

## Original Research Article

# Open reduction and internal fixation treatment of distal tibia fracture with Wise lock plate followed by two year follow up

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## ABSTRACT

**Background:** Distal tibial fractures are high energy injuries with high complication rate. The objective of this study was to reduce the postoperative complications of distal tibial fracture by using indigenously manufactured implants (plates and screws).

**Methods:** This was a prospective study of 10 patients (6 patients had 43-B1 fracture, 4 patients had 43-B2 fracture) with two year follow up period followed by physical exercises after one month of the surgery. The fractures were treated with 3.5 mm Wise lock medial distal tibia plate. X-ray was used to check the union, non-union. Functional outcomes were assessed with visual analog scale (VAS) score.

**Results:** X-ray was showing good results. Average VAS score was 1.5 (90%) 9 patients and 2.5 (10%) in 1 patient. At the end of the first year VAS score is 2 for one patient with 9 others having 1 and at the end of the second year the VAS score is 0 for 9 patients and 1 for one patient.

**Conclusions:** Treatment of distal tibial fracture with 3.5 mm Wise lock medial distal tibia plate shows good outcomes with less complications.

**Keywords:** Distal tibia fracture, Partial articular, Wise-lock implant

## INTRODUCTION

Tibia, the most common fractured long bone represents 2% of all fracture and 36.7% of all long bone fractures in adults.<sup>1</sup> Distal tibia fractures are high-energy injuries that lead to complications such as wound breakdown, infections, osteomyelitis and disastrous outcomes, inconvenient to handle due to its poor blood supply and limited soft tissue envelope. 10% to 30% of high energy injuries are open fracture. For optimal treatment of the distal tibial fracture, soft-tissues are the core of treatment and a delayed surgical treatment protocol is mandatory for optimizing the soft-tissues and preventing postoperative complications.<sup>2-5</sup> Numerous techniques are

used to treat distal tibia fractures such as, open reduction and internal fixation (ORIF), external fixation, intramedullary nailing and minimally invasive plate osteosynthesis (MIPO). Among all these techniques ORIF results in excellent outcomes when the soft tissue envelope is less injured. Osteosynthesis of high energy distal tibial fractures associated with higher postoperative complication rates and poorer outcome as compared to lower energy fractures.<sup>4,6,7</sup> High complication rates following open reduction and internal fixation occur especially in the distal tibia, Zone 43 (type B1 and type B2 fractures were treated in our study) fracture according to AO/OTA fracture classification.<sup>5,8</sup> Despite significant difficulties related to soft-tissue coverage, there has been

an improvement in the results of treatment of these injuries during the last few decades. In this study we selected the ORIF treatment for the distal tibia fracture.

The objective of this prospective study was to reduce the post-operative outcomes of distal tibia fracture treated with the implants (plates and screws-manufactured by Auxein Medical Private Limited) through open reduction internal fixation treatment.

**METHODS**

A prospective study held from February 2016 to February 2018 at Mesoamerican University, Quetzaltenango, Guatemala. All patients with distal tibia fracture (43-B1 and 43-B2, according to AO classification of fracture) were included in the study. The mean age of patients was 34.2 years (range from 34-47 years). Patients with the previous distal tibia surgeries were excluded from the study. All patients involved in the study have high energy open fracture.

Before surgery American Society of Anesthesiologists Physical Status classification System (ASA grade) is used for assessing the fitness of patients. As per ASA grade, 6 Patient were having Grade I (Healthy individual) and 4 patients felt under Grade II (A patient with mild systematic disease) with no report of previous surgery on the affected fracture.

All patients were treated with 3.5 mm Wise lock medial distal tibia plate (Manufactured by Auxein Medical Pvt. Ltd.). All implants were made up of SS and Ti material (stainless steel alloy as per ISO 5832-1 and titanium alloy Ti-6AL-4V as per ISO 5832-3). Implants used in the surgery were used with the same material instruments to avoid bacterial infection. 3.5 mm Wise lock medial distal tibia plate with 3 mm thickness and with 4,6,8,10,11,12, 13,14 number of shaft holes, used with the screws 3.5 mm Wise lock screw and 3.5 mm cortical screw. Fixation with metal wire is recommended when rigid stabilization is not achieved with screws. Functional outcomes were assessed with visual analogue scale (VAS). We use Microsoft excel for the percentage calculation. The surgery was performed with the patients under general anesthesia. All surgery was performed by the same surgeon. Preoperative conditions were assessed in term of pain with VAS score (range 0-10 cm). After osteosynthesis, radiography (X-ray) was used to examine bone union, implant failure and deformities. X-ray were examined on 1months, 6months, 12 month and 24 months. All radiographic measurement were performed by same surgeon. All patients were involved in the radiography performed by the same surgeon. No complaints were found.

**RESULTS**

A total of 10 patients were recruited for the surgery. All of them were operated between 24 to 72 hours of the

injury. Out of 10 patients 5 were women (50%) and the rest 5 were men (50%). As shown in Table 1, the average age of patients was 34.2 years, ranging from 20 to 42 years. According to the AO classification, distal tibia fractures 43-B1 and 43-B2 were observed in 6 (60%) patients and 4 (40%) patients respectively. The locations of the fracture were left and right with 4 (67%) patients on the right and 2 (33%) on the right for 43-B1 out of 6 patients, while for 43-B2 it was 2 (50%) on left and 2 (50%) on the right out of total 4 patients (Table 1). The fracture type was B in both categories. Average VAS score was 1.5 (90%) 9 patients and 2.5 (10%) in 1 patient. At the end of the first year VAS score is 2 for one patient with 9 others having 1 and at the end of the second year the VAS score is 0 for 9 patients and 1 for one patient. All the subjects were interviewed through different channels as per their convenience like telephonic conversations and personal meeting.

**Table 1: Demographic and fracture characteristics.**

Demographic detail	
Average age (range)	34.2 years (range, 34-47 years)
Gender	N (%)
Male	5 (50)
Female	5 (50)
Fracture characteristics	
Fracture type (AO/OTA type)	
43-B1	
Left	4 (67)
Right	2 (33)
43-B2	
Left	2 (50)
Right	2 (50)

**Table 2: Cause of fraction with corresponding number of patients.**

Injury mechanism	No. of patients
	N (%)
Fall and slip	4 (40)
Road accident	6 (60)

**Table 3: Patients clinical evaluation data.**

Evaluation categories	Recovery time (range in weeks)
Callus time	8-12
Union	24-29
Full weight bearing	8-20

The mechanism of injury is shown in Table 2 with 6 patients having accidents and the remaining 4 patients fall or slip. The complete follow up has evaluation after every 6 months till 2 years with respective observations of Callus formation, full weight bearing and union as shown in the Table 3. The mean time showing good callus

growth which is radiologically evident is 9.7 weeks with a range of 8-12 weeks. The mean time for full weight bearing was 13 weeks with a range of 8-20 weeks and for union it was 26.6 weeks with a range of 24-29 weeks. All the observations showed good results.

For the postoperative care the initial 6 months, patients were suggested rehabilitation exercises followed by physiotherapy. At every interval the progress was examined which showed good post-operative results up till the 2nd year of the follow up period. With no complications of indications of reoperation good surgical outcome was reported. It included no case of failure of fixture, non-union and infections.

## DISCUSSION

Distal tibia surgical treatment is a challenging task. Due to the bone location and subcutaneous coverage of the soft tissue very less and bad vascularity it requires expert surgeons in planning the procedure. It possesses complication of the soft tissue when treating the fractures conventionally by adopting periosteal stripping and dissection. Open fractures are prone to get more infected than closed fractures. These experiences are related to the soft tissues and union difficulties.<sup>9</sup> The major concern associated with the treatment for fixation of open fractures is stability of the bony part. The best suitable way to stabilize open fractures is fixation surgically, external or internal. Use of tibia plates and locking system is chosen for fixation of tibia open fractures.<sup>3</sup> It helps recovery of the soft tissue wounds and provides the best possibility of setting soft tissue healing and resistance to healing.<sup>11</sup>

Yang et al, compared the treatment of tibia fracture using plating as well as short intramedullary (IM) nailing.<sup>12</sup> The proposed study concluded that both treatment systems were effective. The use of non contact plates have also delivered good results thereby becoming an alternative to IM nailing for open fractures.<sup>13</sup>

The use of locking plates has proven beneficial not only in open fractures but also a good alternative in infective non-union. These plates come with multiple holes that are distally available thereby giving beneficiary status to the doctors to select hoes for the screw for distal fixation. Depending on the pattern of the fracture the locking system used in this study had 3 mm thickness and with 4,6,8,10,11,12,13,14 number of shaft holes used with the screws 3.5 mm Wise lock screw and 3.5 mm cortical screw.

In order to gain recovery from the surgery physiotherapy is considered the best as he plates does not cross the bony joints. In additions to the benefits findings have presented good adherence of the skin and the relates tissue very easily with the locking screws.<sup>14</sup>

The present study demonstrates use of 3.5 mm Wise lock medial distal tibia plate plates for open fracture with successful outcome. With a follow-up of 2 years no complications were reported. Joveniaux et al conducted a follow-up of 12 months and with an average of 19 months the external fixation was used for 54% of the fractures.<sup>6</sup>

With complete success rate there was no report of reoperation thereby achieving good functional results with excellent morbidity of the muscles. The experience of using of 3.5 mm locking plates was significant to be used for locking plate system for fixation of open fractures of the tibia.

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