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Prospective study of functional outcome of open reduction and internal fixation of trimalleolar fracture

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Abstract

Background: Ankle injuries gain importance because body weight is transmitted through it and locomotion depends upon the stability of this joint. Trimalleolar fractures are one of the most complex fracture around ankle. As with all intra articular fractures, Trimalleolar fractures necessitate reduction and stable internal fixation [1]. The purpose of this study is to assess the functional outcome and results of surgical treatment of Trimalleolar fractures to attain a proper anatomical alignment and stability of ankle joint [2].

Material and Methods: A Prospective study was conducted for 30 patients with trimalleolar ankle fracture. Open reduction and internal fixation was done. Patients were evaluated with functional scoring by Biard and Jackson. The functional outcome of ORIF by subjective, objective and radiological assessment were recorded.

Results: In the present study of 30 patients with trimalleolar ankle fractures treated by open reduction and internal fixation. Excellent results were achieved in 17 (56.67%) patients, good in 8 (26.67%), fair in 3 (10%) and poor in 2 (6.67%) patient. Excellent results were observed young patients with close trimalleolar fractures. More severe injuries, compound fracture and severely osteoporotic fractures were followed by least satisfactory results. The patient with poor result had mild pain with activities of daily living, diminution in the abilities to run and to do work, reduced motion of ankle and narrowing of joint space.

Conclusion: This fracture pattern was classified under Lauge-Hansens on basis of different injury mechanisms, and were treated according to it. After anatomic reduction and stable fixation through the specific operative approach and methods, the short-term outcome was good and complications were reduced to minimum. The operative results were eminently satisfactory in 83.33% of patients.

Keywords: ankle, trimalleolar fracture, syndesmosis, open reduction and internal fixation

Introduction

Ankle fractures constitute a major proportion of injuries received at orthopedic emergencies all over the world.

Although the incidence of trimalleolar ankle fractures is comparatively less, nevertheless, 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.⁵ Recently, 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. According to the mechanics of such an injury, the posterior malleolus fragment is an avulsion fracture due to rupture of the PITFL. 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) [7]. In our study, we conducted a preoperative computed tomography (CT) scan in all our cases to better understand the fracture configuration and plan our fixation. The calculation of the fragment size is better on a sagittal CT of the ankle joint rather than only on a plain lateral ankle radiograph [3].

After anatomical reduction and fixation of the lateral malleolus, the posterior malleolus usually reduces by itself in the majority of the acute cases due to ligamentotaxis by the posterior

inferior tibiofibular ligament (PITFL) [9].

Since the syndesmosis of the ankle ring is stabilized mainly by the PITFL and the apex of the fibular fracture is mainly posterior or posterolateral in such injuries, stabilization from the posterior side becomes paramount.¹⁰ The purpose of this study is 1) to assess the functional outcome and results of surgical treatment of trimalleolar fractures, 2) to know available treatment options for trimalleolar fractures.

Material and Methods

A prospective observational study of 30 patients with fresh Trimalleolar ankle fractures who underwent surgery at a tertiary health setup in Surat, Gujarat, India from August 2019 to August 2020 was conducted. After institutional ethical clearances, informed consents were obtained from all the participating patients and then they were enrolled for the study.

An inclusion criteria were: 1) Age group > 18 years of either sex with Trimalleolar fracture 2) Fracture of Trimalleolar fractures with or without associated fractures. Confirmed by clinical examination, x-rays and CT scan. 3) Patient who gives informed consent and willing for follow up.

An Exclusion criteria were 1) Patients less than 18 years of age 2) Patient who did not give informed consent for surgery 3) Patient unfit for surgery 4) Patient having ipsilateral lower limb fracture other than Trimalleolar ankle fracture.

Initial management was done in the orthopedic emergency area, which included getting standard AP and lateral

radiographs of the ankle joint. Distal neurovascular status and clinical signs to exclude compartment syndrome were assessed and documented. Patients with gross ankle dislocation were attempted to be reduced in the emergency itself under sedation after prior consent from the patient and relatives. A below-knee plaster slab was applied to immobilize the joint and analgesics were instituted. The limb was kept elevated to prevent excessive swelling. The fractures were classified based on Lauge-Hansen and Danis-Weber classification.

Surgical techniques: Under appropriate anaesthesia, Lateral / Prone position for lateral and posterior malleolus fixation and supine position for medial malleolus fixation. Pneumatic tourniquet was applied. Average timing of surgery lasted around 1 ½ to 2 hours. Posterolateral approach was used for lateral and posterior malleolus fixation and Anteromedial/medial approach was used for medial malleolus fixation. For lateral malleolus Fixation: in 24 cases, fixed with 1/3rd Semitubular plate and in 6 cases with reconstructive plate. For medial malleolus fixation: in 14 cases TBW was done and in 16 cases fixation done with 4mm CC screws. For Posterior malleolus: in 7 cases fixed with 4mm CC screw, in 11 cases with buttress plate and in 12 cases with reconstructive plate. Regular monthly follow-ups were conducted. Full weight-bearing was started once the clinical and radiological union was achieved. Ankle score, according to Baird and Jackson Score was documented in all cases.

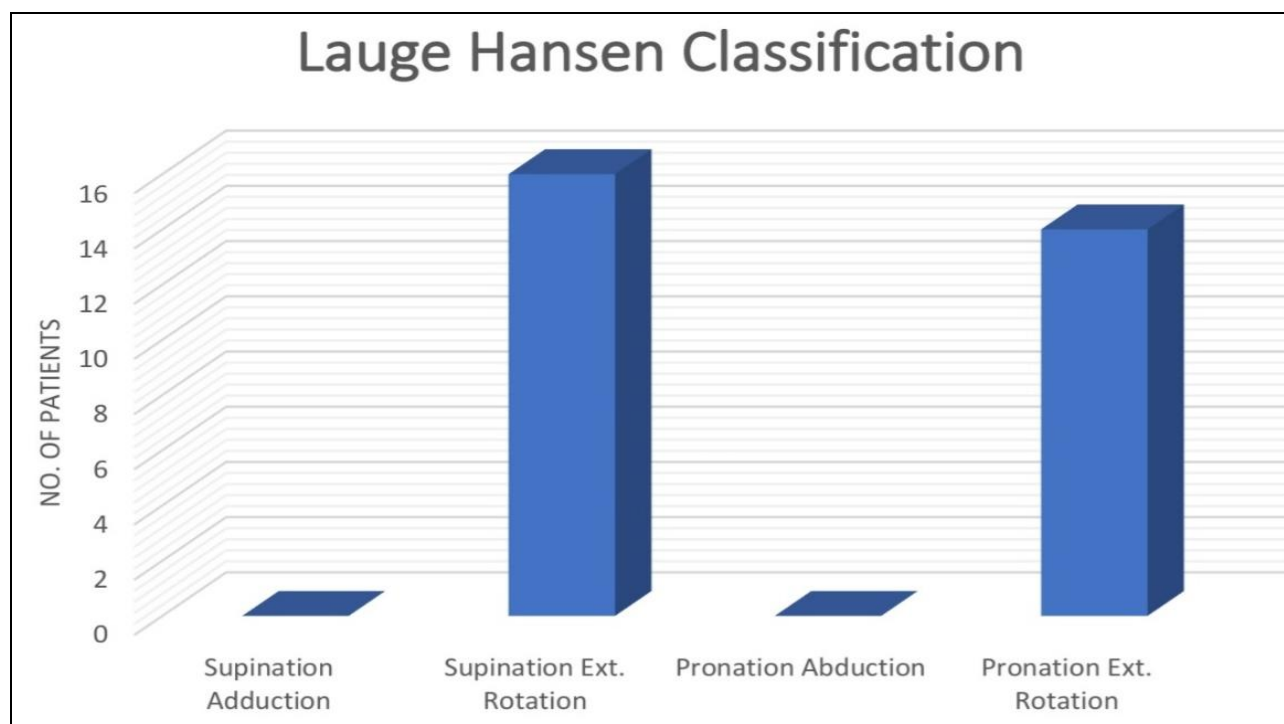


Table 6: Final Score According to Subjective Objective and Radiological criteria

| Grade (No. of Patients) | | | | | | |
|-------------------------|----|----|---|---|---|-------|
| Category | A | B | C | D | E | Total |
| Pain | 18 | 12 | 0 | 0 | 0 | 30 |
| Stability | 3 | 0 | 0 | 0 | 0 | 30 |
| Walking | 25 | 4 | 1 | 0 | 0 | 30 |
| Running | 6 | 16 | 8 | 0 | 0 | 30 |
| Work | 21 | 6 | 3 | 0 | 0 | 30 |
| Motion | 23 | 5 | 2 | 0 | 0 | 30 |
| Radiographs | 3 | 0 | 0 | 0 | 0 | 30 |

Table 7: Composite Score

| Composite Score | No. of Patients | Percentage |
|---------------------------|-----------------|------------|
| Excellent (96-100 Points) | 17 | 56.67 |
| Good (91-95 Points) | 8 | 26.67 |
| Fair (81-90 Points) | 3 | 10 |
| Poor (0-80 Points) | 2 | 6.67 |

Result

Thirty (30) adult patients with an average age of 45.7 years (range 21–62) were followed up prospectively in our case

series, of which 21 were males and 9 females. The most common mode of injury was road traffic accident (n = 22). The average time to union and full weight-bearing was 12.8 weeks (range 10–16 weeks).

The average percentage of the restoration of ROM as compared to the contralateral ankle at the time of union was 90.8% of dorsiflexion, 95% of plantar flexion, 86% of inversion, and 87.3% of eversion. An excellent results were achieved in 17 (56.67%) patients, good in 8 (26.67%), fair in 3 (10%) and poor in 2 (6.67%) patient according to Baird and Jackson Scoring system.

Discussion

Increased knowledge about the normal and post-traumatic anatomy and function of the ankle joint has lead to demands for exact reduction and rigid fixation of the ankle fractures.

Prompt operative treatment of displaced Trimalleolar fractures decreases morbidity and improves functional outcome.

We, in our study, followed a protocol to anatomically reduce and fix the posterior malleolus fragment in all our cases. This method is well supported in the recent literature too^[3].

In all our cases, after fixation of the lateral malleolus, we performed a posterior loading test intraoperatively to see for the stability of the ankle joint. Good clinical and functional outcome was reported in cases with fixation of the lateral malleolus by the application of plate on the posterior surface. Many biomechanical studies have also recognized the advantages of posterior plating of fibula as compared to plating the fibula over the lateral surface^[12]. However, one study has found no significant difference^[13].

We observed that the apex of the fibular fracture was posterior or posterolateral in the majority of such injuries, and we believe that the application of the plate over the fracture apex is biomechanically much superior. Stable fixation of posterior malleolus by plates also has the advantage of making the syndesmosis extremely stable. Additional syndesmotic screw application, thus, becomes unnecessary.

DeSouza *et al.*^[15] conducted study on 150 Trimalleolar ankle fracture treated by open reduction and stable internal fixation using AO ASIF method obtained 90% good results^[15].

Beris *et al.*^[14] conducted study on 44 patients with Trimalleolar ankle fracture. There were good to excellent results in 74.3% patients, fair results in 14.6% and poor result in 11.1%^[14].

Observation in this study support the contention of Yablon *et al.*^[11] that lateral malleolus is the key to the anatomical reduction of Trimalleolar fractures, because the displacement of the talus faithfully followed that of the lateral malleolus. Poor reduction of distal part of fibula would result in persistent lateral displacement or residual shortening.

Conclusion

Adequate preoperative imaging, a thorough understanding of the fracture anatomy and biomechanics, and adequate visualization via a proper exposure and stable fixation of all the three components of a trimalleolar fracture play a key role for good clinical and functional outcome in such injuries.

More severe injuries, compound fractures and severely osteoporotic fractures were followed by least satisfactory results.

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