Research Article

Results of open reduction and internal fixation in closed bimalleolar Pott's Fracture of Ankle in Adults

Girish N Motwani[1], Himanshu D Shah[1], Vishwanath H Chavli[1], Rajiv N Daveshwar[1], Haresh Parmar[1], Pokhraj P Suthar[2]

[1]Department of Orthopedics, Medical College and SSG Hospital, Vadodara, Gujarat, India.
[2]Department of Radiology, Medical College and SSG Hospital, Vadodara, Gujarat, India.
Correspondence to: Girish N Motwani, E-mail: gitz.dr@gmail.com

Received January 23, 2015. Accepted February 5, 2015

Abstract

Background: The movement around ankle joint is very important because of the cultural practices, which involve squatting and sitting cross-legged. Bimalleolar Pott's fractures are very common in ankle joint injuries because of increased incidence of road traffic accidents and industrial trauma. Accurate reduction of fractures around ankle joint is important for a painless ankle joint.

Objective: To study the functional outcome of surgically managed closed bimalleolar fractures of ankle in adults; to evaluate restoration of the anatomy of malleoli and ankle perfectly by operative treatment with internal fixation; to assess the union of fractures after surgical management; and to achieve stable fixation and early mobilization of the ankle.

Materials and Methods: We have evaluated clinical, radiographic, and functional outcomes of 40 patients treated with a combination of different treatment modalities, which involve the combination of tension band wiring (TBW), Kirschner (K)-wire, Rush pin, cortical and cancellous screws, and one-third tubular plates for lateral and medial malleolus fixation.

Results: In this prospective study, 40 cases of bimalleolar fractures of ankle were treated by surgical methods. Road traffic accident was the most common mode of injury. Majority [16 (40%)] of the cases showed supination–external rotation injury, followed by 11 (27.5%) cases with pronation–external rotation injury. Majority [29 (72.5%)] of the medial malleolus fractures were fixed with TBW. In the remaining cases, cancellous screws and K-wire were used. Most [20 (50%)] of the lateral malleolar fractures were fixed with K-wire. In the rest of the cases, one-third tubular plate and Rush pin were used. In our study, the average time taken for union was 10.4 weeks. Excellent results were achieved in 23 cases (57.5%), good in 10 cases (25%), fair in five cases (12.5%), and poor in two cases (5%). Excellent results were observed in most bimalleolar fractures. Of the two cases with poor results, one developed superficial infection and the other showed delayed union.

Conclusion: Unstable bimalleolar ankle fractures are common because of road traffic accidents. Understanding the mechanism of injury is essential for anatomical reduction and fixation. Fibular alignment (length and rotation) has to be maintained for lateral stability of the ankle. Anatomical reduction with restoration of the articular congruence is essential in all intra-articular fractures, more so, if a weight-bearing joint such as ankle is involved. Open reduction and internal fixation restores the articular congruity of the ankle joint. Excellent results are obtained with stable fixation of fracture. TBW is better in internal fixation of medial malleolus compared with K-wire fixation, and lateral plating was the best for fibular fractures. Hence, we conclude that surgical management of bimalleolar ankle fractures provides good functional outcome. By stable surgical fixation of fracture, early mobilization can be done with good functional outcome.

KEY WORDS: Bimalleolar Pott's fractures, TBW, K-wire, rush pin, CC screw, one-third tubular plates

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2015.23012015182	

Introduction

Ankle fractures are the most common type of fractures treated by orthopedic surgeons. The prevalence of such fractures has increased over the last two decades in both young, active patients and the elderly people.[1,2]

Most ankle fractures are complex injuries that are difficult to manage. These injuries are of utmost importance as the ankle transmits the whole body weight and the stability of ankle joint determines the locomotion. They have the potential to produce significant long-term disability and complications in the form of pain, instability, and early degenerative arthritis.[3]

The effective strategies involved in the treatment of ankle fractures have gradually evolved owing to the better understanding of the biomechanics of the ankle, improvements in fixation techniques, and findings of outcome studies. 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 1 mm lateral shift in talus produces about 42% of decrease in tibiotalar 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]

Traditionally, the ankle fractures have been considered noncontroversial regarding the indications for operative intervention; however, recent knowledge about the biomechanics of the ankle has given rise to particular areas of clinical uncertainty. These include suggestive of operation in isolated fractures of the lateral malleolus, the operative techniques used for syndesmotic injury and the subsequent postoperative management, and the trustworthiness of radiographic assessment of ankle fractures.

The purpose of this study on bimalleolar fractures of ankle is to evaluate the functional outcome and results obtained after surgical management by various methods of internal fixation.

Aims and Objectives

1. To study the functional outcome of surgically managed closed bimalleolar fractures of ankle in adults.
2. To evaluate restoration of the anatomy of malleoli and ankle perfectly by operative treatment with internal fixation.
3. To assess the union of fractures after surgical management.
4. To achieve stable fixation and early mobilization of the ankle.

Materials and Methods

This is a prospective study carried out from June 2013 to June 2014 at SSG Government Hospital, Vadodara, Gujarat, India, involving surgical intervention of ankle fractures and followed up for a period of 6–12 months. The study included 40 adult cases who were treated for bimalleolar fractures of ankle. This study was approved by the ethical committee of SSG hospital.

Patients aged 20 years or older, showing closed bimalleolar fractures of ankle, and treated surgically were included for the study. Patients aged younger than 20 years and older than 70 years and with open fractures were excluded from the study.

All the patients with inclusion criteria were explained the methods involved, and an informed written consent was obtained before being including in the study. On admission, the patient's demographic data were noted. Local examination of injured ankle was looked for fractures.

Swelling of the ankle, any deformity, skin condition, and neurovascular statuses were inspected. Lower ends of tibia/fibula and the malleolar parts were palpated and looked for bony tenderness, displacements, any abnormal painful mobility, and crepitus. The interrelation of the malleoli was evaluated by palpation. Dorsalis pedis and posterior tibial arteries pulsations were checked. Distal neural status was also examined.

The instability of the syndesmosis was identified on the basis of the injury mechanism, the fracture pattern, and the external rotation stress test. Pain was elicited using the squeeze test, which involved manual medial–lateral compression across the syndesmosis. 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).[5]

Fractures of the ankle were evaluated using plain radiographs in anteroposterior, lateral, and mortise views. The fractures in this study were classified using the Lauge-Hansen [Table 1] and AO/OTA [Table 2] classification systems. Closed reduction and a below knee posterior plaster of Paris slab were applied.

Radiologically, tibiofibular clear space of more than 6 mm and widening of the medial clear space of more than 4 mm indicate syndesmotic instability. Preoperative routine investigations were as follows: Hb%, urine for sugar, RBS, blood urea, serum creatinine, HIV, HbSAg and ECG.

Operative Technique

In spinal and epidural anaesthesia, the patient was placed in supine position. The ipsilateral buttock was raised on a sandbag to improve the exposure of the lateral side. Pneumatic tourniquet was applied in all cases. The procedure was performed in a bloodless field, which facilitates good visibility to describe the fracture pattern and, thus, facilitates anatomical reduction.

Surgical Approaches and Fracture Fixation

Lateral Malleolus

Operative management of a malleolar fracture involves secured anatomic repair of a displaced lateral malleolus fracture as the most important step owing to the importance of this structure in maintenance of tibiotalar alignment.

Approach

A direct lateral approach over the fibula is the standard for reducing and internally fixing distal fibula fractures. The dissection should be made between the peroneus tertius anteriorly and the peroneus longus and brevis posteriorly. The incision is moved slightly anterior when the need to fix the anterior syndesmosis.

Table 1: Classification of the fractures using the Lauge-Hansen classification system

I. Supination–adduction (SA)	
1	Transverse avulsion-type fracture of the fibula below the level of the joint or tear of the lateral collateral ligaments
2	Vertical fracture of the medial malleolus
II. Supination–everson (external rotation) (SER)	
1	Disruption of the anterior tibiofibular ligament
2	Spiral oblique fracture of the distal fibula
3	Disruption of the posterior tibiofibular ligament or fracture of the posterior malleolus
4	Fracture of the medial malleolus or rupture of the deltoid ligament
III. Pronation–abduction (PA)	
1	Transverse fracture of the medial malleolus or rupture of the deltoid ligament
2	Rupture of the syndesmotic ligaments or avulsion fracture of their insertions
3	Short, horizontal, oblique fracture of the fibula above the level of the joint
IV. Pronation–eversion (external rotation) (PER)	
1	Transverse fracture of the medial malleolus or disruption of the deltoid ligament
2	Disruption of the anterior tibiofibular ligament
3	Short oblique fracture of the fibula above the level of the joint
4	Rupture of posterior tibiofibular ligament or avulsion fracture of the posterolateral tibia
V. Pronation–dorsiflexion (PD)	
1	Fracture of the medial malleolus
2	Fracture of the anterior margin of tibia
3	Supramalleolar fracture of the fibula
4	Transverse fracture of the posterior tibial surface

Fracture Fixation

1. Avulsion fractures of the distal fibula were reduced, held with a reduction forceps, and stabilized by either a tension band wiring (TBW) technique or a lag screw. A larger avulsed fragment of the distal lateral malleolus, typical of AO type A injuries, is best fixed with either a tension band wire or a small oblique screw.
2. AO type B fracture was fixed with one or two lag screws placed perpendicular to the line of the fracture.
3. More secure fixation was achieved with one-third semitubular plate contoured to fit the concave, slightly spiral, lateral surface of the fibula. Compressing the fracture site with an anterioposterior interfragmentary lag screw was used to augment the strength of the fixation.
4. AO type C fractures were reduced and fixed with a one-third tubular plate. The level of the fracture, the condition of the overlying soft tissues, and the extent of the comminution determines the position of the plate [Figures 1–3].

Table 2: Classification of the fractures using the AO/OTA classification system

Type A: Fibula fracture below syndesmosis (infrasyndesmotic)	
A1	Isolated
A2	With fracture of medial malleolus
A3	With a posteromedial fracture
Type B: Fibula fracture at the level of syndesmosis (trans-syndesmotic)	
B1	Isolated
B2	With medial lesion (malleolus or ligament)
B3	With medial lesion and fracture of posterolateral tibia
Type C: Fibula fracture above syndesmosis (suprasyndesmotic)	
C1	Diaphyseal fracture of fibula, simple
C2	Diaphyseal fracture of fibula, complex
C3	Proximal fracture of fibula

Figure 1: Preoperative X-ray of right ankle's lateral (a) and antero-posterior (b) views, showing Pott's fracture of ankle with supination external rotation injury.

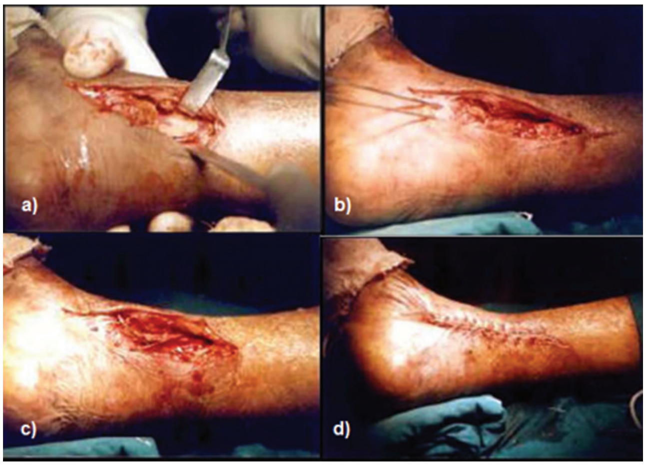

Figure 2: Intra operative image of TBW medial malleolus: a) incision and exposure of fracture site, b) reduction of fracture with fixed by K-wire, c) TBW done and d) suturing of skin.

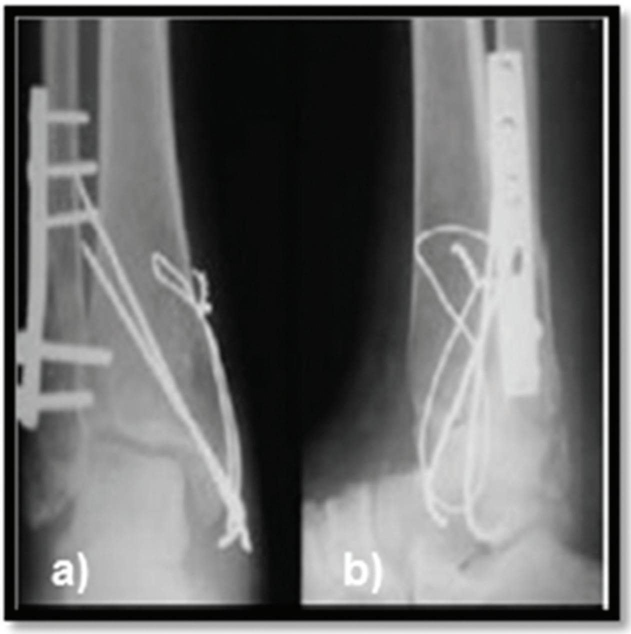

Figure 3: Postoperative X-ray of right ankle's anteroposterior (a) and lateral (b) views showing Pott's fracture of ankle with supination external rotation injury fix with TBW of medial malleolus and one-third tubular plate of lateral malleolus.

Medial Malleolar Fixation

Approach

The medial approach to the ankle centers on the medial malleolus itself and can be shifted toward either anterior to better access the joint or posterior for the back of the tibia to be exposed. The incision used was longitudinal or curvilinear, depending on the exposure needed.

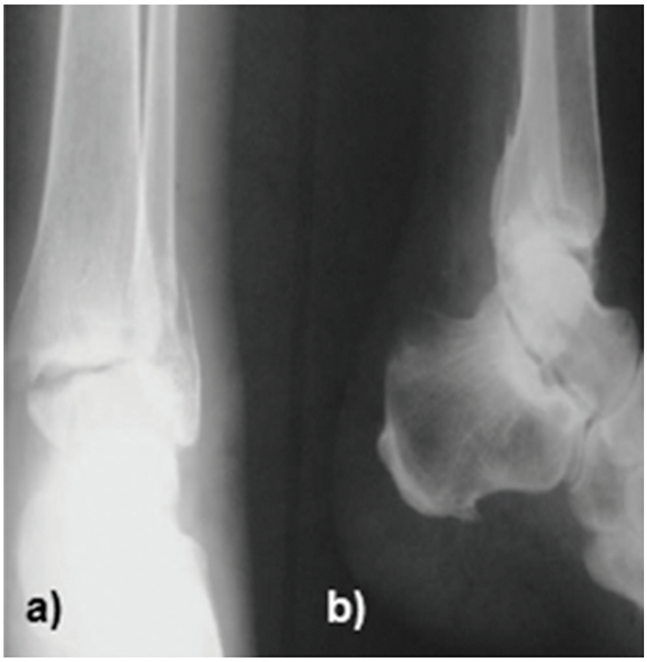

Figure 4: Preoperative X-ray of left ankle's anteroposterior (a) and lateral (b) views showing Pott's fracture of ankle with pronation external rotation injury.

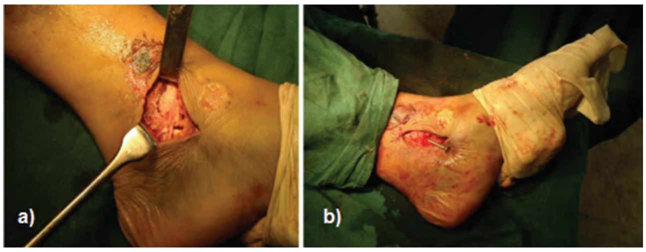

Figure 5: Intra operative image of CC screw fixation of lateral malicious: a) incision of skin and b) CC screw fixation.

Fracture Fixation

1. A sharp turning back of the periosteum and attached fascia exposing both the anterior and the medial aspects of the fracture helps in best reducing the avulsion fractures of the medial malleolus.
2. In the intermediate-sized fragments, a hole for a 4.0-mm partially threaded cancellous screw or malleolar screw is prepared by using one wire and 2.0- or 2.5-mm drill bit [Figures 4–6].
3. In large-sized fragments, provisional fixation requires two such drills, which are replaced with the 4-mm partially threaded screws, one at a time. A lag effect can be obtained by crossing their threads across the fracture and orienting perpendicular to plane of the fracture.
4. When the medial malleolar fragment was too small for screws or if comminuted, Kirschner (K)-wires with a figure-of-eight tension band was used for fixation [Figures 4, 6, and 7].

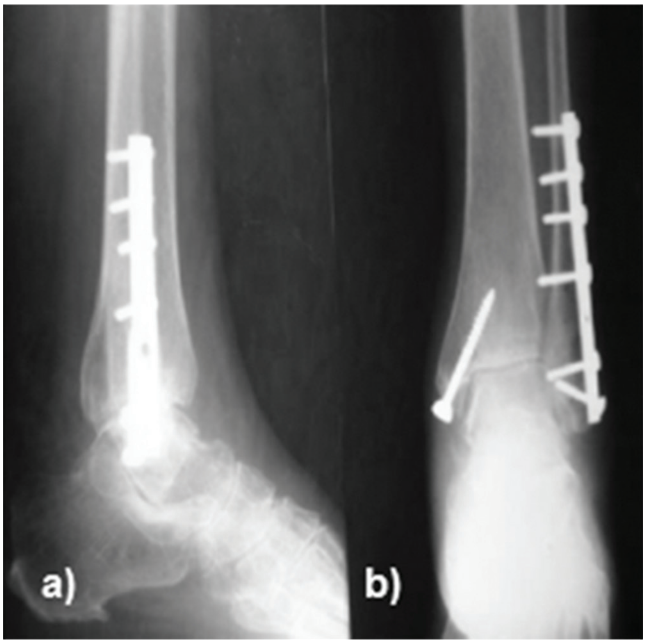

Figure 6: Postoperative X-ray of left ankle's lateral (a) and anteroposterior (b) views showing Pott's fracture of ankle with pronation external rotation injury fixed with CC screw medial malleolus and one-third tubular plate lateral malleolus.

Parenteral antibiotics were given in the postoperative period. After 10 to 12 days, the sutures were removed and a below knee cast was applied for 4 weeks. Nonweight-bearing gait was started from the first or the second postoperative day. Partial weight bearing was started after the removal of the cast (after clinical and radiological signs of union become evident). Full weight bearing was started after the radiological signs of union. Active exercises of the ankle were advised. Patients were discharge after 5 days of surgery.

Follow-up of cases was done at regular intervals for minimum of 6 months. The ankle scoring system of subjective, objective, and radiographic criteria of Baird and Jackson was used for the study. All the patients were evaluated and scores were given.

Scoring System of Baird and Jackson[6]

Scoring System for Subjective, Objective, and Radiographic Criteria

Criteria points

I. Pain:

A. No pain 15
B. Mild pain with strenuous activity 12
C. Mild pain with activities of daily living 8
D. Pain on weight bearing 4
E. Pain at rest 0

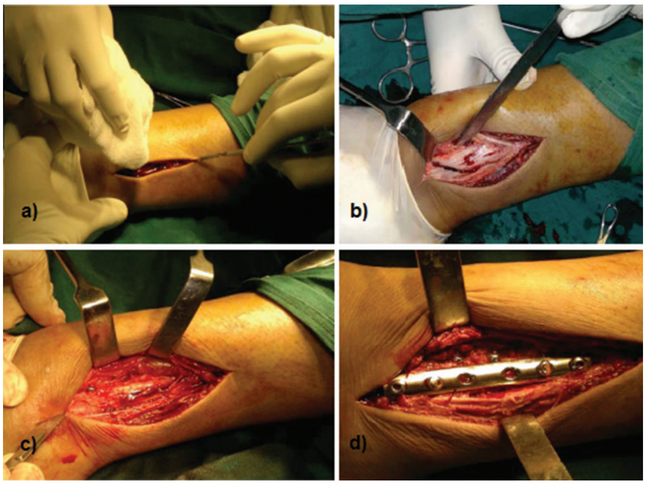

Figure 7: Intra operative image of one third tubular plate fixation of lateral malleolus: a) incision of skin, b) exposure of fracture site, c) reduction, d) fixated with plate and screw.

II. Stability of ankle:

A. No clinical instability 15
B. Instability with sports activities 5
C. Instability with activities of daily living 0

III. Ability to walk:

A. Able to walk desired distances without limp or pain 15
B. Able to walk desired distances with mild limp or pain 12
C. Moderately restricted in ability to walk 8
D. Able to walk short distances only 4
E. Unable to walk 0

IV. Ability to run:

A. Able to run desired distances without pain 10
B. Able to run desired distances with slight pain 8
C. Moderate restriction in ability to run, with mild pain 6
D. Able to run short distances only 3
E. Unable to run 0

V. Ability to work:

A. Able to perform usual occupation without restrictions 10
B. Able to perform usual occupation with restrictions in some strenuous activities 8
C. Able to perform usual occupation with substantial restrictions 6
D. Partially disabled; selected jobs only 3
E. Unable to work 0

VI. Motion of the ankle:

A. Within 10° of uninjured ankle 10
B. Within 15° of uninjured ankle 7
C. Within 20° of uninjured ankle 4
D. <50% of uninjured ankle or dorsiflexion < 5° 0

VII. Radiographic result:

A. Anatomic with intact mortise (normal medial clear space, normal superior joint space, no talar tilt) 25
B. Same as A with mild reactive changes at the joint margins 15

C. Measurable narrowing of superior joint space, with superior joint space >2 mm or talar tilt >2 mm	10
D. Moderate narrowing of superior joint space, with superior joint space between 2 mm and 1 mm	5
E. Severe narrowing of superior joint space, with superior joint space <1 mm, widening of medial clear space, severe reactive changes (sclerotic subchondral bone and osteophtye formation)	0
Maximal Possible Score	**100**

Functional Grading	Score
➢ Excellent	96–100
➢ Good	91–95
➢ Fair	81–90
➢ Poor	0–80

Results

In this prospective study, 40 cases of bimalleolar fractures of ankle were treated by surgical methods. The youngest patient was 21 years old and the eldest patient was 70 years old. The mean age was 39.28 years. In this series, men were more commonly involved, with M:F ratio of 5:1.

Right ankle was involved in 25 (62.5%) cases and left ankle in 15 (37.5%) cases, hence right ankle being more commonly involved than the left side. Road traffic accident was the most common mode of injury involving 18 (45%) cases, followed by 15 (37.5%) cases of fall, and seven (17.5%) cases of twisting injury.

Majority of the cases [16 (40%)] showed supination–external rotation injury, followed by 11 (27.5%) cases of pronation–external rotation injury. The 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. In this study, most of the cases were operated between days 2 and 5 (77.5%) The mean time interval was 3.5 days. Five patients were operated late after 6 days of injury. Of them, three patients showed poor local condition (edema) and two patients came late after injury.

Majority [29 (72.5%) cases] of the medial malleolus fractures were fixed with TBW. In the rest of the cases, cancellous screw and K-wire were used. Below syndesmotic medial malleolus fracture were successfully treated using TBW. Large fracture fragments were fixed by cancellous screw and small undisplaced fractures by K-wire.

Most [20 (50%) cases] of the lateral malleolar fracture were fixed with K-wire. In the rest of the cases, one-third tubular plate and Rush pin were used. Above syndesmotic uncommunited fractures of lateral malleolus were fixed by plating. While the communited above syndesmotic fractures were fixed by Rush pin, the small below syndesmotic fractures were fixed by K-wire.

In our study, the average time taken for union was 10.4 weeks. Most of the cases (80%) showed union between 8 and 14 weeks. In our study, 17.5% patients developed complications. Four patients showed superficial infections, I patient deep infection, and 2 patients delayed union medial malleolus. The superficial infections were managed with oral antibiotics and deep infections debridement and antibiotics. Delayed union medial malleolus was treated with continued immobilization, which eventually united without surgical intervention.

Final Score According to Subjective, Objective, and Radiological Criteria: Scoring System of Baird and Jackson

Functional Results

In this study, 40 patients with bimalleolar fractures were treated surgically. Excellent results were achieved in 23 cases (57.5%), good in 10 cases (25%), fair in five cases (12.5%) and poor in two cases (5%). Of the two patients with poor results, one patient showed superficial infection and the other delayed union. The patients with poor results complained mild pain during their activities of daily living, diminution in their abilities to run and do work, and reduced motion of the ankle and narrowing of joint space.

The excellent and good functional scores were observed in 33 patients; of them, 29 patients were operated for TBW medial malleolus.

Discussion

Of all the intra-articular fractures occurring in weight-bearing joints, the most common joint involved is the ankle joint.[7] The methods involved in restoring function and preventing arthritis include either closed treatment, which is 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.[7]

There has been gradual evolution in the management of ankle fractures owing to improved analysis of biomechanics, improvement in fixation techniques, and analysis of results of recent studies. The goal of the treatment is to provide fracture union with painless full motion of ankle, with anatomical restoration of the injured ankle.

Closed method of treatment is often inadequate in restoring the anatomy and biomechanics of ankle in unstable malleolar ankle 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.[7–9]

The treatment of malleolar fractures with accurate open reduction and stable internal fixation applying AO method and principles was found to provide a high percentage of excellent and good results.[10] This study supports these conclusions. In the current study, 40 patients with bimalleolar ankle fractures were operated upon. All patients were followed up with minimum period of 6 months (range, 6–12 months).

In our study, fractures were common in the 21–30 years age group, with mean age being 39.28 years. Our findings are comparable with the studies by Beris et al.,[10] Roberts,[11] and Lee et al.[12]

Our series had a male predominance with 82.5% and male:female ratio of 5:1, which is comparable with the study by Baird and Jackson.[6] In the current study, road traffic accidents constituted majority of cases, which was in accordance with study by Lee et al.[12]

In this study, right ankle was more commonly affected, in accordance with Roberts[11] and Beris et al.[10] In this study, Lauge-Hansen classification system was used for operative evaluation. The most common type of injury was supination–external rotation (40%), followed by pronation–external rotation injury (27.5%), in accordance with Roberts,[11] Beris et al.,[10] and Baird and Jackson.[6]

The results in this study were compared with thse of Burnwell and Charnley,[7] de Souza et al.,[8] and Beris et al.[10]

In the study by Colton,[13] 70% of the patients showed good to excellent results. Burnwell and Charnley[7] in their series of 132 patients found that 102 (77.3%) showed good results, 16% fair results, and 6% poor score.

In the study by de Souza et al.,[8] 150 cases of ankle fractures were treated by open reduction and internal fixation using AO/ASIF method and obtained 90% good results. In the study by Beris et al.,[10] of 144 patients with ankle fractures, 105 (74.3%) showed good to excellent results.

The functional results of this study were comparable with that of the above-cited studies, with 82.5% showed good to excellent results, 12.5% fair results, and 5% poor results.

Most authors have noted that anatomical reduction of displaced medial malleolus corrects the talar displacement and plays a vital role in treating unstable fractures. However, Heller and coworkers stated 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. that lateral malleolus is very important in the anatomical reduction of bimalleolar fractures, as the talus displacement occurs following 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.

Lateral malleolus can be fixed by various methods. Lateral plate, as recommended by AO group, has become widely accepted for the treatment of fibular fracture. Hughes[14] recommended that lateral malleolus should be fixed first. The 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 TBW. The results were not equally satisfactory in those patients who had less rigid fixation of the medial malleolus using only K-wires. TBW of the medial malleolus gave results equivalent of those fixed with screws and lesser reports of skin irritation.

In many fractured ankles, syndesmosis is stable after reduction and internal fixation of fibula fracture and medial malleolar fracture. Yablon et al.[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, with one showing excellent outcome and the other fair outcome.

Although early mobilization was advocated by AO group, other studies 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 at 4 weeks and full weight bearing when the signs of union were complete. The range of motion of ankle was reduced initially because of stiffness secondary to immobilization for 4 weeks but improved over few weeks.

In our 40 patients, there was no instability of ankle joint, because we allowed sufficient time for the soft tissues around the ankle to heal. We preferred postoperative immobilization rather than allowing active ankle exercise as there was no difference in the results after 6 months of follow-up.

Fair to poor results in the current series were seen because of wound infection and 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 patients with superficial and deep infections affected by pronation–external rotation type of injuries and patients with delayed union affected by supination–external rotation type of injuries.

Majority of the patients (82.5%) showed good to excellent results in the current study, similar to what was observed in other series such as those by Burnwell and Charnley,[7] Colton,[13] and Beris et al.[10]

The 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. This study supports these conclusions and was comparable with those in other studies.

Conclusion

Unstable bimalleolar ankle fractures are common owing to road traffic accidents. Ankle injuries are common in middle-aged men and elderly women.

Understanding the mechanism of injury is essential for anatomical reduction and fixation. Majority of them were caused by external rotation injuries, supination–external rotation (40%) and pronation–external rotation (27.5%). Fibular alignment (length, rotation) has to be maintained for lateral stability of the ankle. Anatomical reduction with restoration of the articular congruence is essential in all intra-articular fractures, more so, if a weight-bearing joint such as ankle is involved. Open reduction and internal fixation restores the articular congruity of the ankle joint. The operative results were satisfactory in 82.5% cases, with good to excellent functional outcome.

Excellent results are obtained with stable fixation of fracture. TBW is better in internal fixation of medial malleolus compared with K-wire fixation, and lateral plating was the best for fibular fractures. Functional results improve when the normal bend of the lateral malleolus is restored while plating. Good functional results are obtained by surgical management of bimalleolar ankle fractures. Early weight bearing and mobilization were achieved in these patients.

Hence, we conclude that surgical management of bimalleolar ankle fractures provides good functional outcome. By stable surgical fixation of fracture, early mobilization can be done with good functional outcome.

References

1. Bauer M, Benger U, Johnell O. Supination–eversion fractures of ankle joint: Changes in incidence over 30 years. J Foot Ankle 1987;8:26–8.
2. Daly PJ, Fitzgerald RH, Melton LJ, Listrup DM. Epidemiology of ankle fractures. Acta Orthop Scand 1987;58:539–44.
3. Carragce EJ, Csongradi JJ, Bleck EE. Early complications in the operative treatment of ankle fractures. J Bone Joint Surg Br 1991;73:79–82.
4. Geissler WB, Tsao AK, Hughes JL. Fractures and injuries of the ankle. In: *Rockwood and Green's Fractures in Adults*, 4th edn., Rockwood CA, Green DP, Bucholz RW, Heckman JD (Eds.). Philadelphia, PA: Lippincott Raven, 1996. pp. 2201–66.
5. Carr JB. Malleolar fractures and soft tissue injuries of the ankle. In: *Skeletal Trauma: Basic Science, Management, and Reconstruction*, 3rd edn., Browner BD, Jupiter JB, Levine AM, Trafton PG (Eds.). Philadelphia, PA: WB Saunders, 2003. pp. 2327–404.
6. Baird AR, Jackson TS. Fractures of the distal part of the fibula with associated disruption of the deltoid ligament. J Bone Joint Surg Am 1987;69:1346–52.
7. Burwell HN, Charnley AD. The treatment of displaced fractures of ankle by rigid internal fixation and early joint movement. J Bone Joint Surg Br 1965;47:634–60.
8. de Souza LJ, Gustilo RB, Meyer TJ. Results of operative treatment of displaced external rotation-abduction fractures of ankle. J Bone Joint Surg Am 1985;67:1066–74.
9. Cimino W, Ichtertz D, Silabaugh P. Early mobilization of ankle fracture after open reduction and internal fixation. Clin Orthop Relat Res 1991;267:152–6.
10. Beris AE, Kabbani KT, Xenakis TA, Mitsionis G, Soucacos PK, Soucacos PN. Surgical treatment of malleolar fractures—A review of 144 patients. Clin Orthop Relat Res 1997;341:90–8.
11. Roberts RS. Surgical treatment of displaced ankle fractures. Clin Orthop Relat Res 1983;172:164–70.
12. Lee YS, Huang CC, Chen CN, Lin CC. Operative treatment of displaced lateral malleolar fractures: The Knowles pin technique. J Orthop Trauma 2005;19(3):192–97.
13. Colton CL. The treatment of Dupuytren's fracture dislocation of the ankle. J Bone Joint Surg Br 1971;53:63–71.
14. Hughes J. The medial malleolus in ankle fractures. Orthop Clin North Am 1980;11(3):649–60.
15. Yablon IG, Heller FG, Shouse L. The key role of lateral malleolus in displaced fractures of the ankle. J Bone Joint Surg Am 1977;57:169–73.

How to cite this article: Motwani GN, Shah HD, Chavli VH, Daveshwar RN, Parmar H, Suthar PP. Results of open reduction and internal fixation in closed bimalleolar Pott's Fracture of Ankle in Adults. Int J Med Sci Public Health 2015;4:893-900

Source of Support: Nil, **Conflict of Interest:** None declared.