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RESEARCH ARTICLE

TRIMALLEOLAR FRACTURES :- FRAGMENT SPECIFIC FIXATION AND IT'S FUNCTIONAL OUTCOMES

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Abstract

Trimalleolar fractures are disabling injuries if not managed properly. Clinical and functional outcomes of trimalleolar fracture are worse as compared to bimalleolar fractures not involving the posterior malleolus. Various surgical approaches and techniques to reduce and fix these fractures described in the literature. In this case study of 11 patients with trimalleolar fractures, a posterolateral approach was used for fixation of posterior malleolus as well as lateral malleolus in all the cases. A preoperative CT scan was done in all the cases. The Olerud and Molendar scoring system was used to assess the functional outcome. The average age of patients was 52.6 years. The most common mode of sustaining injury was twisting of the ankle joint (n = 7). The average time to union and full weight-bearing was 12 weeks (range 10–14 weeks). An excellent functional outcome in 6 patients and a good outcome in 5 patients were obtained at the end of 12 months of follow-up. No significant complications were encountered. The posterolateral approach provides good exposure to fix both posterior and lateral malleolus via single incision. Stable fixation of posterior malleolus plays a vital role in obtaining good clinical and functional outcomes.

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Introduction:-

Ankle fractures constitute a major proportion of injuries received at orthopedic emergencies all over the world.¹ The incidence of trimalleolar fractures is comparatively less, but these are disabling injuries if not managed appropriately. It is well described in the literature that ankle fractures involving posterior malleolar component tend to do clinically and functionally worse as compared to other ankle fractures.² Traditionally, it has been the size (25%) and displacement (>2mm) of the posterior malleolar fragment, which has been the deciding factor for fixation of these fractures. Recent studies have stated that anatomical reduction and fixation of the posterior malleolus should be carried out in all cases of trimalleolar fracture irrespective of its size and type to obtain a good clinical and functional outcome.³ In our study, we conducted a preoperative CT scan in all our cases to better understand the fracture configuration, plan our fixation and to rule out any other bony injury. Various techniques and approaches have been described to fix the posterior malleolar fracture. After anatomical reduction and fixation of the lateral malleolus, the posterior malleolus usually reduces by itself in the majority of the acute cases. A lot of surgeons fix these via percutaneous AP screws but this has various disadvantages associated with it as compared to buttress or

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anti-glide plate method.⁴⁻⁶To fix posterior malleolus with buttress or anti-glide plate, the posterolateral approach has been well described in the literature through this same approach lateral malleolus can be fixed.^{7,8} Studies utilizing this approach to fix such fractures are few in number.^{6,7,9-11}

Material and Methods:-

In this case series, 11 adult patients with closed trimalleolar fractures received and managed at our institute from January 2019 to August 2020 were included. Patients with open fractures or other associated fractures in the body elsewhere were excluded. Patients with pre-existing pathology in ankle, hip or knee were excluded.

Initial management was done in the orthopaedic emergency area, according to ATLS protocols. After patient cleared with isolated ankle injuries without any complication or neuro-vascular injuries, standard AP, lateral and mortise radiographs of ankle were obtained. Patients with gross ankle dislocation were attempted to be reduced in the emergency. A below-knee splint or plaster slab (with slit on anterior aspect of slab for ice packs) was applied to immobilize the joint and analgesics were instituted. The limb was kept elevated and ice packs were applied to prevent excessive swelling. After routine blood investigations and PAC, patients were posted for surgery. An ankle CT scan was conducted in all cases with posterior malleolus fractures as part of the preoperative planning. Intravenous 1.5g cefuroxime was administered 30 min prior to skin incision in the operating room after prior antibiotic sensitivity testing.

Surgical technique:-

After the induction of appropriate anaesthesia, the patient in prone position on a radiolucent operating table. All bony prominences were well padded. The knees were slightly flexed by positioning a bolster underneath the ankles or the ankles were hanged over the edge of table to obtain proper dorsiflexion for fracture reduction. Pneumatic tourniquet was applied to identify and isolate the sural nerve and lesser saphenous vein away from the surgical field. A posterolateral approach was used by making an incision midway between the medial border of the fibula and the lateral border of tendoachilles. The sural nerve courses from medial to lateral part at a point 7 cm proximal to the tip of the lateral malleolus, the nerve is on an average 26 mm posterior to the edge of the fibula.¹² The peroneal longus and brevis tendons were retracted further laterally and anteriorly to expose the fibula. The fibular fixation was carried out first. Anatomical reduction of the lateral malleolus usually made the ankle stable and posterior malleolus reduced by itself in most of the cases or reduces easily with dorsiflexion of the ankle due to ligamentotaxis by PITFL. The posterior malleolus was anatomically reduced and rigidly fixed with 3.5mm or 1/3rd tubular plates in buttress or anti-glide method with at least 2 screws in the proximal part and with or without screw in distal part via same incision between peroneal tendons laterally and flexor hallucis longus medially. Ankle stability was checked via posterior drawer test. Syndesmosis stability checked via cotton test. After thorough wound wash and haemostasis, wound was closed in layers without any drain. The medial malleolus was fixed in supine position via anteromedial approach and fixed with two 4.0mm CCS after incising the periosteum stuck in between the fracture fragments. Wound closed in layers after thorough wound wash. ASD and below knee plaster slab was applied for 2 weeks till removal of stitches. Strict non weight bearing was advised for 10 weeks, partial weight bearing for next 2 weeks and full weight bearing after 12 weeks of surgery was encouraged. Passive ROM exercises were initiated 2 weeks after surgery and gradually increased.

Ankle score, according to Olerud and Molander (Table-1) 12 months of follow-up were documented in all cases.¹³

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

Table1:- Olerud and Molander ankle score.

Results:-

11 adult patients with an average age of 52.6 years (range 24–65) were followed up prospectively in our case study, of which seven were males and four females. The most common mode of sustaining injury was twisting of the ankle joint (n = 7). The average duration of surgery was 100 min. The average blood loss recorded intraoperatively was 110 ml. The average time to union and full weight-bearing was 12 weeks (range 10–14 weeks). The average percentage of the restoration of ROM as compared to the contralateral ankle at the time of union was 90.2% of dorsiflexion, 94% of plantar flexion, 88% of inversion, and 87% of eversion. An excellent outcome in six patients and a good outcome in the five patients at the end of 12 months follow-up were concluded according to the Olerud and Molander scoring system (Table 1). One patient developed superficial infection managed with antibiotics and dressings only. Rest of the patients showed no complications related to soft tissue healing, pain, or hardware impingement.

Discussion:-

Ankle fractures involving the posterior malleolus are usually the result of a supination-external rotation or a pronation-external rotation form of injury. In majority of our cases, it was Weber B or Lauge-Hansen supination-external rotation injury. According to the bio-mechanics, the posterior malleolus fragment is an avulsion fracture and it constitutes stage 3 of the injury pattern to the ankle ring after involving the rupture of the anterior tibiofibular ligament (stage 1) and an oblique fracture of the distal fibula (stage 2). The rupture of the medial collateral ligament or medial malleolus fracture (stage 4).

Traditionally, small posterior malleolus fractures (>25% in size) have been treated conservatively.¹⁴ Fixation, if involvement is more than one-third of the distal articular surface (33%), has been the norm for long.¹⁵ Cadaveric and biomechanical studies are inconclusive to find the posterior malleolar fragment size requiring fixation.^{19,20} In this study, we tried to anatomically reduce and fix the posterior malleolus fragment in all the cases. This method is well supported in the recent literature too.^{3,18}

For long, only AP view, lateral view and mortise view ankle X-rays (Fig.2) had been the used to diagnose and subsequently follow-up these cases. An ankle CT scan formed an essential component of our preoperative assessment. Fracture anatomy, configuration, articular step-offs, osteochondral fragments (Fig.3), and fracture apexes were all studied. The sagittal, coronal, and axial cuts helped us in a better understanding of the same.^{19,20}

In certain studies, all fixations have been performed in prone position itself but a certain amount of difficulty in fixing medial malleolus, with improper fixations and injury to sural nerve has also been reported.⁴

Good clinical and functional outcome was reported in all our eleven cases. The posterior malleolus fixation by buttress plates and anti-glide plates from posterior to anterior direction played a significant role in obtaining good outcomes. Ankle joint being a weight-bearing axially loaded joint demands rigid fixation for early weight-bearing. Stable fixation of posterior malleolus by plates also has the advantage of making the syndesmosis extremely stable. A study compares patients with trimalleolar ankle fractures in whom the posterior malleolus was fixed with posterolateral buttress plating and had superior clinical outcomes at follow-up compared with those treated with AP screws.⁶

Conclusion:-

Adequate preoperative planning, imaging including CT scan, proper understanding of biomechanics of ankle injuries, meticulous surgical technique and stable fixation of all the three segments warrants good clinical and functional outcomes.



Fig.2:- AP, lateral and mortise radiographic views of ankle joint showing trimalleolar fracture.



Fig.3:- CT scan showing posterior malleolus fragment and its displacement.



Fig.4:- AP, lateral and mortise radiographs of ankle on 1st post op. day.



Fig.5:- Radiograph showing fracture union at 12 weeks after surgery.



Fig.6:- Radiograph of another patient showin fixation with same method.

References:-

1. Court-Brown, CM, McBirnie, J, Wilson, G. Adult ankle fractures—an increasing problem? *Acta OrthopScand* 1998; 69: 43–47. [Google Scholar](#) | [Crossref](#) | [Medline](#)
2. Jaskulka, RA, Ittner, G, Schedl, R. Fractures of the posterior tibial margin: their role in the prognosis of malleolar fractures. *J Trauma* 1989; 29: 1565–1570. [Google Scholar](#) | [Crossref](#) | [Medline](#)
3. Qi, L, Zeng, B, Luo, C. A better approach yields a better result: comparison of two different surgical procedures for bi- and trimalleolar fractures with posterior fragments. *Int J Clin Exp Med* 2016; 9(9): 18227–18232. [Google Scholar](#)
4. Huber, M, Stutz, P, 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: 95–103. [Google Scholar](#) | [Crossref](#)
5. Drijfhout van Hooff, CC, 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: 673–678. [Google Scholar](#) | [SAGE Journals](#) | [ISI](#)
6. O'Connor, TJ, Mueller, B, Ly, TV. “A to P” screw versus posterolateral plate for posterior malleolus fixation in trimalleolar ankle fractures. *J Orthop Trauma* 2015; 29(4): e151–e156. [Google Scholar](#) | [Crossref](#) | [Medline](#) | [ISI](#)
7. Talbot, M, Steenblock, TR, Cole, PA. Posterolateral approach for open reduction and internal fixation of trimalleolar ankle fractures. *Can J Surg* 2005; 48: 487–490. [Google Scholar](#) | [Medline](#) | [ISI](#)
8. Gardner, MJ, Streubel, PN, McCormick, JJ. Surgeon practices regarding operative treatment of posterior malleolus fractures. *Foot Ankle Int* 2011; 32: 385–393. [Google Scholar](#) | [SAGE Journals](#) | [ISI](#)
9. Tornetta, P, Ricci, W, Nork, S. The posterolateral approach to the tibia for displaced posterior malleolar injuries. *J Orthop Trauma* 2011; 25: 123–126. [Google Scholar](#) | [Crossref](#) | [Medline](#) | [ISI](#)
10. Forberger, J, Sabandal, PV, Dietrich, M. Posterolateral approach to the displaced posterior malleolus: functional outcome and local morbidity. *Foot Ankle Int* 2009; 30: 309–314. [Google Scholar](#) | [SAGE Journals](#) | [ISI](#). Court-Brown, CM, McBirnie, J, Wilson, G. Adult ankle fractures—an increasing problem? *Acta OrthopScand* 1998; 69: 43–47. [Google Scholar](#) | [Crossref](#) | [Medline](#)
11. Jaskulka, RA, Ittner, G, Schedl, R. Fractures of the posterior tibial margin: their role in the prognosis of malleolar fractures. *J Trauma* 1989; 29: 1565–1570. [Google Scholar](#) | [Crossref](#) | [Medline](#)
12. Qi, L, Zeng, B, Luo, C. A better approach yields a better result: comparison of two different surgical procedures for bi- and trimalleolar fractures with posterior fragments. *Int J Clin Exp Med* 2016; 9(9): 18227–18232. [Google Scholar](#)
13. Huber, M, Stutz, P, 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: 95–103. [Google Scholar](#) | [Crossref](#)
14. Drijfhout van Hooff, CC, 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: 673–678. [Google Scholar](#) | [SAGE Journals](#) | [ISI](#)
15. O'Connor, TJ, Mueller, B, Ly, TV. “A to P” screw versus posterolateral plate for posterior malleolus fixation in trimalleolar ankle fractures. *J Orthop Trauma* 2015; 29(4): e151–e156. [Google Scholar](#) | [Crossref](#) | [Medline](#) | [ISI](#)
16. Talbot, M, Steenblock, TR, Cole, PA. Posterolateral approach for open reduction and internal fixation of trimalleolar ankle fractures. *Can J Surg* 2005; 48: 487–490. [Google Scholar](#) | [Medline](#) | [ISI](#)
17. Gardner, MJ, Streubel, PN, McCormick, JJ. Surgeon practices regarding operative treatment of posterior malleolus fractures. *Foot Ankle Int* 2011; 32: 385–393. [Google Scholar](#) | [SAGE Journals](#) | [ISI](#)
18. Tornetta, P, Ricci, W, Nork, S. The posterolateral approach to the tibia for displaced posterior malleolar injuries. *J Orthop Trauma* 2011; 25: 123–126. [Google Scholar](#) | [Crossref](#) | [Medline](#) | [ISI](#)
19. Forberger, J, Sabandal, PV, Dietrich, M. Posterolateral approach to the displaced posterior malleolus: functional outcome and local morbidity. *Foot Ankle Int* 2009; 30: 309–314. [Google Scholar](#) | [SAGE Journals](#) | [ISI](#).