

Various modalities of surgical management of bimalleolar fractures of ankle in adults

¹Dr. Gaurav M, ²Dr. Deepak HR, ³Dr. Narasimha murthy N, ⁴Dr. Ravi Varma V N

^{1,2}Assistant Professor, Department of Orthopedics, BMCRI, Bangalore, Karnataka, India

³Senior specialist, Department of Orthopedics, BMCRI, Bangalore, Karnataka, India

⁴Senior Resident, Department of Orthopedics, BMCRI, Bangalore, Karnataka, India

Corresponding Author:

Dr. Ravi Varma V N

Abstract

Bimalleolar ankle fractures disrupt the medial and lateral stabilizing structures of the ankle joint. Displacement reduces the tibio-talar contact area and alters joint kinematics. Surgical reduction and internal fixation has become the mainstay for the treatment of most of the unstable malleolar fractures. The various surgical modalities include fixation with cancellous lag screws, malleolar screw, tension band wiring, plating, fixation with rush pin or K wires. A prospective study of 35 cases of bimalleolar fractures of ankle in adults, managed surgically by various techniques satisfying the inclusion and exclusion criteria were studied. The functional outcome was evaluated using the Olerud and Molander scoring system. In our study we achieved 85.7% excellent to good results, 8.6% fair results, 5.7% poor results. The results were comparable to other studies.

Keywords: Bimalleolar ankle fractures, fractures, operative, bone screws, bone plates

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].

As a result of a better understanding of the biomechanics of the ankle, improvements in fixation techniques and findings of outcome studies, 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. 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 ^[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].

Although fractures about the ankle have traditionally been considered non- controversial with respect to the indications for operative intervention, recent advances in the understanding of the biomechanics of the ankle have given rise to particular areas of clinical uncertainty. These include the indications for the operative treatment of isolated fractures of the lateral malleolus, the operative techniques for syndesmotic injury and its post-operative management and the reliability of radiographic assessment of fractures about the ankle.

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.

Methodology

Inclusion criteria

1. Patients with Bimalleolar fractures of ankle.
2. Patients above 18 years of age.
3. Patients willing for treatment and given informed written consent.

Exclusion criteria

1. Open fractures of the ankle.
2. Those patients who are below 18 years.
3. Stable malleolar ankle fractures (treated conservatively).
4. Patients which were treated by non-operative methods were excluded.
5. Patients who are medically unfit for surgery.

35 patients with bimalleolar fractures of ankle who were admitted and operated were included in the present study.

All the patients were explained about the aims of the study, the methods involved and an informed written consent was obtained before being included in study.

On admission of the patient, a careful history was elicited from the patient and/or attendants to reveal the mechanism of injury and the severity of trauma. The patients were then assessed clinically to evaluate their general condition and a complete survey was done to rule out significant injuries.

Careful examination was done to rule out fractures at other sites. Local examination of injured ankle and following clinical signs were looked for.

Inspection

Swelling of the ankle, any deformity, skin condition, neurovascular status.

Palpation

Skeletal components of the ankle i.e., lower ends of tibia/fibula and the malleolar parts were palpated and looked for bony tenderness, displacements, any abnormal painful mobility and crepitus. The inter-relation of the malleoli was also noted. Dorsalis pedis artery and posterior tibial artery pulsations were checked and noted. Distal neural status was also examined and noted.

Instability of the syndesmosis was identified on the basis of the mechanism of injury and the fracture pattern. Pain elicited with the squeeze test (manual medial- lateral compression across the syndesmosis) and the external rotation stress test was considered as indicative of

clinical syndesmotic instability. Radiologically, tibiofibular clear space of more than six millimeters and widening of the medial clear space of more than four millimeters were considered as indications of syndesmotic instability. 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).

Fractures of the ankle were evaluated using plain radiographs in anteroposterior, lateral and mortise views. The fractures were classified using the Lauge-Hansen, AO/OTA classification systems and anatomical types. Closed reduction and a below knee posterior POP slab was applied.

Patients with minimally displaced mono-malleolar fractures, avulsion fractures and stable fractures were excluded from the study. Patients with unhealthy skin, those who were medically unfit for surgery were managed by closed reduction and were not included in the study.

Routine investigations were done. The patients were taken for surgery as early as possible once the general condition is stable and fit for surgery. The routine investigations were as follows: Hb%, Urine for sugar, RBS, Blood urea, Serum creatinine, HIV, HbSAg and ECG.

Preoperative preparation of patients

- Patients were kept nil orally for eight hours before surgery.
- Intravenous fluids as per need.
- Adequate amount of compatible blood was kept reserved, for any eventuality.
- Preparation of whole extremity.
- Tetanus toxoid 0.5 ml IM and lignocaine test dose.
- Tranquilizers if needed.
- A written and informed consent for surgery.
- Parenteral antibiotics, given at the time of induction of anaesthesia.

Operative technique

Under 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 facilitating anatomical reduction.

Results

Table 1: Time Interval Between Injury and Intervention

Day	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7 or >
No. of cases	2	2	10	9	6	4	2
Percent	5.7	5.7	28.6	25.7	17.2	11.4	5.7

In this study, most of the cases were operated between day 3 and 6 (82.9%). The mean time interval was 4.1 days.

Table 2: Treatment of Medial Malleolus Fractures

Implants	Malleolar screw	Cancellous screw	TBW	K- wire	Total no. of MM#
No. of cases	16	4	11	4	35
Percentage	45.8	11.4	31.4	11.4	100

Majority of the medial malleolar fractures were fixed with malleolar screws i.e. 16 cases (45.8%). In the rest of the cases, cancellous screw, tension band wiring, and K-wire was used.

Table 3: Treatment of lateral Malleolus Fractures

Implants	Plating	Rush pin	K-wire	TBW	Total no. of Lat. Malleolar#
No. of cases	22	3	5	5	35
Percentage	62.9	8.5	14.3	14.3	100

Most of the lateral malleolar fractures i.e. 22 cases (62.9%) were fixed with plate, of which 18 with one-third Tubular plate, 2 with 3.5mm DCP and 2 with 3.5mm reconstruction plate. In the rest of the cases rush pin, K-wires or TBW was used.

In two cases (5.7%), Syndesmotic injury was noted and in these two cases it was fixed with a fully threaded screw. Weight bearing was deferred till screw removal, which was done at 6-8 weeks.

Table 4: Union

Duration of Union	6-10 weeks	10-14 weeks	14-18 weeks
No. of cases	20	13	2
Percentage	57.1	37.1	5.8

In our study, the average time taken for union was 10.9 weeks. Most of the cases (94%) showed union between 6-14 weeks.

Table 5: Functional Results

Functional Results	No. of patients	Percentage
Excellent	19	54.3
Good	11	31.4
Fair	3	8.6
Poor	2	5.7

In the present study, 35 patients with Bimalleolar fractures were treated surgically. Excellent results were achieved in 19 cases (54.3%), good in 11 cases (31.4%), fair results in 3 cases (8.6%) and poor results in 2 cases (5.7%). Excellent to good results were obtained in 85.7%. 5 patients (14.3%) 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. 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

The results in current study were compared with that of Burnwell & Charnley, Colton, De souza *et al.*, Beris *et al.*

In Colton series, 70% of the patients had a good to excellent results. Burnwell & Charnley in their series of 132 patients, 102 (77.3%) had good results, 16% had fair results and 6% were found to poor score.

In De Souza series, 150 cases of ankle fractures treated by open reduction and internal fixation using AO/ASIF method, obtained 90% good results. In a study by Beris *et al.*, of 144 patients with ankle fractures, 105 (74.3%) had good to excellent results.

The functional results of the present study were comparable with that of the above cited studies, with 85.7% had good to excellent results, 8.6% had fair results and poor results in 5.7%.

Table 6: Comparison of Outcome

Study	Good to excellent	Fair results	Poor results
Burnwell & Charnley ^[5]	102 (77%)	22 (17%)	8 (6%)
Colton ^[6]	18 (70%)	4 (15%)	4 (15%)
Beris <i>et al.</i> ^[7]	105(74.3%)	21(14.6%)	16(11.1%)
DeSouza ^[8]	135(90%)	9(6%)	6(4%)
Present study	30(85.7%)	3(8.6%)	2(5.7%)

Most authors have stated that anatomical reduction of displaced medial malleolus ensures correction of talar displacement and is of paramount importance in treating unstable fractures. However, Heller *et al.* state 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 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. In the current study, the two patients with poor outcome didn't have anatomical reduction of the medial malleolus possibly due to soft tissue interposition.

Lateral malleolus can be fixed by various methods. Lateral plate, as advocated by AO group has become widely accepted for treatment of fibular fracture. Hughes *et al.* 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 equally 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. Yablon 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. Excellent and good outcomes were seen in one patient each.

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 and full weight bearing when the signs of union were complete. The range of motion of ankle was reduced initially, but improved over few weeks.

In our series there was 30 degrees or more plantar flexion in 32 patients (91.4%) and 20 degrees or more dorsiflexion in 30 (85.7%) patients.

In our 35 patients there was no instability of ankle or subtalar joints, 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.

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

- Method of fixation of medial malleolus: majority of cases were treated with malleolar and cancellous screw fixation (57%).
- Most of patients with fibular fracture underwent fixation by one-third tubular plate (51%).
- Syndesmotic transfixation was achieved with a fully threaded screw.
- Most of the cases (83%) were operated between the third and sixth days of injury.
- Average time for union was 11 weeks with most cases (94%) showed union between 6-14 weeks.

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.

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