

## Surgical Management of Bimalleolar Fractures By Open Reduction Internal Fixation

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### Abstract

*Introduction:* Ankle joint is highly congruous and any disturbance of the normal articular relationship may result in some progressive arthrosis of biomechanical dysfunction. Malleolar fractures are one of the most common fractures in orthopaedic traumatology. As with all intra articular fractures, malleolar fractures necessitate accurate reduction and stable internal fixation. This study was therefore performed to study the functional outcome and results of surgical treatment of bimalleolar fractures and to know the complications of open reduction internal fixation of bimalleolar fractures. *Materials and methods:* 30 patients who came to the emergency ward in our hospital with fresh bimalleolar fractures were included into the study. The lower end of tibia fibula including both malleoli, calcaneus and talus were examined and looked for local bony tenderness and bony irregularities, displacement, on natural mobility crepitus, inter relation of malleoli, springing of fibula, dorsalis pedis and posterior tibial artery pulsations were checked and noted. After the surgery, the patients were followed up until the union was complete. *Results:* The mean age of our study was 40 years with 73% of the patients being male. The most common mode cause of injury was road traffic accidents affecting 15 (50%) of the people, while slipping was the cause in 13 cases. The most common type of injury was Supination external rotation affecting 40% of the patients, followed by pronation abduction in 20% of the patients. 16.7% of the patients were affected by pronation external rotation and 11.3% of them had supination adduction. In the present study, 13 (43.3%) had no pain and 14 (46.7%) patients had grade B i.e. pain with strenuous activities and remaining 3 (10%) had pain with activities of daily living. In the present study of 30 patients with bimalleolar ankle fractures treated by open reduction and internal fixation. Excellent results were achieved in 13 (43%), good in 10 (33%), fair in 6 (20%) and poor in 1 (3%) of patients. The patients with poor result had mild pain with activities of daily living, diminution in the abilities to run/work, reduced ankle movements and decreased joint space. *Conclusion:* Open reduction and internal fixation in accordance with AO principles was an efficient way to manage Bimalleolar Ankle Fractures.

**Keywords:** Bimalleolar Ankle Fractures; Open reduction; Internal fixation

### Introduction

Ankle injury is the most common weight bearing orthopaedic musculoskeletal trauma encountered in emergency medicine and practice. Ankle joint is highly congruous and any disturbance of the normal articular relationship may result in some progressive arthrosis of biomechanical dysfunction.<sup>1</sup> In the clinical setting determination

of ankle stability is critical when planning fracture management. Stable fractures can be treated conservatively with good results although outcomes in the management of unstable ankle fractures are often better with surgical treatment.<sup>2</sup>

Malleolar fractures are one of the most common fractures in orthopaedic traumatology. As with all intra articular fractures, malleolar fractures

necessitate accurate reduction and stable internal fixation. Lateral malleolar fractures in the setting of a competent deep deltoid ligament can usually be treated non-operative with good results. In contrast, a lateral malleolar fracture with an incompetent deep deltoid ligament is clinically equivalent to a bimalleolar ankle fracture and may result in talar subluxation and degenerative arthritis when treated non-operative.<sup>3</sup>

This study was therefore performed to study the functional outcome and results of surgical treatment of bimalleolar fractures and to know the complications of open reduction internal fixation of bimalleolar fractures.

### Materials and Methods

This study was done by the Department of Orthopedics at Chalmeda Ananda Rao Medical College over a period of two years and four months. 30 patients who came to the emergency ward in our hospital with fresh bimalleolar fractures were included into the study. 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 were put through a thorough clinical examination. Radiographs of both anteroposterior and lateral views of the ankle joints were taken for all the patients. The fractures were classified based on Lauge-Hansen's classification in adults.

The lower end of tibia fibula including both malleoli, calcaneus and talus were examined and looked for local bony tenderness and bony irregularities, displacement, on natural mobility crepitus, inter relation of malleoli, springing of fibula, dorsalis pedis and posterior tibial artery pulsations were checked and noted. Active and passive movements of ankle joint are noted. Analgesics were given and patients were put on a below knee posterior pop slab to alleviate pain. Also antibiotics and tetanus toxoid and tetanus immuno-globulins were given as needed.

After obtaining informed consent, routine blood investigations were done for all the patients. Prior to the surgery, they were kept in fasting for 8-10 hours. 30 minutes before surgery, Inj. Cefotaxime 1 gm intravenous was administered. Xylocaine test dose and Tetanus toxoid was given.

The patient is placed supine on the operating table. A sand bag placed underneath the affected buttock will rotate the leg internally tilting the table

away from the operative side with further increase internal rotation and allow adequate exposure of the lateral aspect of the leg. A direct lateral approach over the fibula is standard for reducing and internally fixing distal fibula fractures. The dissection should be kept anterior to the peroneal tendons, which can be left undisturbed posterior to the distal fibula proximately enough muscle is dissected to expose the bone without stripping periosteum. The dissection plane is between the peroneus tertius anteriorly and the peroneus longus and brovis posteriorly. The peroneal tendons may need to be partially removed from the retinaculum to place a plate on the posterior surface of the fibula or to provide access to manipulate the posterior malleolus.

The medial malleolus is approached directly through a longitudinal incision over the malleolus. In the anterior part of the incision, care must be taken to avoid the saphenous vein and the accompanying nerve. Posteriorly, the posterior tibial tendon is the first structure behind the medial malleolus moving the incision slightly anterior and dissecting.

The fibula fracture is exposed and the fracture margins are cleaned enough to allow the fracture to be directly visualized and reduced. Traction and rotation of the foot reduce the fracture once reduction is obtained. It is maintained with a tenaculum cump or AO serrated tooth reduction clamp.

The serrated-tooth reduction clamp may itself be used as a reduction tool. The clamp is applied to the partially reduced fibular fracture, while longitudinal traction on the foot is maintained, the clamp is rotated 30° clockwise towards the proximal fragment on the left side and counter clockwise on the right side in a supination. External rotation, anatomic reduction is affected. The rotation is reversed in a pronation external rotation fracture. The reduction is then maintained with a tenaculum clamp.

If there is comminution of the fibula and shortening the lateral malleolus is held with a means of towel clip and pulled down repeatedly but with care to reduce the fibula into the fibular notch of the tibia. The trial reduction is stabilized with a K-wire or temporarily holds with a plate and a mortise view is obtained to confirm that correction has been obtained.

Closed suction drainage for 24-48 hours may be helpful in multi-malleolar fractures to reduce the tendency for haemadoma formation. External compression with Jones dressings allows for control of distension while providing some measure of comfort for the first several days postoperatively.

Elevation and cold thereby further facilitate management of edema and pain.

All the patients were followed until the union occurred.

**Note:** The statistical analysis was done based on percentages and the number of cases. These data have been presented.

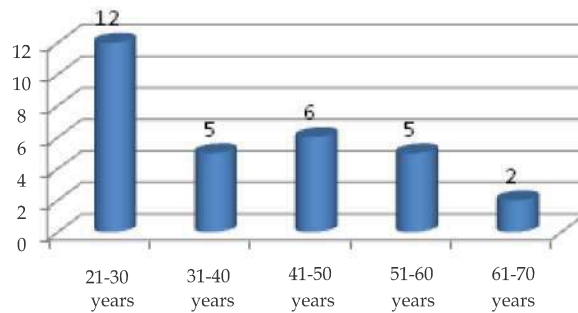
**Results**

Of the 30 patients in the study, most of them (40%) were between 21–30 years of age. 6 (20%) of the patients were of 41–50 years age group and

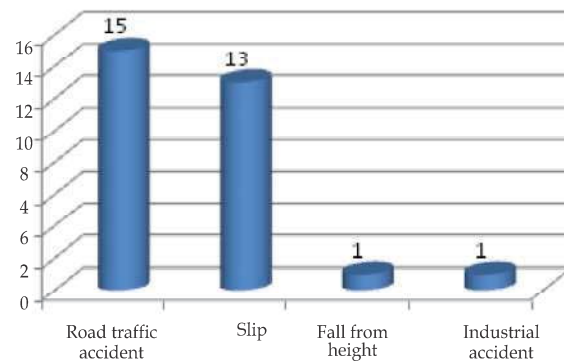
5 (16.7%) each were in the 31–40 and 51–60 years age group (Fig. 1). The mean age was 40 years old. 22 patients (73.3%) were males and 8 (26.7%) were females.

The most common mode cause of injury was road traffic accidents affecting 15 (50%) of the people, while slipping was the cause in 13 cases (43.3%) (Fig. 2).

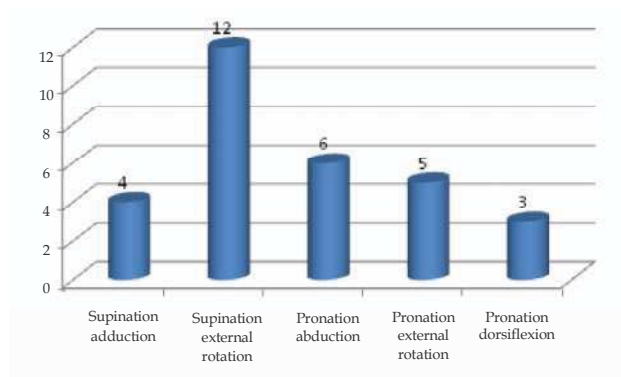
The most common type of injury was Supination external rotation affecting 12 (40%) of the patients, followed by pronation abduction in 6 (20%) of the patients. 5 (16.7%) of the patients were affected by pronation external rotation and 4 of them (13.3%) had supination adduction (Fig. 3)



**Fig. 1:** Age-wise distribution of the patients



**Fig. 2:** Mode of injury



**Fig. 3:** Type of injury among the patients



Fig. 4: Fracture reduction with reduction forceps



Fig. 5: Drilling the holes for fixation



Fig. 6: After fixation with semitubular plate



Fig. 7(a): Pre-operative X-ray



Fig. 7(a): Pre-operative X-ray



Fig. 7(c): Follow-up at 3 months

Most of the patients were operated between 2 and 5 days. Average duration between trauma and surgery was 3 days in our study. Average duration of surgery was about 1 hour. Four patients had superficial skin infection which healed by 3 weeks. There were no other complications. In the present study, 13 (43.3%) had no pain and 14 (46.7%) patients had grade B i.e. pain with strenuous activities and remaining 3 (10%) had pain with activities of daily living. None of the patients had clinical instability. Majority i.e. 25 (83.3%) of patients could walk desired distances without limp or pain and 5 (16.7%) patients were able to walk desired distance with slight pain. Eighteen (60%)

patients were able to run desired distances without pain, 10 (33.3%) patients were able to run desired distances with slight pain and 2 (6.7%) patients had moderate restriction in ability to run with mild pain. 25 (83%) patients were able to perform usual occupation without restriction and the rest 5 (16%) patients were able to perform usual occupation with restriction in some strenuous activities. 21 (70%) patients had range of motion of the ankle within 10° of uninjured ankle and 7 (23%) patients were having motion within 15° of uninjured ankle. The rest 2 (6%) patients had motion within 20° of uninjured ankle (Table 1) (Figs 3-7).

**Table 1:** Final score according to subjective, objective and radiological criteria

Category	Grade A	Grade B	Grade C	Grade D	Grade E	Total
Pain	13	14	3	-	-	30
Stability	30	-	-	-	-	30
Walking	25	5	-	-	-	30
Running	18	10	2	-	-	30
Work	25	5	-	-	-	30
Motion	20	8	2	-	-	30
Radiography	27	2	1	-	-	30

**Table 2:** Composite score

Composite score	No. of patients	Percentage
Excellent (96-100 points)	13	43
Good (91-95 points)	10	33
Fair (81-90 points)	6	21
Poor (0-80 points)	1	3
Total	30	100

In the present study of 30 patients with bimalleolar ankle fractures treated by open reduction and internal fixation. Excellent results were achieved in 13 (43%), good in 10 (33%), fair in 6 (20%) and poor in 1 (3%) of patients. The patients with poor result had mild pain with activities of daily living, diminution in the abilities to run/work, reduced ankle movements and decreased joint space (Table 2).

## Discussion

Fractures of the ankle being articular and in a weight bearing extremity needs accurate reduction if residual pain and disability are to be avoided and the incidence of arthritis is to be reduced. In fractures of the ankle only the slightest variations from normal anatomy are compatible with good function of the joint. Treatment of malleolar fractures with accurate open reduction and internal fixation using AO principles was found to give good results.

The scoring system of Baird and Jackson is a composite score with slight variations from normal about 76% of patients in this series achieved excellent to good results, 20% achieved fair results and 3% achieved poor result. All had anatomical reduction of the malleolus radiologically.

The mean age in the present study was 40 years, which was similar to another study by Burwell S Charnley wherein it was 45 years.<sup>4</sup> Other studies by Gregory Joy *et al.* and Frank Wilson and Arne the mean age was 44.4 years.<sup>5,6</sup> A slightly lower

age of about 30 years was seen in a study by Baird and Jackson.<sup>7</sup> IN India, in a study by Jhathoth *et al.* also, more number of patients were in the same age group corroborating the present study.<sup>7</sup>

In the present study, the number of males was 73%, which was corroborated by studies of Baird and Jackson<sup>8</sup> and Erhan Yilmaz *et al.* wherein a male dominance of 70% and 64% was seen respectively.<sup>9</sup> In contrast, a study by Gregory Joy *et al.* reported a male incidence of 46%.<sup>5</sup>

The most common cause of the ankle injury was road traffic accident in the present study, which was in accordance to the study by Lee *et al.*<sup>10</sup> However, Falling from height was the most common cause in a study by Baird and Jackson<sup>4,8</sup> and slipping or stumbling was the cause in the study by Burwell and Chornley<sup>4</sup>.

The most common type of injury was supination-external rotation in our study which was in accordance to other studies by Gregory Joy *et al.*<sup>5</sup>, Baird and Jackson [8] and Burwell and Chronney.<sup>4</sup>

In our study, good to excellent results were obtained in 76% of patients, fair result in 20% and poor in 3% of patients. In a study by Sonj KJ, good to excellent results were obtained about 89% (32) of cases<sup>11</sup>, Yilmaz *et al.* reported good results in 58%, moderate in 26% and poor results in 16% patients<sup>9</sup>, Frank Wilson reported 42 (77%) had excellent to good results and only one had poor result.<sup>6</sup> 74.6% excellent results was observed in another similar study by Shekhar and Reddy.<sup>12</sup> Fractures of the medial malleolus close to the plafond require more exact reduction to restore normal Tibio-Talar relationship.

## Conclusion

Good anatomical reduction is essential for good clinical outcome irrespective of the type of fracture. Open reduction and internal fixation in accordance with AO principles was an efficient way to manage Bimalleolar Ankle Fractures. However an Understanding the mechanism of injury is essential for good reduction and internal fixation so that the bend of lateral malleolar should be reproduced during lateral plating for fibula and maintaining the fibular length for good ankle stability.

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