

Modified Tension Band Wiring in Medial Malleolus Fractures: A Prospective Study

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ABSTRACT

Introduction: Ankle fractures are one of the commonest occurring injuries which if not adequately treated can lead to severe comorbidities. Various treatment options have been developed since decades for treating these fractures. The study was undertaken to assess the functional and clinic radiological outcome of tension band wiring in medial malleolus fractures.

Materials and Methods: 51 cases of medial malleolus fracture treated with tension band wiring were included in the study between May 2010 and May 2011 at rural medical college, Loni.

Results: The mean age of the patient was 41.9 years. Right side was predominantly involved. The mean operative duration of time was 38.4 minutes. The average time duration of surgery from the time of injury was 5.1 days. The average time taken for the fracture radiological Union was 12.3 weeks. As per the Olerud and Molander ankle scoring system, there were 8 (15.5%) patients with excellent, 29 (56.8%) patients with good and 14 (27.4%) patients with fair results respectively.

Conclusion: 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.

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

INTRODUCTION

Ankle fractures are the second most common type of fractures of the lower limb following proximal femoral fractures with an incidence of 9%.^[1] There has been a surge in past three decades with a bimodal age group having more number of younger males and older females.^[2,3] Ever since Lauge and Hansen has classified ankle injuries in 1950, there has been a better understanding in the mechanism of injury and thus the treatment for such common injuries.^[4] The objective of the present study was to assess the clinical-radiological and functional outcome of pronation injuries of ankle, leading to medial malleolus

fracture as per the Lauge-Hansen classification using modified tension band wire technique.

MATERIALS AND METHODS

51 cases of Medial malleolus fractures were included in the study between May 2010 and May 2011 at Rural Medical College, Loni. The inclusion criteria were closed displaced Medial malleolus fractures involving the age group between 18-65 years. 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 (Fig 1) and haematological investigations were done.

Well written informed consent was taken from the patient and their ken. 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



Fig 1: Pre-operative Lateral and AP view

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. Anteromedial approach was used in all the cases with a curved incision of around 6cm long. Adequate skin flaps were raised. Proper care was taken to avoid injury to the

long saphenous vein and nerve. After proper exposure of the fracture fragments, the hematoma was removed and proper anatomical reduction was done and was help with the towel clip. Proper articular congruity was maintained, which was checked with the help of tooth pick and under C arm in both the orthogonal views. Two 1.8 mm K wires were drilled through the tip of medial malleolus across the fracture site parallel and engaging the lateral cortex. Reduction was checked under image intensifier. If satisfactory, a transverse hole was drilled in medial tibial cortex about 3 cm proximal to the fracture site. No 20 G stainless steel wire was passed through this hole, cross looped in figure of 8 manners, over the medial surface through deltoid ligament deep to the protruding K wires (Fig 2). 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 (Fig 3).

Postoperatively, a compression dressing was done and active and passive

range of movement was started as per pain tolerance. All the patients were given three doses (One after spinal anaesthesia and two post operatively) of third generation cephalosporin. Post-operative X rays were taken in both the orthogonal views (Fig 4). Non weight bearing mobilization was started on Post operative day 1. Wound check dressing was done on post-operative

day 2. Gradual toe touch weight bearing was started after 8 weeks and full weight bearing was started after 12 weeks of surgery. The weight bearing protocol was modified as per the clinical as well as radiological union (Fig 5). Serial follow ups were done at 3, 6 and 12 months. The final scoring was done by modified Olerud and Molander scoring system. [5]

Table 2: Modified Olerud and Molander scoring system

Parameter	Degree	Score
Pain	None	25
	While walking on uneven surface	20
	While walking on surface outdoors	10
	While walking indoors constant and severe	5
Stiffness	None	10
	Stiffness	0
Swelling	None	10
	Only in evenings	5
	Constant	0
Stair climbing	No problems	10
	Impaired	5
	Impossible	0
Running	Possible	5
	Impossible	0
Jumping	Possible	5
	Impossible	0
Squatting	No Problems	5
	Impossible	0
Supports	None	10
	Taping, Wrapping	5
	Stick or Crutch	0
Work, Activities of daily life	Same as before injury	20
	Loss of Tempo	15
	Change to simpler job	15
	Severely impaired work capacity	0

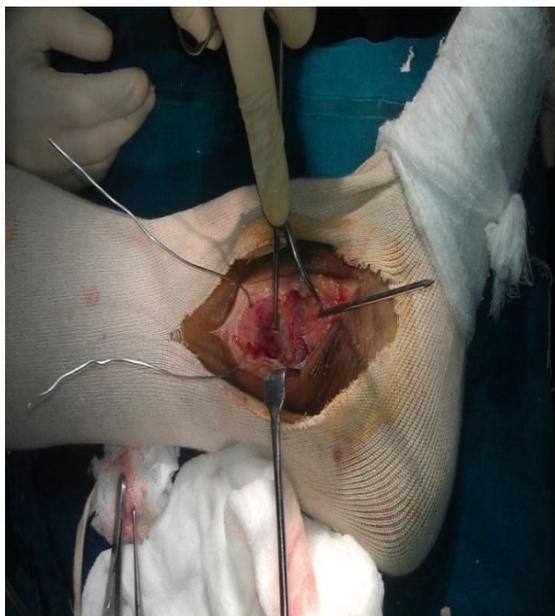


Fig 2:Reduction held and insertion of wires



Fig 3: Final Reduction of Fracture



Fig 4: Immediate Post-operative x ray AP and Lat view



Fig 5: AP and Lat views after union

RESULTS

The mean age of the patient was 41.9 years. Right side was predominantly involved in the present study with 37 (72%) patients whereas there were 14 (27.45%) patients with left side involvement. There were 29 (56.85) Males and 22 (43.2%) females were in the study. The mode of injury was Road traffic accident in 34 (66.6%) patients and fall or twisting of ankle in (33.45) patients. The mean operative duration of time was 38.4 minutes. There were 29 (56.8%) patients who had transverse fracture pattern, whereas 14 (27.4%) and 8 (7.9%) patients had oblique

and comminuted fracture pattern respectively. 47 (92.1%) patients had simple injury while 4 (7.9%) patients had compound fracture pattern. The average time duration of surgery from the time of injury was 5.1 days. The average time taken for the fracture radiological union was 12.3 weeks.

As per the modified Olerud and Molander ankle scoring system, there were 8 (15.5%) patients with excellent, 29 (56.8%) patients with good and 14 (27.4%) patients with fair results respectively. There were no patients with poor results encountered in the present study. Two (3.9%) patients had joint stiffness post operatively, which resolved completely in one patient with physiotherapy. There was 1 (1.96%) patient who has a superficial infection on the lateral aspect where there was an antiglide plate for fracture fibula. The infection subsided completely with oral antibiotics.

DISCUSSION

Ever since Fredrick pauwel described the principle of Tension band wiring in orthopaedics in 1935, there has been a revolutionary change in the treatment of eccentrically placed bones like Olecranon, patella and medial malleolus.^[6,7] The principle of tension band wiring

states that “By application of tension band wires on the tensile side, the distractive forces are converted into compressive forces”. This technique is very useful in eccentrically placed bones with one side having intact cortical contact. If a tension band produces fairly constant forces at the fracture site during motion, then it is called as Static tension band as in case of medial malleolus. Conversely, if the compression force increases with motion, then it is termed as dynamic tension band as seen in patella. [8]

Ankle injuries are usually caused by simple twisting injury to high energy injuries. [9,10] The incidence is highest in elderly women. Two third of the ankle injuries are isolated medial malleolar fractures, one fourth constitutes bimalleolar fractures and 7% is trimalleolar. Open fractures accounts for 2% of the total cases. [11] Tension band wiring helps in achieving stable internal fixation with the advantage of early mobilization.

Lauge Hansen classification which is one of the most important and useful tool to determine the diagnosis as well as the future outcome was used in the present study. [12] The classification system has two parts, part one describes the position of the foot at the time of injury whereas part two describes the direction of force at the time of injury. The most common type of injury pattern seen in the present study was supination external rotation type (43%) while there was least number of patients with supination adduction type of injury. In the present study, the mean age was 41.9 years, which was similar to the other studies like Gregory joy et al, [13] Georgiadis DM, White DB [14] and Ostrum RF, Litsky AF. [15] Right side predominance and Road traffic accident as the mode of injury was also similar to the other studies like Georgiadis DM, White DB. [14]

In the present study, modified Olerud and Molander ankle scoring system was used. There were 37 (72.3%) patients with excellent to good results which were similar to the other studies as mentioned

before. There were no patients with poor results in the present study. The present study had similar findings in terms of good to excellent results and an observation that Tension band wiring is a good option in the treatment of displaced medial malleolus fractures which is biomechanically strong as well as clinically acceptable. [15]

Rovinsky et al [16] in his study showed that the tension-band is technically more advantageous for fixation of small fracture fragments while it is not recommended for the fixation of vertical fracture. There was no patient of vertical medial malleolus fracture encountered in the study.

Beris et al [17] in their series showed no significant difference in terms of limited post-operative plaster support and early mobilization. However, no patient was given post-operative immobilization in the present study. There were 2 (3.9%) patients with post-operative ankle stiffness out of which one resolved completely with physiotherapy over 6 weeks of duration. The cause of the stiffness in the second patient can be attributed to the compound and comminuted nature of the fracture and also because of the delay in presentation since the time of injury of 15 days. It was seen in the present study that the isolated medial malleolus fractures have a better prognosis as compared to the bi and tri malleolar fractures. Also the time of presentation since injury to surgery plays a vital role in the post-operative clinical outcome.

The present study had few limitations like less number of sample size and lack of long term follow up.

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. 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. The learning curve is less with high promising results. Further meta-analysis with long term follow up needs to be carried out in future.

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