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Case Series

Prospective study of outcome of trimalleolar ankle fractures

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ABSTRACT

Trimalleolar fracture are complex and challenging to treat. We conducted a study on 15 patients with trimalleolar fracture. Fractures were classified based on Lauge Hansen classification. They were treated with open reduction and internal fixation (ORIF) with plate and screws for posterior malleolus and lateral malleolus, tension band wire (TBW)/cannulated cancellous (CC) screw for medial malleolus functional and radiological outcomes were assessed by Olerud and Molender score and Kristenson's criteria respectively. Functional outcome was satisfactory in 93% of cases and radiological outcome in 86%. Early treatment without delay, anatomical reduction of fracture with stable fixation of every fracture component, stringent post operative mobilization should help to improve outcome in operated trimalleolar fracture patients.

Keywords: Trimalleolar fracture, Olerud and Molender score, Kristenson's criteria, Posterior malleolar fixation

INTRODUCTION

Ankle is one of the most commonly injured joint among the lower limb trauma. As with all intraarticular fractures trimalleolar fractures also require anatomical reduction and stable internal fixation. Posterior malleolus fractures are involved in 7-44% of rotational ankle fractures.[1] Surgical fixation has been the recommended course of treatment in fractures affecting more than 25% of the articular.[2,3] Ankle fractures are widely classified based on Lauge Hansen and Danis Weber classification system. The clinical significance of posterior malleolar (PM) fracture morphology and pattern however has not yet been determined.[3]

The posterior inferior tibiofibular ligament (PITFL) may tear as a result of the ankle fracture's typical rotational injury mechanism or it may avulse the posterior malleolar fragment. Research has shown the value of even minor posterior malleolar fragments for ankle stability and surgical indications have increased. Typically buttress plates are used in a posterolateral (PL) approach to fix posterior malleolar fragments or percutaneous anterior to posterior (AP) screws. Fixation with AP screws requires ligamentotaxis of the posterior inferior tibiofibular ligament and reduction of the fibula along with reduction of the posterior malleolus whereas fixation with a posterolateral approach allows direct reduction of the fracture fragment. The majority of AO type B injuries are treated with buttress plating rather than screw fixation. We believed that posterolateral buttress plating may have advantages over percutaneous AP screw fixation. Studies have shown that ankle fractures involving the posterior malleolus have worse outcomes than ankle fractures without posterior malleolar involvement. Purpose of the study is to assess the functional and radiological outcome along with results of trimalleolar fracture treated by different method such as TBW/CC screw fixation for medial malleolus and ORIF with plate and screws for lateral malleolus and posterior malleolus fracture to obtain stable ankle joint.

CASE SERIES

This is prospective study performed in our tertiary centre between 2020 September and May 2022. 15 patients with rotational type of ankle fracture with concomitant posterior malleolus fracture were considered and confirmed with radiographic evaluation. Study group of 15 patients included 9 male and 6 female patients. Inclusion criteria 18 years and older with closed rotational type of ankle fracture with posterior malleolus fracture. Exclusion criteria were polytrauma patients associated with distal tibial pilon fracture and open fractures.

Patient in lateral position, posterior-lateral approach gives direct access to posterior malleolar fragment between achilles tendon and fibula. Make 10-15 cm longitudinal incision between fibula and achilles tendon. Skin and subcutaneous tissue to be dissected care to be taken not to damage sural nerve. Peroneal muscles to be retracted laterally which exposes the Volkmann fragment. Reduction of fragment anatomically and articular step off should be reduced precisely and supported with buttress plate and screws. Once the fragment has been fixed peroneal muscles to be retracted medially to expose fibula with lateral malleolus fracture, plated through the same incision and allow peroneal muscles to return to its normal anatomical position covering the plate. Deep fascia along with subcutaneous tissue and skin was closed. Medial malleoli fractures are fixed last with CC screw/tension band wiring.

Figure 1: Patient in lateral position and posterolateral incision.

Postoperative period and follow up

The duration of stay in hospital was 5 days. Patient were put in slab for 3 weeks. Suture removal was done after 15 days. Range of motion exercises were started with non-weight bearing mobilization. Partial weight bearing was started at 6 weeks and full weight bearing by 12 weeks. Patients were called for follow up at 2 weeks, 6 weeks, 3 months, 6 months and 12 months post operatively follow up assessment was done with help of Olerud and Molendar scoring system for functional assessment and Kristenson's criteria for radiological outcome.

Results

Majority of our patients had good and excellent functional outcomes and were able to return to their activities as similar to Hong et al.[10] Almost all the fractures united in 13 weeks with range between 11-20 weeks. Delayed union seen in 2 of our patients. Functionally excellent outcome was seen in 5 patients followed by 6 patients had good outcome, fair in 3 patients and poor in 1 patient. Kristenson's criteria were used to assess the radiographic outcome. Radiological outcomes were similar to Khandelwal et al with poor outcome in 2 patients.[11] Ankle range of movements was regained in all patients except two. Complications such as superficial infection was noted in 2 out of 15 patients which corelated with fact of delayed union. Infection was treated with intravenous antibiotics. One patient developed post operative stiffness which was managed by physiotherapy.

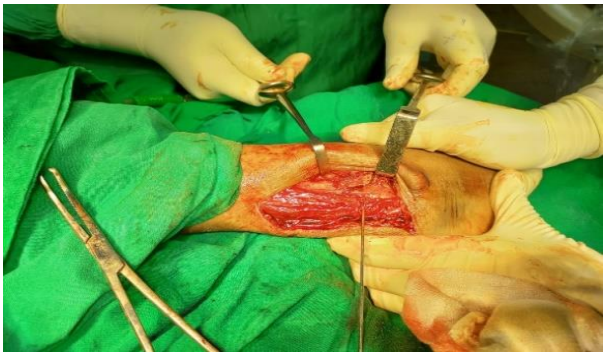

Figure 2: Exposure of posterior and lateral malleolus fracture component.

Table 1: Master chart.

S. no	Age/ sex	Injury side	Mechanism of injury	Plantarflexion	Dorsiflexion	Olerud and Molendar score	Kriestensons radiological criteria	Radiological union
1	40/F	Right	RTA	0-40	0-25	90	Good	United
2	56/M	Left	RTA	0-45	0-20	95	Good	United
3	76/M	Right	Self-fall	0-20	0-15	45	Poor	Delayed union
4	54/M	Right	RTA	0-35	0-25	85	Good	United
5	61/M	Right	RTA	0-30	0-20	70	Fair	United
6	67/F	Left	Self-fall	0-40	0-20	75	Good	United
7	51/M	Right	RTA	0-35	0-25	65	Fair	United

Continued.

S. no	Age/ sex	Injury side	Mechanism of injury	Plantarflexion	Dorsiflexion	Olerud and Molendar score	Kriestensons radiological criteria	Radiological union
8	38/M	Right	RTA	0-45	0-25	90	Good	United
9	45/M	Right	RTA	0-35	0-25	95	Good	United
10	45/F	Left	RTA	0-35	0-25	70	Fair	United
11	38/F	Right	RTA	0-40	0-20	95	Good	United
12	63/F	Right	Self-fall	0-25	0-15	60	Poor	United
13	40/M	Right	Self-fall	0-30	0-20	65	Fair	Delayed union
14	40/M	Right	RTA	0-45	0-25	80	Good	United
15	51/M	Left	RTA	0-35	0-25	75	Fair	United

Table 2: Olerud and Molender score (functional assessment score).

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

A score of 90-100 – excellent, 70-89 – good, 50-69 – fair, and less than 50 – poor

Table 3: Radiological criteria.

S. no	Criteria
	Good
1	Talus-correctly placed
2	Medial malleolus -no displacement or fracture gap of less than 2 mm
3	Lateral malleolus -negligible lateral displacement and up to 2 mm of posterior displacement
4	Posterior malleolus- upward displacement of less than 2 mm
	Fair
1	Talus- correctly placed
2	Medial malleolus -no displacement or fracture gap of less than 2 mm
3	Lateral malleolus -negligible lateral displacement and up to 2 mm of posterior displacement
4	Posterior malleolus- upward displacement of less than 2 mm

Continued.

S. no	Criteria
	Poor
1	Talus- correctly placed
2	Medial malleolus -no displacement or fracture gap of less than 2 mm
3	Lateral malleolus -negligible lateral displacement and up to 2 mm of posterior displacement
4	Posterior malleolus- upward displacement of less than 2 mm

Figure 3: Plate fixation of posterior malleolus.

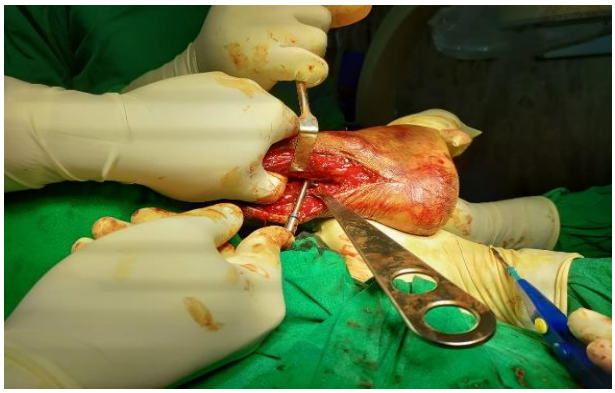

Figure 4: Exposure of lateral malleolus through same incision.

Figure 5: X-ray.

DISCUSSION

Study population consisted of patient aged between 38-76 years old. Road traffic accidents (RTA) was common mode of injury followed by fall. 60% were males and 40% were females with predominant right-side injury. Supination external rotation type of injury was most common mode of injury in our study as comparable to study by Weening et al.[4]

Riede et al in his study showed that if posterior malleolus is displaced that would result in increased damage to remanent cartilage and lead to posttraumatic arthritis. Multiple studies consider posterior malleolar fixation would result in better outcome.[5,6] Hence we fixed posterior malleolus with buttress plate to avoid long-term complications which may need further follow up. Gardner et al compared posterior malleolar fixation with syndesmotic fixation in a pronation-external rotation 4 model.[7] They found 70% restoration of good ankle function with posterior malleolar fixation versus 40% with syndesmotic fixation. Posterior malleolar fixation was equivalent to fixation with syndesmotic screws or combined fixation. We have used posterolateral approach which was similar to the study Talbot et al.[8] Lateral malleolus was fixed with plate and screw while medial malleolus was fixed with 4 mm CC screw/TBW. We have not used syndesmotic screw as Kortekangas et al showed no difference in clinical and radiological out come after 4 years follow up.[9]

Majority of our patients had good and excellent functional outcomes and were able to return to there activities as similar to Hong et al.[10] Almost all the fractures united in 13 weeks with range between 11-20 weeks. Delayed union seen in 2 of our patients. Functionally excellent outcome was seen in 5 patients followed by 6 patients had good outcome, fair in 3 patients and poor in 1 patient. Kristensons criteria was used to assess the radiographic outcome. Radiological outcomes was similar to Khandelwal et al with poor outcome in 2 patients.[11] Ankle range of movements was regained in all patients except two. Complications such as superficial infection was noted in 2 out of 15 patients which corelated with fact of delayed union. Infection was treated with intravenous antibiotics. One patient developed post operative stiffness which was managed by physiotherapy.

Anatomical reduction with stable fixation of every component of fracture is probably more important than the way of fixation. It is accepted that anatomical reduction is the goal of ORIF of every fracture. Can be better achieved with a posterior approach and posterior buttress plate fixation, even in cases with poor bone quality. In addition, excellent stability was achieved and allowed better function. We do know that fractures with posterior

malleolar involvement do worse than similar fractures without posterior malleolar involvement. Instability rendered in a posterior malleolar fracture is in fact an important variable in the outcome of patients. The results of these studies would lead to the conclusion that even small posterior malleolar fractures should be repaired in ankle fractures with syndesmotic disruption The two clinically relevant problems in treatment of trimalleolar fracture-dislocations are the non-anatomical reduction and the relatively unstable primary fixation of the posterior malleolus. By open reduction through a posterolateral approach and stabilization of the fragment with a dorsal buttress plate, anatomical reduction was significantly improved with better primary stability. Langenhuijsen found that it was not the size of the fragment that affected outcome rather, whether a congruent reduction was obtained even in posterior malleolar fractures making up only 10% of the joint surface. There is also improved biomechanical stability of the fracture in fixation with a buttress plate that can resist shear. As these are the main goals of surgical treatment of fractures, this surgical approach seems currently preferable. The complication rate was no higher than that documented for currently recommended techniques. However, whether better reduction with the method presented here leads to less clinically relevant osteoarthritis of the ankle remains to be established by long term study.

CONCLUSION

Posterior malleolar fixation along with medial and lateral malleolus fixation will lead to better functional and radiological results. Trimalleolar fracture with stable anatomical fixation would result in early rehabilitation and return to activity. Development of long-term complications such as arthritis needs further follow up and evaluation.

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