

A Prospective Study on Surgical Management of Medial Malleolar Fractures with Tension Band Wiring

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ABSTRACT

Introduction: Ankle injuries were among common but complicated in terms of fracture patterns and complex osseoligamentous injuries. Many modalities of treatments were proposed with equally reasonable results. The present study was undertaken to study the results of tension band wiring in medial malleolar fractures.

Material and Methods: thirty adult patients with medial malleolar fractures were treated surgically by tension band principle between December, 2013 to may,2016

Results: Understanding the mechanism was essential for good reduction and internal fixation. The results were excellent in (43%) of patients Anatomical reduction is the most important factor for a good outcome. Type of fracture did not make any difference for the ultimate clinical results. Slab immobilization for 4 weeks did not affect the range of motion as after 12 weeks most of the patients achieved near normal range of motion.

Conclusion: this study shows the importance of preoperative understanding of fracture mechanics for good reduction and fixation, in turn better out come

Keywords: Medial malleolus, fracture, tension band wiring, internal fixation

INTRODUCTION

Ankle is the most common injured joint of the body but least well treated. Malleolar fracture have varied presentations and have the potential to produce significant long term disability and complications in the form of pain, instability and early degenerative arthritis. two different mechanisms of the fracture of fibula it was recognized that for subluxation of the joint to occur, there must be either a malleolus fracture or a ligamentous injury or both.¹

As with all intra articular fractures, malleolar fractures necessitate accurate reduction and stable internal fixation. When malleolar fractures are not reduced accurately they may lead to post traumatic painful restriction of motion or osteoarthritis or both. A thorough understanding of the ankle anatomy, mechanism of the injury, interpretation of the radiographs and adherence to basic principles of fracture management are the basis for a good result.

Various methods² are available for the fixation of the medial malleolar fractures but in our study the emphasis has been laid on tension band wiring.

Tension band wiring is based on the principle of conversion of distractive forces into compressive forces at the fracture site (Pauwell), advantages being rigid fixation and early ambulation in relation to other methods of internal fixation.³

Considering all of the above, we have tried to analyze the results of medial malleolar fractures treated by tension band wiring at MGM Hospital, Warangal

MATERIAL AND METHODS

This study comprise randomly selected 30 patients with both bi malleolar and isolated medial malleolar fractures who attended Mahatma Gandhi Hospital attached to Kakatiya Medical College from the period of September 2013 to August 2015. Informed consent was taken from all patients and ethical approval was taken from the college ethical board.

As soon as the patients were brought to the casualty a complete survey was carried out to rule out significant injuries. Then the patient's radiographs were taken, both anteroposterior and lateral views of the ankle joints.

On admission to the ward detailed history was taken relating to the age,sex, occupation, address, mode of injury, associated past medical illness, patients general condition was assessed and then they were put through a thorough clinical examination. In all these patients the following clinical signs were looked for relation of ankle to foot, Inter relation of malleoli and fossa in front of malleoli. Prominence of tendo achilles fossa on both sides of tendoachilles. Pattern position and size of heel for broadening.

Inclusion criteria

1. Bimalleolar and Isolated medial malleolar fractures
2. Age between 18 – 70 years
3. Both males and females included
4. Closed as well as grade 1 and grade 2 (Gustilo- Anderson) compound fractures

Exclusion criteria

1. Associated tibial pillion fractures
2. Associated posterior malleolar fractures
3. Polytrauma cases
4. Grade 3 compound fractures

Implants used for fixation: (figure-1)

1. 1.5mm – 2 mm Kirschner wire
2. 20 SWG Stainless steel cerclage wire
3. Cortical screws with washers

Surgical procedure: Tension band fixation was done for all cases (figure-2)

Approach: Anteromedial incision was given that begins

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Figure-1: Instruments and Implant



Figure-2: Tension band wiring application

approximately 2 cm proximal to the fracture line, extends distally and slightly posteriorly, and ends approximately 2 cm distal to the tip of the medial malleolus. Skin incision was given carefully, reflecting the skin flap along with its underlying subcutaneous tissue. Care was taken to protect the greater saphenous vein and saphenous nerve.

Procedure: Distally and anteriorly displaced distal fragment of the medial malleolus is reduced and a small fold of periosteum commonly is interposed between the fracture surfaces removed with a curette and cleared the serrations of fracture. Small, loose osseous or chondral fragments are debrided; large osteochondral fragments are preserved and supported with a bone graft. With a bone-holding clamp or towel clip, detached malleolus is brought into the normal position. posterior K-wire using 1.6 mm K-wire is passed, as perpendicularly as possible to the fracture plane, special care is taken to not to cross the fracture line too close to the joint. The anterior K-wire is a second 1.6 mm K-wire is inserted into the medial malleolus, parallel to the first wire. These two K-wires stabilize the fracture against rotation and will be used to anchor the figure-of-eight wire distally. Reduction checked under image intensification.

A 2.5 mm hole, with the protection of a drill sleeve is drilled 2-3 cm above the level of the horizontal joint line, medial cortex is tapped, and a unicortical screw is inserted with a washer. *In osteoporotic bone, this screw must be bicortical.* 0.8 -1.0 mm wire is taken and looped at approximately one third along its length. Twist the free ends together. The wire twist is loosely prepared ensuring that each end of the wire spirals equally,

forming a double helix –twisting one wire around the other (straight) wire is avoided. The wire is tensioned by pulling on the twists. *In osteopenic bone care must be taken to avoid excessive tensioning.* The 2 k wires are cut. The K-wires are then driven home, sinking their curved ends into the bone in order to prevent backing out and skin injury. Take check x-rays in both planes.

After Treatment: The ankle is immobilized in a posterior plaster splint and elevated. the splint can be removed on the first postoperative visit If the bone quality is good, and the fixation is secure, and replaced with a removable splint or fracture boot. Range of-motion exercises are begun. Weight bearing is restricted for 6 weeks, after which partial weight bearing can be started if the fracture is healing well and progressed accordingly. Immobilization may be prolonged if skin conditions, bone quality, or other factors have prevented secure fixation. The limb is kept in either a short-leg or a long-leg non-weight-bearing cast, depending on the stability of the fixation. If a long-leg cast is used, it can be converted to a short-leg cast after 4 weeks.

The immobilization continued until fracture healing is progressing well (3months). A short-leg walking cast is worn, and weight bearing is progressed. The cast is removed when the fracture has united.

At the time of follow up period assessment of the cases was done based on the Baird and Jackson's ankle scoring system of Subjective, Objective and Radiographic criteria. All the patients were evaluated and scores were given.

Baird and Jackson Scoring System Is based on Pain, Stability to ankle, Ability to walk, Ability to run, Ability to work, Motion of the ankle and Radiographic result.

All the results were followed until union occurred. Results were analysed both clinically and radio graphically. Almost all fractures united at the end of 12 weeks.

Final score according to subjective, objective and radiological criteria

Most of the patients were operated between 2 and 5 days. Average duration between trauma and surgery was 3 days in our series. All the patients were given spinal anaesthesia.

Esmarch in a few cases and Pneumatic tourniquet in few cases was used. Average duration of surgery was about 1 hour, Tension banding done for all cases using 1.5-2 mm K wires, 30-40mm CC screw with washer and 18- 20 size SS wire.

RESULTS

In our series, there were 30 cases with medial malleolus fractures and all of them were fixed with tension band wiring (100%). Three patients had superficial skin infection which healed by 3 weeks. There were no other complications. In this series 13 (43.3%) had no pain and 15 (50%) patients had Grade B i.e. pain with strenuous activities and remaining 2 (6.7%) had pain with activities of daily living. All the patients had no clinical instability. Majority i.e. 23 (76.7%) of patients could walk desired distances without limp or pain and 7 (23.3%) patients were able to walk to desired distance with slight pain. 12 (40%) patients were able to run desired distances without pain, 18 (60%) patients were able to run desired distances with slight pain. In our series 16(53.3%) patients were able to perform usual occupation without restriction and the rest 14 (46.7%) patients were able to perform usual occupation with restriction

in some strenuous activities. In this series, 27 (90%) patients had range of motion of the ankle within 10° of uninjured ankle and 1 (3.3%) patient had motion within 15° of uninjured ankle. The rest 2 (6.7%) patients had motion within 20° of uninjured ankle. In the present study of 30 cases including both Bimalleolar and Isolated medial malleolar fractures treated by open reduction and internal fixation, Excellent results were achieved in 12(43.3%), Good 9(30%), Fair 6(20%) and Poor 2 (6.7%) of patients. The patients with poor results had moderate restriction of the daily activities, diminution in the abilities like walking, running, reduced ankle movements and decrease in joint space. The major cause of fracture in our study was road traffic accidents in 20 (66.7 %) and in 8(26.6%) due to slipping and stumbling. The rest i.e. 2 (6.7%) had fractures due to fall from height.

Right ankle was involved in 18 (60%) patients and in 12 (40%) patients left ankle was involved.

In the present series 12 (40%) patients had Supination external rotation injuries which is majority followed by 9 (30%) patients having pronation external rotation injury, followed by 5 (16.7%) patients having pronation abduction injury and 4 (13.3%) patients having supination adduction injury (table-1).

DISCUSSION

Fractures of the ankle being articular and in a weight bearing extremity needs accurate reduction, if residual pain and disability are to be avoided and the incidence of arthritis is to be reduced. In fractures of the ankle only the slightest variations from the normal anatomy are compatible with good function of the joint. Treatment of medial malleolar fractures with accurate open reduction and internal fixation using AO principles was found to give good results. This study supports these conclusions. The scoring system of Baird and Jackson is a composite score with slight variations from normal about 73% of patients had excellent to good result, 20% achieved fair results and 6% had poor result. All had anatomical reduction of the malleolus radiologically.

The mean age of this study was 38 years. This finding was somewhat similar to observation of Gregory joy et al⁴ Georgiadis DM, White DB⁵; Ostrum RF, Litsky AF⁶ and Burnwell and Charnley⁷, Male predominance observed in this series as in other studies. The commonest mode of injury was road traffic

accident in the present study. In this study right ankle was affected more, i.e. 23 (76.3%) patients which is similar to other studies.

In the present study Lauge Hansen’s Classification system (table-2) was used for operative evaluation. The most common type of injury was Supination External rotation type and least common was Supination Adduction type.

The results in this study are compared with Maruti CV Venugopal N⁸, Al Lamy Al Obaidy¹¹, Erhan Yilmaz et al⁹ and Beris et al.¹⁰ In the Maruti CV Venugopal N series, good to excellent results were obtained in about 90%(36) of cases, Al Lamy Al Obaidy series, good to excellent results were obtained in 80% of cases Erhan Yilmaz series, good to excellent results were obtained in 58% of cases In Beris et al series, good to excellent results were obtained in 74.3% of cases. Poor results were in 16% of cases in Erhan Yilmaz et al series and 11.7% in Beris et al series. All this were comparable to this study where good to excellent results were obtained in 73% of patients, fair results in 20% and poor in 6% of patients.

The observation in this study supports the contention of Gregory Joy et al⁴ that anatomical reduction and good post reduction x-rays correlate with good clinical outcome. Fractures of the medial malleolus close to plafond require more exact reduction to restore more normal tibio-talar relationship. Two patients who had poor result in the present study had poor reduction according to postoperative x-ray. The type of fracture did not affect the final outcome in the present study as it did in study of Bistrom.¹² But this study supports the view of Klosser and Kristensen¹³, according to which reduction determines the final clinical result irrespective of the type of fracture.

This study supports the view of Ostrum RF and Litsky AS, according to which the tension band fixation provides the greatest resistance to pronation forces. Tension band fixation of the medial malleolus fractures, is strong biomechanically and clinically acceptable method for treating displaced medial malleolus fractures.

It also supports the views in the study by Georgiadis GM and White DB, in that modified tension band wiring remains an acceptable method for fixation of selected displaced medial malleolar fractures.

Early mobilisation was advocated by AO and immobilization has also been supported. Others have found no significant

Category	Grade A	Grade B	Grade C	Grade D	Grade E	Total
Pain	13	15	2	-	-	30
Stability	28	2	-	-	-	30
Walking	23	7	-	-	-	30
Running	12	18	-	-	-	30
Work	16	14	-	-	-	30
Motion	23	7	-	-	-	30
Radiography	27	1	2	-	-	30

Table-1: Final score based on subjective, objective and radiological criteria

Series	No. of Patients	Most common type	Percentage
Gregory joy et al ⁴	117	Supination-External rotation	41%
Burwell and Charnley ⁷	35	Supination-External rotation	46%
Ostrum, Litsky ⁶	30	Supination-External rotation	42%
Present study	30	Supination-External rotation	40%

Table-2: Type of injury in various studies as determined by Lauge Hansen’s classification.

difference in results produced by early motion or immediate plantar splintage (Beris et al.). In this series immobilization with slab for two weeks then partial weight bearing by four weeks and by the end of ten weeks complete weight bearing was allowed. A number of different regimes have been suggested. Ahl et al. showed that early weight bearing in plaster slab had a tendency to display better clinical results, he also found that addition of ankle movements using ankle arthroslab showed better results.

According to Makwana the risk of complications after internal fixation is low but higher with closed treatment. Most of the complications were minor and resolved within 3 months. In our series there were no malunions or non unions of the medial malleolus.

Medial malleolar fractures have varied presentation. When compared the Isolated medial malleolar fractures had a better outcome when compared to the Bimalleolar fractures. Thorough understanding of the mechanism of injury, patho anatomy and treatment options along with accurate reduction and early mobilisation can give rewarding results.

CONCLUSION

In our study, Ankle injuries were common in middle aged men. Age with the youngest being 18 years and the oldest being 70 years. Males were more prone to injury than females with Road traffic injury being the major cause of injury.

Most of the cases were caused by external rotation injuries. Supination External rotation (40%) being the commonest Lauge-Hansen type followed by Pronation External rotation (30%). AO type was the most common type of fractures. The results were excellent in (43%) of patients. Post operatively below knee slab immobilisation did not affect the movements at the ankle if the duration of immobilization is short. In cases with bimalleolar fracture maintenance of fibular length was key for ankle stability. The most common complication encountered was superficial skin infection.

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