

Study of internal fixation of bimalleolar fractures

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How to citation this article: Dr. N. Kranthi Kumar, Dr. B. Sindhura, Dr. K. Jyotsna Vibhari, Dr. K. Kiran, Dr. P. Keerthi, Dr. Kethavath Srinivas, “Study of internal fixation of bimalleolar fractures”, IJMACR- October - 2023, Volume – 6, Issue - 5, P. No. 21 – 29.

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Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: 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. 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.

Aims And Objectives: To evaluate the results, obtained by the surgical treatment of Bimalleolar fractures in adults by various methods and to analyse results of internal fixation in displaced bimalleolar ankle fractures, faster rehabilitation, and complications.

Methods: In our prospective study, 30 patients above the age of 21 years with Bimalleolar fractures of ankle, treated with internal fixation by various surgical methods at Government General Hospital, Guntur Medical College, Guntur, during the period from September 2015 to November 2017 were studied for a period of 6 – 18months. Results of the study were compared and analysed with other studies.

Results: In the present study, 30 patients with Bimalleolar fractures were treated surgically. Excellent results were achieved in 8 cases (26.6%), good in 18 cases (60%), fair results in 3 cases (10%) and poor results in 1case (3.3%). Excellent to good results were obtained in 86.6%. 4 patients (13.3%) had fair to poor results, were seen in those with associated syndesmotic injury, and in

patients with delayed union of medial malleolus and those with superficial or deep infections.

Keywords: Bimalleolar Fractures, Dynamic Compression Plate, Cancellous Screw.

Introduction

Ankle fractures are the most common type of fractures treated by orthopaedic 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].

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. 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].

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. The main aim of this dissertation is to evaluate the results, obtained by the surgical treatment of Bimalleolar fractures in adults by various methods.
2. To Analyse results of internal fixation in displaced bimalleolar ankle fractures.
3. To Analyse results of faster rehabilitation.
4. To Analyse the results of complications.

Materials And Method

Study design

Our prospective study was conducted at the hospital to evaluate the surgical management of Bimalleolar ankle fractures by stable internal fixation and early mobilization provides good functional outcome.

Study period, place of study and duration

The study was conducted in the Government general hospital, Guntur during the period from September 2015 to November 2017.

Sample size

The sample size has been estimated to 30 patients with bimalleolar fracture admitted in our institute.

Inclusion criteria

1. Age between 18-60 years
2. Those who gave Consent to participate in study
3. All displaced bimalleolar ankle fractures in adults were included

Exclusion criteria

1. Those not consented for participation in the study
2. Associated co – morbid conditions making the patient unfit for multiple surgeries.
3. Undisplaced fractures and fractures treated by closed reduction
4. Childhood and epiphyseal injuries around ankle were excluded from the study.

Surgical technique

Lateral Malleolus

With the patient in supine position on fracture table, a direct lateral approach over the fibula was standard for reducing and internally fixing distal fibula fractures. The dissection plane was between the peroneus tertius anteriorly and the peroneus longus and brevis posteriorly. Avulsion fractures of the distal fibula are reduced, held with a reduction forceps, and stabilized by either a tension band technique or a lag screw.

AO/OTA type B fractures are fixed with one or two lag screws placed perpendicular to the line of the fracture. An oblique fracture was fixed with lag screws alone. More secure fixation was achieved with one third tubular plate contoured to fit the concave, slightly spiral, lateral surface of the fibula. Compressing the fracture site with an anterior proximal to posterior distal interfragmentary lag screw was used to augment the strength of the fixation.

Medial Malleolar Fixation

The medial approach to the ankle is centred on the medial malleolus itself and is shifted either anteriorly for better access to the joint or posteriorly to expose the back of the tibia. The incision used was longitudinal or curvilinear, depending on the exposure needed [5,6].

For Intermediate-sized fragments, one wire and 2.0- or 2.5-mm drill bit was used to prepare a hole for a 4.0 mm partially threaded cancellous screw or malleolar screw.

For larger fragments, two such drills are used for provisional fixation and replaced one at a time with the 4-mm partially threaded screws. To obtain a lag effect, their threads must cross the fracture and they should be oriented perpendicular to plane of the fracture.

When the medial malleolar fragment was too small for screws or if comminuted, K-Wires with a figure-of-eight tension band was used for fixation.

Syndesmosis Trans Fixation

Talus must be reduced in the mortise. Any associated medial or lateral malleolar fractures were fixed. The reduction of the tibiofibular joint must be maintained during placement trans-syndesmotic fixation. The fixation screw or position screw (fully threaded) was used independently or in conjunction with a plate, depending on the type and location of the fibular injury.

The screw was inserted at the top of the fibular sulcus in the tibia, fixation is usually obtained by placing one or two screws from postero-laterally 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, weightbearing was delayed till screw removal.



Figure 1: Draping



Figure 2: Exposure of Lateral Malleolus



Figure 3: Reduction And Fixation with Semi Tubular Plate



Figure 6: Reduction And Provisional Fixation with K Wires



Figure 4: Wound Closure



Figure 7: CC Screw Fixation of Medial Malleolus



Figure 5: Exposure of Medial Malleolus



Figure 8: Post op X - Ray

Post op period and evaluation

After 10 to 12 days, the sutures were removed and a below knee cast was applied for 4 weeks. Non- weight bearing gait was started from 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).

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 minimum of 6 months. At each assessment, all patients were questioned regarding pain, use of analgesics, stiffness, swelling, activities of daily living, use of walking aids, and return to work and participation in sports. At 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.

Olerud and molander ankle scoring system was used for the study. All the patients were evaluated and scores were given.

Results

Table 1: Age Incidence

Age Group(Years)	No Of Patients	Percentage (%)
21-30	4	13
31-40	10	34
41-50	12	40
51-60	4	13

Majority of the cases ,22 (73.3%) was from 30 to 50 years age group. The youngest patient was 24 years old and eldest patient was 58 years. The mean age was 40.8years.

Table 2: Sex Incidence

Sex	No. of Cases	Percentage (%)
Male	18	60
Female	12	40

In the present study, it seen that bimalleolar fractures are slightly more common in males than females.

Table 3: Side Involvement

Side	No. of Cases	Percentage (%)
Right	19	63
Left	11	37

Right side was involved in 19 (63.33%) cases and left ankle in 11 (36.66%) Right ankle more commonly involved.

Table 4: Mode of Injury

Mode of Injury	No. of Cases	Percentage (%)
Road Traffic Accident	18	60
Fall	8	27
Twisting Injury	4	13

18 cases (60%) affected were due to road traffic accident, 8 cases (27%) due to fall, and 4 cases (13%) due to twisting injury. Road traffic accident was the most common mode of injury.

Treatment of Individual Fractures

A. Medial Malleolus

Table 5

Implants	No. Of Cases	Percentage (%)
Malleolar Screw	16	54
LCP	1	3
TBW	9	30
K-Wire	4	13

Majority of the medial Malleolar fractures were fixed with Malleolar screws i.e.,16 cases (54%) followed by tension band wiring i.e 9 cases, K- wire used for 4 cases, LCP for 1 case.

B. Lateral Malleous

Table 6

Implants	No. of Cases	Percentage (%)
Plating	18	60
Rush pin	7	23
K-wire	3	10
TBW	2	7

Most of the lateral Malleolar fractures i.e., 18 cases were fixed with plate, of which 16 with one-third Tubular plate,

and 2 with 3.5 mm DCP. In the rest of the cases rush pin, K-wires or TBW was used.

C. Syndesmotic Fixation

In 2 cases (6.6%), Syndesmotic injury was noted and, in those cases, it was fixed with a fully threaded screw. Weight bearing was deferred till screw removal, which was done at 6-8 weeks.

Complications

Table 7

Complications	No. of Cases	Percentage
Superficial infection	3	10
Deep infection	1	3
Delayed union	1	3

16 % patients had complications. 3 patients had superficial infection, 1 patient deep infection, 1 patient delayed union of medial malleolus. The infections (superficial and deep) were managed with debridement and antibiotics. Delayed union of #MM was treated with continued immobilization, which united eventually without surgical intervention.

Functional Outcome

Table 8

Functional Outcome	No. of Patients	Percentage (%)
Excellent	8	27
Good	18	60
Fair	3	10
Poor	1	3

In the present study, 30 patients with Bimalleolar fractures were treated surgically. Excellent results were achieved in 8 cases (27%), good in 18 cases (60%), fair results in 3 cases (10%) and poor results in 1 case (3%). Excellent to good results were obtained in 87%. 4 patients (13%) had fair to poor results were seen in those with associated syndesmotic injury, delayed union of medial malleolus, superficial or deep infections. The patients with poor results had pain during walking on any kind of surface, constant swelling of the ankle, reduced motion of the ankle and narrowing of joint space and diminution in

their abilities to run, jump or squat and impaired work capacity.

Discussion

Of all the intra-articular fractures occurring in weight bearing joints, the most common joint involved is the ankle joint. 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 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 Bimalleolar ankle fractures. Closed treatment is reserved for Undisplaced or minimally displaced isolated 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 Bimalleolar fractures of ankle provides better results [5].

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 meritorious results [6]. This study supports these conclusions. In the current study, we have 30 patients with Bimalleolar ankle fractures, who were operated upon. All patients were followed up at 2 weeks, 6 weeks, 12 weeks, 6 months, 12 months, and at 18 months.

In our study, fractures were commoner in the 30-50 years **Age group**, with mean age being 40.8 yrs. Our findings are comparable to the studies made by Roberts RS ^[7] with mean age of 40yrs.

Sex distribution between male: female ratio of 18:12 in 30 cases (60% male), which is nearly comparable to the studies made by Zakirah Shah et al ^[8] with male: female ratio of 24:16 in 40 cases (60% male).

Mode of injury by road traffic accidents constituted majority of cases, Followed by fall which was in accordance with study by Lee et al ^[9]. Most of the cases of road traffic accidents involved relatively younger age group, whereas the mode of injury in older age group is fall.

In the present study, **side involvement** of right ankle (63.33%) was more commonly affected, followed by left ankle (36.66%) in accordance with Roberts RS ^[7]. The **functional results** of the study with 87% good to excellent results, 10% fair results and poor results in 3 % were compared with the study of De souza et al ^[10] with 90% good to excellent and 4% fair results. Observation in this study support the contention of Yablonet al ^[11] that lateral malleolus is the key to the anatomical reduction of Bimalleolar fractures, because the displacement of the talus faithfully followed that of the lateral malleolus. Poor reduction of the lateral malleolus # 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.

Hughes et al ^[12] 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 cancellous or malleolar screw. The results were not that 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. Yablon⁴⁵ 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. K. Nageswara Rao et al ^[13] surgical treatment of ankle fractures may be accompanied by several complications. The overall complication rate following ORIF of ankle fractures varies considerably in the literature ranging from 1% to 40%. In our study it was 16.6 percent.

After following Post op and Rehabilitation protocol given in rehabilitation and ankle fractures by Stanley hoppenfeld ^[14] and final score according to olerud and molander scoring system, the functional results of the present study are majority of the patients (86.6%) had good to excellent results. 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 ^[6]. This study supports these conclusions and was comparable with those in other studies.

Conclusion

Bimalleolar ankle fractures incidence was more common in middle aged patients (73.3%), involving right ankle more often (63%). For majority of the injuries most common etiology being Road Traffic Accident (60%). Method of fixation of medial malleolus: majority of cases were treated with malleolar and cancellous screw fixation (53%) followed by tension band wiring. Tension band wiring is the method preferred for small fragments and osteoporotic bones of both medial and lateral malleolus. Most of patients with fibular fracture underwent fixation by one-third tubular plate (60%). The bend of the lateral malleolus should be reproduced when the plate is being used. The fibular length has to be maintained for lateral stability of the ankle. Syndesmotic transfixation was achieved with a fully threaded screw.

Most of the cases (93%) were operated between the two and fourth day of injury. Most common complication faced was postoperative superficial infection in 10% patients. Functional outcome was measured using Olerud and Molander scoring system. At the end of the study excellent to good results were seen in 26 (87%) cases, 3(10%) cases had fair results and 1 (3%) had poor result. Hence, we conclude that, surgical management of Bimalleolar ankle fractures provides good functional outcome by stable surgical internal fixation of fracture and early mobilization.

References

1. Bauer M, Bengert U, Johnell O. Supination–eversion fractures of ankle joint: Changes in incidence over 30 years. *J Foot Ankle*.1987; 8: 26-28.
2. Daly PJ, Fitzgerald RH, Melton LJ, Lstrup DM. Epidemiology of ankle fractures. *ActaOrthopaedica Scandinavica*.1987; 58: 539-544.

3. Carragee EJ, Csongradi JJ, Bleck EE. Early complications in the operative treatment of ankle fractures. *J Bone Joint Surg*.1991; 73B :79-82.
4. Geissler WB, Tsao AK, Hughes JL. Fractures and injuries of the ankle. *Rockwood and Green’s fractures in adults*.4th ed. Lippincott Raven ;1996: 2201-2266.
5. Burwell HN, Charnley AD. The treatment of displaced fractures of ankle by rigid internal fixation and early joint movement. *J Bone Joint Surg*.1965; 47B: 634-660.
6. Beris AE, Kabbani KT, Xenakis TA, Mitsionis G, Soucacos PK, Soucacos PN. Surgical treatment of Bimalleolar fractures – a review of 144 patients. *ClinOrthopaed Related Research*.1997; 341: 90-98.
7. Roberts RS. Surgical treatment of displaced ankle fractures. *ClinOrthop*. 1983; 172: 164-70.
8. Zakir ali shah, Uzma arif. Surgical Management of Bimalleolar Fractures of Ankle. *Pakistan Journal of Medical and Health Sciences*.2013;7(2):471.
9. LeeYih-Shiunn, Huang, Chun-Chen NSP, Chen, Cheng-Nan, LinChienChung. Operative treatment of displaced lateral Bimalleolar fractures: The 107 Knowles pin technique. *J Orthop Trauma*. 2005; 19(3):192-197.
10. De Souza LJ, Gustilo RB, Meyer TJ. Results of operative treatment of displaced external rotation-abduction fractures of ankle. *J Bone Joint Surg*. 1985; 67A: 1066-1074.
11. Yablon IG, Heller FG, Shouse L. The key role of lateral malleolus in displaced fractures of the ankle. *J Bone Joint Surgery*.1977; 57A: 169-173.
12. Hughes J. The medial malleolus in ankle fractures. *Orthopaedic Clinics of North America*. 1989; 11(3): 649-660.

13. K. Nageswara Rao, Asif Hussain K. S, P. Chandra Shekar, C. Vijay Krishna. Functional outcome and complications of surgically managed malleolar fractures at ankle. *Int J Res Orthop.* 2017;3(4):770-774.
14. Stanley Hoppenfeld, Vasantha L. Murthy, Treatment and Rehabilitation of Fractures. Lippincott Williams & Wilkins Publications. 398-400.