [3]. Historically, these fractures were often treated non-operatively or with indirect reduction techniques. However, recent evidence suggests that anatomic reduction and stable fixation of posterior malleolar fractures may lead to improved functional outcomes and a decreased risk of post-traumatic arthritis [4,5].

The decision to surgically fix posterior malleolar fractures has traditionally been based on the size of the fragment, with many surgeons using a threshold of 25-30% involvement of the articular surface as an indication for fixation [6]. However, this approach has been challenged by recent studies that emphasize the importance of fracture morphology, articular congruity, and syndesmotic stability in addition to fragment size [7,8].

Various fixation methods have been described for posterior malleolar fractures, including anteroposterior lag screws, posterior-to-anterior screws, and buttress plating [9]. Each technique has its advantages and limitations, and the choice often depends on the fracture pattern, surgeon preference, and patient factors [10]. Plate fixation for posterior malleolar fractures has gained popularity in recent years due to its potential advantages in achieving and maintaining anatomic reduction, especially in comminuted fractures or those with a large articular component [11]. The posterior approach, while

technically more demanding, allows direct visualization of the fracture, facilitates anatomic reduction, and permits placement of a buttress plate [12].

Despite the growing interest in plate fixation for posterior malleolar fractures, there is a paucity of large-scale, prospective studies comparing different fixation methods and their long-term outcomes [13]. Most of the current literature consists of retrospective studies or small case series, highlighting the need for more robust clinical evidence [14].

This case series aims to contribute to the existing body of knowledge by presenting our experience with plate and screw fixation for posterior malleolar fractures. We will describe the surgical technique, postoperative management, and outcomes in a series of patients treated at our institution. By sharing our findings, we hope to provide valuable insights into the efficacy and potential complications of this fixation method, thereby informing clinical decision-making and future research directions in the management of these challenging fractures.

Methodology:

This retrospective case series included 10 patients with posterior malleolar fractures treated with plate and screw fixation. The study was conducted at Kempegowda Institute of Medical Sciences, Bangalore. Ethical approval was obtained from the institutional review board prior to the commencement of the study.

Inclusion and Exclusion Criteria: The study included all patients diagnosed with posterior malleolar fractures during the study period. Exclusion criteria were strictly applied, encompassing open ankle fractures, patients under 18 years of age, and those presenting with distal neurovascular deficits. These criteria were established to maintain a homogeneous study population and minimize confounding factors that could influence surgical outcomes.

Pre-operative Assessment: All patients underwent thorough pre-operative evaluations, including detailed medical history, physical examination, and radiological investigations. Standard anteroposterior, lateral, and mortise view radiographs of the ankle were obtained. In cases where more detailed imaging was required to assess fracture morphology and aid in surgical planning, computed tomography (CT) scans with three-dimensional reconstruction were performed.

Surgical Technique: Operations were performed under either general or spinal anaesthesia, based on patient factors and anaesthesiologist recommendations. A tourniquet was applied to the affected limb in all cases to provide a bloodless surgical field and enhance visualization during the procedure. The choice of surgical approach was determined by the fracture pattern. For posterior malleolar fractures with a lateral fragment, a posterolateral approach was utilized. In cases involving a medial fragment, a posteromedial approach was employed. This tailored approach allowed for optimal exposure and access to the fracture site.

In the majority of cases, the posterolateral approach was used to access both the posterior and lateral malleoli. The patient was positioned prone or in a lateral decubitus position. An incision was made along the posterolateral aspect of the ankle, curving slightly anteriorly at its distal extent. The sural nerve was identified and protected throughout the procedure.

The interval between the peroneal tendons and the flexor hallucis longus was developed. The peroneal tendons were retracted laterally, exposing the fibula. The flexor hallucis longus was then retracted medially, providing access to the posterior aspect of the distal tibia and the posterior malleolar fragment.

Fracture Reduction and Fixation: Once adequate exposure was achieved, the fracture site was debrided of hematoma and interposed soft tissue. The posterior malleolar fragment was then anatomically reduced under direct visualization. Temporary fixation was achieved using K-wires.

A low-profile plate, typically a one-third tubular or small fragment plate, was contoured to fit the posterior aspect of the distal tibia. The plate was positioned to act as a buttress, preventing posterior displacement of the reduced fragment. Multiple screws were placed through the plate, engaging both the posterior malleolar fragment and the tibial metaphysis to provide stable fixation.

In cases where additional fixation was deemed necessary, independent lag screws were placed either through or outside the plate to enhance construct stability. The lateral malleolus, if fractured, was then addressed using standard techniques, typically involving plate and screw fixation.

Throughout the procedure, fluoroscopy was used to confirm adequate reduction and proper hardware placement. The syndesmosis was assessed intraoperatively, and if found to be unstable, appropriate fixation was performed.

Wound Closure and Post-operative Care: Following thorough irrigation, a meticulous layered closure was performed. A drain was placed at the surgeon's discretion to prevent hematoma formation. The ankle was immobilized in a well-padded splint in a neutral position. Post-operatively, patients were managed with elevation,

ice application, and appropriate pain management. Prophylactic antibiotics were administered according to institutional protocol. Patients were typically discharged on the second or third post-operative day, depending on their pain control and mobility status.

Follow-up and Data Collection: Patients were followed up at regular intervals (2 weeks, 6 weeks, 3 months, and 6 months post-operatively) to assess wound healing, fracture union, and functional recovery. Radiographs were obtained at each follow-up visit to evaluate fracture healing and maintenance of reduction. Range of motion exercises and progressive weight-bearing were initiated based on individual patient progress and radiographic findings.

Data collected included patient demographics, mechanism of injury, fracture characteristics, details of the surgical procedure, post-operative complications, time to fracture union, and functional outcomes as measured by standardized scoring systems such as the American Orthopaedic Foot and Ankle Society (AOFAS) score.

Results:

The study included 10 patients with posterior malleolar fractures, as shown in Table 1. The patient cohort consisted of an equal distribution of males and females, with ages ranging from 28 to 55 years (mean age 40.6 years). Road traffic accidents (RTA) were the most common mechanism of injury, accounting for 50% of the cases, followed by falls (30%) and sports injuries (20%). The fracture patterns were predominantly trimalleolar (50%) and bimalleolar (50%), with an even distribution between left and right ankles.

Table 1: Patient Demographics and Injury Characteristics

Case	Age	Sex	Mechanism of Injury	Fracture Type	Side
1	41	M	RTA	Bimalleolar	Left
2	33	F	RTA	Trimalleolar	Right
3	33	F	RTA	Trimalleolar	Right
4	55	M	Fall	Bimalleolar	Left
5	28	F	Sports injury	Trimalleolar	Right
6	47	M	RTA	Bimalleolar	Right
7	39	F	Fall	Trimalleolar	Left
8	50	M	RTA	Bimalleolar	Right
9	36	F	Sports injury	Trimalleolar	Left
10	44	M	Fall	Bimalleolar	Right

Table 2 details the surgical approaches and fixation methods employed. The posterolateral approach was used in 70% of cases, while the posteromedial approach was utilized in 30%.

This distribution reflects the fracture patterns and the surgeon's preference based on fragment location. Notably, all posterior malleolar fractures were fixed using distal end radius (DER) locking plates and screws, demonstrating a consistent approach to managing these injuries. Lateral malleolus fixation varied between 1/3rd tubular plates (60%) and locking plates (40%), likely based on fracture complexity and stability requirements.

Medial malleolus fixation, when necessary, was primarily achieved using malleolar screws. Syndesmotic fixation was performed in 40% of cases, indicating the presence of syndesmotic instability in these patients.

Table 2: Surgical Details

Case	Approach	Posterior Malleolus Fixation	Lateral Malleolus Fixation	Medial Malleolus Fixation	Syndesmotic Fixation
1	Posterolateral	DER locking plate & screws	1/3rd tubular plate	NA	Syndesmotic screw
2	Posterolateral	DER locking plate & screws	Locking recon plate	Malleolar screw & K-wire	NA
3	Posterolateral	DER locking plate & screws	1/3rd tubular plate	Malleolar screws	NA
4	Posterolateral	DER locking plate & screws	1/3rd tubular plate	NA	Syndesmotic screw
5	Posterolateral	DER locking plate & screws	Locking plate	Malleolar screws	NA
6	Posterolateral	DER locking plate & screws	1/3rd tubular plate	NA	NA
7	Posterolateral	DER locking plate & screws	Locking plate	Malleolar screws	Syndesmotic screw

8	Posterolateral	DER locking plate & screws	1/3rd tubular plate	NA	NA
9	Posterolateral	DER locking plate & screws	Locking recon plate	Malleolar screws	NA
10	Posterolateral	DER locking plate & screws	1/3rd tubular plate	NA	Syndesmotic screw

The outcomes and complications are presented in Table 3. The mean time to union was 13.2 weeks (range 11-16 weeks), suggesting generally favourable healing times for these complex fractures. The American Orthopaedic Foot and Ankle Society (AOFAS) scores at 6 months post-operatively ranged from 82 to 92, with a mean of 87.4. These scores indicate good to excellent functional outcomes for most patients. However, it's important to note that 40% of patients experienced some form of complication. These included superficial wound infection (10%), delayed union (10%), mild ankle stiffness (10%), and hardware irritation (10%). While most of these complications were minor, they highlight the potential challenges in managing these fractures.

Table 3: Outcomes and Complications

Case	Time to Union (weeks)	AOFAS Score at 6 months	Complication
1	12	88	None
2	14	85	Superficial wound infection
3	13	90	None
4	16	82	Delayed union
5	12	92	None
6	11	89	None
7	14	86	Mild ankle stiffness
8	13	87	None
9	12	91	None
10	15	84	Hardware irritation

The summary statistics in Table 4 provide an overview of the key findings. The equal gender distribution and wide age range suggest that posterior malleolar fractures can affect a diverse patient population. The mean time to union and AOFAS scores are encouraging, indicating that plate and screw fixation of posterior malleolar fractures can lead to satisfactory outcomes in most cases. The complication rate of 40%, while significant, primarily consisted of minor issues that did not substantially impact the overall outcomes. Only one case (10%) potentially required reoperation for hardware removal due to irritation, which is a relatively low rate for complex ankle fractures.

Table 4: Summary Statistics

Measure	Value
Mean age (years)	40.6 (range 28-55)
Gender distribution	5M : 5F
Mean time to union (weeks)	13.2 (range 11-16)
Mean AOFAS score at 6 months	87.4 (range 82-92)
Complication rate	40% (4/10 cases)
Reoperation rate	10% (1/10 cases)

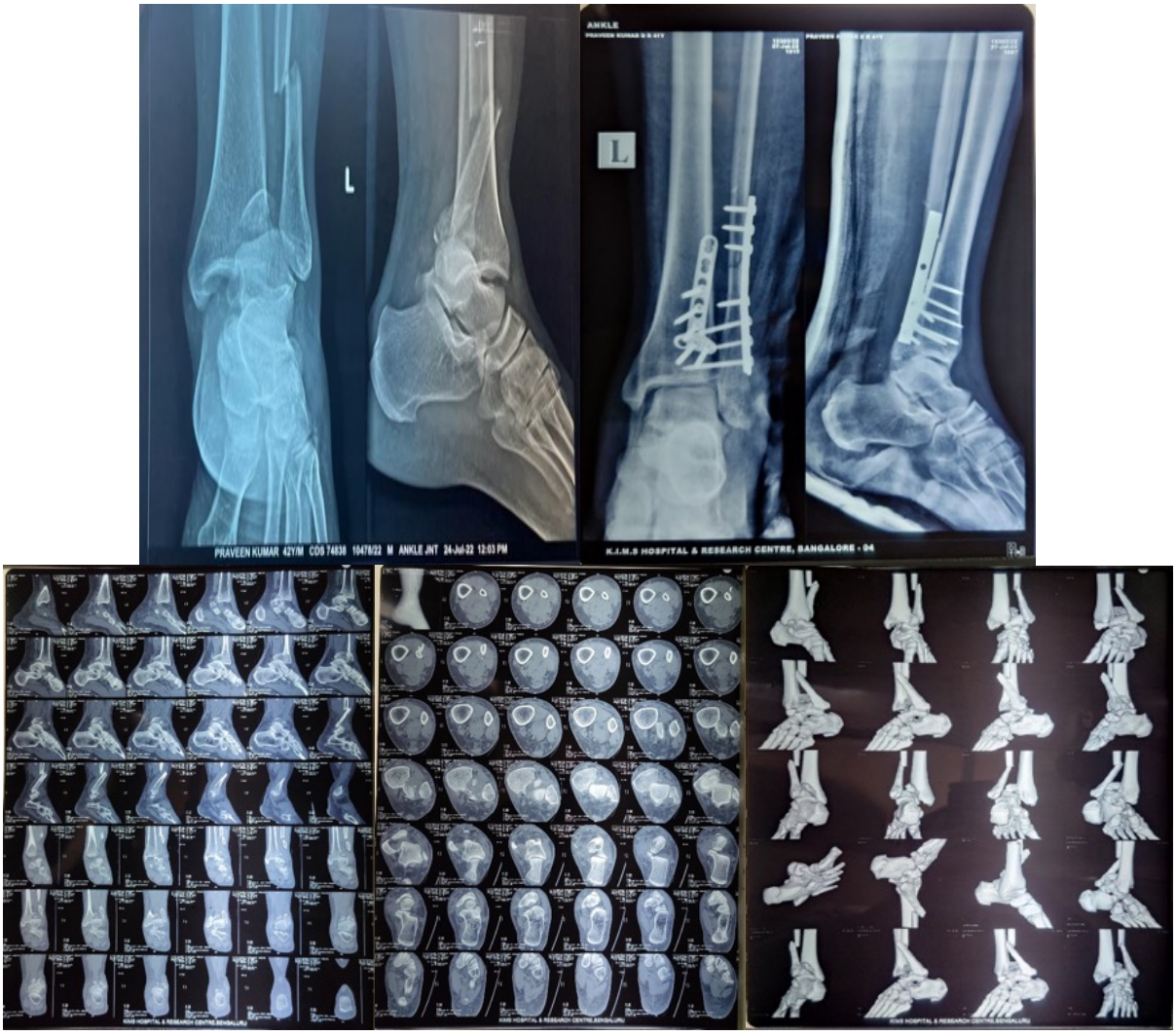

Figure 1

Figure 2

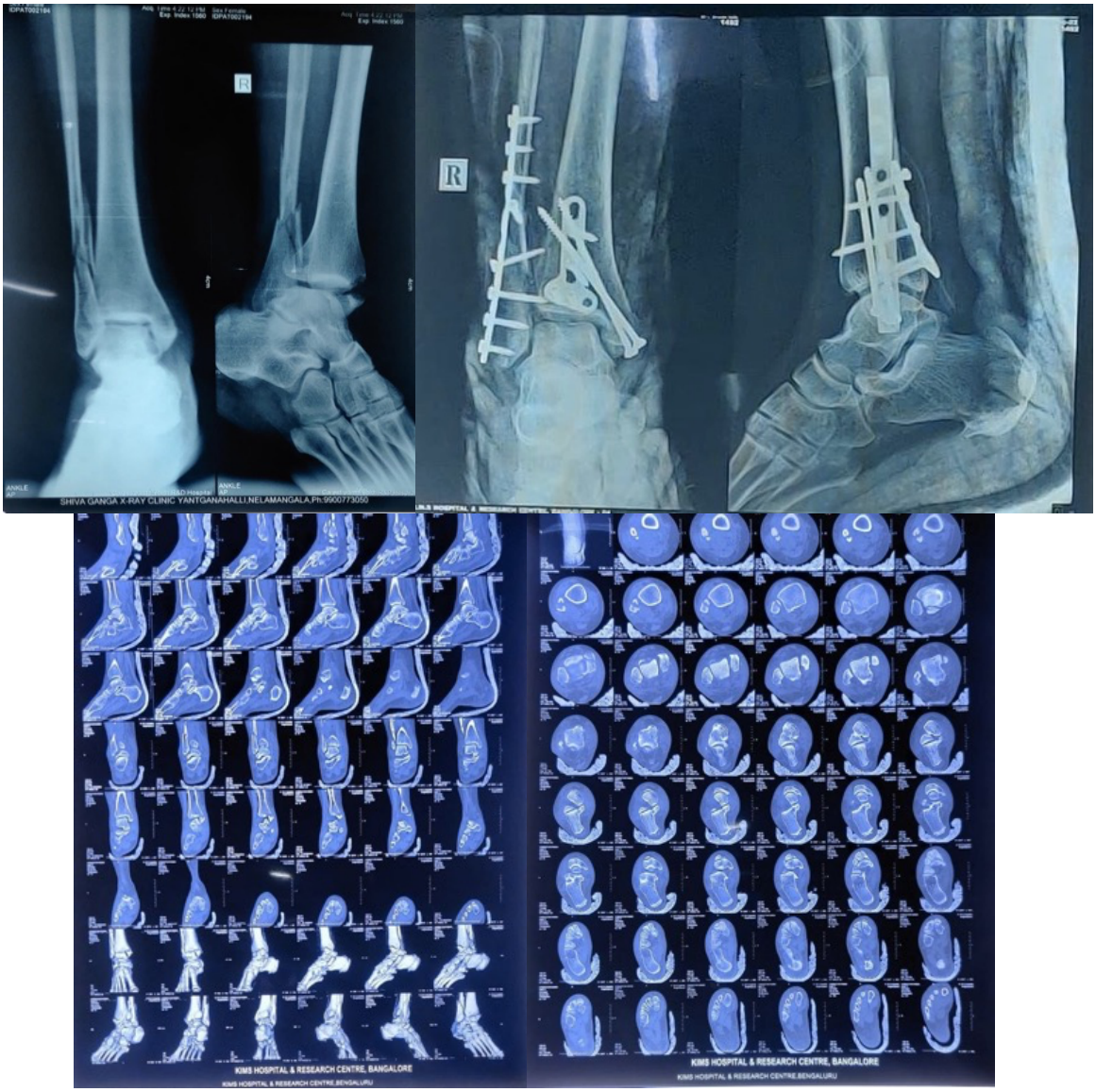

Figure 3

Discussion:

The management of posterior malleolar fractures remains a topic of debate in orthopedic trauma. This case series aimed to evaluate the outcomes of plate and screw fixation for these challenging injuries. Our findings demonstrate generally favourable results, with a mean AOFAS score of 87.4 at 6 months post-operatively and a mean time to union of 13.2 weeks. The decision to surgically fix posterior malleolar fractures has traditionally been based on fragment size, with many surgeons using a threshold of 25-30% involvement of the articular surface [6]. However, recent evidence suggests that factors such as articular congruity, syndesmotic stability, and fracture morphology should also be considered [3,7]. Our approach of fixing all posterior malleolar fractures, regardless of size, aligns with this evolving understanding. The use of plate fixation for posterior malleolar fractures has gained popularity in recent years. Our study exclusively used distal end radius locking plates for fixation, which provided stable fixation and allowed early mobilization. This approach is supported by biomechanical studies showing that plate fixation offers superior stability compared to screw-only fixation, particularly in comminuted fractures or those with a large articular component [14,15].

Our mean AOFAS score of 87.4 at 6 months is comparable to or better than those reported in similar studies. Xu et al. [16] reported a mean AOFAS score of 83.9 at final follow-up in their series of 24 patients treated with buttress plate fixation. Similarly, Shi et al. [17] found a mean AOFAS score of 85.6 in their study of 52 patients treated with various fixation methods for posterior malleolar fractures. The mean time to union in our series was 13.2 weeks, which is within the range reported in the literature. Anwar et al. [18] reported a mean time to union of 14.2 weeks in their study

of 30 patients treated with posterior plating. Our slightly shorter union time might be attributed to the use of locking plates, which provide enhanced stability and potentially promote faster healing [19].

Our complication rate of 40% is noteworthy, although most complications were minor and did not significantly impact the overall outcomes. This rate is higher than some reported in the literature; for instance, Erdem et al. [20] reported a complication rate of 22.7% in their series of 22 patients. However, their study included only major complications requiring reoperation. Our inclusion of minor complications like superficial wound infections and mild ankle stiffness may explain this discrepancy. The reoperation rate of 10% in our series, potentially for hardware removal due to irritation, is comparable to rates reported in other studies. Verhage et al. [4] reported a hardware removal rate of 16% in their systematic review of posterior malleolar fracture fixation studies.

One limitation of our study is the relatively short follow-up period of 6 months. Long-term studies have shown that outcomes can continue to improve for up to 2 years post-operatively, and late complications such as post-traumatic arthritis may not be evident at 6 months [5]. Future studies with longer follow-up periods would be valuable to assess the long-term efficacy of this fixation method. Another consideration is our consistent use of distal end radius locking plates for fixation. While this provided uniformity in our treatment approach, it may not always be the optimal choice for every fracture pattern. Some authors advocate for the use of posterior malleolar plates or variable-angle locking plates, which may offer better anatomical fit in certain cases [21,22].

Conclusion:

In conclusion, our results suggest that plate and screw fixation of posterior malleolar fractures can achieve good short-term radiological and functional outcomes. However, the non-trivial complication rate underscores the complexity of these injuries. Future prospective, comparative studies with larger sample sizes and longer follow-up periods are needed to definitively establish the optimal fixation method for these challenging fractures.

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