

Effectiveness of Modified Tension Band Wiring for Medial Malleolus Fracture of Tibia

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ABSTRACT

Introduction: Medial malleolus fracture is one of the commonest fractures. Non-operative approach may fail to produce anatomical reduction leading to ankle instability, nonunion and post traumatic osteoarthritis of the ankle. Proper anatomical reduction and stable internal fixation remains the key in treatment of displaced fracture. Good result had been achieved with Modified Tension Band Wiring. **Aims:**The purpose of our study was to evaluate the functional outcome of medial malleolus fracture treated with modified tension band wiring. **Methods:**This prospective observational study was conducted in department of Orthopaedics of Nepalgunj Medical College and Teaching Hospital from September 2018 to August 2021. Patients were evaluated for mode of injury, type of fracture, associated injury, radiological union, functional outcome, accompanying complications. All of the medial malleolus fractures in this study were treated by modified tension band wiring and outcomes were evaluated using Olerud and Molander Score. **Results:**In this study of 40 patients with the mean age of 41.60+13.75 year, 31(77.5%) were male and 9 (22.5%) were female. Majority of fractures were observed between 35 to 44 years, right side was predominantly involved, road traffic accident was the most common mode of injury. The average time duration of surgery from the time of injury was 5.25 days. Final functional outcome as per Olerud and Molander score showed, seven (17.5%) patients had excellent results, 30 (75%) patients had good results and three (7.5%) patients had poor results. The most common complication noted was hardware prominence at 7.5%, followed by superficial wound infection in 5% of patients. **Conclusion:** Modified Tension band wiring of medial malleolus results in good to excellent outcome in most of the patients with few complications .

Keywords: Medial malleolus fracture, modified tension band wiring, Olerud and Molander score, open reduction and internal fixation

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INTRODUCTION

The ankle is a complex hinge joint composed of articulations among the fibula, tibia, and talus with complex ligamentous system. The distal articular surface is referred to as the plafond, which together with the medial and lateral malleoli, forms the mortise.¹ Ankle joint is highly susceptible to injuries because it is relatively mobile and bear much of the stresses associated with weight bearing.² Ankle fracture is the second most common type of fractures of the lower limb.³ Though isolated medial malleolus fractures are less common than lateral malleolar fractures, there is a concern that a non-operative approach may fail to produce an anatomical reduction leading to ankle

instability, nonunion and post traumatic osteoarthritis of the ankle.⁴ There are several classifications of medial malleolus fracture. The most common classification system is devised by Pervical Pott.⁵ The next commonly used classification is by Lauge-Hansen.⁶

Undisplaced medial malleolus fracture can be managed conservatively while displaced fractures need anatomic reduction and stable fixation. There are various modalities of surgical fixation discussed in literature each having its own advantage and disadvantage.⁷ Open reduction helps in direct visualization of fracture to achieve anatomical reduction of articular surface.⁸

There has been a revolutionary change in the treatment of medial malleolus fracture ever since Fredrick Pauwel described the principle of Tension band wiring (TBW).⁹ The principle of TBW states that “by application of tension band wires on the tensile side, the distractive forces are converted into compressive forces”.¹⁰ TBW is useful for treating fractures of the medial malleolus that are small in size.¹¹ Cleak and Dawson presented a modified technique that involved the use of a medial screw to anchor the figure-of-eight wire.¹²

In this study, the functional outcome of medial malleolus fracture was evaluated by Olerud and Molander score¹³ after treatment with modified TBW.

METHODS

This prospective observational hospital-based study was carried out in the department of orthopedics, Nepalgunj Medical college teaching hospital, Kohalpur from September 2018 to August 2021. The inclusion criteria were all patients with age between 18- to 75-year-old who required surgical intervention for displaced medial malleolus fracture with or without distal fibula fracture, fracture disturbing the ankle mortise. Patients who were excluded from the study were patients with age <18 years and >75 years old, undisplaced medial malleolus fracture, vertically oriented medial malleolus fracture, open fractures, pathological fractures, patients with congenital anomalies of the foot and the ankle joint, patient with previous ankle stiffness, patients with any medical contraindication regarding surgery and anaesthesia, not giving written informed consent for surgery and patients unable to comply with follow up. A total of 40 patients fulfilled the criteria.

All patients with suspected medial malleolus fracture were hospitalized from the emergency, outpatient department (OPD). After general condition of patient was established, detailed history was taken to determine the demographic details, mode of injury, and clinical evaluation was done to determine status of soft tissue, fracture pattern, and neurovascular status. The diagnosis and displacement of medial malleolus fracture was confirmed by appropriate X-rays. After diagnosis was confirmed, patients meeting inclusion criteria underwent preoperative investigations and were operated after getting signed informed consent.

All the fractures were approached via standard surgical approach mentioned in standard text books after maintaining aseptic precaution, painting and draping. Proper care was taken to avoid injury to the long saphenous vein and nerve. After proper exposure of the fracture fragments, the hematoma and interposed periosteum was removed and proper anatomical reduction was done and held with the tenaculum. Proper articular congruity was maintained, checked under C-arm and fracture stabilized with two parallel K wires (2 millimeters) drilled through the tip of medial malleolus engaging the lateral cortex. A hole was drilled on the medial aspect of the tibia,

approximately two to three cm cephalad to the fracture site, and roughly half way between the fracture in the sagittal plane. A 3.5-mm cortical screw was then inserted without tapping and without completely seating. K wires were withdrawn slightly so that they were fully seated after their ends were bent. No. 20 G stainless steel wire was passed around screw, cross looped in figure of 8 manner over the medial surface through deltoid ligament deep to the protruding K wires. Loop was tightened, secured with twist and was cut short. Distally protruding K wires were acutely bend, cut short, rotated 180 degrees and impacted and embedded into the medial malleolus fragment so that they were not prominent. Cotton test was done using tenaculum to rule out syndesmotic injury. Wound was closed in layers after ensuring proper haemostasis. Compressive dressing was done and below knee slab was applied.

Post operatively patient was put on antibiotics and analgesics, limb was elevated and toes movement encouraged. Post-operative X rays was taken in anteroposterior and lateral view. Wound inspection was done on second postoperative day. Dressing was done on alternate day and patient was discharged from the hospital in the absence of wound infection.

Follow Up: Patients were followed up initially at two weeks when wound was inspected and sutures were removed. Thereafter patients were followed every 4–6-week interval. The below knee slab was continued till six weeks post operatively and then removed. Physiotherapy exercise for ankle movement were started after removal of plaster. They were evaluated clinically and radiologically at every follow-up to assess the progress of union and position of implants. Union was evident by absence of pain or tenderness at fracture site and was defined radiologically as radiographic consolidation marked by obliteration of fracture line across the fracture fragments. Once the fracture showed signs of union, partial weight bearing was advised, which was approximately at 6-8 weeks and it was then gradually increased to full weight bearing. Functional outcome of all patients were evaluated at final follow up as per Olerud and Molander score.¹³ The scores for each component of this scale were assessed by use of a questionnaire, in combination with clinical objective criteria. The scoring scale has a maximum of 100 points. Poor: 0 %-30 %, Fair: 31 %-60 %, Good: 61 %-90 %, Excellent: 91 %-100 %.

Statistical method: All the data were recorded as per the proforma attached. Microsoft word 2016 was used. Descriptive statistical method (mean, standard deviation, frequency) were applied using the SPSS 25.0 for windows 10 package program. The ethical clearance was taken from the institutional review committee of NGMCTH, Kohalpur, Nepal prior to starting study.

RESULTS

In this study, most of the patients 21(52.5%) were in the age group 35 to 44 years and the mean age was 41.60 ± 13.75 years as shown in table I. There were 31(77.5%) males and 9

(22.5%) females with a male to female ratio being 3.44:1. Right limb was more often involved than left with right limb at 28 (70%) and left limb at 12(30%). The most common mode of injury was road traffic accident (RTA) at 24(60%) followed by twisting injury followed by fall as shown in figure 1.

| Age in Years | Frequency | Percent | Mean ±SD |
|--------------|-----------|---------|-------------------|
| 15-24 | 1 | 2.5 | 41.60±13.75 years |
| 25-34 | 9 | 22.5 | |
| 35-44 | 21 | 52.5 | |
| 45-54 | 0 | 0 | |
| 55-64 | 5 | 12.5 | |
| 65+ | 4 | 10 | |
| Total | 40 | 100 | |

Table I: Age distribution of patients

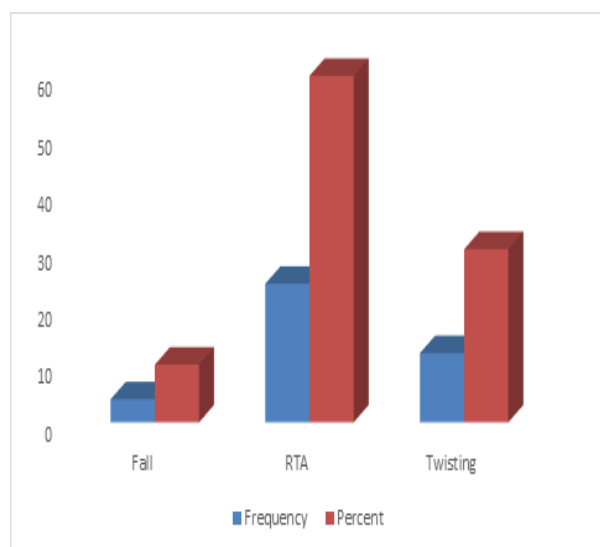


Figure 1: Distribution of Patients according to the mode of injury

Most of the patients had associated lateral malleolar fracture at 18(45%), thirteen (32.5%) patients had isolated medial malleolus fracture and nine (22.5%) patients had associated lateral malleolar fracture and syndesmotic injury. Most of the patients (40%) were operated on 5th day with mean duration at 5.25 ± 0.92 days. Distribution of functional outcome in total patients (n=40) in final follow up (24 to 26 weeks) according to Olerud and Molander score.

| Ankle Injury | Excellent | Good | Fair | Poor |
|--|-----------|-----------|----------|----------|
| Isolated medial malleolus | 3 | 10 | 0 | 0 |
| Medial malleolus +lateral malleolus | 3 | 14 | 1 | 0 |
| Medial malleolus+Lateral malleolus+ Syndesmotic injury | 1 | 6 | 2 | 0 |
| Total | 7 | 30 | 3 | 0 |

Table II: Distribution of functional outcome in patients

The functional outcome is shown in table II, out of thirteen patients with isolated medial malleolus fracture, three (23%) patients had excellent result and 10(77%) patients had good result. Similarly, out of eighteen patients with both medial and lateral malleolus fracture, three (16.67%) patients had excellent results, fourteen (77.78%) patients had good results and one (5.55%) had fair results and lastly out of nine patients with medial and lateral malleolus fractures with syndesmotic injury, one (11.11%) had excellent result, six (66.67%) had good results and two (22.22%) had fair results. Overall, seven (17.5%) patients had excellent results, thirty (75%) had good results and three (7.5%) had poor results as shown in table II.

The most common complication was hardware prominence at three patients (7.5%), followed by superficial surgical site infection at two patients (5%), which improved with oral antibiotics and dressings.

| Radiological union in weeks | Frequency | Percent | Mean ± SD |
|-----------------------------|-----------|--------------|--------------------|
| 8-12 | 27 | 67.5 | 12.30 ± 4.00 weeks |
| 13-17 | 8 | 20.0 | |
| 18-22 | 3 | 7.5 | |
| 23+ | 2 | 5.0 | |
| Total | 40 | 100.0 | |

Table III: Radiological union

The radiological union is shown in table 3 where most of the patients had union at 8-12 weeks with mean duration of union at 12.30 ± 4.00 weeks.

DISCUSSION

Traditionally medial malleolus fracture has been managed conservatively but because of higher incidence of re-displacement, delayed gain of range of motion, nonunion and development of posttraumatic arthritis, there has been shift of trend from conservative to operative management.¹⁴

Most of the patients 21 (52.5%) were in the age group 35 to 44 years with mean age of 41.60 ±13.75 years which was similar to study conducted by Kanth CR et al¹⁵ where the mean age was 42.6 years and Mohammad AA et al¹⁶ also found that the mean age of the patient was 37 years. People between the age group of 35 to 44 years are more involved in outdoor activities so are more prone to injury.

Majority of patients 31(77.5%) were male and nine (22.5%) were female which was similar to study conducted by Georgiadis GM et al¹⁷ in which the medial malleolus fracture was predominant in male. There is higher incidence of male compared to female due to outdoor activities that males pursue, hence more vulnerable to vehicular accidents. Due to usual society practice, certain tasks which involve high risk are done by males e.g. working at height, driving, labour and

travelling.

Right ankle was more commonly involved which was similar to study conducted by King CM et al.¹⁸ Most of the patients sustained injury following RTA which was similar to study conducted by Maruti C et al⁷ and Gaurav S et al² in which RTA followed by fall injury was common mode of injury.

Most of the patients had associated lateral malleolar which was similar to study conducted by Badgire K et al.¹⁹

Majority of the patients had good to excellent results which was comparable to study by Badgire K et al¹⁹ in which eight (15.5%) patients had excellent results, twenty-nine (56.8%) had good and fourteen (27.4%) had fair results.

The time of union was comparable to study done by Mohammad AA et al¹⁶ in which mean duration of radiological union was 9.4 weeks.

LIMITATIONS

The major limitation of this study is the study design and the duration of study. It would have been a better study if it were a randomized controlled trial with a longer duration of study.

CONCLUSION

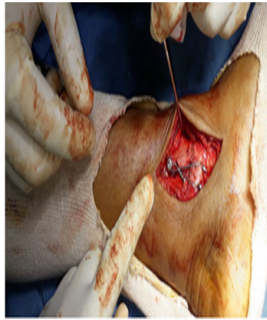
Medial malleolus fractures are one of the commonest fractures to occur and also commonly undertreated. Proper anatomical reduction and stable internal fixation remains the key in the treatment of such fractures like in any other intra articular fracture. This study showed that modified TBW is an easy procedure to perform and results in good to excellent outcome in most of the patients with few complications.

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Preop Xray



Intraop picture



Immediate post op AP and Lateral X-rays



X-rays at follow-up AP and Lateral view



Immediate post op after implant removal



Ankle plantarflexion at final followup



Ankle dorsiflexion at final follow-up