



## **Clinical Impact of Posterior Malleolus Fixation in Trimalleolar Ankle Fracture – A Retrospective Study**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aims and Objectives:** The aim of our study is to evaluate the clinical, functional and radiological outcomes of the patients with the trimalleolar fracture that had posterior malleolus fixation.

**Study Design:** Level 4, retrospective study.

**Place and Duration of the Study:** Dept. of Orthopaedics, Smt. NHL Medical College, Ahmedabad, Gujarat, India. Between Jan 2014 to Dec 2017.

**Materials and Methods:** A retrospective study was performed on 30 adult patients who sustained a trimalleolar ankle fracture in our hospital. Patients were selected according to inclusion and exclusion criteria and posterior malleolus was fixed using different modalities in those patients having joint incongruity or instability even after fixation of lateral malleolus fracture. Clinical, radiological and functional outcomes were evaluated using Olerud and Molander score of ankle fractures.

**Results:** Total 30 patients with a mean age of 48.03 years and mean follow-up of 16 months were operated for trimalleolar fracture. Posterior malleolus fixation was done with buttress plate in 8

patients and with cannulated cancellous screw in 22 patients. Out of 30 patients, according to Olerud and Molander score 14 patients showed an excellent result, 10 patients showed good results, 4 patients fair results and 2 patients showed poor results.

**Conclusions:** The anatomic reduction of the posterior malleolus is essential for maintaining the tibiotalar alignment and joint congruency, that is achieved by stable fixation of the posterior malleolus fragment regardless of size to improve post-operative function and quality of life.

*Keywords: Posterior malleolar fractures; buttress plate; cannulated cancellous screw; olerud and molander score.*

## 1. INTRODUCTION

Ankle fractures are common fractures seen at the emergency department. Posterior malleolar fractures are a common component of the ankle fractures with the incidence of 7-44% of ankle fractures [1]. The posterior malleolus contributes to the congruity of the ankle joint [2]. The main ligamentous attachment for the posterior malleolus includes the posterior inferior tibiofibular ligament provides 42% of the syndesmotic stability [3-5]. Inadequate anatomical reduction of the ankle fractures leads to prolonged periods of pain, decreased range of motion and early arthritis [6-11]. The size of the fragment, usually given as the percentage of involvement of distal tibial articular surface as measured on the lateral ankle radiographs, is an important parameter used to decide whether a fragment should be fixed or not. When the ratio of the posterior fragment is less than 25% of the Antero-posterior dimension of the articular surface, conservative treatment is suggested by some authors [2,12-21]. However, the joint congruency and stability are shown to be more important than the size of the posterior malleolus fragment for long-term radiological outcome [22-23].

The aim of our study is to evaluate the clinical, functional and radiological outcomes of posterior malleolus fixation in trimalleolar ankle fracture.

## 2. MATERIALS AND METHODS

A retrospective study was performed on all adult patients who sustained a trimalleolar ankle fracture from 2014 to 2017 in our hospital. 47 patients that had trimalleolar fractures were evaluated and out of which 30 patients were selected on the basis of the following criteria.

### Inclusion criteria

1. Age of the patient above 18 years,
2. Posterior malleolus fracture associated with joint incongruency irrespective of the its size

3. Both medial and lateral malleolar fracture with fixation.
4. Full treatment completed in our institution
5. Patients who comply with the regular follow-up for at least for 6 months postoperatively.

### Exclusion criteria

1. Patients below 18 years of age
2. Pathological fractures,
3. Associated with any other fractures in the same limb
4. Open fractures.
5. Fractures associated with neurovascular injuries

Patients were initially assessed in the emergency department, appropriate radiological and laboratory investigations as per our hospital protocol were carried out. The fractures were classified according to the AO classification. The length of the PM fracture measurement was conducted from preoperative lateral X-rays. Limb was immobilised with below knee splint and skeletal traction was given in severe displacement, ankle joint subluxation or dislocation. Rest, ice application and Bohler splint elevation were given to all the patients to reduce soft tissue oedema. All the patients underwent surgical intervention after assessment of local soft tissue condition.

All the patients were operated under spinal anaesthesia. Pneumatic tourniquet applied over proximal thigh and the prone position was given with a bolster under the distal lower leg to facilitate reduction of ankle joint. A standard posterolateral approach was taken and proper reduction and fixation of lateral malleolus were done prior to the fixation of posterior malleolus in all cases with the 3.5 mm Dynamic Compression Plate or 3.5 mm Reconstruction Plate or Lower End Fibula Anatomical Plate, cannulated cancellous screw or intramedullary nail depending upon fracture location and geometry. After fixation of the lateral malleolus, the

anatomy of the posterior malleolus and ankle joint stability was checked clinically and under fluoroscopic control. If ankle joint remained unstable even after lateral malleolus fixation only then posterior malleolus were fixed in the same position. The posterior malleolus was approached through the interval between the peroneals and flexor hallucis longus. Two implants were used to fix posterior malleolus in all our patients depending upon the size of the fracture fragment. In the small fragment sized less than 25%, 4 mm cannulated cancellous screw was used and in a large fragment sized more than 25%, buttress plate was used for fixation. Then, the patient was turned to supine position for the fixation of medial malleolus through standard posteromedial approach. Kirschner wires and tension band wiring or cannulated cancellous screws were used to fix the fracture according to the fracture pattern. Syndesmosis stability was checked by laterally displacing the distal fibula from the tibia while observing the relationship of the two bones. If more than 3 to 4 mm of lateral shift of the talus occurs, instability is present. However, in this study none of the patients had syndesmotic fixation done.

The limb was kept immobilised with below knee slab postoperatively till the removal of stitches at the average on the 15th postoperative day. The slab was removed at 3 weeks and crepe support was given. Rehabilitation was begun in form of toes mobilisation immediate post-surgery. After removal of splint gradual ankle mobilisation was started. Partial weight-bearing and full weight bearing walking were started after radiological examination for assessing fracture union in follow-ups. The patients were reviewed at one, two, three and six months postoperatively and assessment of the patients' ankles were done using a modification of the scoring system proposed by Olerud and Molander which includes parameters of pain, stiffness, swelling, stair climbing, running, jumping, squatting, supports, work activities of daily life [24].

### 3. RESULTS

In our study, 47 patients were found having trimalleolar fractures and 17 were excluded for not meeting the inclusion criteria. Among 30 eligible patients for the study, 23 (76.67%) were male and 7 (23.33%) female, male to female ratio was 3.29:1. Mean age was 48.03 years (range from 23 to 71 years). According to AO/OTA classification, there were 15 (50%) type

44A, 10(33.33%) type 44B and 5 (16.67%) fractures type 44C in the study. Out of 30 patients, 17 patients had the history of road traffic accident, 6 had a history of fall from a height, 4 had a history of fall of the heavy object over limb and 3 had a history of twisting. A fracture-dislocation was seen in 11 out of 30 patients. The mean size of the posterior malleolar fragment was 19.4% (range 11%-46%). The average time of follow-up was ~16 months. Mean time from injury to operation was ~4 days till the oedema subsided. (ranging from 2 to 8 days).

Both the medial and lateral malleoli of the patients were fixed with different implants of fixation in every patient. Among the 30 patient having the trimalleolar fracture, lateral malleolus was fixed with intramedullary nailing in 6 patients, with plate in 23 patients and with cannulated cancellous screw in 1 patient. Out of 30 patients, posterior malleolus fixation with buttress plate was done in 8 (26.67%) patients and cannulated cancellous screw fixation was done in 22 (73.33%) patients. The average union time decided by radiological evaluation was 10.34 weeks. Out of 30 patients, according to Olerud and Molander score 14 (46.67%) patients showed the excellent result, 10 (33.34%) patients showed good results, 4 patients showed fair results (13.34%) and 2 (6.67%) patients showed poor results. Mean of Olerud and Molander score was 81.33 (range 35-100).

In our study, 3 (10%) patients developed a superficial infection which was managed with antibiotics and dressing. The infections resolved completely in all cases. The postoperative pain remained in 4(13.33%) patients, ankle arthritis developed in 2 (6.67%) patients, delayed union in 2 (6.67%) patients, non-union in 1(3.33%) and removal of the implant was done in 1 (3.33%).

### 4. DISCUSSION

The goal of the treatment of trimalleolar fractures is to return the patient to as close to their pre-injury ankle function as possible by doing an anatomical reduction of ankle joint, stable fixation and early mobilisation. Macko et al and Hartford et al found a decrease in the contact area with an increase of the fragment size [4,25]. This decrease in contact area is suggested to be the cause of early post-traumatic arthritis. Therefore, Hartford et al. suggested reposition and fixation of fragments larger than 25% [4] Juan et al. reported that functional outcomes are better in

those with posterior malleolar fragment <25% of the articular surface [26]. Papachristou et al. found that with axial loading of the ankle joint with the foot in a neutral position in a cadaver model, the posterior quadrant of the tibiotalar joint was not loaded [27] Tejwani et al. reported that presence of a posterior malleolar fragment in unstable ankle fractures results in worse outcomes at 1 year but this seems to even out over time at 2 years [28]. Since there is still debate on posterior fragment fixation according

to the size of the fragment ratio, we have included patients in our study depending upon stability and congruity of ankle joint rather than posterior malleolus size. We believe that operative intervention will prevent joint incongruity, posterior subluxation of the talus, impaction of the joint surface, and avoidance of a free intra-articular fragment. We found that the fixation of PM gives a better mid-term outcome in term of functional improvement and anatomic reduction with fewer complications.

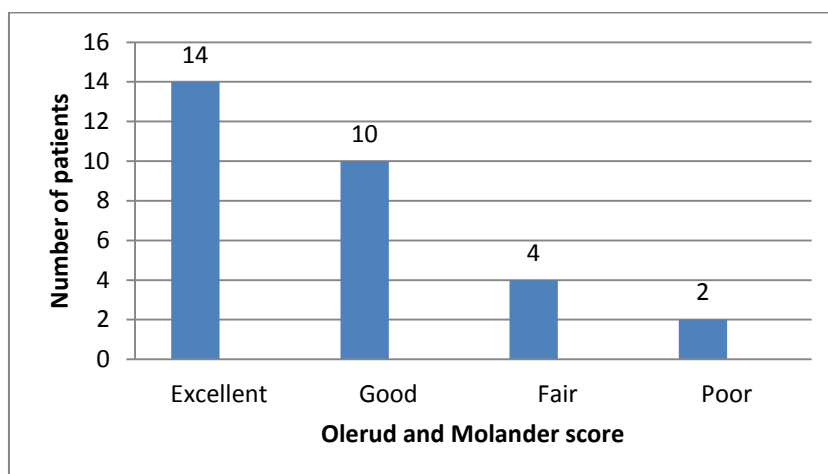


Fig. 1. Showing Olerud and Molander score of patients operated for posterior malleolus

Clinical case-1



Fig. 2a



Fig. 2b



Fig. 3



Fig. 4a



Fig. 4b

Fig. 2a,2b. X-ray and 3D CT Scan of 45-year-old male patient showing AO type 44B3.2 trimalleolar fracture with ankle joint subluxation

Fig. 3. 4 months postoperative x-ray showing complete union and stable joint  
Fig. 4a,4b. Clinical pictures



**Clinical Case -2**



**Fig. 5**



**Fig. 6**



**Fig. 7a**



**Fig. 7b**

**Fig. 5. X-ray of 52-year-old patient having the AO type 44A3.3 trimalleolar fracture with ankle joint subluxation**

**Fig. 6. 5 months postoperative X-ray with the complete union**

**Fig. 7a,7b. Clinical pictures**

De Vries et al. and Heim showed a statistically significant poorer outcome for ankle fracture-dislocation compared to non-dislocated ankle fractures and the significantly larger posterior malleolus fragment seen in patients with fracture-dislocation, indirect evidence can be considered that larger fragments might actually lead to worse long-term outcome [15-16]. In our study, we also found that the functional outcome in trimalleolar ankle fracture co-relates with the displacement of the posterior malleolar fragment. On top of that, the concomitant soft tissue injury during an ankle fracture-dislocation can also contribute to the poorer outcome. Presence of soft tissue damages such as ligamentous and tendon injuries can result in chronic swelling and stiffness, therefore, contributing to the dismal outcome. However, many other factors such as the type of fractures, fracture comminution, soft tissue interposition, soft tissue conditions, the general condition of the patients, and type of medial and lateral malleolus injury also affect the outcome [21,22,23,25,27].

In our study, we fixed the posterior malleolus with open reduction and internal fixation with buttress plate and percutaneous cannulated cancellous screw directed from posterior to anterior

depending upon size of the fragment and local skin condition. Shah et al. reported in their series of 69 patients with Weber B and C ankle fractures that 50% of their patients still had residual pain, 63% were still complaining of stiffness and around 45% still had ankle swelling at 5 years post-treatment [29]. Our study showed that residual pain was experienced by 13.33% patients followed by infections in 10% patients, ankle arthritis in 6.67% patients, delayed union in 6.67% patients, implant failure in 6.67% patients, removal of the implant in 3.33% patients and non-union in 3.33% patient. Several other studies have already shown similar results suggests that ankle fractures with posterior malleolar fragment often have poorer outcomes, severe arthritic changes, and consequent symptoms [2,4,6,12,16-17,21,25,27]. In our study, the majority of the complications such as delayed union, implant failure, non-union were seen in patients treated with percutaneous cannulated cancellous screw, whereas complications such as infection, residual pain and arthritis were common in the patients treated with plating.

A Cochrane review on the rehabilitation for ankle fractures in adults conducted in 2008

demonstrated early commencement of exercise in a removable brace or splint significantly improved activity limitation, pain and ankle range of motion but there is a need to monitor for wound complications [30]. Early rehabilitation can, therefore, be introduced in these patients to encourage a better range of movement and active recovery. Hence, patients with trimalleolar ankle fractures should be adequately advised on the possibility of continuing to have residual symptoms post-fixation and that they may not return to their pre-injury level of activity. This is particularly important in managing their post-operative expectations.

Limitation of our study was that it had a small number of the cohort which may not strongly support our result of the outcome of an operative intervention of posterior malleolus. Our study was based on the mid-term follow up of the operative outcome which needs further follow-up for the better evaluation of the functional and radiological outcome and any development of a new complication. Also our study being a retrospective in nature, it can lead to selection bias.

## 5. CONCLUSION

The anatomic reduction of the posterior malleolus is essential for maintaining the tibiotalar alignment and joint congruency. This is achieved by stable fixation of the posterior malleolus fragment regardless of size to improve post-operative function and quality of life of patients. However, the amount of displacement of fracture fragments, fracture comminution, soft tissue injuries also contribute to the final outcome of the posterior malleolus fractures.

## CONSENT AND ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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