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Original Research Article

Comparative Study of Fixation versus Conservative Treatment of Posterior Malleolar Fragment in Ankle Fractures

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Abstract

Background: Ankle fracture involving posterior malleolus, whether to fix it or not has always been a subject of controversy for a long time. Aim of this study was to compare the outcomes of fixation vs conservative treatment of trimalleolar ankle fractures.

Material and Method: A total of 30 patient with ankle fracture were taken into study. In group I Posterior malleolus fracture was fixed by means of screw or plate in 18 patients along with medial and lateral malleolus while in group II posterior malleolus fracture was left unfixed in 12 patients .In addition to reduction quality at fracture site, pain and range of motion at ankle joint was assessed in each follow up.

Results: The mean follow up was 12 month. Ankle pain and motion was assessed according to Olerud and Molander scoring system. The score was found significantly higher in group I.

Conclusion: Fixation of posterior malleolus restores the articular surface and helps in maintaining the congruity of tibial plafond. These results suggested that posterior malleolar fracture fixation has better functional and radiological outcome in an ankle fracture.

Keywords: Ankle fracture, posterior malleolar fragment, posterior malleolar fracture fixation.

Introduction

Ankle joint fractures are clinically common and account for 3.92% of all fractures sustained in the entire body. [1] Posterior malleolar fracture (PMF) occurs in 7% to 44% of all ankle fractures, most in setting of rotational ankle fractures and are rarely seen alone. [2] Simple posterior malleolar fracture is rare, accounting for about 0.5% to 1% of all fractures. [3] The incidence has been increasing especially in women over the age of 65. [4] These types of fracture usually include the posterior tubercle of the distal tibia Or posteromedial tibial plafond. [5]

Clinical studies have shown that the presence of a posterior malleolar fracture (PMF) is important as a prognostic factor or functional outcome in the treatment of ankle fractures. [3] Ankle fractures that did

not involve the posterior malleolus had a 30 % lower rate of traumatic arthritis than posterior malleolar fractures. [3]

Radiological study of posterior tibial rim fragment was initially studied by chaput in 1907 followed by Destot who further introduced the term “malle'oleposte'rieure” (Posterior Malleolus) in 1911. [6] In 1915, cotton described a new type of ankle fracture, eventually named after him which was a bimalleolar fracture along with a fracture of PM. Later in 1932 Henderson introduced the term trimalleolar fracture. [6] The classification systems of the posterior malleolus fracture are the following types: AO classification, Heim classification, Haraguchi classification and Bartonicek classification. The first two types are based on X-ray and the later two are classified according to CT images.

Most commonly used classification system of of ankle fractures are the Lauge-hansen and Dannis-Weber/AO classification systems. Dannis-weber/AO classification systems has more reliability and reproducibility compared to Lauge-hansen classification systems. However, Lauge-hansen systems provides the most clinically relevant information, because the ankle fractures are categorised as basis for injury mechanism using a combination of foot position and direction force. [7]

CT imaging may be helpful in defining fracture configuration in more complex patterns particularly where the posterior malleolus is involved. [8] The goal is to provide detailed information about the pattern of fracture before deciding management and planning surgery.

Posterior malleolus fracture is often accompanied by posterior dislocation of an ankle joint, cartilage lesion, and even die-punch. Posterior malleolar fracture often involves the weight bearing articular surface of the tibiotalar joint, resulting in the impact and compression. At this time some bone fragments are often embeded in between the fracture suture; this sign is called die-punch. [3]

It has been suggested that the unevennes in reduction and increased fragment size may be related to post-traumatic arthritis; however fixation may not consistently improve the evenness and radiographic arthritis may not correlate to a clinically significant difference in function. [4]

Several biomechanical studies have demonstrated that PM has an important role in transferring load between the distal tibia and talar dome, as well as in posterior stability, especially when lateral restraints are injured. [2]

Posterior malleolus fractures are frequently left unfixed because they are expected to be reduced spontaneously after open reduction of lateral malleolus [5]. The indication for fixation of posterior malleolus fragments is controversial. Most scholars consider that the posterior malleolus fragment should be fixed when it accounts for ≥25% of the articular surface at the distal end of tibia. [1]

As the surgical treatment of posterior malleolus fracture require approaches other than traditional medial and lateral incision, orthopaedic surgeons may have a tendency to neglect the posterior malleolus fracture or underestimate the size of fragment.

Traditionally method of posterior malleolus fracture fixation is indirect reduction and an anteroposterior screw. Although minimally invasive, the anterior incision has limited visualisation of the fragments further hindering a proper anatomic reduction leading to poor prognosis. [9] Therefore posterolateral incision is gaining popularity due to adequate visualisation and accurate anatomic reduction.

Material and Method

This study has been conducted in Tertiary Medical College and Associated Hospitals of Madhya Pradesh for managementt of

posterior malleolar fragment in ankle fracture. In this hospital based study a total of 30 cases were considered from July 2019 to June 2021 of ankle fracture. Patients were divided into two groups on the basis of surgical management and conservative management of posterior malleolar fragment. Adult patient with more than 20 years of age were included in this study whereas polytrauma patients and pathological fracture were excluded. Informed and written consent was taken from all patient undergoing surgery and study protocols were told to them in local language.

At the time of presentation all patients had marked swelling. Prereduction radiography of ankle was done in all patients. For confirming the fracture primarily X-ray of ankle with AP and lateral view was done. CT scan of ankle joint was done in patients for assessment of posterior malleolar fracture fragment and position.

Depending upon findings of radiological reports18 patients were included in group I in which posterior malleolus was fixed with either screw or plate where 12 patients were included in group II in which posterior malleolus was left unfixed. The details of the patients demographics are given in the table 1.

Table 1: Demographic and clinical details of patients.

Number of patients	30
Male: Female	17:13
Average age	42(20-70)
Average time to surgery	4 days(1-7days)
Average follow up	15 month (12-24)

Size of the fracture was not taken as a definitive criteria to fix Posterior malleolar fragment. In cases where posterior malleolar fragment fracture (PMFF) was get reduced after fixation of associated lateral malleolus then it was left unfixed.

Antero-posterior screw was used in 8 patients whereas plate was used in 10 patients using different approach to fix posterior malleolar fragment in group I. In posterolateral incision fibula fracture was also addressed along with PMFF and separate medial approach was used for medial malleolus. Conventional medial and lateral approach was used to fix medial and lateral malleolus in group II.

Surgical Technique

Associated medial and/or lateral malleolus fracture were fixed by various means. After fixation of lateral malleolus if the PMFF was found reduced then it was managed conservatively.

To fix the PMFF we used 3 different surgical approach:

1. Poster lateral approach

Under complete affect of spinal anaesthesia patient was taken over OT table in prone position. A longitudinal incision was made between the lateral border of the Achilles tendon and the medial border of the fibula. Fixation of the fibular fracture was done first. Blunt subcutaneous dissection was done onto the peroneal tendon by carefully guarding the sural nerve to prevent injury. The posterior aspect of the fibula was reached through the interval just lateral to the peroneal tendon. After debriding the fracture, it was reduced and fixed using a buttress plate.

The flexor halluces longus muscle was bluntly dissected off the interosseous membrane and the lateral side of the tibia through the interval medial to the peroneal tendon. Careful dissection was done to prevent injury to paroneal artery and its branches. Now by retracting the muscle medially the posterior aspect of the tibia was seen. The periosteum was used to expose the posterior malleolar fracture.

Adequate care was taken to prevent damage to posterior inferior tibiofibular ligament (PITFL). Loose fragments were removed by levering the fragment distally. Pointed reduction clamp was used to reduce the posterior fragment after maximal dorsiflexion of the ankle. Then anatomical reduction was achieved and held temporarily by K-wires and it was confirmed on c-arm. Then appropriate size buttress plate was used to fix the fragment. The incision is closed in layers after confirmation of reduction.

2. Posteromedial approach

Under complete affect of spinal anaesthesia patient was placed in supine position. Incision was made over the posterior border of distal tibia which was curved anteriorly over the apex of medial malleolus. Subcutaneous tissue and fascia dissected. Tibialis posterior and flexor digitorum logus tendon retracted anteriorly by carefully guarding the posteromedial neurovascular structure. Posteromedial fracture fragment and medial malleolus are identified. Then reduction of PMFF was achieved and was fixed with appropriate size plate. Horizontal medial malleolus fracture are fixed with obliquely placed compression screw. Multifrgmentary fractures are fixed with a medial plate.

3. Anteroposterior or posteroanterior screw fixation

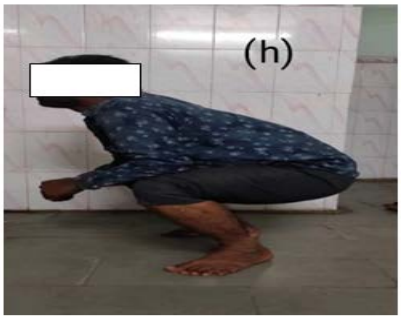
Patient was placed in supine position. Posterior fragment is reduced after dorsiflexion of ankle joint. A small incision was given over anterolateral aspect of distal tibia and pointed reduction clamp was placed over anterolateral and posteriolateral tubercle of distal tibia to achieve temporary reduction.it was temporarily fixed with a k wire. Then Definite fixation was done by cancellous screw placing parallel to the distal articular surface.

Limb was maintained in elevated position for swelling to subside post-operatively. Radiograph were obtained at each follow up at 1,3, and 6 month and 12 month post operatively. Reduction quality, functional score (Olerud Molandar ankle score) [10] and degenerative changes were assessed in each follow up. Post-operatively below knee slab/splint was used in all group II patients for 6 weeks in which posterior malleolar fragment was not fixed but not used in group I patients. Passive range of motion exercise was started in all patients of group I immediate post-operatively.Patients were mobilised toe-touch weight bearing with the help of walker or crutches for 6-12 weeks.

Subjective score was classified into 4 groups as depicted in table 2:

Table2: Subjective score classification.

Poor	<60
Fair	60-80
Good	81-90
Excellent	>90



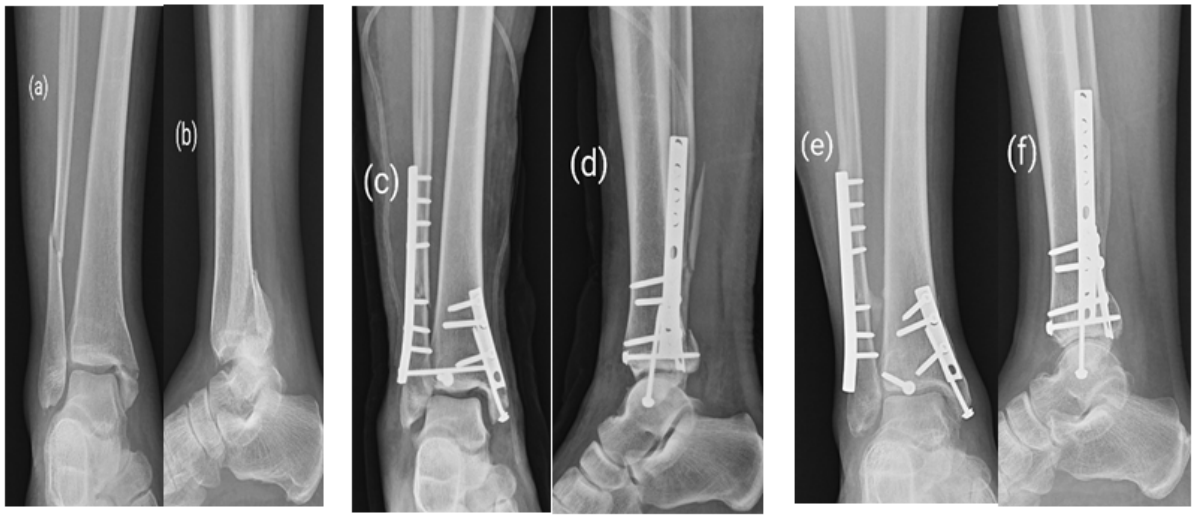


Figure 1.posterior malleolar fracture treated with anteroposterior screw fixation (a) preoperqtive AP, (b) preoperative Lateral, (c) immediate postoperative AP, (d) immediate postoperative lateral, (e) postoperative 12 month AP, (f) postoperative 12 month lateral, (g) standing 12 month follow up, (h) squatting 12 month follow up

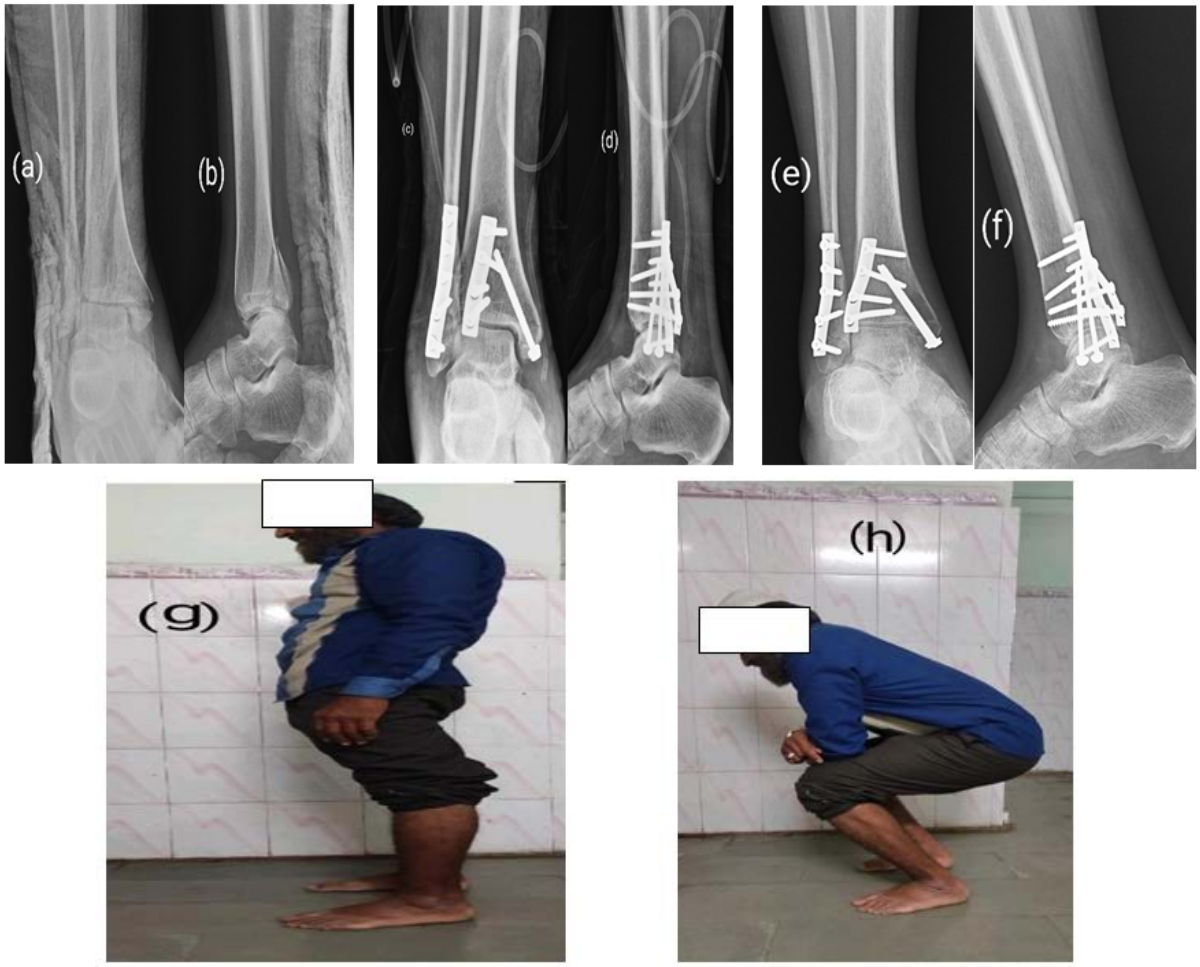


Figure 2.posterior malleolar fracture treated with plate fixation (a) preoperqtive AP, (b) preoperative Lateral, (c) immediate postoperative AP, (d) immediate postoperative lateral, (e) postoperative 6 month AP, (f) postoperative 6 month lateral, (g) standing 12 month follow up, (h) squatting 12 month follow up.

Results

Fracture healed within 3 month in all patients after surgical fixation.No loss of reduction found on radiographic follow up. No hardware irritation or loosening was seen.2 patients had developed surgical site infection which was managed with debridement and parenteral antibiotic.Mean injury to operation interval was 4 days (1-7 days). Syndesmotic screw fixation was done in 7 patient in group I and 1 patient in group II.

At final follow up the median of olerud molander score of the patient was 95(80-95) in group I and 85(65-95) in group II .Olerud and Molandar ankle score was significantly higher in group I as compared to group II.

Degree of arthrosis was grade 0 in 8 ankles, grade I in 8 ankles, grade II in 2 ankles in group I. No grade III arthrosis was found in group I.In group II one ankle had grade 0 ,six patients had grade I , three patients had grade II and two patients had grade III arthrosis.

Table 3: Grading upon Olerude Molander scoring.

	Group I (n=18)	Group II (n=12)
Olerud Molandar score(range)	95(80-95)	85(65-95)
Arthrosis degree		
Grade 0	8	1
Grade I	8	6
Grade II	2	3
Grade III	0	2
Grade IV	0	0

Discussion

With increase in understanding about the normal and post injury anatomy and function of ankle joint, it has lead to demands for anatomic reduction and rigid fixation of fractures of ankle joint. Early operative management of displaced fractures of ankle joint improves functional outcome and also decreases complications similar results were observed by De Las et al. [11]

The cut-off size above which the posterior malleolar fragment should be fixed is controversial. A number of biomechanical cadaveric studies have been performed without providing one clear conclusion similar uncut results were observed by Nasrallah K. [12]

Few studies have shown that open reduction and internal fixation with a posterolateral approach leads to reduced postoperative displacement compared to closed reduction with anterior-posterior screw fixation. [13] However in our study no such difference was found. In our study the average fragment size in group I is higher than group II. [14]

Postoperative step-off is an important influential risk factor for reducing the risk of post-traumatic osteoarthritis and thus increasing the likelihood of good functional outcomes in the long term.

Conclusion

Even with increasing knowledge and awareness, there is always some doubts arises regarding management of PMFF. Simple presence of posterior fragment can have adverse result. With proper use of CT scan and by adequate diagnosis and classification, the surgical treatment of the Posterior malleolar fragment can be made easy.

It has been found that only the size of the posterior malleolar fragment does not decide the management plan. Intra-

articular reduction and anatomic fixation has better effect on clinical outcome.

Evenness at the articular surface of distal end of tibia after reduction of posterior malleolar fragment has a definite effect on the result. Therefore we should always try to restore the articular surface evenness and especially when the fragment size is more than 25%. Even fixation of small fracture fragment can provide stable construction to the distal articular surface**.** In this study we found that fixation of posterior malleolar fragment has better outcome than the conservative management of PMFF in an ankle fracture**.**

It has been found than step-off has an important role in developing post-traumatic osteoarthritis and poorer functional outcome. Therefore step-off should be prevented as much as possible and intra-articular surface should be reduced and fixated.

Limitations

Variation in practice and difference in preference of surgical approach and implant among treating surgeons can have different impact on results, which is considered to be a limitation of this study. Short duration of follow is also considered to be one of the limitations.

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