e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2023; 13(4); 178-183

Original Research Article

Outcome Analysis of Open Reduction and Internal Fixation of Posterior Malleolus Fragment by Posterolateral Approach

Brajesh Meher[1], Praveen Khatri[2], Chetan Solanki[3], Ankit Prasad[4], Vishal Nigwal[5], Suneet Tandon[6]

[1]Senior Resident, Department of Orthopaedics, Gandhi Medical College, Bhopal, M.P., India
[2]Senior Resident, Department of Orthopaedics, Gandhi Medical College, Bhopal, M.P., India
[3]Senior Resident, Department of Orthopaedics, Gandhi Medical College, Bhopal, M.P., India
[4]PG Resident, Department of Orthopaedics, Gandhi Medical College, Bhopal, M.P., India
[5]Senior Resident, Department of Orthopaedics, Gandhi Medical College, Bhopal, M.P., India
[6]Professor and HOD, Department of Orthopaedics, Gandhi Medical College, Bhopal, M.P., India

Received: 30-01-2023 / Revised: 26-02-2023 / Accepted: 30-03-2023
Corresponding author: Ankit Prasad
Conflict of interest: Nil

Abstract

Background: Posterior malleolus fracture quiet commonly occurs due to rotational ankle injury. Management of PM fragment is still controversial but recently operative management is being preffered. Posterolateral approach has become popular nowadays and most surgeons are preffering this approach.

Material and Method: A total of 30 patients was taken into study.All patients were operated by posterolateral approach. A total duration of 12-24 months follow up was taken.

Result and Conclusion: In order to achieve proper anatomical reduction and to lessen the complication like post-operative osteoarthritis, this operative method of posterolateral approach has become popular. A direct visualisation and anatomic fixation of posterior malleolar fragment is possible, which is by far the major advantage of this approach.

Keywords: Posterior Malleolus Fracture, Post-Operative Osteoarthritis, Posterolateral Approach.

Introduction

Ankle fractures are injuries with an annual occurrence of approximately 100/100,000 person yearly.[1] Among which about 7% to 44% are accompanied by posterior malleolus fracture, which are rarely seen alone. [2,3]

Posterior malleolus fractures are quite common and usually result from rotational ankle injuries and commonly associated with unimalleolar or bimalleolar fracture.

Functional outcome of a PM fracture mainly depends on reduction of the fragment. Although size of the PM fragment was given atmost impotance in determining the outcome in the past. But recently more focus has been

given on reduction and maintaining joint congruency. Few other important factor that are being considered now-a-days for determining functional outcome is the post operative step off and development of osteoarthritis.

Several studies have mentioned that when the size of PM fragment increases up to 33% [4,5], the contact surface area in tibiotalar joint significantly decreases and chances of posterior subluxation increases by 25% to 40% [6,7]

AO advises not to fix a PM fragment of size less than 25% of intra-articular surface area when joint stability is mainained after fixation of lateral and medial malleolus.

In the past fixation of PM fragment was mainly done by close reduction and AP/PA screw fixation. But recently open reduction and internal fixation by posterolateral approach is preffered because of direct visualisation and anatomical fixation.

CLASSIFICATION

Several classification method has been proposed for ankle fracture

1. Lauge-Hansen classification

This classification is basically a cadaveric study and is based on mechanism of injury.

Supination external rotation	1) Injury of the anterior inferior tibiofibular ligament (AITFL)
	2) Oblique/spiral fracture of distal tibia
	3) Injury of the posterior inferior tibiofibular ligament (PITFL)
	4) Medial malleolus fracture or injury to the deltoid ligament
Supination adduction	1) Transverse fracture of the distal fibula
	2) Vertical fracture of medial malleolus
Pronation external rotation	1) Medial malleolus fracture or injury to the deltoid ligament
	2) Injury of the anterior inferior tibiofibular ligament (AITFL)
	3) Oblique or spiral fracture of the fibula proximal to the tibial plafond
	4) Injury of the posterior inferior tibiofibular ligament (PITFL) or avulsion of the posterior malleolus
Pronation abduction	1) Medial malleolus fracture or injury to the deltoid ligament
	2) Injury of anterior inferior tibiofibular ligament
	3) Transverse or comminuted fracture of the fibula proximal to the tibial plafond

2. Danis-weber classification

This classification is based on radiographic criteria. The position of distal fibula in relation to syndesmosis taken into consideration.

Type A: Infrasyndesmotic.Associated oblique or vertical medial malleolus fracture.
Type B: Syndesmotic.
Type C: Suprasyndesmotic.

3. Haraguchi classification

Based on CT findings.

Type I: Posterolateral- oblique type.
Type II: Medial extension type.
Type III: The small shell type.

4. Bartonicek classification

Also based on CT findings

Type I: Extraincisural fragment with an intact fibular notch.
Type II: Posterolateral fragment extending into fibular notch.

Type III: Posteromedial two part fragment involving the medial malleolus.
Type IV: Large posterolateral triangular fragment.

Material and Method

This study has been conducted in Gandhi medical college and associated hospital, a tertiary centre in Madhyapradesh for the management of posterior malleolar fragment in an ankle fracture. A total of 30 patient were taken for study from July 2019 to June 2021. All the patient included were more than 20 yr of age where poly trauma patient, pathological fracture and less than 20 yr age group were excluded from the study. All the patient were operated between 1 to 7 days post trauma depending on presence of swelling. Informed consent were taken from all patient for surgical procedure.

Prereduction radiography of ankle was done in all patients. 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.

Table 1: 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)
Weber classification A B C	 0 23 7
Fragment size <25% >=25%	 14 16
Fracture dislocation	4

Although indications for fixation of the posterior malleolus still remains controversial, the existing indications are evolving which includes fractures involving >25% to 33% of the articular surface, displacement > 2 mm, ankle instability with concomitant syndesmotic injury, and persistent posterior subluxation of the talus.

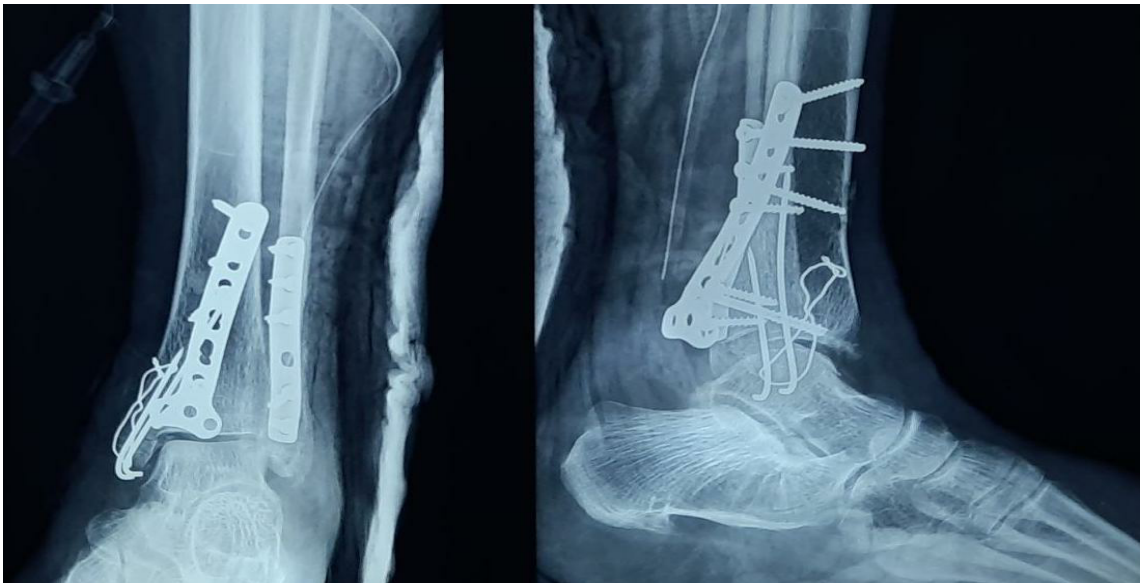
All included trimalleolar fractures were treated operatively. The lateral and medial malleoli were fixated as indicated according to standard protocol. Single posterolateral approach was used for both lateral and posterior malleolus.

Treatment

Surgical Technique: Posterolateral Approach

Under full affect of spinal anaesthesia patients were taken on OT table in either prone or semi-prone position. If no medial amalleolus was involved then lateral position was preffered. A linear incision of around 8cm-10cm was made between posterior border of fibula and lateral aborder of Achilles tendon. Careful dissection was done to prevent injury to sural nerve.A deep plane was made between flexon hallucis longus medially and both long and short peroneus tendon laterally to expose the posterior malleolar fragment. Then carefully posterolateral fragment was mobilised without hampering the posterior tibiofibular ligament. Fracture end was cleared and then reduced and hold with k wire.Comminuted osteochondral fragment which were not desirable to fixation were resected. Then definite fixation was done

with either lag screw or butress plate. Preffered implant was decided based on size and bone quality of posterior malleolar fragment. In the same incision, fracture fibula was addressed and fixed with plate. And finally medial malleolus was fixated in separate medial approach. Then closure done layer by layer.



Case 1: (Operated by posterolateral approach)

Case 2: (Operated by posterolateral approach)

Complication

Several complications of ankle fractures are noted like infection, malunion, non-union, osteoarthritis, reflex sympathetic dysthrophy, wound dehiscence, compartment syndrome, nerve injury, deep vein thrombosis, embolism etc. A systematic review done by E . S. Velman *et al* on 768 patients shows that wound infection was found in 39 patients, wound dehiscence in 16 patients, non-union in 19 patients and post-tramatic osteoarthritis in 16 patient. 9 patients had post-traumatic reflex dystrophy and nerve damage is found in 2 patients.[11]

Discussion

In 2005 Talbot *et al* [8] initially described the details of open posterolateral approach and later by Tornetta *et al* [9]. Anatomical reduction and favourable outcome can be achieved by this approach. Large incision is considered to be one of possible disadvantage this procedure. In the past a long medial incision was used to approach posterior fragment but extensive soft tissue dissection required. Holt *et al* [10] has described the arthroscopic reduction of posterior malleolar fragment. Weber *et al* [11] has also mentioned a combined posteromedial and posterolateral approach. Anterior incision has not been much fruitful in removing blood clots and debris as compared to posterior approach. All this approaches used in the past had extensive dissection and minimal visualisation. The main advantage of posterolateral approach is direct visualisation and proper anatomical reduction of fragment. Also, the standard anatomical reduction was frequently associated with open posterolateral approach as compared to blind procedure done in AP/PA screw fixation.

Also direct visualisation and cleaniong of callus and periosteum was possible in case of delay in surgery and also proper inspection of osteochondral fragment was easily done. In the past posterior malleolus was not given much focus for fixation.But with passage of time size was considered one of the criteria for fixation. Fragment Size of more than 25% of surface area of distal tibia plafond was considered optimal for surgical fixation [12].

However size should not be considered the only criteria for surgical fixation keeping in mind the anatomical reduction, fracture pattern and posterior stability at ankle joint. A study done by Harper and Hardin shows that there is no difference in outcome when comparing the conservative vs surgical management of posterior malleolar fragment [13]. Langenhujsen *et al* suggested fixation of posterior fragment should be considered if found displaced after fixation of lateral and medial malleolus [14]. In preoperative planning CT should be considered essential to determine the fracture pattern. Magid *et al* and Haraguchi *et al* proposed that the calculation method for fragment size based on CT images is more accurate. Haraguchi *et al* also suggested the use of CT for exact evaluation of fragment size [15].

Miller and colleagues found in a clinical study that after anatomic fixation of posterior fragment, the distal fibular fragment perfectly fits into fibular notch[16]. O'connor and colleagues found that outcome is superior after posterior butress plate than AP screw fixation [17]. Fitzpatrick *et al* have shown that posteriuor instability of ankle joint is not observes as long as the medial and lateral soft tissue and bone remain intact or undergoes anatomic reduction [18].

Conclusion

Posterolateral approach is considered one of the best in fixating posterior malleolar fracture. Direct visualisation, and proper exposure to joint is believed to be the major advantage of this approach.Controlled anatomical fixation with better inspection of the fracture site helps in gaining good functional stability of ankle joint. Complications are minimal with adequate soft tissue coverage post-operatively. Postoperative step off of the posterior fragment is found minimal as compared to conservative or AP screw fixation, so does the post traumatic osteoarthritis.

References

1. Daly PJ, Fitzgerald RH Jr, Melton LJ, Ilstrup DM. Epidemiology of ankle fractures in Rochester, Minnesota. Acta Orthop Scand. 1987;58:539–44.
2. Court-Brown CM, McBirnie J, Wilson G. Adult ankle fractures–an increasing problem? Acta Orthop Scand. 1998; 69(1): 43–47
3. Hai-lin XU, Li-min LIU, Bao-guo JIANG et al. Multicenter follow-up study of ankle

fracture surgery. Chinese Medical Journal. 2012; 125(4):574–578
4. Hartford JM, Gorczyca JT, McNamara JL, Mayor MB. Tibiotalar contact area. Contribution of posterior malleolus and deltoid ligament. Clin Orthop Relat Res. 1995;320: 182-187
5. Macko VW, Matthews LS, Zwirkoski P, Goldstein SA. The joint-contact area of the ankle. The contribution of the posterior malleolus. J Bone Joint Surg Am. 1991; 73(3):347-351
6. Raasch WG, Larkin JJ, Draganich LF. Assessment of the posterior malleolus as a restraint to posterior subluxation of the ankle. J Bone Joint Surg Am. 1992; 74(8): 1201-1206
7. Scheidt KB, Stiehl JB, Skrade DA, Barnhardt T. Posterior malleolar ankle fractures: an in vitro biomechanical analysis of stability in the loaded and unloaded states. J Orthop Trauma. 1992; 6(1):96-101.
8. Talbot M1, Steenblock TR, Cole PA. Posterolateral approach for open reduction and internal fixation of trimalleolar ankle fractures Can J Surg. 2005 Dec; 48(6):487-90
9. Tornetta P 3rd, Ricci W, Nork S, et al. The posterolateral approach to the tibia for displaced posterior malleolar injuries. J Orthop Trauma. 2011 Feb;25(2):123-6.
10. Holt E.S. Arthroscopic Visualization of the Tibial Plafond during Posterior Malleolar Fracture Fixation. Foot and Ankle International, 1994; 15: 206-208.
11. Weber M. Trimalleolar Fractures with Impaction of the Posteromedial Tibial Plafond: Implications for Talar Stability. Foot and Ankle International, 2004; 25: 716-727
12. Gardner, M.J., Streubel, P.N., McCormick, J.J., Klein, S.E., Johnson, J.E. and Ricci, W.M. (2011) Surgeon Practices Regarding Operative Treatment of Posterior Malleolus Fractures. Foot and Ankle International, 2011; 32: 385-393.
13. Harper, M.C. and Hardin, G. Posterior Malleolar Fractures of the Ankle Associated with External Rotation-Abduction Injuries. Results with and without Internal Fixation. The Journal of Bone and Joint Surgery, 1988; 70:1348-1356
14. Langenhuijsen J.F., Heetveld M.J., Ultee, J.M., Steller E.P. and Butzelaar, R.M.n Results of Ankle Fractures with Involvement of the Posterior Tibial Margin. Journal of Trauma and Acute Care Surgery, 2002; 53: 55-60.
15. Haraguchi N., Haruyama H., Toga H. and Kato,F. Pathoanatomy of Posterior Malleolar Fractures of the Ankle. The Journal of Bone and Joint Surgery, 2006; 88: 1085-1092
16. Miller AN, Carroll EA, Parker RJ, Helfet DL, Lorich DG. Posterior malleolar stabilization of syndesmotic injuries is equivalent to screw fixation. Clin Orthop Relat Res. 2010 Apr;468(4):1129-35.
17. O'Connor TJ, Mueller B, Ly TV, et al. "A to P" screw versus posterolateral plate for posterior malleolus fixation in trimalleolar fractures. J Orthop Trauma. 2015 Apr; 29(4):151-6
18. Fitzpatrick DC, Otto JK, McKinley TO, Marsh JL, Brown TD. Kinematic and contact stress analysis of posterior malleolus fractures of the ankle. J Orthop Trauma. 2004 May-Jun;18(5):271-8.