Original research article

A Clinical Study Of Functional Outcomes Of Bimalleolar Ankle Fractures

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ABSTRACT

Background: About 9% of all adult fractures are ankle fractures. The primary method of therapy for such injuries is open reduction and internal fixation. However, problems might arise after surgery, and the results are not always as expected. To assess the functional results of bimalleolar ankle fractures treated with open reduction and internal fixation, this study was conducted. The present study aimed to analyze the surgical management of bimalleolar ankle fractures reported to our tertiary care hospital.

Methods: Clinical and radiological examinations were performed on the patients who arrived at the casualty and outpatient departments. All instances underwent closed reduction and plaster of Paris immobilization. Check x-rays were taken and planned for surgery accordingly. Planning for reduction and selecting the right implants are both aided by high-quality radiographs. In a few situations, radiographic images of the opposite ankle are obtained for comparison.

Results: The overall function was found to be excellent and good in 40% of cases with scores of > 81% poor scores were found in only n=2(6.66%) of all the cases details depicted in table 3. Excellent results were found in most cases of SER followed by good results. N=2 cases with poor results in this category of fractures. In PER cases results were excellent and good no case of poor results. The same pattern is seen in SAD cases. However, in PAB cases one case was with fair results.

Conclusion: supination external rotation is the most common type of injury in cases of bimalleolar ankle fractures and this was also associated more commonly with dislocations and complications. Pronation-External Rotation type produced Excellent and good results with minimal rate of complication.

Key Words: Bimalleolar Ankle Fractures, Operative Management, Functional Outcome of Ankle Fractures

INTRODUCTION

The most frequent weight-bearing orthopedic musculoskeletal trauma seen in emergency care and practice is ankle injury. [1] Due to an increased tendency to fall, increased weight, and polypharmacy, ankle fractures are more common in elderly patients. The ankle joint is very congruous, and any disruption of the natural articular connection may cause biomechanical dysfunction or progressive arthrosis. [1] Baron, Dupuytren, and Maisonneuve were the first French authors to write extensively on ankle injuries, but it wasn't until Ashurst and Bromer's study from 1922 that the classification and mechanism of ankle fractures were properly understood. [2] Lauge-Hansen identified four patterns between 1948 and 1954 based on pure injury sequences and taking into account the location of the foot, the direction of the deforming force, and the injury to the ankle. It is required to perform anatomical reduction by open technique and internal fixation of Bimalleolar ankle fracture to prevent complications, as in other intraarticular fractures. When planning the care of fractures in a clinical environment, the evaluation of ankle stability is essential. Although surgical intervention is frequently more effective in managing unstable ankle fractures, stable fractures can be managed conservatively with positive results. Open reduction internal fixation has been fully shown to be better than closed therapy in the literature. [3] One of the most frequent fractures in orthopedic traumatology is the malleolar fracture. Malleolar fractures need precise reduction and secure internal fixation, as with other intra-articular fractures. When a strong deep deltoid ligament is present, lateral malleolar fractures may typically be treated successfully without surgery. A lateral malleolar fracture with an ineffective deep deltoid ligament, on the other hand, is clinically identical to a bimalleolar ankle fracture and, if left untreated, may lead to talar displacement and degenerative arthritis. [4] This study aimed to examine the functional results of surgically treating bimalleolar ankle fractures and to learn about the drawbacks of doing an open reduction internal fixation on bimalleolar fractures.

Material and Methods

This cross-sectional study was done in the Department of Orthopedics, Dr. Patnam Mahender Reddy Institute of Medical, Sciences, Hyderabad, Telangana State. Institutional Ethical approval was obtained for the study. The method of sampling used was convenient sampling. Written consent was obtained from all the patients included in the study.

Inclusion criteria:

1. Bimalleolar ankle fractures
2. Age group-20-60 years

Exclusion criteria:

1. Systemic Infection
2. open injury with dislocation
3. skin diseases
4. previous arthrodesis at the target level.

Preoperative planning and care: Clinical and radiological examinations were performed on the patients who arrived at the casualty and outpatient departments. All instances underwent

closed reduction and plaster of Paris immobilization. Check x-rays were taken and planned for surgery accordingly. Planning for reduction and selecting the right implants are both aided by high-quality radiographs. In a few situations, radiographic images of the opposite ankle are obtained for comparison. Computed tomography was used to evaluate the distal tibiofibular joint involvement, size, and location of the malleolar fragment in four patients. In some cases, magnetic resonance imaging was used to evaluate soft tissue damage and ligament involvement. This is helpful to get a satisfactory functional result. X-rays were used to determine the fracture's displacement and stability. To maintain tibiotalar congruity, reduction of the displaced fracture was carried out right away. In some patients, stress radiographs were used to evaluate preoperative syndesmotic damage. Shenton's line is broken and a dime sign is visible in syndesmotic instability.

Intraoperative Management: All of our cases were managed intraoperatively without the use of a tourniquet in all circumstances. First, the fibula was exposed. After the hematoma at the fracture site was cleaned, the fracture was reduced. The reduction was held in place using sharp reduction forceps. Anteroposterior lag screws were utilized with a 3.5 mm cortical screw. The Workhorse plate of the distal fibula is a low-profile, tubular plate that offers enough strength for the majority of fractures.

The medial malleolus was then exposed and the hematoma was cleaned and the fracture site was reduced after clearing soft tissue interposition and held in position with towel clips pointed reduction forceps and k wires. The definitive fixation was undertaken with malleolar screws, cancellous screws, and tension band wiring. A suction drain was placed and the wound closed in layers after complete hemostasis. A compression bandage was applied and a below-knee slab was applied.

Postoperative Management: Following surgery, the affected limb was kept elevated on pillow toe motions and quadriceps exercises were commenced, and the injured leg was maintained elevated on a cushion. Following three days on parenteral antibiotics (Cefotaxime 1g and Gentamycin 80 mg), the patients were switched to oral antibiotics. On the second post-operative day, the drain was removed and the first wound was examined. The second wound assessment was performed and the dressings were changed on the fifth postoperative day. Wound examination and dressing changes were made following the state of the wound. If there was drainage, the sample was submitted for culture and sensitivity, and the patient was prescribed the proper medications. Suture removal was done after 12 to 14 days. The patient was discharged from the hospital with a cast that was below the knee. Routinely, postoperative X-rays were taken to assess the congruity of the joint and assess the alignment of the fractures.

Follow-Up: The maximum follow-up was two years and the Minimum follow-up was six months. Patients were called for a review in the 6^{th} week, 3^{rd} month, 6^{th} month, and 12^{th} month. If there is substantial evidence of union both clinically as well as radiologically,

gradual weight bearing started accordingly and patients were put on physiotherapy for mobilization of the ankle joint.

Results

Out of the n=40 cases selected in the study based on the inclusion and exclusion criteria. N=32(80%) were males and n=8(20%) were females. The male-to-female ratio was 4: 1. Based on the age group of involvement the commonest age group involved with this fracture was 21 – 30 years with 37.5% of all the cases followed by 31 – 40 years with 27.5% of the cases. The other distribution of cases based on age has been depicted in table 1. The laterality of involvement of the joint showed that in 62% of the cases right leg was involved and in n=38% left leg was involved the distribution is depicted in figure 1. The mode of injuries has been depicted in figure 2 which shows that in 55% of cases the fractures occurred due to Road Traffic Accidents (RTAs) followed by 20% of cases with falls and twisting and fall from height in 15% and lastly sports-related injuries occurred in 10% of cases.

Table 1: Age-wise and sex-wise distribution of cases in the study

Age (In years)	*Male*	*Female*	*Frequency (%)*
21-30	11	4	15 (37.5%)
31-40	8	3	11 (27.5%)
41-50	7	1	8 (20.0%)
51-60	6	0	6 (15.0%)
> 60	0	0	0 (00.0%)
Total	32	8	40 (100.0%)

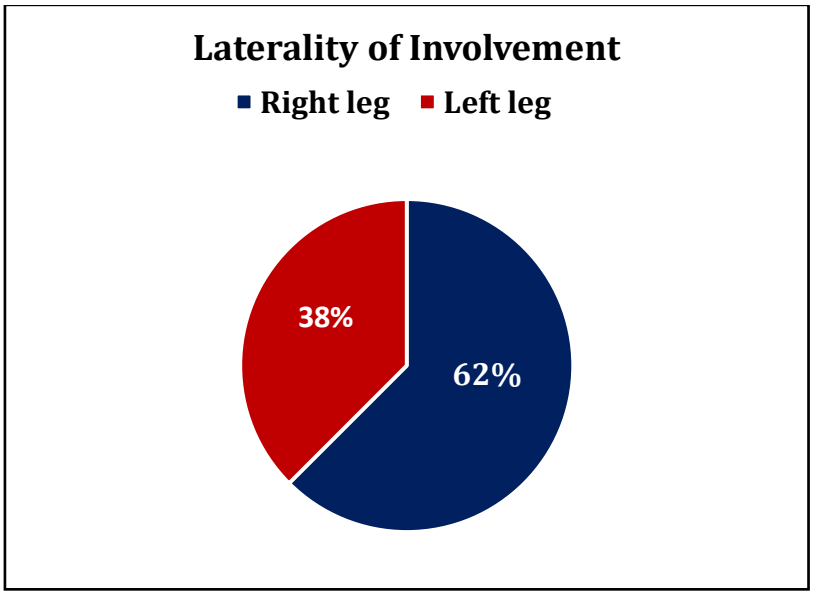

Figure 1: Distribution of cases based on the side involved

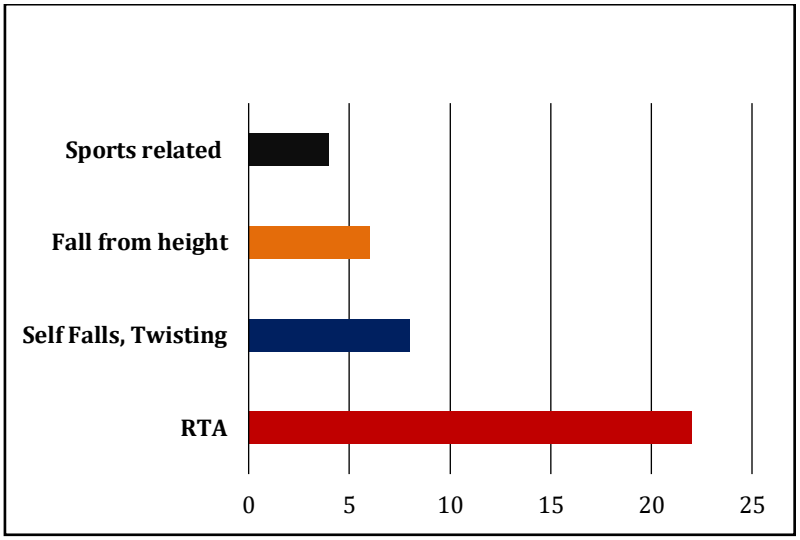

Figure 2: Showing the mode of injuries in the study

Based on the position of the foot and direction of force applied to the foot, four types of injury patterns described by Lauge-Hansen classification showed in 57.5% of cases Supination-External rotation was affected followed by Pronation-External rotation in 22.5% of cases Pronation-External rotation Supination-Adduction and 12.5% and 7.5% respectively depicted in figure 3.

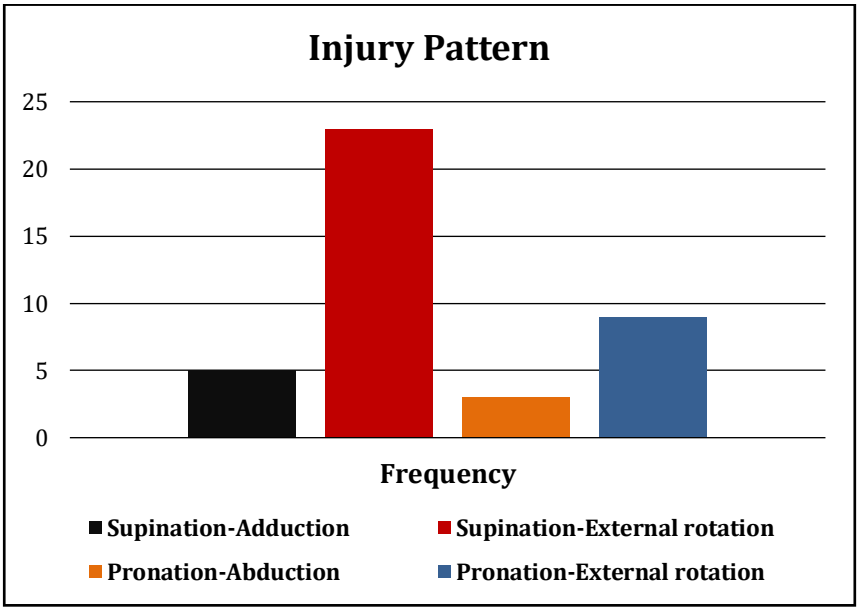

Figure 3: Injury patterns based on Lauge-Hansen classification

The management of the fibula was done with the one-third tubular plate in 47.5% of cases followed by the reconstruction plate in 32.5% and K wires and conservative management was done in 10% of cases. Similarly, the medial malleolus management was done by malleolar screws in 52.5% and cancellous screws in 25% of cases. K wires were used in 12.5% and Tension band wiring in 10% of cases details depicted in table 2.

Table 2: Methods of management of fibula and medial malleolus in the cases of the study

Fibula Management	*Frequency*	*Percentage*
One-third tubular plate	19	47.5
Reconstruction plate	13	32.5
K-Wires	04	10.0
Conservative	04	10.0
Total	40	100.0
Medial Malleolus Management		
Malleolar screws	21	52.5
Cancellous screws	10	25.0
Tension Band Wiring	04	10.0
K wires	05	12.5
Total	40	100.0

The overall function was found to be excellent and good in 40% of cases with scores of > 81% poor scores were found in only n=2(6.66%) of all the cases details depicted in table 3. Excellent results were found in most cases of SER followed by good results. N=2 cases with poor results in this category of fractures. In PER cases results were excellent and good no case of poor results. The same pattern is seen in SAD cases. However, in PAB cases one case with fair results the details have been depicted in figure 4.

Table 3: Overall functional outcome of patients

Results	*Frequency*	*Percentage*
Excellent (>90%)	17	42.50%
Good (81% - 90%)	16	40.00%
Fair (60% - 80%)	05	12.50%
Poor (<60%)	02	6.66%

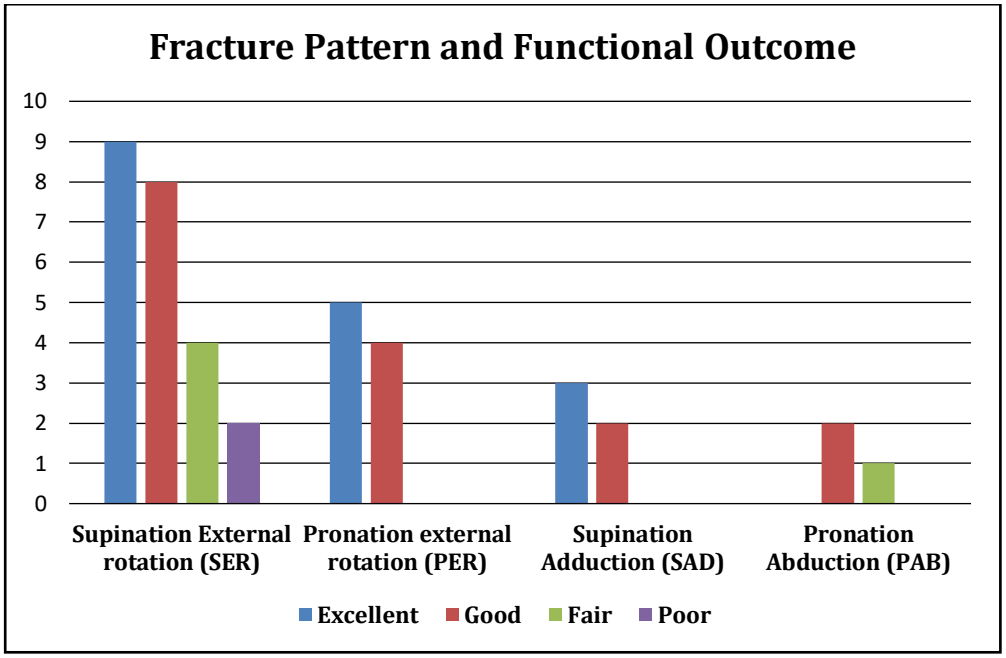

Figure 4: Fracture pattern and the functional outcomes in the cases

Most patients with complications with superficial infections were treated with repeated saline dressing and antibiotics. They responded well to this treatment. No cases of deep infections were noted. The instances of non-union of medial malleolus were treated with freshening of the fracture site and revision of fixation was done. In one case the implant removal was done early due to pain over the hardware. The details of the distribution of complications have been depicted in table 4.

Table 4: Complications recorded in the cases of the study

Complications	*SER*	*PER*	*SAD*	*PAB*	*Total*
Superficial Infections	2	1	1	1	5
Deep infections	0	0	0	0	0
Non-union	1	0	0	1	2
Malunion	0	0	0	0	0
Arthritis	1	0	0	0	1
Talar tilt	1	0	0	0	1
Talar shift	0	0	0	0	0
Total	5	1	1	2	9

Discussion

In the current study out of the n=40 cases selected n=32(80%) were males and n=8(20%) were females. The male-to-female ratio was 4: 1. Common age group involved was the third decade with 37.5% of the cases. The right side was involved in 62% of cases and the left side was involved in 38% of cases. The most common cause of fractures was RTAs in 55% of cases. This shows that the young generation who use motorcycles and automobiles and are much more active and traveling are more likely to face these kinds of

fractures and because the males are more involved in outdoor activities, they are more prone to these fractures as compared to females. Supination external rotation (SER) type was the injury pattern that was most frequently observed in our study. For determining ankle instability, stress radiographs are helpful. According to Seidel A et al., [5] a gravity stress test is more pleasant and accurate than a manual stress test. Stress radiographs, according to Weber, overstate instability. Stress radiographs are used to evaluate deep deltoid ligament injuries linked to ankle instability and to distinguish SER2 injuries from SER4 similar injuries. SER4 fractures require ligament restoration and syndesmotic stability because they are unstable. [6] In the SER pattern, n=17 out of n=23 patients had good to excellent functional outcomes. Among three patients who had dislocations with SER type of bimalleolar fracture, two had good outcomes due to early closed reduction of ankle joint followed by open reduction and internal fixation of malleoli; in another patient with dislocation who had reported late, we had fair outcome indicating the importance of early reduction of ankle dislocation. Among the Supination-Adduction type, all patients had good to excellent outcomes, and we used tiny size K wire, a single malleolar screw, or a lag screw to address the fibular fragment that was too small to be fixed. As suggested by Ramsey PL et al., [7] in their study, we chose an anteromedial technique to treat the articular pathologies and repair the fracture rather than the conventional hockey stick incisions used for other types of fractures. In five of the patients with pronation abduction injury, we have fixed medial malleolus first followed by extra periosteal plating for fibula, the advantage of which (to overcome the higher incidence of non-union according to their study) has been reported by Ebraheims et al., [8] Ankle mortise and syndesmotic stability play a key role in pronation external rotation injury repair of fibular length and rotation. With the use of syndesmotic screws and fibular plating, we were able to maintain the syndesmotic stability and fibular length in all the patients with pronation external rotation damage. Displacement is the talus's location within the mortise and is dependent on the deep deltoid ligament's integrity. [9] If the deep deltoid is ripped, it must be repaired since repairing the malleolar fragment would not restore ankle stability. Axial force does not cause stable fractures to shift. [10] Depending on how stable the fracture is, treatment options are chosen. The severity of the damage determines the prognosis. [7] If the deep deltoid is ripped, it must be repaired in addition to the malleolar fragment to restore ankle stability. Although the Lauge-Hansen classification defines the pattern of an ankle fracture in great detail, it does not address syndesmotic injuries. Patients whose fibula were fixed with K wires experienced less favorable outcomes than patients whose fibula were fixed with contoured reconstructions or one-third tubular plates. This could be a result of the fact that contoured plates accommodate the fibula's valgus bend and give the fibular reduction enough rigidity. The overall function was found to be excellent and good in 40% of cases with scores of > 81% poor scores were found in only n=2(6.66%) of all the cases. Hafiz et al., [11] study, the subjective scoring outcome was excellent and good in 84% and objective scoring was good in 78.8% and poor in 4.2% and the results are comparable with our study. In our series, n=9(22.5%) cases had complications such as wound infection, non-union, and arthritis. Superficial infection (27%) with skin necrosis was the commonest complication we encountered. Skin necrosis was very much less

when the plate and screws of the 3.5 mm system is used. The superficial infections were treated with repeated saline dressing and antibiotics. They responded well to this treatment.

Conclusion

Within the limitations of the current study, it was found that supination external rotation is the most common type of injury in cases of bimalleolar ankle fractures and this was also associated more commonly with dislocations and complications. Pronation-External Rotation type produced Excellent and good results with minimal rate of complication. A favorable functional outcome is achieved with correct anatomical reduction, the restoration of articular congruity, and early surgical fixation with the proper implants.

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