

## Surgical Management of Bimalleolar Fractures of Ankle in Adults

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**Abstract:** Ankle fractures are the most common type of fractures treated by orthopedic surgeons in daily practice. Most of these fractures are complex type and difficult to manage. If not treated properly, may produce significant long-term disability and complications like pain, instability and early degenerative arthritis. Good functional results are obtained by surgical management of bimalleolar ankle fractures. Early weight bearing, and mobilization is achieved in these patients. This study was conducted at Prathima Institute of Medical Sciences, Karimnagar from January 2016 to December 2017. 40 adult patients with bimalleolar fractures of ankle who underwent open reduction and internal fixation were included in this study. Follow up was done at regular intervals of 6 weeks for minimum of 6 months. Baird and Jackson's ankle scoring system of subjective, objective and radiographic criteria was used for the study. 24(60%) cases of medial malleolar fractures were fixed with malleolar screws, followed by cancellous screw in 4(10%) cases, tension band wiring in 10(25%) cases and K-wire in 2(5%) cases. 28(70%) cases of lateral malleolus were fixed with plate (24 with one-third tubular plate, 2 with 3.5mm DCP and 2 with 3.5mm recon plate) followed by malleolar screw in 4(10%) cases, Rush nail in 5(12.5%) cases and K wire/TBW in 3(7.5%) cases. Average time to union in our study was 10.4 weeks. However, most (80%) of the cases (80%) united by 8-12 weeks. Excellent results were achieved in 23(57.5%) cases, good results in 10(25%) cases, fair in 5(12.5%) cases and poor in 2(5%) cases. Open reduction and stable internal fixation of unstable bimalleolar ankle fractures restore the articular congruity of the ankle joint. Operative results in our study were satisfactory in 82.5% cases, with good to excellent functional outcome. Functional results were much better in younger age groups and men. Early weight bearing, and mobilization is achieved in these patients.

**Keywords:** Bimalleolar fractures, Open reduction and stable internal fixation.

### INTRODUCTION

Ankle fractures are the most common type of fractures treated by orthopedic surgeons. There has been an increase in the prevalence of such fractures over the last two decades both in the young, active patients and in the elderly [1, 2]. Most ankle fractures are complex injuries that are difficult to manage. These injuries gain importance because the whole body weight is transmitted through the ankle and locomotion depends upon the stability of the ankle joint. They have the potential to produce significant long-term disability and complications in the form of pain, instability and early degenerative arthritis [3]. As a result of a better understanding of the biomechanics of the ankle, improvements in fixation techniques and findings of outcome studies, there has been a gradual evolution in the effective strategies for the treatment of ankle fractures.

The goals of treatment include achieving sound union of fracture and an ankle that moves and functions

normally without pain. As has been shown experimentally by Paul L. Ramsey, about one mm lateral shift in Talus, produces about 42 per cent of decrease in tibio-talar contact area [2]. This obviously shows the need for perfect anatomical reduction, which could be better, achieved by open reduction and better maintained by internal fixation. The operative method restores the anatomy and contact-loading characteristic of the ankle. Additional advantages include easier rehabilitation without a cast, early mobilization and earlier weight bearing [4].

Although fractures about the ankle have traditionally been considered non- controversial with respect to the indications for operative intervention, recent advances in the understanding of the biomechanics of the ankle have given rise to particular areas of clinical uncertainty. These include the indications for the operative treatment of isolated fractures of the lateral malleolus, the operative techniques for syndesmotic injury and its post-operative

management and the reliability of radiographic assessment of fractures about the ankle.

Aim of this study is to evaluate the functional outcome and results obtained after surgical management of unstable bimalleolar fractures of ankle with various methods of internal fixation.

## MATERIALS AND METHODS

This study was conducted at Prathima Institute of Medical Sciences, Karimnagar from January 2016 to December 2017. 40 adult patients with bimalleolar fractures of ankle were included in this study. Inclusion criteria was unstable fractures treated operatively, age between 20 and 65 years and closed fracture. Stable fractures treated conservatively, open fractures and non-operatively treated cases were excluded from the study. All the patients were subjected to clinical and radiological examination along with routine pathological investigations.

Instability of the syndesmosis was identified on the basis of the mechanism of injury and fracture pattern. Pain elicited with the squeeze test and external rotation stress test was considered as indicative of clinical syndesmotism instability. Radiologically, more than six millimeters clear tibiofibular space and more than four millimeters widening of the medial space were considered as indications of syndesmotism instability. Intraoperatively, the stability was checked by laterally displacing the distal fibula from the tibia, if >3 or 4 mm of lateral shift of talus occurs, it suggests instability (Cotton test).

Fractures of the ankle were evaluated using plain radiographs in anteroposterior, lateral and mortise views. The fractures were classified using the Lauge–Hansen, AO/OTA classification systems and anatomical types. Closed reduction and a below knee posterior POP slab was applied. Patients with minimally displaced mono-malleolar fractures, avulsion fractures and stable fractures were excluded from the study. Patients with unhealthy skin, those who were medically unfit for surgery were managed by closed reduction and were not included in the study.

AO type A lateral malleolus fractures were fixed with tension band wire or a small oblique screw. AO type B fracture was fixed with lag screw placed perpendicular to fracture line or more securely with one third semi-tubular plate. AO type C fractures were reduced and fixed with a one-third tubular plate. Medial malleolus fractures were fixed with partially threaded cancellous screw or malleolar screw. If the fragment is too small or comminuted, K-wires with a figure-of-eight tension band was used for fixation.

Trans-syndesmotism screw was inserted at the top of the fibular sulcus in the tibia, fixation is usually

obtained by placing one or two screws from posterolaterally in the fibula to antero-medially in the tibia about 1.5 to 3.0 cm above the plafond. Fixation of the syndesmosis was done with the ankle in full dorsiflexion to avoid over tightening of the mortise and loss of dorsiflexion postoperatively. Removal of the screw was done after at least 4 to 8 weeks.

Non-weight bearing walking was allowed from first or the second postoperative day. Partial weight bearing was started after clinical and radiological signs of union become evident. Active exercises of the ankle were advised. In patients with syndesmotism screw fixation, weight bearing was delayed till screw removal.

Follow up of cases was done at regular intervals of 6 weeks for minimum of 6 months. At each assessment, all patients were questioned with regard to pain, use of analgesics, stiffness, swelling, activities of daily living, use of walking aids, and return to work and participation in sports. At each examination, the gait, any thickening, swelling, tenderness of the ankle and the range of motion of the ankle were evaluated. Antero- posterior, lateral and mortise radiographs of ankle were made at the time of examination. Baird and Jackson's ankle scoring system of subjective, objective and radiographic criteria was used for the study.

## RESULTS

In our series, 12(30%) cases were in the age group 21-30 years, 17(42.5%) were in the age group of 31-40 years, followed by 6 (15%) in the age group 41-50 years and 5(12.5%) in the age group 51-65 years. The youngest patient was 22 years old and eldest patient was 63 years. The mean age was 37.4 years. In the present series, males were more commonly involved. 24(60%) cases were male and 16(40%) female, with male: female ratio of 3:2. Right side was involved in 25 (62.5%) cases and left side in 15 (37.5%). 18(45%) cases affected were due to road traffic accident, 14(35%) cases due to fall, and 8(20%) cases due to twisting injury. Road traffic accident was the most common mode of injury. 14(35%) cases were associated with other injuries like head injury (4 cases), ipsilateral tibia fracture (4 cases), ipsilateral forearm fracture (1 case), ipsilateral distal radius fracture (1 case) and ipsilateral humerus fracture (2 cases).

In the present study, majority of the cases i.e. 15 (37.5%) had supination-external rotation injury followed by 12 (30%) cases with pronation -external rotation injury, 8(20%) cases with pronation – abduction injury and 5(12.5%) cases with supination – adduction injury. AO type B was the most common, involving 20 (50%) patients, followed by type C in 15 patients (37.5%) and least in type A (12.5%).

24(60%) cases of medial malleolar fractures were fixed with malleolar screws, followed by

cancellous screw in 4(10%) cases, tension band wiring in 10(25%) cases and K-wire in 2(5%) cases. 28(70%) cases of lateral malleolus were fixed with plate (24 with one-third tubular plate, 2 with 3.5mm DCP and 2 with 3.5mm recon plate) followed by malleolar screw in 4(10%) cases, Rush nail in 5(12.5%) cases and K wire/TBW in 3(7.5%) cases.

2(5%) cases of syndesmotom injury were noted in this study, which were fixed with a fully threaded screw, which was removed after 6-8 weeks. Weight bearing was deferred till screw removal. Average time to union in our study was 10.4 weeks. However, most (80%) of the cases (80%) united by 8-12 weeks.

In the present study, 4(10%) patients had superficial infection, 1(12.5%) patient had deep infection and 2(5%) patients delayed union medial malleolus. Superficial and deep infections were managed with debridement and antibiotics. Delayed union of medial malleolus fracture was treated with continued immobilization, which eventually united without surgical intervention.

Baird and Jackson's ankle scoring system was followed for evaluation of final results. Excellent results were achieved in 23(57.5%) cases, good results in 10(25%) cases, fair in 5(12.5%) cases and poor in 2(5%) cases. Fair to poor results were observed with patients who had complications of syndesmotom injury, delayed union of medial malleolus fracture, superficial and deep infections. Patients with poor results had mild pain during activities of daily living, diminished ability to run, decreased range of motion of ankle and narrowed joint space.

## DISCUSSION

Fractures of ankle joint are the most common intra-articular fractures occurring in weight bearing joints. Methods to restore function and to prevent arthritis are either closed treatment, which includes manipulative reduction and immobilization in plaster cast or open reduction with internal fixation. Burwell and Charnley showed that anatomical reduction and rigid fixation led to early return to function [5]. There has been gradual evolution in management of ankle fractures due to improved analysis of biomechanics, improvement in fixation techniques and analysis of results of recent studies. The goal of treatment is to provide fracture union with painless full motion of ankle and anatomical restoration of ankle joint.

Closed method of treatment is often inadequate in restoring the anatomy and biomechanics of ankle in unstable malleolar fractures. Conversely, open reduction with internal fixation is an excellent method for restoration of normal anatomy of joint. Several studies indicated that, internal fixation of displaced malleolar fractures of ankle provides better results [5-

7]. Treatment of malleolar 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 [8].

In the present study, 40 patients with bimalleolar ankle fractures who underwent surgical fixation were included. All patients were followed up with minimum period of 6 months, ranging from 6 to 18 months.

In our study, fractures were commoner in the 31-40 yrs age group, with mean age being 37.4 yrs similar to the studies of Beris *et al.*, [7], Roberts RS [9], Baird and Jackson [14] and Lee *et al.*, [10]. Male: female ratio in our study was 7:1, which is comparable to Baird & Jackson [14] study. Road traffic accidents constituted majority of cases (75%), which was in accordance with study by Lee *et al.*, [10].

Right ankle was more commonly affected (62.5%), in accordance with Roberts RS [9], Beris *et al.*, [8]. Lauge -Hansen classification system was used in this study for operative evaluation. Most common type of injury was Supination-external rotation (37.5%), followed by Pronation-external rotation injury (30%). Similar findings were reported by Roberts RS [9], Beris *et al.*, [8] and Baird and Jackson [14].

Results of current study were compared with that of Burnwell & Charnley [5], Colton [11], De souza *et al.*, [6], Beris *et al.*, [9]. In Colton [11] series, 70% of the patients had a good to excellent results. Burnwell & Charnley [5] series of 132 patients, 102 (77.3%) had good results, 16% had fair results and 6% had poor score. In De souza [6] series, 150 cases of ankle fractures treated by open reduction and internal fixation using AO/ASIF method, obtained 90% good results. Beris *et al.*, [10] study of 144 patients with ankle fractures, 105 (74.3%) had good to excellent results. Functional results of the present study were comparable with that of the above cited studies, with 82.5% had good to excellent results, 12.5% had fair results and poor results in 5%.

Most authors have stated that anatomical reduction of displaced medial malleolus ensures correction of talar displacement and is of paramount importance in treating unstable fractures [12]. However, Heller *et al.*, [15] state that talus is more accurately repositioned in mortise by anatomical reduction of lateral malleolus. Observation in this study support the contention of Yablon *et al.*, [15] that lateral malleolus is the key to the anatomical reduction of bimalleolar fractures, because the displacement of the talus followed that of the lateral malleolus. Poor reduction of the lateral malleolus fracture would result in persistent lateral displacement or residual shortening. This does not necessarily lessen the importance of medial

malleolus, but it does serve to emphasize that the lateral malleolus should no longer be ignored. In the current study, the two patients with poor outcome, didn't have anatomical reduction of the medial malleolus possibly due to soft tissue interposition. Lateral malleolus can be fixed by various methods. Lateral plate, as advocated by AO group has become widely accepted for treatment of fibular fracture [16]. Hughes *et al.*, [16] recommended that lateral malleolus should be fixed first. Medial malleolus is then inspected for stability and fixed if necessary. This allows minimal postoperative immobilization and rapid recovery of function.

In the current study, the functional outcome was better in patients who underwent stable internal fixation of the medial malleolus by cancellous or malleolar screw. The results were not equally satisfactory in those patients who had less rigid fixation of the medial malleolus using only Kirschner wires. Tension band wiring of the medial malleolus gave results equivalent of those fixed with screws and lesser reports of skin irritation which was more frequent in those patients with screw fixation. In many fractured ankles, syndesmosis is stable after reduction and internal fixation of fibula fracture and medial malleolar fracture.

Yablon [15] stated that anatomical reduction of the fibula is the key factor in achieving good outcome of the treatment of ankle fractures with syndesmotic disruption. In the current series, two patients underwent trans-syndesmotic screw fixation. Excellent and fair outcomes were seen in one patient each.

Although early mobilization was advocated by AO group, other studies [5] have found no significant difference in the results produced after early mobilization. In the current study, immobilization was done for 4 weeks. Partial weight bearing was advised for those with early radiological signs of union and full weight bearing when the signs of union were complete. The range of motion of ankle was reduced initially but improved over few weeks. In our series there was 30 degrees or more plantar flexion in 35 patients (87.5%) and 20 degrees or more dorsiflexion in 33 (82.5%) patients.

In our 40 patients there was no instability of ankle or subtalar joints. Fair to poor results in the current series were seen due to wound infection, associated syndesmotic injury, delayed union of medial malleolus. Restricted activity level and range of movement without radiological evidence of arthritis was noted in four patients. Poor results were seen in Pronation-external rotation and Supination-external rotation type of injuries. Majority of the patients (82.5%) had good to excellent results in the current study, similar to what was observed in other series like Burnwell & Charnley [5], Colton [11], De souza *et al.*,

[6], Beris *et al.*, [10]. Treatment of bimalleolar 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 [8]. This study supports these results and was comparable with those in other studies.

## CONCLUSION

Anatomical reduction with restoration of the articular congruence is essential in all intra articular fractures especially in a weight bearing joint like ankle. Understanding the mechanism of injury is essential for anatomical reduction and fixation. Fibular alignment (length, rotation) must be maintained for lateral stability of the ankle. Open reduction and internal fixation restore the articular congruity of the ankle joint. Cancellous screws or malleolar screws are better for internal fixation of medial malleolus compared to Kirschner -wire fixation and lateral plating was the best for fibular fractures. Operative results in our study were satisfactory in 82.5% cases, with good to excellent functional outcome. Functional results were much better in younger age groups and men. Early weight bearing, and mobilization is achieved in these patients. Excellent results are obtained with stable fixation of fracture. Hence, we recommend open reduction and stable internal fixation of all unstable bimalleolar ankle fractures.

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