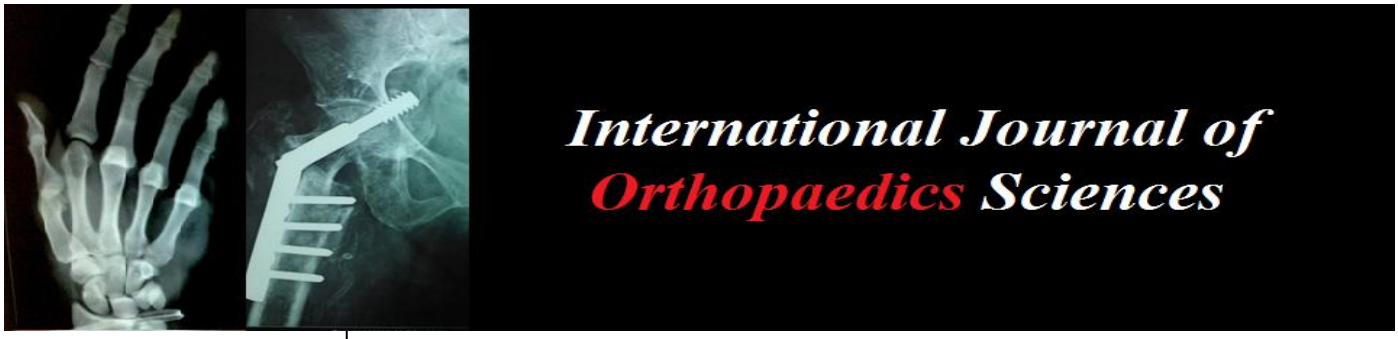

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Functional outcome of postero-lateral approach for fixation of posterior malleolus fracture in case of trimalleolar fractures of ankle: A study of 32 cases

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Abstract
Introduction: Trimalleolar fracture fixation has undergone a sea change in the recent times. Posterior malleolus component used to be fixed by anteroposterior approach which has not been optimum as far as results are concerned. Posterolateral approach has been well described in literature but very few are using it. This study has tried to evaluate the results of this approach.
Methods: Total 32 patients were included in this study. They underwent posterolateral approach and fixation of fibular fracture and posterior malleolus fracture in prone position . Medial malleolus fracture was fixed in supine position. Posterior malleolus was classified based on Haraguchi classification on CT scan. Final evaluation was done using Olerud and Molander scoring system.
Results: All fractures united within three months duration. Excellent results were seen in 40.6%, Good in 43.8%, Fair in 9.4% and Poor in 6.2% cases. Most of the patients could return to pre-injury work levels by six months.
Conclusion: Direct posterolateral approach allows fixation of fibula and anatomical restoration of ankle joint congruity and syndesmotic stability also, obviating the need of syndesmotic screw. Posterior malleolus fixation is essential in tri-malleolar fractures for good functional outcome.

Keywords: posterior malleolus, syndesmosis, tri-malleolar

1. Introduction
Ankle fractures account for a significant portion of all orthopaedic emergencies all over the world [1]. Tri-malleolar fractures have a reported incidence of 7% to 14% of all ankle fractures [1 2]. These fractures have bad prognosis compared to bimalleolar fractures [3]. These fractures are often associated with disruption of distal tibio-fibular syndesmosis. Earlier concept of fixation of posterior malleolus was based on the size, that is if it was more than 25% it should be fixed. This was based on lateral radiograph of ankle. It has now been amply documented that plain radiographic analysis is a poor method of determining the site, size and extent of displacement of posterior malleous fracture [4, 5]. With better imaging techniques and advances in study of ankle biomechanics, importance of posterior syndesmotic stability and fibular notch congruence has been better studied, documented and accepted [6, 7]. Management of posterior malleous fracture has been a topic of debate in recent times. Proponents of ORIF have proposed to fix the posterior malleolar fragment irrespective of its size. Recent studies have shown that irrespective of the size of posterior malleolus, fixation by ORIF has better syndesmotic stability and better functional outcome [8]. However one study has shown no difference between the groups in which the posterior malleolus was internally fixed and other group in which it was not fixed [6, 9]. There is difference of opinion as some surgeons routinely fix all posterior malleolus fractures and some surgeons feel that if fibula is fixed anatomically then fixing the posterior malleolar fragment is not essential [10]. There is further difference of opinion as regards to the approach to this fracture. Antero-posterior fixation by percutaneous technique has been practiced by many. However it has several disadvantages as compared to direct posterior approach [11, 12]. Posterolateral approach has been well described but still not widely put into practice by many orthopaedic surgeons for these fractures [13, 14]. In this study we have tried to evaluate the clinical and functional outcome of posterior malleolus fractures treated by postero-lateral approach.

Materials and Methods

This study was conducted at GMERS, GOTRI MEDICAL COLLEGE, VADODARA from Jan-2014 to Dec-2020. A total of 40 patents with tri-malleolar fractures who had undergone ORIF were initially enrolled in the study. Out of these 08 patients were lost to followup and 32 cases could be followed up till their final outcome evaluation. All cases were selected after careful inclusion and exclusion criteria.

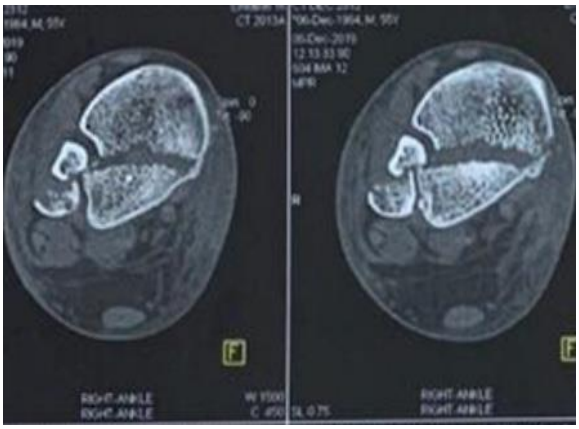
Inclusion Criteria: Age between 18 to 70 years. Radiological documentation of Tri-malleolar fracture. Patient willing for surgery. Medically fit patient.

Exclusion Criteria: Bilateral lower limb inury. Open fractures. Other systemic or skeletal injury. Patient refusing surgical management.

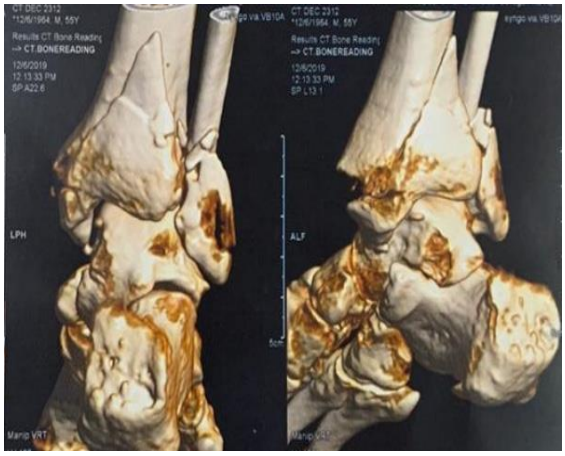
All patients were initially evaluated on outdoor basis or in emergency setup. Thorough clinical examination was done to rule out other associated systemic or skeletal injury. Radiological assessment was done in form of standard AP and Lateral view of ankle joint. If ankle was subluxated or dislocated it was reduced as emergency procedure and then immobilized in below knee slab. Three dimensional computed tomogram was done to have better understanding of fracture pattern. The fracture was subsequently classified based on Haraguchi *et al* classification [15] Primary treatment in form of rest, elevation and analgesics was given and pre-operative evaluation and assessment was done for fitness of patient for surgery. All patients were operated under spinal anaesthesia using a tourniquet. First prone position was given and standard posterolateral approach was taken. Sural nerve was identified and safely retracted. As a first step fibula fracture was anatomically reduced to regain fibular length and fixed with anatomical plate or semitubular plate under fluoroscopic control. Through the same approach posterior malleolar fragment was reduced anatomically and held with wires and fixation confirmed under fluoroscopy. It was then fixed using T-Buttress plate. Wound lavage was done and the incision was closed in layers. Patient was then turned to supine position and then medial malleolus fixation was done by either tension band wiring or cannulated cancellous screws and the incision was closed and sterile dressing applied. Post-fixation x-rays were taken for record purpose. Limb elevation was done in post operative phase and gentle ankle mobilization exercises were started as per pain tolerance of patient. Stitch removal was done around 14th day and additional below knee splint was given for four weeks. Patient was evaluated at 6 weeks, 12 weeks and 24 weeks. Partial weight bearing was started at 6 to 8 weeks time. Final assessment was done at six months by using the OLERUD and MOLANDER scoring system [16].

Pre-operative x-ray.

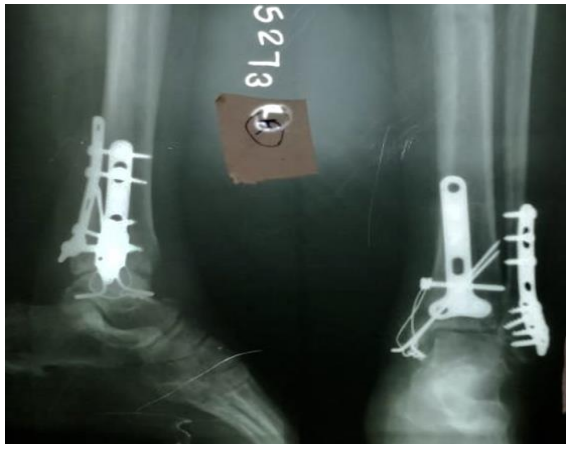
Axial CT scan.



Sagittal cut section.



3-D CT – scan image.



Post-operative x-ray.

Parameter	Degree	Score
Pain	None	25
	While walking on uneven surface	20
	While walking on surface outdoors	10
	While walking indoors constant and severe	5
Stiffness	None	10
	Stiffness	0
Swelling	None	10
	Only in evenings	5
	Constant	0
Stair climbing	No problems	10
	Impaired	5
	Impossible	0
Running	Possible	5
	Impossible	0
Jumping	Possible	5
	Impossible	0
Squatting	No Problems	5
	Impossible	0
Supports	None	10
	Taping, Wrapping	5
	Stick or Crutch	0
Work, Activities of daily life	Same as before injury	20
	Loss of Tempo	15
	Change to simpler job	15
	Severely impaired work capacity	0

Olerud and Molander scoring system

Results

A total of 32 patients were included in the study with 26 males and 06 females. Mean age of occurance was 41 years with a range of 19 to 65 years. Twisting injury to the ankle was the most common mechanism of injury in all cases. Side of injury was 16 each on left and right side. Average duration of admission to operation interval was 6 days with a range of 2 to 12 days. Average duration of hospital stay was 10 days with a range of 4 to 16 days. Based on Haraguchi classification there were 23 cases of type I fracture and 09 cases of type II fracture of posterior malleolus. All the fractures united by around three months time. Weight bearing was started by most of the patients within 6-8 weeks. Superficial wound infection was seen in only 1 case with a incidence of 3%. There was no incidence of deep infection. Metal irritation was seen in 6 patients that too on medial malleolus side and they underwent implant removal. However none of them had any complaint on lateral or posterior side. There was no incidence of nerve injury in our series. Functional range of motion was achieved in all the cases. Incidence of ankle stiffness and arthritic changes was seen in 2 patients. Based on OLERUD and MOLANDER scoring system we had Excellent results in 40.6%, Good results in 43.8%, Fair results in 9.4% and Poor results in 6.2% cases.

	TypeI	Type II	Total	Percent
Excellent	08	05	13	40.6%
Good	11	03	14	43.8%
Fair	02	01	03	9.4%
Poor	02	00	02	6.2%

Discussion

Two to three decades back the approach to ankle fractures was very limited. Lot of importance was given to restoration of medial and lateral pillar of ankle joint. Most surgeons used to follow the earlier criteria based on fragment size, that is if it was more than 25 percent it needed fixation or else it could be treated conservatively. De Vries *et al* in their study could not find any statistical difference in the outcome with regards to the size of posterior malleolus and to the type of fixation [17]. Advances in imaging techniques and various biomechanical studies have changed the approach towards fixation of posterior malleolus fractures. Cadaveric studies have shown that ORIF of posterior fragment provides greater stability compared to syndesmotic screw fixation [6]. Biomechanical studies have shown that accurate reduction and fixation of posterior malleolus restores nearly 50% of total strength of syndesmosis. Old conventional teaching says that AP screw fixation of posterior malleolus is a good option [18, 19, 10]. However this approach has limited preference because accurate reduction and hold of the fracture fragment is usually difficult. Also these fracture pattern are subjected to large vertical shear forces during loading. Hence these cannot be adequately fixed with AP screws alone. [12, 13, 20]. This often results in loss of reduction resulting in eventual ankle arthritis. Although posterolateral approach has been described almost two decades back, it has still not become universally accepted [21]. This approach provides direct visualization of the fracture fragment which is helpful in better articular congruity restoration and stability of syndesmosis is also possible. The same approach can be used to fix fibula fracture also. Biomechanical studies have proved advantages of posterior plating of fibula versus lateral plating [22]. Shi *et al* have reported superior functional outcome by direct approach of posterior malleolus fracture [23]. Verhage *et al* found the posterolateral approach for fixation of posterior malleolus fracture to be better in terms of articular reduction [24]. Li *et al* have shown better syndesmotic stability after posterolateral approach and fixation as compared to antero-posterior screw fixation [25]. O' Connor *et al* also concluded that posterolateral approach and fixation of posterior malleolus had better outcome than those treated by AP screw fixation [12].

Milton *et al* had an overall infection rate of 4.4%. They had an implant removal incidence of 7% due to hardware irritation [26]. There was 3% incidence of superficial wound infection in our study which eventually healed with antibiotics and dressing.

Conclusion
Restoration of fibular length in Trimalleolar fractures is of paramount importance and a key corner-stone for good functional outcome. Fixation of posterior malleolus under direct vision by antiglide plate is essential for restoration of articular congruity and prevention of late ankle stiffness and arthritis. Both these goals are very well achieved by the posterolateral approach and hence this approach is highly recommended for all orthopaedic surgeons while treating Trimalleolar fractures of ankle.

Limitation of Study
The sample size in the study was small hence large sample size is needed to further reinforce our findings.

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This study has not been funded by any government or non-government organization.

Conflict of Interest
The authors have no conflict of interest to declare.

Ethics Approval
Was not required.

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Reference
1. Court-Brown CM, McBirnie J, Wilson G. Adult ankle fractures - An increasing problem? Acta Orthop Scand. 1998;69(1):43-7.
2. Koval KJ, Lurie J, Zhou W, Sparks MB, Cantu RV, Sporer SM *et al*. Ankle fractures in the elderly: What you get depends on where you live and who you see. J Orthop Trauma. 2005;19(9):635-9.
3. Varma R, Rai SK, Wani SS, Chaudhary A. Evaluation of the role of posterior malleolus fixation in trimalleolar ankle fractures: a prospective study. Int J Res Orthop. 2017;3(3):512.
4. Büchler L, Tannast M, Bonel HM, Weber M. Reliability of radiologic assessment of the fracture anatomy at the posterior tibial plafond in malleolar fractures. J Orthop Trauma. 2009;23(3):208-12.
5. Meijer DT, Doornberg JN, Sierevelt IN, Mallee WH, Van Dijk CN, Kerkhoffs GM, *et al*. Guesstimation of posterior malleolar fractures on lateral plain radiographs. Injury. 2015;46(10):2024-9.
6. Gardner MJ, Brodsky A, Briggs SM, Nielson JH, Lorich DG. Fixation of posterior malleolar fractures provides greater syndesmotic stability. Clin Orthop Relat Res. 2006;(447):165-71.
7. 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;468(4):1129-35.
8. Baumbach SF, Böcker W, Polzer H. [Open reduction and internal fixation of posterior malleolus fractures]. Oper Orthop Traumatol 2021;33(2):112-24.
9. Harper MC, Hardin G. Posterior malleolar fractures of the ankle associated with external rotation-abduction injuries. Results with and without internal fixation. J Bone Joint Surg Am [Internet]. 1988;70(9):1348-1356. Available from: http://europepmc.org/abstract/MED/3141426
10. Heim UF. Trimalleolar fractures: late results after fixation of the posterior fragment. Orthopedics [Internet]. 1989;12(8):1053-1059. Available from: http://europepmc.org/abstract/MED/2771825
11. Huber M, Stutz PM, Gerber C. Open reduction and internal fixation of the posterior malleolus with a posterior antiglide plate using a postero-lateral approach-a preliminary report. Foot Ankle Surg 1996;2(2):95-103.
12. O'Connor TJ, Mueller B, Ly TV, Jacobson AR, Nelson ER, Cole PA. "A to P" screw versus posterolateral plate for posterior malleolus fixation in trimalleolar ankle fractures. J Orthop Trauma. 2015;29(4):e151-6.
13. Talbot M, Steenblock TR, Cole PA. Surgical technique: Posterolateral approach for open reduction and internal fixation of trimalleolar ankle fractures. Can J Surg. 2005;48(6):487-90.
14. Gardner MJ, Streubel PN, McCormick JJ, Klein SE, Johnson JE, Ricci WM. Surgeon practices regarding operative treatment of posterior malleolus fractures. Foot Ankle Int. 2011;32(4):385-93.
15. Haraguchi N, Haruyama H, Toga H, Kato F. Pathoanatomy of posterior malleolar fractures of the ankle. J Bone Jt Surg - Ser A 2006;88(5):1085-92.
16. Olerud C, Molander H. A scoring scale for symptom evaluation after ankle fracture. Arch Orthop Trauma Surg. 1984;103(3):190-4.
17. De Vries JS, Wijgman AJ, Sierevelt IN, Schaap GR. Long-term results of ankle fractures with a posterior malleolar fragment. J Foot Ankle Surg. 2005;44(3):211-7.
18. Weber BG. Die Verletzungen des oberen Sprunggelenkes. Bern: Huber 1972.
19. Charnley J. Technique of Internal Fixation of Fractures. By M. E. Müller, M. Allgöwer and H. Willenegger. With contributions by W. Bandi, H. R. Bloch, A. Mumenthaler, R. Schneider, S. Steinemann, F. Straumann and B. G. Weber. Revised for the English edition by G. Seg. J Bone Joint Surg Br [Internet]. 1966;48-B(1):200-1. Available from: https://doi.org/10.1302/0301-620X.48B1.200
20. Van Hooff CCD, Verhage SM, Hoogendoorn JM. Influence of fragment size and postoperative joint congruency on long-term outcome of posterior malleolar fractures. Foot Ankle Int. 2015;36(6):673-8.
21. Bois AJ, Dust W. Posterior fracture dislocation of the ankle: Technique and clinical experience using a posteromedial surgical approach. J Orthop Trauma. 2008;22(9):629-36.
22. Schaffer JJ, Manoli A, The antiglide plate for distal fibular fixation. A biomechanical comparison with fixation with a lateral plate. J Bone Joint Surg Am 1987;69(4):596-604.
23. Phillips WA, Schwartz HS, Keller CS, Woodward HR, Rudd WS, Spiegel PG *et al*. A prospective, randomized study of the management of severe ankle fractures. J Bone Joint Surg Am 1985;67(1):67-78.
24. Verhage SM, Boot F, Schipper IB, Hoogendoorn JM. Open reduction and internal fixation of posterior

malleolar fractures using the posterolateral approach. Bone Jt J 2016;98-B(6):812-7.
25. Li M, Collier RC, Hill BW, Slinkard N, Ly TV. Comparing Different Surgical Techniques for Addressing the Posterior Malleolus in Supination External Rotation Ankle Fractures and the Need for Syndesmotic Screw Fixation. J Foot Ankle Surg [Internet] 2017;56(4):730-4. Available from: http://dx.doi.org/10.1053/j.jfas.2017.01.053
26. Little MTM, Berkes MB, Lazaro LE, Sculco PK, Helfet DL, Lorich DG. Complications following treatment of supination external rotation ankle fractures through the posterolateral approach. Foot Ankle Int 2013;34(4):523-9.