

Outcome of Tension Band Wiring Over Malleolar Screw in Medial Malleolus Fractures Tibia: A Prospective Study

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ABSTRACT

Background: Ankle fractures are one of the commonest occurring injuries which if not adequately treated can lead to severe co-morbidities. Various treatment options have been developed since decades for treating these fractures. The study was undertaken to assess the functional outcomes of tension band wiring over malleolar screws in medial malleolus fractures. **Methods:** 25 cases of medial malleolus fractures treated with tension band wiring over malleolar screw were included in the study between July 2018 and December 2020 at Government medical college, Amritsar. **Results:** The mean age of the patient was 38.56 years. Right side was predominantly involved. The average time duration of surgery from the time of injury was 2.9 days. The time taken for the fracture radiological Union was 12 weeks in majority 96% patients. As per the AOFAS ankle-hindfoot scoring system, there were 22 (88%) patients with excellent, 03 (12%) patients with good and none patients with fair/poor results respectively. **Conclusion:** Tension band wiring over malleolar screw has been one of the time tested technique with excellent to good results requiring relatively cheaper implants which are available very easily.

Keywords: Medial malleolus, Tension band wiring, Ankle Fracture.

INTRODUCTION

As per Sir Robert Jones “Ankle is the most injured joint of the body but least well treated”. Ankle injuries are important because whole of the body weight is transmitted through it and locomotion depend upon its stability.^[1]

Ankle joint is highly congruous and any disturbance of the normal articular relationship may result in some progressive arthrosis of biomechanical dysfunction.^[2] Medial malleolus is an important part of ankle mortise. It is a slightly expanded medial portion of distal tibia.

These fractures typically results from low energy, indirect rotational force in which the ankle is twisted and the talus tilts or rotates forcefully in the mortise causing fractures with or without associated ligament injury.^[3]

Undisplaced fractures of medial malleolus can be treated with cast immobilisation. However, in individuals with high functional demands, internal fixation may be appropriate to accelerate healing and early rehabilitation allowing early mobilization.

However, no method is perfect and each has its own pros and cons. Malleolar screw fixation and tension band wiring are the two most commonly used surgical methods for fracture fixation.

In the present study we have combined both the techniques, that is malleolar screw fixation enforced with tension band wiring.

Tension Band Wire

Tension band is a device which exerts a force equal in magnitude but opposite in direction to an applied distracting tensile force.^[4] Tension band principle was given by PAUWEL.^[5] It converts tensile forces into compression forces on the convex side of eccentrically loaded bone.

MATERIALS AND METHODS

25 cases of Medial malleolus fractures were included in the study between June 2018 and October 2020 at Government medical college, Amritsar. The inclusion criteria were closed displaced Medial malleolus fracture of either sex more than 14 years of age. The Exclusion criteria were Compound and comminuted medial malleolus fractures. The fractures were classified as per the Lauge Hansen classification system (Table 1). All the patients fulfilling the inclusion criteria were treated primarily in the form of Below Knee slab, following which their pre-operative work up in the form of X-rays and haematological investigations were done. Well written informed consent was

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taken from the patient. The Local Ethical committee approval was obtained prior to the commencement of the study.

Table 1: Lauge Hansen classification

| | |
|--|--|
| I. Supination- Adduction (SA) type | |
| 1. | Transverse avulsion-type fracture of the fibula below the level of the joint or tear of the lateral collateral ligaments |
| 2. | Vertical fracture of the medial malleolus |
| II. Supination- Adduction (SA) type | |
| 1. | Disruption of the anterior tibiofibular ligament |
| 2. | Spiral oblique fracture of the distal fibula |
| 3. | Disruption of the posterior tibiofibular ligament or fracture of the posterior malleolus |
| 4. | Fracture of the medial malleolus or rupture of the deltoid ligament |
| III. Pronation- Abduction (PA) type | |
| 1. | Transverse fracture of the medial malleolus or rupture of the deltoid ligament |
| 2. | Rupture of syndesmotic ligaments or avulsion fracture of their insertions |
| 3. | Short horizontal, oblique fractures of the fibula above the level of the joint |
| IV. Pronation-Eversion (External rotation) type | |
| 1. | Transverse fracture of the medial malleolus or disruption of the deltoid ligament |
| 2. | Disruption of the anterior tibiofibular ligament |
| 3. | Short oblique fracture of the fibula above the level of the joint |
| 4. | Rupture of the posterior tibiofibular ligament or avulsion fracture of the posterolateral tibia |
| V. Pronation-Dorsiflexion (PD) type | |
| 1. | Fracture of the medial malleolus |
| 2. | Fracture of the anterior margin of tibia |
| 3. | Supramalleolar fracture of fibula |
| 4. | Transverse fracture of the posterior tibial surface |



Figure 3: Completion of TBW over malleolar screw



Figure 4: Pre-op radiograph AP ad lateral view



Figure 1: Exposure of fracture site



Figure 5: Post-op radiograph 6 weeks AP ad lateral view



Figure 2: Malleolar screw fixation



Figure 6: Post-op radiograph 12 weeks AP ad lateral view



Figure 7: Plantarflexion and Dorsiflexion at 12 weeks post-op

Operative Technique

All the patients were given spinal anaesthesia and a bolster was kept underneath the opposite hip for proper exposure of the medial aspect of ankle. After drapping an anteromedial incision beginning 2 cm proximal to the fracture line was given and extended distally approximately 2 cm distal to the tip of medial malleolus. The great saphenous vein and its accompanying nerve was protected on reaching the bone. The fracture site was exposed and fracture fragments distracted by eversion of foot. An interposed fold of periosteum was removed and loose fragments debrided. Fracture was reduced by a large towel clip and anatomical reduction was achieved

A transverse cortical screw was inserted or holes were made in both anterior and medial cortex at the same level in the lower part of tibia proximal to the fracture line and stainless steel (s-s) wire (18 gauge) was made to pass around the head of the screw or through the holes. Fracture was fixed with a 4 mm self-tapping cancellous lag screw (malleolar screw) of appropriate length. Then the stainless steel wire was wound around the head of the screw beneath the washer making a figure of eight. Holding both ends of wire it was tightened fully by twisting them. The last turns of the screw were tightened fully ankle movements were checked, a below knee POP back splint was applied after closure.

Post-Operative

Check radiographs in AP and lateral view were done on the second post-operative day. Check dressing was done on third, fifth and eighth post-operative day to know the condition of operative wound. Sutures were removed on twelfth post-operative day. POP slab was removed after three weeks postoperatively and Active range of movements were started. Partial weight bearing was allowed four to six weeks post operatively and full weight bearing was allowed in all cases after complete radiological union of fracture has occurred.

Follow up was done on OPD basis at third, sixth and twelfth weeks post operatively with clinical and radiological evaluation and results were assessed based on ankle hindfoot scale.

After twelve weeks patients will be assessed based on Ankle Hindfoot Score:

Excellent - >80 score

Good - 60-79 score

Fair - 40-59 score

Poor - <39 score

AOFAS Ankle-Hindfoot Scale (100 Points Total)

| | |
|---|----|
| Pain (40 points) | |
| • None..... | 40 |
| • Mild, occasional..... | 30 |
| • Moderate, daily..... | 20 |
| • Severe, almost always present..... | 0 |
| Function (50 points) | |
| Activity limitations, support requirement | |
| • No limitations, no support..... | 10 |
| • No limitation of daily activities, limitation of recreational activities, no support...7 | |
| • Limited daily and recreational activities, cane...4 | |
| • Severe limitation of daily and recreational activities, walker, crutches, wheelchair, brace...0 | |
| Maximum walking distance, blocks | |
| • Greater than 6..... | 5 |
| • 4-6..... | 4 |
| • 1-3..... | 2 |
| • Less than 1..... | 0 |
| Walking surfaces | |
| • No difficulty on any surface..... | 5 |
| • Some difficulty on uneven terrain, stairs, inclines, ladders..... | 3 |
| • Severe difficulty on uneven terrain, stairs, inclines, ladders..... | 0 |
| Gait abnormality | |
| • None, slight..... | 5 |
| • Obvious..... | 4 |
| • Marked..... | 0 |
| Sagittal motion (flexion plus extension) | |
| • Normal or mild restriction (30° or more)..... | 8 |
| • Moderate restriction (15°-29°)..... | 4 |
| • Severe restriction (less than 15°)..... | 0 |
| Hindfoot motion (inversion plus eversion) | |
| • Normal or mild restriction (75%-100% normal)..... | 6 |
| • Moderate restriction (25%-74% normal)..... | 3 |
| • Marked restriction (less than 25% normal)..... | 0 |
| Ankle-hindfoot stability (anteroposterior, varus-valgus) | |
| • Stable..... | 8 |
| • Definitely unstable..... | 0 |
| Alignment (10 points) | |
| • Good, plantigrade foot, midfoot well aligned..... | 10 |
| • Fair, plantigrade foot, some degree of midfoot malalignment observed, no symptoms..... | 8 |
| • Poor, nonplantigrade foot, severe malalignment, symptoms..... | 0 |

RESULTS

The mean age of the patient was 38.56 years. Right side was predominantly involved in the present study with 15 (60%) patients whereas there were 10 (40%) patients with left side involvement. There were 19 (76%) Males and 6 (24%) females were in the study. The mode of injury was Road traffic accident in 17 (68%) patients, fall or twisting of ankle in 4 (16%) patients and direct hit 2(8%). Fractures were classified based on Lauge Hansen classification, out of 25 cases 11 (44%) were having supination external rotation type of injury, 6 (24%) cases had sustained supination adduction type of injury. 5 (20%) cases had

pronation abduction type of injury while 3 (12%) cases had sustained pronation external rotation type of injury. The average time duration of surgery from the time of injury was 2.96 days.

Out of 25 cases, none achieved union on follow-up at 6th week. 24 (96%) cases achieved radiological union on follow-up at 12th week whereas 1(4) % case showed union later when called for follow-up after 1 month (16th week). The average period of hospital stay was 10.96 days. As per the AOFAS ankle-hind foot scoring system, there were 22 (88%) patients with excellent, 03 (12%) patients with good and none patients with fair/poor results respectively. In 23 cases wound healed with primary intention, there being no evidence of any superficial or deep infection. 2 (8%) cases reported superficial infection, the wound healed within 2-3 weeks with appropriate antibiotics (subject to culture sensitivity) and antiseptic dressings every alternative day. 1 (4%) case had stiffness at ankle while 22 (88%) cases had no complications.

DISCUSSION

Malleolar injuries are the most common significant lower extremity fracture. They primarily involve medial malleolus. They are caused indirectly by shearing and tensile forces applied through the talus.^[6,7]

The literature on ankle fractures is vast and extensive work is done by many researchers. 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.

Closed method of treatment is often inadequate in restoring the anatomy and biomechanics of ankle in unstable malleolar ankle fractures. Conversely, studies support the ORIF for the restoration of the normal anatomy of the joint provide better results.^[8,9]

The mean age of this study was 38.56 years. And our observation is in accordance with the studies conducted by Roberts SR¹⁰ (40years) and Ozkan Kose et al (41years).^[11]

Males were predominantly affected in our series (76%) compared to females (24%). High incidence of males involved in RTA may be reason for male predominance. Baird and Jackson,^[12] in their study found high incidence of injury in males (70%) and Kose O et al,^[11] also reported higher incidence of injury in males (63.63%).

Lauge–Hansen classification system considers the position of the foot and the deforming force that resulted in injury for assessment.^[14] We followed

this system to classify the ankle trauma. The most common type of injury was supination external rotation (44%), followed by supination adduction injury (20%), and our observation is in accordance with studies conducted by Roberts SR,^[10] Baird and Jackson and Beris, et al.^[12,13] who also reported predominance of supination external rotation type of injury in their studies.

Right side (60%) was more commonly affected than left (40%) in our study. In a study conducted by Roberts SR and Beris et al right side involvement occurred in 56% and 50.69% respectively.^[10,13]

Time taken for union depends on various factors and has been around 10.4 weeks as reported by Motwani et al.^[14] while a longer duration of 13 weeks has been reported by Kulloli et al.^[15] In our study union occurred in most of the patients (96%) by 12 weeks which was close to union achieved by Motwani et al and Kulloli et al in their studies.^[14,15]

We did not observe non-union in our study, which was similar to the study of Barnes et al,^[16] who fixed medial malleolus fractures with headless compression screws. Öçgüder et al,^[17] reported only one delayed union out of 20 patients who were operated with malleolar screws and 100% union in the patients operated with tension band wiring.

In our study wound healed with primary intention in 23 (92%) cases, there being no evidence of any superficial or deep infection in them, 2 (8%) cases reported superficial infection, the wound healed within 2-3 weeks with appropriate antibiotics (subject to culture sensitivity) and antiseptic dressings every alternative day. 1 (4%) case had stiffness at ankle while 23 (88%) cases had no complaints. Most of the complications were minor and resolved within next 1 to 2 months. We did not observe non-union in our study, 24 (96%) cases had radiological union on follow-up at 12th week, whereas radiological union was not present in 1 (4%) case at 12th week which showed union on further follow-up at 16th week. Öçgüder et al,^[17] reported only one delayed union out of 20 patients who were operated with malleolar screws and 100% union in the patients operated with tension band wiring. Nabeel Shams et al,^[18] in his study of 30 patients, reported superficial infection in 2 patients.

The American Orthopaedic Foot and Ankle Society (AOFAS) scoring system was used for clinical evaluation postoperatively and in our study we achieved (range of 73-97 points) with excellent results in 88% and good results in 12% cases as per the criteria adopted. Sang-Hanko and Young-Junpark,^[19] reported 89% excellent results in cases treated with tension-band wiring and achieved excellent and good results in 78% of cases treated with malleolar screws and. Li et al.^[20] who performed a minimally invasive surgery for medial malleolus fracture, also reported good and excellent

results in 91.6% of patients. Kose O et al,^[11] reported mean AOFAS score of 94.9±5.7 points (range 85-100 points) in their study. The high rate of ankle hindfoot score in our study could be due to closed fractures, early treatment with anatomic reduction and rigid fixation.

CONCLUSION

Medial malleolus fractures are one of the commonest fractures to occur and also commonly undertreated. Majority of them were caused by supination external rotation injuries followed by supination adduction injuries. The most common etiology being road traffic accident. Proper anatomical reduction and stable internal fixation remains the key in the treatment of such fractures like in any other intra articular fracture. Tension band wiring has been one of the time tested technique with excellent to good results requiring relatively cheaper implants which are available very easily.

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