

# Functional and radiological outcome of surgical treatment of distal tibial fracture by MIPPO technique

<sup>1</sup>Dr. Punith Kumar PC, <sup>2</sup>Dr. Girisha KG, <sup>3</sup>Dr. E Saikrishna

<sup>1</sup>Senior Resident, Department of Orthopedics, HIMS, Hassan, Karnataka, India

<sup>2</sup>Senior Resident, Department of Orthopedics, MMCRI, Mysore, Karnataka, India

<sup>3</sup>Senior Resident, Department of Orthopedics, MMCRI, Mysore, Karnataka, India

**Corresponding Author:**

Dr. E. Saikrishna

## Abstract

**Introduction:** Treatment of distal tibial fractures has always been challenging. Fractures of the distal third tibia are unique in that the bone is subcutaneous with depleted muscular cover; the consequent decreased vascularity leads to complications like delayed bone union, wound complications such as dehiscence and infection. Minimally invasive Percutaneous plate osteosynthesis (MIPPO) is an established technique for fixation of fractures of the distal third tibia. The aim of our study was to manage extraarticular fractures of the distal third tibia by the minimally invasive plate osteosynthesis technique and follow them prospectively. Clinical and radiological outcomes were studied and clinical indications & efficacy of the procedure reviewed.

**Methods:** The patients coming to Mysore Medical College & Research Institute, Mysore during January 2019 to June 2020 with distal tibial fractures. The patients treated with locking compression plates using Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) would be reviewed for inclusion and exclusion criteria's. The sample size in our study is 30. The patients will be followed minimum for 6 months, 9 months, upto 12 months. Functional outcome was assessed using AOFAS scoring system.

**Results:** Out of the total 30 cases, 20 were males and 10 were females. The mean fracture healing time was 17 weeks (range 16-22weeks) and average AOFAS score was 87.2 out of a total possible 100 points. According to AOFAS scoring system, excellent results were observed in 15 cases, good results in 9 cases, satisfactory results in 3 cases and poor results in 3 cases. At last follow up, superficial infection occurred in 6 patients, deep infection in 1 patient, ankle stiffness in 1 patient, LLD<1cm in 1 patient and malunion in 3 patients.

**Conclusion:** MIPPO technique provides good bone healing and decreases incidence of nonunion and need for bone grafting. This technique should be used in distal tibia fractures where locked nailing cannot be done like fractures with small distal metaphyseal fragments, vertical splits, markedly comminuted fractures.

**Keywords:** Distal tibia fracture, locking compression plate (LCP), percutaneous plating, distal tibia fractures, AOFAS scoring system

## Introduction

Treatment of distal tibial fractures has always been challenging. Fractures of the distal third tibia are unique in that the bone is subcutaneous with depleted muscular cover; the consequent decreased vascularity leads to complications like delayed bone union, wound complications such as dehiscence and infection. Closed fractures of the tibial shaft traditionally have been treated with closed reduction and a cast. These fractures can be managed with various techniques. Small wire fixators and Open reduction and plating have been used with varying results <sup>[1]</sup>.

With operative treatment shortening and other complications associated with prolonged immobilization can be avoided <sup>[2]</sup>. ORIF have been performed for distal tibial fractures and is associated with complications like infection and delayed or non-union due to dampened blood supply to bony fragments and also additional damage to soft tissue <sup>[3]</sup>. Soft tissue

management plays a vital role in management along with bony reconstruction. There are plenty of devices available for fixation, including intramedullary nail, extramedullary traditional plate and the relatively new precontoured 3.5mm distal locking compression plates. Recently, there has been an increasing trend toward use of a locking compression plate for treatment of distal tibia fractures. Locking compression plate provides better stability and protection against loss of reduction and minimizes contact with bone<sup>[4,5]</sup>.

In current orthopaedic practice, minimally invasive percutaneous plating osteosynthesis (MIPPO) and interlocking nailing are the preferred techniques for fractures of the distal third tibia. The intramedullary nail spares the extraosseous blood supply, allows load sharing, and avoids extensive soft tissue dissection. However, proximal and distal shaft fractures can be difficult to control with an intramedullary device, increasing the frequency of malalignment. The recent innovation of nails with tip locking is a testimony that earlier nails were insufficient fixation tools for distal tibia; however tip locking is technically difficult and fractures that require it are essentially difficult to fix with nails<sup>[6]</sup>.

These techniques are based upon the principles of limited soft tissue stripping, maintenance of the osteogenic fracture hematoma and preservation of vascular supply to the individual fracture fragments while restoring axial and rotational alignment and providing sufficient stability to allow progression of motion, uncomplicated fracture healing and eventual return to function.

### **Methodology**

This is a prospective study comprising of patients with distal tibial fracture admitted to Hospital. The patients treated with locking compression plates using Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) would be reviewed for inclusion and exclusion criterias. The patients will be followed minimum for 6 months, 9 months, upto 12 months. Patients fitting into inclusion criteria, followed for required period would form the study group. Based on confidence interval approach, at 5% level of significance taking prevalence of cases in hospital as 2.85 with an allowable absolute error of 6% calculated sample size is 30.

### **Inclusion criteria**

- 1) Patients above 18 years.
- 2) Fractures coming under AO Classification distal tibia fractures-A1, A2, A3.

### **Exclusion criteria**

- 1) Patient less than 18 years.
- 2) Fractures coming under Gustillo Anderson III open fractures.
- 3) Associated vascular injuries.
- 4) Pathological fractures.
- 5) Compartment syndrome.
- 6) Intraarticular fractures.

On admission of the patient, a careful history was elicited to reveal the mechanism of injury and the severity of the trauma. The patients were then assessed clinically to evaluate their general condition and the local injury. General condition was assessed with the vital signs and systemic examination. Methodical examination was done to rule out fractures at other sites.

Local examination of the injured extremity revealed swelling, deformity and loss of function. Palpation revealed abnormal mobility and crepitus at the fracture site. Distal neurovascular status was assessed by the posterior tibial artery and dorsalis pedis artery pulsations, capillary filling, local temperature, pallor and paraesthesia. Antero-posterior and lateral radiographs of the affected leg along with ankle were taken and the fracture patterns were classified based on the AO/OTA classification of fractures of distal tibia. The limb was then immobilized in an above knee Plaster of Paris slab till definitive fixation with locking compression plate done.

Patients with open fractures were graded using the Gustilo Anderson classification for open

fractures. Antibiotics were started immediately for all patients. Injection cefotaxime 1-gram intravenous twice daily along with injection Amikacin 500mg intravenous twice daily were the antibiotics. Injection Tetglob (Tetanus immunoglobulin) 500 IU IM and single dose of tetanus toxoid was given.

After obtaining the necessary radiographs, Type I and II open fractures were treated by cleaning of the wound with copious amount of normal saline, and Hydrogen peroxide, followed by painting of the skin around the wound with Povidone iodine and surgical spirit. This was followed by primary wound closure. The limb was then immobilized in an above knee Plaster of Paris slab till definite fixation was done.

All cases of fibula fractures were treated with internal fixation using either k wires or plate.

## Results

Of the 30 cases 8(26.6%) cases took 41-50 minutes, 11 (36.6%) took 51-60 minutes, 2(6.8%) took 61-70 minutes 6(20%) took 71-80 minutes, 3(10%) took 81-90 minutes.

**Table 1:** Duration of surgery

Duration (in minutes)	No. of Cases	Percentage
41-50	8	26.6
51-60	11	36.6
61-70	2	6.8
71-80	6	20
81-90	3	10

The average time for fracture union in our study was 17.2 weeks with range between 14 to 22 weeks. Fractures of 5 (16.6%) patients united in 14 weeks, 8 (26.6%) patients united in 16 weeks, 9 (30%) patients united in 18 weeks and 5 (16.6%) patients united in 20 weeks and 3 (10%) patients united in 22 weeks. All cases fibula fracture healed without complications.

**Table 2:** Radiological union

Duration (In Weeks)	No. of patients	Percentage
14	5	16.6%
16	8	26.8%
18	9	30%
20	5	16.6%
22	3	10%
Total	30	100

At the end of 6 months of the 30 patients treated, 12 (52%) patients had excellent outcome, 4(17%) had good results, 4 (17%) had fair outcome and 3 (14%) patient had a poor result.

**Table 3:** Functional outcome

Functional outcome	Frequency	Percentage
Poor	3	10
Satisfactory	3	10
Good	9	30
Excellent	15	50
Total	30	100

**Table 4:** AOFAS score

AOFAS Score	Frequency	Percentage
95-100	15	50
75-94	9	30
51-74	3	10
<50	3	10

6 patients (20%) in our study developed superficial skin infection, one patient (3%) developed ankle stiffness, shortening of <2 cm was seen in one patient (3%), One patient (3%) developed deep skin infection, 3 patients (10%) developed malunion.

**Table 5:** Complications

Complications	Frequency	Percentage
Ankle stiffness	1	3.3
Deep infection	1	3.3
Malunion	3	10.0
Shortening <1cm	1	3.3
Superficial infection	6	20.0
Total	18	60.0

## Discussion

The average surgical time was 63 minutes. It is comparable with the average of 97.9 minutes taken by J.J. Guo *et al.* [6] in their study.

The average time for fracture union in our study was 17 weeks which was comparable with studies conducted by Cory Collinge *et al.* [7] (21 weeks), Hazarika *et al.* [8] (19 weeks) and Abid Mushtaq *et al.* [9] (22 weeks).

The functional score in our study was 87.2% which was comparable to studies conducted by Collinge *et al.* [7] and J.J. Guo *et al.* [6].

Hazarika *et al.* [8], a series of 20 patient of distal tibial fracture treated using locking compression plates through MIPPO technique. This approach aims to pressure bone biology and minimise surgical soft tissue trauma. This provided 87.5% of good to excellent results. Fractures were classified according to the AO system and performed as scored stage surgery after sterilization with external fixators primarily.

Gao *et al.* [24], studied 32 adult patients with very short metaphyseal fragments in fractures of distal treated with a polyaxial locking system. The polyaxial locking system shown results of 87.3 functions out come with American Orthopaedic Foot and Ankle Society score which offer more fixation versatility, may be a reasonable treatment option for distal tibia fracture with very short metaphyseal segments. The Functional outcome was comparable to our study, where AOFAS score was 87.2.

Ozkaya U *et al.* [11], a retrospective review of 22 patients [11] with distal third tibial fractures were treated with titanium locking compression plates using minimally invasive technique good biological fixation of distal tibial. A total of 81% of good to excellent outcome was assessed using American Orthopaedic Foot and Ankle Society which was comparable to our study [12].

6 patients (20%) in our study developed superficial skin infection, who were treated with intravenous antibiotics for a week. One patient (3%) developed ankle stiffness because of poor compliance in the post-operative period. Shortening of <2 cm was seen in one patient (3%) who had highly comminuted distal tibial fracture with diaphyseal extension. It was managed with heel raise. One patient (3%) developed deep skin infection for which implant removal was done and external fixation was applied and later internal fixation was carried out after the control of infection. 3 patients (10%) developed malunion. Since it did not hamper the day to day activities of the patients, no intervention was carried out. Non-union was not seen in any of our cases.

## Conclusion

In our study 30 patients with distal tibia fractures had undergone closed reduction through MIPPO technique using distal tibia anatomical locking compression plates. This technique has resulted in the effective stabilization of these fractures and allows early range of motion at ankle joint. MIPPO technique decreases the incidence of non-union and need for bone grafting since it provides good bone healing. MIPPO technique should be used in distal tibia fractures like fractures with small distal metaphyseal fragments, vertical splits, markedly

comminuted fractures where intra medullary nailing cannot be done.

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