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Original Research Article

A HOSPITAL BASED OBSERVATIONAL STUDY TO ASSESS THE FACTORS AFFECTING THE OUTCOME OF OPERATIVE MANAGEMENT OF MALLEOLAR FRACTURES IN A TERTIARY CARE CENTER

Sumer Singh Shekhawat[1], Pramod Sunda[2], Ronak Patidar[3], Rajat Saini[4]

[1]Assistant Professor, Department of Orthopaedics, Jawahar Lal Nehru Medical College, Ajmer, Rajasthan, India.
[2]Junior Specialist, Department of Orthopaedics, Shri Kalyan Medical College & Attached Group of Hospital, Sikar, Rajasthan, India.
[3]Final Year Resident, Department of Orthopaedics, Jawahar Lal Nehru Medical College, Ajmer, Rajasthan, India.
[4]Junior Specialist in Orthopaedics, Sub District Hospital, Makrana, Rajasthan, India.

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Corresponding Author:
Dr. Rajat Saini,
Junior Specialist in Orthopaedics, Sub District Hospital, Makrana, Rajasthan, India.
Email: dr.rajatsaini@gmail.com

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ABSTRACT

Background: Malleolar fractures are one of the most common fractures in orthopedic traumatology. Treatment of these fractures is complicated and challenging as the outcome influences the locomotion; inadequate and improper treatment may result in long-term orthopedic complications and disability. The purpose of this study is to analyze the factors influencing the outcome of operative management of malleolar fractures.

Material & Methods: A hospital based prospective study done on twenty patients with malleolar fractures of ankle presenting in department of orthopaedics at JLNMC, Ajmer, Rajasthan, India during one-year period were operated with open reduction and internal fixation by various methods. All patients were assessed clinically, radiologically. The stability of the structures involved at the fracture site, damage to the neighboring structures, mechanism of injury was assessed. Radiologically, tibiofibular clear space of >2 mm and widening of the medial clear space of >2 mm were considered as indicators of syndesmotic instability. Follow-up of cases was done at regular intervals of 6 weeks for a minimum of 6 months and assessed using Biard and Jackson's ankle scoring system.

Results: Out of 20 there were 15 males and 5 females, in 12 patients (60 %) right ankle was involved and in 8 patients (40%) it was left ankle. Functional outcome was assessed using Biard and Jackson's ankle scoring system at follow-up. 12 (60.0%) showed excellent functional score, while 5 (25%) had good score. Two patients showed fair and one patient showed poor outcome due to infection. Pain was the common complaint in 11 (55%) patients of whom 10 patients had Grade B, i.e., pain with strenuous activities and only one patient had mild pain with activities of daily living. None of the patients had clinical instability.

Conclusion: We conclude that anatomical reduction is essential in all malleolar fractures of ankle as it is a weight bearing joint. Open reduction and internal fixation guaranty high standard of reduction besides eliminating the chances of loss of reduction.

Keywords: Malleolar Fracture, Open Reduction, Internal Fixation, Functional Outcome, Ankle Joint.

INTRODUCTION

Ankle joint is one of the unstable joints in the body due to its anatomic position and is more prone to injury during daily activities. Malleolar fractures are one of the most common fractures in orthopedic traumatology.[1] The annual incidence of ankle fracture is between 107 and 184 per 100,000

persons.[2-4] Moreover, the prevalence and incidence of these lesions have increased within the last three decades, especially in young men and elderly women, with a mean age of 46 years, significantly higher than the age of isolated ankle sprains. Furthermore, it is anticipated that the number of these lesions could be expected to triple by 2023.[5]

As with all intra articular fractures accurate reduction and stable internal fixation of malleolar fractures is desirable. The results of inaccurately reduced malleolar fractures are post traumatic painful restriction of motion or osteoarthritis of ankle or both. Treatment of these fractures is complicated and challenging as the outcome influences the locomotion; inadequate and improper treatment may result in long-term orthopedic complications and disability.[6,7] Hence, malleolar fractures require accurate reduction and stable internal fixation similar other intra-articular fractures. Thus, the treatment aims at restoring the joint anatomy and functions to normal or near normal; minimize pain, and other complications.

Operative method restores the anatomy and contact-loading characteristic of the ankle. Surgical intervention can be either closed reduction or open reduction with internal fixation (ORIF). Conservative technique of closed reduction in stable injury yields satisfactory outcome while unstable, displaced, and open fractures need ORIF. The superiority of ORIF over closed treatment has been thoroughly demonstrated in the literature.[8] However all studies in operative treatment have not obtained good results in cases of malleolar fractures. A rewarding outcome for the patient and surgeon which is a proper anatomical alignment and stability of ankle joint can be achieved only with open reduction and internal fixation technique for malleolar fractures. The purpose of this study is to analyze the factors influencing the outcome of operative management of malleolar fractures.

MATERIAL AND METHODS

A hospital based prospective study done on twenty patients with malleolar fractures of ankle presenting in department of orthopaedics at Jawahar Lal Nehru Medical College, Ajmer, Rajasthan, India during one-year period were operated with open reduction and internal fixation by various methods.

Inclusion Criteria

- Patients with unstable malleolar fracture, skeletally matured, closed type, type I and type II compound fractures, acute fractures (seen within 72 hrs of the injury).

Exclusion Criteria

- Patients were skeletally immature, compound fractures of type III A, B and C,
- Fractures associated with pilon or plafond fractures of tibia.
- Previous ankle fracture.
- Polytrauma, associated with bilateral lower limb fractures.
- Any concomitant painful or disabling disease of lower limb that could interfere with evaluation of the affected ankle.

Methods

All patients were assessed clinically, radiologically. The stability of the structures involved at the fracture site, damage to the neighboring structures, and mechanism of injury was assessed. Radiologically, tibiofibular clear space of >2 mm and widening of the medial clear space of >2 mm was considered as indicators of syndesmotic instability.

Fractures of the ankle were evaluated using plain radiographs in anteroposterior, lateral and mortise views. Fractures were classified using the Lauge–Hansen,[9] arbeitsgemeinschaft für osteosynthesefragen (AO), ("Association for the Study of Internal Fixation" in English)/orthopedic trauma association system classification systems[10] and anatomical types.[11,12] Closed reduction and a below knee posterior plaster of Paris (POP) slab were applied.

All included patients underwent surgical intervention, i.e., ORIF, and received post-operative care. Under spinal and/epidural anesthesia, patients were placed in supine position. The ipsilateral buttock was raised on a sandbag for better and clear view of the lateral side. A pneumatic tourniquet was applied in all cases. The procedure was performed in a bloodless field, which facilitated good visibility to describe the fracture pattern and anatomical reduction. Appropriate surgical techniques were applied as per the fracture site. Intraoperatively, the stability was checked by laterally displacing the distal fibula from the tibia and the presence of >2 mm of lateral shift of talus suggested instability (cotton test).[13]

Parenteral antibiotics were given during the post-operative period for 3-5 days, according to the wound condition. After 10-12 days, sutures were removed, and a below knee cast was applied for 4 weeks. Non-weight bearing gait was started from first or the second post-operative day. Partial weight bearing was started after the removal of the cast (after clinical and radiological signs of union become evident). Active exercises of the ankle were advised. In patients with syndesmotic screw fixation, weight bearing was delayed till screw removal. Follow-up of cases was done at regular intervals of 6 weeks for a minimum of 6 months and assessed using Biard and Jackson's ankle scoring system.[14]

Statistical Analysis

Data were captured on the predesigned, pre-approved pro forma. Results were expressed as frequency, percentage, range and tables were used to depict the results and explained using descriptive analysis.

RESULTS

Out of 20 there were 15 males and 5 females, in 12 patients (60 %) right ankle was involved and in 8 patients (40%) it was left ankle. Patients were aged between 20 years to 70 years with an average of 46.8 yrs. The majority were in the 4th decade. 10 (50%) patients presented to us with the history of Road Traffic Accidents, in 6 [30%] patients' fracture was due to slipping and tumbling. Fall from height was the cause of fracture in the rest 4 [20%] patients. Hansen's classification in 11 (55%) patients sustained fracture due to supination external rotation, followed by pronation external rotation type in 5 (25%) patients, supination adduction type in 3 (15%) and only in 1 (5%) patient sustained injury by pronator abduction type. The AO Type B was the most common injury involving 13 (65%) patients, followed by Type C in 5 (25%) and was least in Type A (10%). [Table 1]

Patients were operated on days 1-3; 9 (45%) were operated on day 2, 5 (25%) on day 3, and 4 (20%) were operated on day 1. Only 2 patients (10.0%) were operated on day 4 or more.

Fibula fractures were fixed with Dynamic compression plate (DCP) in 11 (55%) cases, DCP with lag screw in 5 (25%) cases, DC buttress plate, DCP with syndesmotic screw, tension band wiring and lag screw alone in one case each (5%). Medial malleolar fractures were fixed with malleolar screw with k wire in 12 (60%) patients, malleolar screw alone in 3 (15%) patient, tension band wiring in 3 (15%) patients and 2 (10%) patients with Buttress plate. [Table 3 & 4]

Complete union was seen in all patients, with a mean time taken for the union of 10.3 weeks, and a range of 8-14 weeks.

Functional outcome was assessed using Biard and Jackson's ankle scoring system at follow-up. 12 (60.0%) showed an excellent functional score, while 5 (25%) had good score. Two patients showed fair, and one patient showed poor outcome due to infection. The patient who had poor results had mild pain during their activities of daily living, diminution in their ability to run and do work, reduced motion of ankle, and narrowing of joint space. Infections were managed with debridement and administering antibiotics. Delayed union fracture of medial malleolus was treated with continued immobilization, which eventually united without surgical intervention.

Combined functional score was calculated using Biard and Jackson's ankle scoring system and grouped into five categories (A-E). Pain was the common complaint in 11 (55%) patients of whom 10 patients had Grade B, i.e., pain with strenuous activities and only one patient had mild pain with activities of daily living. None of the patients had clinical instability. Following surgery 17 (85%) patients regained the ability to walk the desired distance without pain or limp. 11 (55%) patients were able to run desired distances without pain. 8 (40%) patients were able to perform their usual occupation without restriction. The range of motion within 10 of the uninjured ankles was seen in 17 (85%) patients while 3 (15%) had a range within 15 of the uninjured ankle. Anatomical reduction with normal medial clear space and superior joint space was seen in 19 (95%) patients. [Table 4]

Table 1: Demographic variables of patients

Variables		No. of patients (N=20)	Percentage
Age (Mean±SD)		46.8±10.2	
Gender	Male	15	75%
	Female	5	25%
Site	Right	12	60%
	Left	8	40%
Mode of accident	Road Traffic Accidents	10	50%
	slipping and tumbling	6	30%
	Fall from height	4	20%
Lauge-Hansen fracture classification type	Supination –adduction	3	15%
	Supination-external rotation	11	55%
	Pronation abduction	1	5%
	Pronation external rotation	5	25%
	Pronation dorsiflexion	0	0%
AO Classification	Type A	2	10%
	Type B	13	65%
	Type C	5	25%

Table 2: Implants used for medial malleolus

Type of Implants	No. of patients (N=20)	Percentage
Malleolar screws	3	15%
Malleolar screw + K- Wire	12	60%
Tension band wiring	3	15%
Buttress plate	2	10%

Table 3: Implants used for lateral malleolus

Type of Implants	No. of patients (N=20)	Percentage
Dynamic compression plate	11	55%

Lag screw + Dynamic compression plate	5	25%
DC Buttress plate	1	5%
Syndesmotic screw + Dynamic compression screw	1	5%
Tension band wiring	1	5%
Lag screw alone	1	5%

Table 4: Combined functional scores in different categories (A-E)

Category	A	B	C	D	E
Pain	9	10	1	0	0
Stability	20	0	0	0	0
Walking	17	2	1	0	0
Running	11	7	2	0	0
Work	8	12	0	0	0
Motion	17	3	0	0	0
Radiographs	19	1	0	0	0

DISCUSSION

Operative method restores the anatomy and contact-loading characteristic of the ankle. Methods adopted to restore the function and prevent arthritis are either closed treatment that includes manipulative reduction and immobilization in the POP cast or ORIF. Burwell and Charnley showed that anatomical reduction and rigid fixation lead to the early return to function.[15] Recent advances have resulted in an evolution in the management strategies of ankle fractures; improved analysis of biomechanics, improvement in fixation techniques and analysis of result of recent studies contributed toward a better surgical outcome. The goal of treatment in these patients is to provide fracture union with a painless full motion of the ankle and with an anatomical restoration of the injured ankle.

Mean age of patients in our study was 46.8 years (range 20 to 70 years). This finding was similar to Beris et al,[7] (43 years), but in Baird and Jackson,[14] study the average age was found to be 30 years. There was male preponderance in this series with 15 [75%] males and 5 [25%] were females. Our study supported with Venugopal S M et al,[16] there was male preponderance (64%), whereas in Beris et al,[7] there was female preponderance. Lauge-Hansens classification system was used to classify the injuries in the present study. The most common type of injury was Supination External Rotation and least common was Pronation Abduction. This finding was similar to observation with Baird and Jackson,[14] Beris et al,[7] and Burwell HN et al.[15]

Road traffic injuries are the frequent cause of ankle fracture,[17-19] and this is again proven in our study. In contrast, Maruthi et al,[20] report fall as the main cause of fracture, which was the second common cause in our study and in other previous studies.[17-19] Right ankle was the most commonly involved joint in our study similar to the previous reports18,20 while; there are reports where in left side was the most commonly involved joint.[19]

AO Type B was the most common (65%) and least in Type A (10%). Motwani et al,[18] too report a similar observation. The period between the injury and the surgery is critical and often determines the outcome; surgery after 5 days is associated with delayed bone healing. Delaying surgery often increases the rate of infection. Hence, ideally, these patients should be operated at the earliest.[21] Motwani et al. too operated their patients between days 2 and 5 (77.5%) with a mean time interval of 3.8 days.18 We operated our patients on day 2 and day 3 (70.0%) while only 10.0% were operated on day 4 or later. We maintained the time frame well, within the acceptable time period.

The ankle joint is subject to enormous forces across a relatively small surface area of contact, with up to 1.5 times body weight with gait and greater than 5.5 times body weight with more strenuous activity. Maintaining congruency of the ankle joint is therefore critical to the long-term viability of the ankle. Decreased surface contact area leads to an abnormal distribution of joint stresses, which leads to post traumatic arthritis. Thordarson and colleagues,[22] showed that 2 mm of shortening or lateral shift of fibula or external rotation greater than or equal to 50 increases contact forces in the ankle joint, which may predispose to ankle arthritis.

Observation in this study support the contention of Yablon et al,[23] that lateral malleolus is key to anatomical reduction of the malleolar fractures, because the displacement of the talus faithfully followed that of the lateral malleolus. Poor reduction of distal part of fibula would result in persistent lateral displacement or residual shortening. This does not necessarily lessen the importance of the medial malleolus in contributing to the congruity of the medial aspect of the ankle, but it does serves to emphasize that the lateral malleolus should no longer be ignored in the treatment of ankle injuries.

A number of different post-operative protocols are in practice. Burnwell and Charnley,[15] series followed joint mobility exercises in bed until motion was restored followed by full weight bearing in a cast. Lund–Kristensen et al,[24] either used no cast or applied one for a few days postoperatively and then allowed full joint mobilization out of the cast. Crutches were used to maintain a non-weight bearing status. Meyer and Kumler,[25] series had a post- operative cast but only for an average of 3.8 weeks followed by non-weight bearing mobilization until fracture union. Whereas in our series a below

knee POP cast was applied with a dorsal window, to facilitate passive dorsiflexion movement of the foot. Non-Weight- bearing mobilization was allowed for 4 weeks. After 4 weeks, cast was discontinued, and active range of motion was started with partial weight bearing. Full weight bearing was allowed after 12 weeks.

Time taken for union depends on various factors and has been around 10.4 weeks as reported by Motwani et al.18 while a longer duration of 13 weeks has been reported by Kulloli et al.19 Mean time for the union was 10.3 weeks in our study population with a range of 8-14 weeks, which was similar to the study by Motwani et al.[18]

The success of the surgery is determined by the outcome. Baird and Jackson grading system to describe the outcome is a well-accepted, adopted method and we categorized the outcome in our patients using this grading system. Greater proportion of our patients had good to excellent (85%) outcome compared to reports by Cotton (70.0%),[13] Beris et al. (74.3%),[7] and Burwell and Charnley,[15] but lesser than that by Maruthi et al. (90.0%).[20] Fair to poor results in our patients can be attributed to wound infection and delayed union of the medial malleolus. Restricted activity level and range of movement without radiological evidence of arthritis were noted in two patients.

CONCLUSION

The mechanism of injury is essential in deciding the method of treatment and for accurate anatomical reduction and fixation. We conclude that anatomical reduction is essential in all malleolar fractures of ankle as it is a weight bearing joint. Open reduction and internal fixation guaranty high standard of reduction besides eliminating the chances of loss of reduction. Restoration of fibular length and rotation is critical in re-establishing a stable ankle mortise and perfect talar alignment. Tension band wiring is the preferred method for small fracture fragments and osteoporotic bones of both medial and lateral malleolus. Application of plaster slab and cast for 6 weeks allows the soft tissues around the ankle to heal adequately, thereby reducing clinical instability. And the dorsal window facilitates the early passive mobilization of the ankle, preventing ankle stiffness postoperatively.

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