

**Clinical Article  
Orthopaedics**

# MALLEOLAR SCREW AS AN ADJUNCT TO TENSION BAND WIRING IN MEDIAL MALLEOLAR FRACTURES

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**Abstract:**

50 cases of medial malleolar fractures were treated by open reduction and internal fixation using malleolar screw with tension band wiring in a tertiary care hospital of Punjab. Most of these patients were males {35 ( 70%)}, in the age group of 22-70 years of age (average age 44.4 years) with road side accident (80%) as the common cause. Bimalleolar fracture was the most common {in 30 (60%) cases} presentation. The fracture was fixed accordingly and pop back slab was given till 10<sup>th</sup> postoperative day i.e. the day of stitch removal. Partial weight bearing was allowed within 3-6 weeks. Solid union was achieved in 8- 12 weeks. 92% of the cases showed good to excellent results. From the present study it was observed that the tension band wiring along with malleolar screw has a well established advantage over the tension band wiring alone/malleolar screw alone/ kirschner wire fixation alone and also over the conservative methods of treatment of medial malleolar fractures like pop cast application. In the present method the rigid fixation is achieved through screw and the incidence of wire back out, pin tract infection, migration of pins is totally eliminated. Since this method provides rigid fixation and obviates the need of plaster cast immobilization & also the weight bearing is early as compared to the other methods of treatment of medial malleolar fractures; is a better method of open reduction & internal fixation.

**Key words:** *bimalleolar fracture, open reduction, internal fixation, malleolar screw, tension band wiring*

## Introduction

The ankle joint is a saddle-shaped articulation among the talus, distal tibia, and fibula. Stability of the ankle relies on the integrity of the medial and lateral osseo-ligamentous complexes as well as the distal tibio-fibular syndesmosis.<sup>1</sup>

The medial malleolar osseoligamentous complex comprises the medial malleolus and the superficial and deep deltoid ligaments.<sup>2</sup> The superficial deltoid ligament functions primarily to resist eversion of the hind foot, whereas the deep deltoid, which is oriented more transversely, limits external rotation of the talus.<sup>3</sup> The superficial deltoid originates from the anterior colliculus of the medial malleolus, and the deep deltoid originates from the larger and more distal posterior colliculus. An understanding of this anatomy is critical because an isolated injury of the anterior colliculus may not necessitate open reduction and internal fixation if the ankle joint is otherwise stable.<sup>2</sup>

Medial malleolar fractures in adult population resulting from subluxation or dislocation of talus from the ankle mortise are associated with ligamentous disruptions. The presentation is either the isolated fracture of the medial malleolus or a bimalleolar fracture or it is trimalleolar fracture with the inclusion of the posterior malleolus also. These can be simple, compound or comminuted depending upon the mode and severity of the injury.

The problem of ankle fractures dates back to antiquity. Evidence of healed ankle fractures has been found in the remains of mummies of ancient Egypt.<sup>4</sup> Even in 5<sup>th</sup> century B.C. Hippocrates commented upon the ankle fractures & recommended close

reduction by extension and traction in simple fractures.<sup>5</sup> Thereafter in 1768 Percival P. described the fractures in detail along with the mechanism of injury and recommended the knee to be in flexed position to relax the calf muscles to allow the close reduction of fracture with minimal traction.<sup>6</sup> With the advancement in orthopaedics treatment option tilted in favour of open reduction and internal fixation with Zuelzar first using the hook plates in the avulsion fractures of the medial malleolus.<sup>7</sup> Now a days the trend is in favour of rigid internal fixation and early mobilization with no or minimal period of plaster immobilization & hence minimal morbidity.

Tension band wiring of fracture of medial malleolus is the recent and most common method of open reduction and internal fixation. This modality of treatment works on the principle first published by Pauwel which states that the tensile forces across the fracture site are counteracted and converted into compressive forces when the compression band is applied.<sup>8</sup> It was Muller along with his associates who first applied this principle in the fixation of fractures of medial malleolus in 1970.<sup>9</sup> This could obviate the need of plaster application and achieving solid union with a very few complications.

The latest technique of open reduction and internal fixation with malleolar screw with tension band wiring, which we have used in present study is an additional advantage & a step forward in achieving solid union with a very few complications.

## Material And Methods

The present study consisted of 50 cases of either sex with simple fracture of medial malleolus admitted in a tertiary care hospital in Punjab, India.

It was duly approved by the ethical committee. The patients admitted in the emergency department received first aid in the form of splintage of the affected part along with analgesics and anti inflammatory drugs. X-rays were taken in antero-posterior and lateral views in accordance with Ottawa rules (i.e. ankle X-ray is only required if there is any pain in the malleolar zone).

Details of the patient were recorded with special attention paid to the mode of injury. Patients were thoroughly investigated and prepared for the surgery. All associated injuries were recorded and treated accordingly. Every effort was made to treat the patients at the earliest possible.

The patients were operated under spinal or general anaesthesia. The part was painted with povidone iodine after thorough scrubbing and was adequately draped.

An anteromedial incision similar to the Colonna and Ralston approach was given beginning 2.0 cms proximal to the fracture line extending distally and slight posteriorly ending 2.0 cms distal to the tip of the medial malleolus. the fracture was exposed, reduced anatomically and was fixed with self tapping 4mm cancellous lag screw (malleolar screw) of appropriate length along with washer; thereafter encirclage wire was wound around the head the screw beneath the washer making a figure of eight. Holding both ends of the wire, it was tightened fully and twisted. The last turns of the screw were tightened in the end. At the end of the procedure the fracture was checked for anatomical stability and ankle movements were also checked. Wound was stitched in layers and aseptic dressing was done to conclude the surgery.

Postoperatively P.O.P slab was

given till the removal of the stitches i.e. 10<sup>th</sup> post operative day. Thereafter the P.O.P cast was discarded & active movements at the ankle joint were started. Partial weight bearing was allowed at 03 weeks and full weight bearing was allowed only after clinical and radiological evidence of the union (usually after 8–12 weeks) was established.

Patient was followed at 3, 6 and 12 weeks.

**Observations And Results**

- The patients were in the age group of 22-70 years of age with average age 44.4 years.
- Commonest age group was 40-50 years of age.
- The male: female ratio was 7: 3.
- Majority of the patients sustained injuries as a result of road side accidents.
- 60% (30) fractures were on right side and 40% (20) fractures were on left side.

**Table 1  
Incidence Of Various Types Of Fractures**

Type Of Fracture	No. Of Cases	Percentage
Fracture of medial malleolus alone	12	24%
Bimalleolar fracture	30	60%
Fracture of medial malleolus with fracture of lower one third of fibula	08	16%
Total	50	100%

\* Bimalleolar fracture was the commonest one.

**Table 2  
Incidence Of Various Types Of Injuries**

S. No.	Type Of Injury	No. Of Cases	Percentage
01	Pronation abduction injury	34	68%
02	Supination adduction injury	06	12%
03	Supination external rotation injury	06	12%
04	Pronation external rotation injury	04	08%
Total		50	100%

\*Commonest was the Pronation abduction injury around the ankle.

**Table 3  
Operation Lag Time After Injury**

SN	Time Period	No. of Cases	Percentage of Cases
01	With In 48 Hours	26	52%
02	3- 10 Days	10	20%
03	11 – 60 Days	14	28%
	Total	50	100%

\*Most of the cases were operated between 24-48 hours.

**Table 4  
Results After ½ Year To 11/2 Year Follow Up**

S N.	Results	No. Of Cases	Percentage
01.	Excellent	40	80%
02.	Good	06	12%
03.	Poor	04	08%
04.	Total	50	100%

**Cases With Post-Operative Wound Status, Range Of Motion And Pre & Post Operative X-Rays**

**Case No. 01**



**Figure 1 range of motion**



**Figure 2: Healed stitch line**



**Figure 3: pre operative X-rays**



**Figure 4: Post operative X-rays**

**Case No. 2**



**Figure 5: Range of motion**



**Figure 6: Healed stitch line**



**Figure 7: Pre operative x-rays**



**Figure 8: Post operative x-rays**

**Case No. 3**



**Figure 9: Range of motion**



**Figure 10: healed stitich line**



**Figure 11: Pre operative X-rays**



**Figure 12: Post operative X-rays**

**Case No. 4**



**Figure 13: Range of motion**



**Figure 14:Healed stitch line**



**Figure 15: Post operative x-rays**

**Case No. 5**



**Figure 16: range of motion**



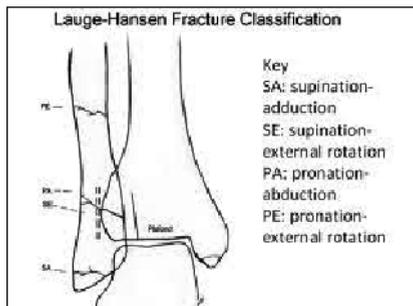
**Figure 17: Healed stitch line**



Figure 18: Pre operative X- rays



Figure 19: Post operative x-rays



- Pronation abduction injuries (PA)
- Pronation external rotation injuries (PER)
- Pronation dorsiflexion injuries (DENIS WEBER'S CLASSIFICATION is not included as it is not prognosis oriented).

The most common mode of injury was pronation abduction injury (68%) in our series.

There are various methods of treatment of medial malleolar quoted in literature ranging from:-

Close reduction and POP cast application: This method is for stable fractures only. For unstable bimalleolar and trimalleolar fractures, fractures with an associated deltoid ligament rupture, and comminuted fibular fractures with shortening, it's not the method of choice. The risk of managing these fracture types non-operatively is that of mal-union. Mal-united ankle fractures may result in abnormal contact pressures in the ankle joint, an increased risk of post-traumatic osteoarthritis and a poor functional outcome<sup>13</sup>.

Open reduction and fixation using K wires only: associated with complications like migration and loosening of wires<sup>14</sup>. This method usually required the removal of K wires at a later date

Open reduction and fixation by tension band wiring: associated with complications like pin tract infection, sudeck's osteodystrophy, tibio fibular

synostosis, failure of reduction.<sup>15</sup> This method usually required the removal of wires at a later date due to pain at fracture site and dehiscence of skin at fracture site due to loosening of wires.

Malleolar screws alone: associated with complications like infection, cutting through of the screw, dehiscence of skin at fracture site due to loosening of screw<sup>16</sup>

Although recent studies have trialed the use of suture button devices and bio-reabsorbable screws, citing the advantage of not having to be subsequently removed from the patient. The latter have been associated with reports of osteolysis, foreign body reaction, late inflammatory reaction and osteoarthritis as a result of polymer debris entering the joint<sup>17</sup> & are not followed.

The main aim of the present study was to assess the advantages of the malleolar screw with tension band wiring over the other methods of treatment. The fractures of medial malleolus were managed with malleolar screw with tension band wiring. The fractures of lateral malleolus were managed accordingly with screw/ k wire/ tension band wiring/ 1/3<sup>rd</sup> tubular plate. 80% of the patients were operated within 48 hrs, other 20% were operated between 5-7 days after the oedema had subsided. The most common complication was wound infection; though other complications like loosening & migration of wires, sudeck's atrophy, tibio fibular synostosis, post operative arthritis, persistant pain on medial side of ankle joint are reported in previously adopted methods of open reduction and internal fixation of these fractures were not there. A brief comparison of post operative complications of previous studies with the present study is tabulated below in table no. 5

**Discussion**

It is quite clear from the present series that the malleolar fractures are quite common & to add further are mostly bimalleolar in nature. The most common fracture in present series was of bimalleolar type (60%). The mean age is 41-50 years of age with predominantly male patients.

There are several classifications for these fractures in the literature (Ashhurst and bromers classification<sup>10</sup>, Handersons classification<sup>11</sup>) but the most commonly used classification for these fractures is the LAUGE HENSON CLASSIFICATION<sup>12</sup> according to which these fractures are divided into five sub groups arranged as below in order of decreasing frequency

- Supination external rotation injuries (SER)
- Supination adduction injuries (SA)

**Table 5**  
**Incidence Of Infection/ Complications Post Operatively In Previous & Present Series – Comparison**

Series	Method	Year	Complications	%
Thomas et al <sup>19</sup>	Malleolar screw alone/TBW with K wires	1980	Wound infection, loosening migration of K wires	26%
Roberts et al <sup>15</sup>	Malleolar screw alone/TBW with K wires	1983	Infection Sudeck’s atrophy Tibiofibular syostosis	28% 08% 04%
Lindsjo <sup>18</sup>	Malleolar screw alone /TBW with K wires	1985	Wound Infection Post operative arthritis	1.8% 14%
Mac et al <sup>20</sup>	Malleolar screw alone/TBW with K wires	1985	Wound Infection Post operative arthritis Non union	8.6% 09% 02%
Georgadis and White <sup>21</sup>	Malleolar screw/TBW with K wires	1995	Wound Infection Persistant pain on medial side of ankle	26% 18%
Yilmez et al <sup>22</sup>	Malleolar screw/TBW with K wires	2002	Post operative arthritis	06%
Present series	TBW with malleolar screw	2017	Infection Delayed union	08% 08%

From the above table it is imperative that our method of open reduction and internal fixation of medial malleolar fractures has least rate of infection barring one study done by Lindsjo<sup>18</sup> in which the infection rate was 1.8%. To add further the present mode of fixation was devoid of complications like loosening & migration of wires, sudeck’s atrophy, tibio fibular synostosis, post operative arthritis, persistant pain on medial side of ankle joint as reported in various other methods of fixation( Malleolar screw/TBW with K wires ) of medial malleolar fractures.

Moreover complications like loosening and migration of K wires (Thomas et al 26%) is totally eliminated in the present series.<sup>19</sup>

A brief comparison of post operative results of previous studies with the present study is tabulated below in table no. 6

**Table 6**  
**A Comparison Of Post Operative Results With Previous Studies**

Series	Years	Results %		
		Excellent	Good/average	Poor
Thomas et al <sup>19</sup>	1980	73.3	22.5	04.2
Roberts et al <sup>15</sup>	1983	64.1	24.0	12.0
Mac et al <sup>20</sup>	1985	90%		10.0
Lindsjo <sup>18</sup>	1985	82	08	10.0
Georgadis and white <sup>21</sup>	2002			
Yilmez et al <sup>22</sup>	2002	58	26	16.0
Present series	2017	90	---	10.0

In our series excellent to good results were seen in 90% of the cases & is clearly higher than the previously done studies and are at par with Mac et al<sup>20</sup>.

Average period of union in the present series was 8 -10 weeks which is in accordance with Thomas et al<sup>19</sup>, Lindsjo<sup>18</sup>, Mac et al<sup>20</sup> and better than that of Roberts et al<sup>15</sup> i.e. 12 weeks; who adopted different methods of open reduction and internal fixation.

**Conclusion**

It is imperative from the above discussion that open reduction and internal fixation of fractures of medial

malleolus with a malleolar screw along with tension band wiring is a superior method as compared to other methods of handling of ankle fractures because:-

- It does not cause stiffness of the ankle joint and there are less chances of non union (compared to close reduction and P.O.P. cast application)
- Very less chances of mal union due to displacement of fragments in P.O.P cast application.
- There are no chances of proximal migration of the screw and pin tract infection

(compared to tension band wiring with two K wires.

- There are very less chances of loosening of screw as supplement compression is provided with tension band wiring (compared with ORIF with malleolar screw alone.

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