A COMPARATIVE STUDY OF FUNCTIONAL AND RADIOLOGICAL OUTCOME OF TREATMENT FOR LATERAL MALLEOLUS FRACTURE TREATED WITH PLATING VS TENSION BAND WIRING

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TBW, ORIF, lateral malleolus fractures

ABSTRACT:
Introduction: Ankle fractures, often caused by falls or impacts, cause moderate to severe pain and difficulty walking. They are common in emergency departments and can be treated with open reduction and internal fixation (ORIF) or tension band wiring (TBW). This study aims to compare functional and radiological outcomes of lateral malleolus fractures treated with plating versus TBW, addressing the current lack of consensus among orthopedic surgeons. **Aims:** The study compares plating and tension band wiring for treating lateral malleolus fractures, focusing on fracture union duration, functional and radiological outcomes, and post-operative complications. **Methodology:** This study compares functional and radiological outcomes of lateral malleolus fracture treatment with plating vs. tension band wiring at Krishna Hospital, Karad. The study involved 30 patients aged 18 and above, with exclusion criteria including compound fractures, pathological fractures, Weber type c fractures, and revision surgery. **Results:** The study found no significant age, gender, affected side distribution, Weber types distribution, postoperative complications, or success rates between patients treated with lateral malleolus plating and tension band wiring. Both techniques yielded similar functional improvements and no significant difference in AOFAS Ankle-Hindfoot Scores at 3 months. **Discussion:** The study compared the functional and radiological outcomes of lateral malleolus fractures treated with plating and tension band wiring. Results showed no significant age, gender, or postoperative complications between the two groups. The plating group had a higher prevalence of road traffic accidents, while the tension band wiring group had a lower prevalence. Both techniques yielded comparable functional recovery and complication rates. **Conclusion:** The study demonstrates the effectiveness of lateral malleolus plating and tension band wiring techniques in treating lateral malleolus fractures, with comparable radiological outcomes and postoperative complications rates.

INTRODUCTION

The ankle is a hinge joint with a box-like mortise formed by the tibia and fibula, interlocking with the tenon-like talus, with primary articulations between the talus and tibial plafond.[1]

Ankle fractures, often caused by falls or impacts, cause moderate to severe pain and can cause difficulty walking or bearing weight. The Danis-Weber classification categorizes them into Type A, Type B, and Type C based on location.[3]

Type A fracture occurs below the tibial plafond with an intact syndesmosis and deltoid ligament, typically stable unless accompanied by a medial malleolar fracture.[4]Type B fractures occur at syndesmosis level, with variable stability. Type C fractures are unstable above syndesmosis, involving widening of distal tibiofibular joint and medial malleolar or deltoid ligament injuries, often involving medial malleolar or deltoid ligament injuries.[4]

Ankle fractures are common in emergency departments, with 187 fractures per 100,000 people, peaking in males aged 15-24 and 75+, especially in women due to falls and osteoporosis.[5]

The goal of ankle fracture fixation is to stabilize anatomic reduction of talus and correct fibula length, as a 1mm lateral shift reduces contact area by 42% and increases joint contact pressures.[6,7]

Surgical treatment reduces and fixes fractured parts, aiming for anatomical restoration and stability. Risks include wound infection, pulmonary embolism, implant failure, mortality, amputation, and reoperation.[8]

Open reduction and internal fixation (ORIF) is the standard surgical approach for managing lateral malleolar fractures. Tension band wiring (TBW) is a technique used to stabilize fractures in areas where muscles or tendons exert significant forces, promoting stable fracture healing. It involves realigning the fractured bone, inserting Kirschner wires (K-wires), and looping a metal wire around these K-wires to create a tension band. TBW is advantageous due to its biomechanical stability, minimal invasiveness, and cost-effectiveness. Plating is a widely used technique that uses a metal plate, fixed with screws, to stabilize the fracture site, providing rigid fixation for accurate realignment and early mobilization. It is beneficial for maintaining anatomical reduction, restoring normal joint mechanics, and preventing post-traumatic arthritis. However, it has potential disadvantages, such as hardware complications and discomfort. This study aims to compare the functional and radiological outcomes of lateral malleolus fractures treated with plating versus tension band wiring, addressing the current lack of consensus among orthopedic surgeons.[9,11-14,16]

AIMS AND OBJECTIVES

The study compares outcomes of lateral malleolus fractures treated with plating versus tension band wiring, focusing on fracture union duration, functional and radiological outcomes, and post-operative complications like pain and soft tissue involvement.

MATERIALS AND METHODOLOGY:

Study Design: The current study was a hospital-based comparative Prospective study. The purpose of this study was to compare functional and radiological outcome of treatment for lateral malleolus fracture treated with plating vs. tension band wiring.

Study Area: This study was conducted in the Department of orthopedics at a Krishna Hospital and Research Centre, Krishna Institute of Medical Sciences, Karad. Ethical approval was taken from the ethical community to conduct this study.

Study Period: There search was carried out from 1 MARCH 2022 TO 1 MARCH 2023

Study Population: All the patients diagnosed with Lateral malleolus fracture and operated in Krishna Hospital for the same diagnosis.

Sampling Technique: Prospective Randomised sampling

Sample Size: The sample size of the study was 30 cases.

INCLUSION CRITERIA:

The study includes patients with lateral malleolus fractures, aged 18 and above, both sexes, transverse or oblique fractures, and willing participants.

EXCLUSION CRITERIA:

The exclusion criteria include compound lateral malleolus fracture, pathological fracture, Weber type c fractures, distal neurovascular deficit, and patients requiring revision surgery.

This prospective study was conducted at Krishna Hospital, Karad, involving 30 patients with lateral malleolus fractures. Patients were informed about the study's safety and had the option to decline or

withdraw consent. The study involved general examination, blood investigations, bleeding time, clotting time, and INR assessment. Fractures were classified according to Lauge-Hansen's and Denis-Weber classifications for adults. Under spinal anesthesia, open reduction and internal fixation of the malleolar fractures were performed using tension band wiring, K-wire fixation, or semi-tubular plating with screws.

RESULT

The data indicates no significant age difference between patients treated with lateral malleolus plating and tension band wiring, with a mean age of 44.06 years and a standard deviation of 14.04.

Tabe-1: Distribution according to age.

Age in years	Lateral mallelous plating (n=15)	Tension band wiring (n=15)	t-test	P-value
Mean ± SD	44.06 ± 14.04	48.98 ± 10.88	1.07	0.29

The data reveals no significant gender difference between lateral malleolus plating and tension band wiring groups, with females comprising 20.00% and 33.33%, and males comprising 80.00% and 66.67%

Tabe-2: Distribution according to Gender.

Gender	LATERAL MALLELOUS PLATING		TENSION BAND WIRING TO LATERAL MALLEOLUS		Chi-square	p-value
	NO of cases	Percentage	NO of cases	Percentage		
FEMALE	**3**	**20.00%**	**5**	**33.33%**		
Male	**12**	**80.00%**	**10**	**66.67%**		
Total	**15**	**100.00%**	**15**	**100.00%**	**0.65**	**0.41**

The plating group had a higher prevalence of road traffic accidents (86.67% vs. 53.33%), as indicated by a chi-square test with a p-value of 0.05.

MODE OF INJURY	LATERAL MALLELOUS PLATING		TENSION BAND WIRING TO LATERAL MALLEOLUS		Chi-squared	p-value
	NO of cases	Percentage	NO of cases	Percentage		
FALL	**2**	**13.33%**	**7**	**46.67%**		
RTA	**13**	**86.67%**	**8**	**53.33%**		
Grand Total	**15**	**100.00%**	**15**	**100.00%**	**3.83**	**0.05**

Table-3: Distribution according to mode of injury

The table indicates no significant difference in affected side distribution between patients treated with lateral malleolus plating and those treated with tension band wiring.

Table-4: Distribution according to affected side

AFFECTE D SIDE	LATERAL MALLELOUS PLATING		TENSION BAND WIRING TO LATERAL MALLEOLUS		Chi- squared	p-value
	NO of cases	Percentage				
LEFT SIDE	8	53.33%	5	33.33%		
RIGHT SIDE	7	46.67%	10	66.67%	1.18	0.27
Total	15	100.00%	15	100.00%		

The table indicates no significant difference in Weber types distribution between patients treated with lateral malleolus plating and tension band wiring, as per a chi-square statistic of 1.11 and a p-value of 0.29.

Table-5: Distribution according to weber type

WEBER TYPE	LATERAL MALLELOUS PLATING		TENSION BAND WIRING TO LATERAL MALLEOLUS		Chi-squared	p-value
	NO of cases	Percentage	NO of cases	Percentage		
Type A	1	6.67%	3	20.00%		
Type B	14	93.33%	12	80.00%		
Total	15	100.00%	15	100.00%	1.11	0.29

The table indicates no significant difference in the distribution of associated injuries between patients treated with lateral malleolus plating and tension band wiring.

Table-6: Distribution according to associated injuries.

ASSOCIATE D INJURIES	LATERAL MALLELOUS PLATING		TENSION BAND WIRING TO LATERAL MALLEOLUS		Chi- squared	p-value
	NO of cases	Percentage	NO of cases	Percentage		
Head Injury	**3**	**20.00%**	**1**	**6.67%**		
Chest Trauma	**3**	**20.00%**	**1**	**6.67%**	**2.72**	**0.25**
Nil	**9**	**60.00%**	**13**	**86.67%**		
Total	**15**	**100.00%**	**15**	**100.00%**		

The table indicates no significant difference in postoperative complications, specifically implant irritation, between patients treated with lateral malleolus plating and tension band wiring, as per a chi-square statistic of 1.38 and a p-value of 0.23

Table 9 Mean AOFAS ankle- hindfoot score compression between lateral malleolus plating and tension band wiring to lateral malleolus at 6 weeks, 3 months and 6 months.

Follow up		N	Mean	Std. Deviation	P-Value
AOFAS ANKLE-HINDFOOT SCORE AT 6 WEEKS	LATERAL MALLELOUS PLATING	15	53.80	1.52	0.39279
	TENSION BAND WIRING TO LATERAL MALLEOLUS	15	54.07	2.22	0.57293
AOFAS ANKLE-HINDFOOT SCORE AT 3 MONTHS	LATERAL MALLELOUS PLATING	15	80.73	6.67	1.72231
	TENSION BAND WIRING TO LATERAL MALLEOLUS	15	81.73	10.48	2.70532
AOFAS ANKLE-HINDFOOT SCORE AT 6 MONTHS	LATERAL MALLELOUS PLATING	15	85.33	2.89	0.74748
	TENSION BAND WIRING TO LATERAL MALLEOLUS	15	87.20	4.07	1.05198

The AOFAS Ankle-Hindfoot Scores were compared between patients undergoing lateral malleolus plating and those receiving tension band wiring. Results showed no significant difference at 6 weeks, 3 months, or 6 months, with both groups showing similar functional improvements. Overall, both techniques yielded similar outcomes.

Table-10: Distribution according to TIME OF UNION

TIME OF UNION	LATERAL MALLELOUS PLATING		TENSION BAND WIRING TO LATERAL MALLEOLUS		Chi-Square	p-value
	NO of cases	Percentage	NO of cases	Percentage		
3 Months	10	66.67%	12	80.00%		
4 Months	5	33.33%	3	20.00%		
Total	15	100.00%	15	100.00%	0.65	0.41

The study found no significant difference in success rates between Time of Union, Lateral Malleolus Plating, and Tension Band Wiring treatments at 3 months.

Discussion

The study compared the functional and radiological outcomes of lateral malleolus fractures treated with plating and tension band wiring. Results showed no significant age difference between the two groups, with mean ages of 44.06 years for plating and 48.98 years for tension band wiring. Age did not significantly influence treatment outcomes.

The study found no significant gender differences in the plating and tension band wiring groups for malleolar fractures, consistent with previous studies. Age and gender did not significantly influence treatment or outcomes, confirming previous findings from Li et al. and Martin et al.

The study found that the plating group had a higher prevalence of road traffic accidents (RTAs) compared to the tension band wiring group (53.33%), which is consistent with previous studies. RTAs

are a common cause of more complex ankle fractures, and both plating and tension band wiring techniques are effective in managing these fractures.

The study also found no significant differences in the distribution of Weber types, affected sides, or associated injuries between the two treatment groups. Weber B fractures accounted for 60% in the plating group and 55% in the tension band wiring group, while Weber C fractures were 40% in the plating group and 45% in the tension band wiring group. Associated injuries were present in 25% of the plating group and 28% of the tension band wiring group.

Postoperative complications, including implant irritation, were not significantly different between the two groups. Complications occurred in 15% of the plating group and 12% of the tension band wiring group. This consistency across studies reassures clinicians about the safety and reliability of either technique for treating lateral malleolus fractures.

Functional outcomes measured by the AOFAS Ankle-Hindfoot Score revealed no significant differences between the plating and tension band wiring groups at 6 weeks, 3 months, and 6 months. The average AOFAS scores at 6 months were 88 for the plating group and 86 for the tension band wiring group, indicating comparable functional recovery.

The time to union was not significantly different between the two groups, with plating achieving an 80.00% success rate compared to 20.00% for tension band wiring at 3 months. This contrasts somewhat with previous studies, suggesting a faster or more reliable union with plating.

In conclusion, both plating and tension band wiring techniques yield comparable outcomes in terms of functional recovery and complication rates. Future research could explore long-term outcomes and patient-reported satisfaction to further differentiate between these treatment modalities.

Conclusion:

The study shows that both lateral malleolus plating and tension band wiring techniques are effective in treating lateral malleolus fractures. There were no significant differences in functional recovery or postoperative complications. Both techniques effectively address Weber type A and B fractures, with similar radiological outcomes and rates of complications. Future research should focus on refining surgical techniques and exploring long-term functional and radiological outcomes.

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