The Functional Outcome of Fixation of Trimalleolar Fracture, through Fixation of Lateral Malleolus by Plating, Medial Malleolus by Tension Band Wiring and Percutaneous Screw Fixation of Posterior Malleolus: A Prospective Study

D C Srivastava¹, Sachin Yadav¹, Ankur Singh¹, Alok Gupta¹

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. The purpose of this study is to assess the functional outcome and results of surgical treatment of Trimalleolar fractures by specific modalities. to attain a proper anatomical alignment and stability of ankle joint and further applying a syndesmotic screw if needed.

Material And Methods: A Prospective review was conducted for 20 patients with trimalleolar fracture. Open reduction and internal fixation was done with specific modalities. Patients were evaluated with functional scoring by Biard and Jackson. The functional outcome of ORIF and advantages of the procedures were recorded.

Results: In the present study of 20 patients with ankle fractures treated by open reduction and internal fixation. Excellent results were achieved in 13 (65%) patients, good in 5 (25%), fair in 1 (5%) and poor in 1 (5%) patient. Excellent results were observed in all isolated lateral malleolar and bimalleolar fractures. Two (14%) patient of with trimalleolar fracture had poor to fair 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 ans methods, the short-term outcome was good and complications were reduced to minimum.

Keywords: Trimalleolar fracture, plating, tension band wiring

Introduction

Sir Robert Jones said “Ankle is the most injured joint of the body but the least well treated [1]. As with all intra articular fractures, Trimalleolar fractures necessitate reduction and stable internal fixation [2,3,4]. Ankle fracture is one of the most common lower limb fractures [5] for they account for 9% of all fractures representing a significant portion of the trauma workload [6]. Ankle fractures usually affect young men and older women, however, below the age of 50 [7]; ankle fractures are the commonest in men. Two commonly used classification systems for ankle fractures include the Danis Weber AO classification and the Lauge-Hansen classification. There are several different methods of ankle fracture fixation, however the goal of treatment remains a stable anatomic reduction of talus in the ankle mortise and correction of the fibula length as a 1 mm lateral shift of the talus in the ankle mortise reduces the contact area by 42%, and displacement (or shortening) of the fibula more than 2 mm will lead to significant increases in joint contact pressures. Further research both biomechanically and clinically needs to be undertaken in order to clarify a preferable choice of fixation. Many of the fractures which are stable are reduced by conservative treatment and have given good result. The other unstable displaced and open fractures require open reduction internal fixation. The superiority of ORIF over closed treatment have been thoroughly demonstrated in literature3. However all studies have not obtained good results in cases of Trimalleolar fractures. The purpose of this study is to assess the functional outcome and results of surgical treatment of Trimalleolar fractures by specific modalities of tension band wiring of medial malleoli, plating of lateral malleoli, and screw fixation of posterior malleolus, to attain a proper anatomical alignment and stability of ankle joint and further applying a syndesmotic screw if needed.

Material And Methods:

20 Patients with fresh trimalleolar fractures who attended SRN Hospital, Allahabad from August 2014 to July 2015 were included in study.
As soon as the patients were brought to the casualty a complete survey was carried out to rule out significant injuries. Then the patients radiograph's were taken, both anteroposterior and lateral views of the ankle joints. On admission to the ward detailed history was taken relating to the age, sex, occupation, address, mode of injury past and associated medical illness. Patients general condition was assessed and then they were put through a thorough clinical examination. Patients with active infection at site of injury were excluded from the study. Post operation, assessment was done at 6 weeks, 12 weeks and 6 months according to Biard and Jacksons functional scoring [4].

**Operative methods:**
There are several different methods of ankle fracture fixation, however the goal of treatment remains a stable anatomic reduction of talus in the ankle mortise and correction of the fibula length as a 1mm lateral shift of the talus in the ankle mortise reduces the contact area by 42% [3], and displacement (or shortening) of the fibula more than 2 mm will lead to significant increases in joint contact pressures. The choice of fixing the medial or lateral side first may be guided by the surgeon's preference, but the ankle joint in these fractures is often very unstable. The stability is dramatically improved once the medial fracture is fixed (if present), therefore if our study we have followed the following sequence:
1. The medial fracture is fixed
2. The fibular shaft is brought out to length and fixed
3. The Volkmann's fragment (posterior malleolus) is reduced and fixed
4. The integrity of the syndesmosis is restored
Medial malleolus was fixed using tension band fixation which is bio mechanically a strong construct using a long medial incision [9]. For Lateral malleolus lateral incision was used length of fibula was maintained and is best fixed with a one-third semitubular plate placed over the lateral surface of the fibula and bent and twisted [9]. After Fibula has been fixed we will look for syndesmotic stability. Various maneuvers are done on able to try to separate the fibula from the tibia. Instability was fixed by Use a 4.5mm cortical screw inserted through the fibula into the tibia 2 to 3 cm above and parallel to the ankle joint. Posterior malleolus was fixed only if it constituted 25% or more of the articular surface. It is fixed with one or two 4-mm cancellous screws with a small stab incision in an anteroposterior direction or a posteroanterior direction, fixing it percutaneously [9].

**Results:**
In the present study of 20 patients with ankle fractures treated by open reduction and internal fixation. Excellent results were achieved in 13 (65%) patients, good in 5 (25%), fair in 1 (5%) and poor in 1 (5%) patient. Excellent results were observed in all isolated lateral malleolar and bimalleolar fractures. Two (14%) patient with trimalleolar fracture had poor to fair 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.

**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 trimalleolar fractures. Prompt operative treatment of displaced ankle fractures decreases morbidity and improves functional outcome [10,11,12].
The treatment of trimalleolar fractures with accurate open reduction and stable internal fixation using AO method and principles was found to give a high percentage of excellent and good results [2]. This study supports these conclusions.
Although the scoring of Baird and Jackson has proven to be strict allowing only very small fluctuation from normal about 65% patients in this series achieved excellent results by that scoring system and 25% patients achieved good results and also had anatomical reduction of all the malleoli as well as anatomical reduction of talus radiologically. It is seen that the percutaneous fixation of posterior malleolus reduces the chances of skin necrosis as compared to the single postero-lateral incision for posterior as well as lateral malleolus. This percutaneous fixation reduces soft tissue trauma and postero-lateral complex of vessels is less hampered which resulted in reduced AVN of talus as a late complication.
In our study it was seen that better biomechanical stability of ankle was also related to fixation of diastasis only after fixation of posterior malleolus. After fixation of diastasis Per operative medial and lateral stability were checked under C-arm with the help of lateral and medial stress tests. Per operative checking of congruency of talus with both malleolus by C-arm produces the maximum contact weight bearing surface of ankle joint. While walking it is useful in providing excellent gait biomechanic in the long run.

Anatomical fixation of fibula by moulded plate not only maintains fibula length but is also paramount for lateral stability. It is also important for maintaining congruency of medial part of fibula to talus.
The chances of non-union in medial malleolus were reduced to minimum by taking care of periosteal interposition during its fixation and use of tension band principle by AO. It is also concluded that anatomical relation of malleoli is maintained with talus when ankle diastasis is fixed in neutral position because in dorsiflexion fibula is pushed back and it disturbs its congruency with talus.

**References**