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**Dr. Amit Chandrakant Supe**
Assistant Professor,
Department of Orthopedics,
Mahatma Gandhi Institute of Medical Sciences, Sevagram,
Wardha, Maharashtra, India.

**Dr. Kirti Vinayak Kinge**
Assistant Professor,
Department of PSM,
Indira Gandhi Government Medical College, Nagpur, India.

**Dr. Chandrashekhar Martand Badole**
Professor and Head,
Department of Orthopedics,
Mahatma Gandhi Institute of Medical Sciences, Sevagram,
Wardha, Maharashtra, India.

**Dr. Kiran N Wandile**
Associate Professor,
Department of Orthopedics,
Mahatma Gandhi Institute of Medical Sciences, Sevagram,
Wardha, Maharashtra, India.

**Dr. Kisan R Patond**
Director- Professor (Orthopaedics) and Dean,
Mahatma Gandhi Institute of Medical Sciences, Sevagram,
Wardha, Maharashtra, India.

**Correspondence**
**Dr. Amit Chandrakant Supe**
Assistant Professor,
Department of Orthopedics,
Mahatma Gandhi Institute of Medical Sciences, Sevagram,
Wardha, Maharashtra, India.

# Minimally invasive percutaneous plate osteosynthesis in distal tibial fracture: A series of 32 cases

**Dr. Amit Chandrakant Supe, Dr. Kirti Vinayak Kinge, Dr. Chandrashekhar Martand Badole, Dr. Kiran N Wandile, Dr. Kisan R Patond**

**Abstract**
The distal tibial fractures are unique. These fractures are considered as most challenging fractures to treat. The location of the fracture is close to the ankle joint and it is not uncommon for the fracture line to extend into the joint. There are various methods to treat distal tibial fractures like cast, ORIF with plating, intramedullary nail, external fixator. These methods are associated with their complications.
We operated 32 patients of distal tibia fractures between May 2010 to October 2012 with MIPPO technique. These fractures were classified according to AO classification. Results of this study were analyzed using American Orthopaedic Foot and Ankle Score which is 94.4 (mean) in this study. There were complications like infection in two cases, plate bending in one and plate irritation in one patient. We didn't notice non-union or delayed union.
We conclude that MIPPO is good treatment choice in distal tibial fractures with very few complications and good fracture union rate.

**Keywords:** Distal tibia fracture; ORIF; MIPPO; American Orthopaedic Foot and Ankle Score

## 1. Introduction
Treatment of fractures of the distal end of the tibia can be very challenging for orthopedic surgeons. These fractures make up 1% to 10% of all lower extremity fractures. As the energy of injuries increases, so does the number of these complex fractures [1].
Most of these fractures are managed with an operative intervention such as closed reduction and intramedullary interlocking (IMIL) nailing or open reduction and internal fixation (ORIF) with plating or closed reduction and per cutaneous plating or external fixators. Each of these techniques has their own merits and demerits [2]. IMIL nailing has been reported with higher rate of malunion because it is difficult to achieve two distally locking screws [3]. Wound infection, skin breakdown and delayed union or non union requiring secondary procedures like bone grafting are some of the complications associated with conventional osteosynthesis with plates [4]. Similarly, pin tract infection, pin loosening, malunion and nonunion leading to osteomyelitis is potential complication of external fixators and hence not preferred as definitive fixation method [5, 6].
Recently, techniques of closed reduction and minimally invasive percutaneous plate osteosynthesis (MIPO) with locking compression plate (LCP) has emerged as an alternative treatment option for distal tibia fracture. Percutaneous plating preserves the soft tissue envelope and the periosteum, maintains arterial vascularity and therefore minimises the surgical trauma to the zone of injury [7].
We prospectively studied 32 patients with distal tibia fractures operated with locking compression plate by minimally invasive percutaneous plate osteosynthesis technique.

## 2. Material and Methods
This study was conducted in the Department of Orthopaedics, from May 2010 to October 2012 on patients having fracture of the distal tibia. This study included 32 patients of distal tibia fractures with age ranging from 16-72 yrs presenting to orthopaedic emergencies and outdoor department, who were treated with minimally invasive percutaneous plate osteosynthesis (MIPPO) technique.
In this study, we included all distal tibia fracture that are intraarticular or periarticular with or without extension of fracture into distal diaphysis, low grade open fractures of distal tibia, that

is grade I compound fractures, pilon fracture with sufficient medial soft tissue coverage, unstable distal metaphyseal and diaphyseal fractures.

We classified distal tibia fractures according to AO classification. we got 10 patients (31.2%) of fracture 43A1, 13 patients (40.6%) 43A2, 8 patients (25%) 43A3 and 1 patient (3.1%) 43B1type.The surgery was delayed to 5-7 days untill soft tissue oedema subsides and skin began to wrinkle.

After clinical evaluation and consent for surgery, patients were taken to operation room. After administration of spinal/general anaesthesia, patients were operated. We applied torniquetes in all cases. We operated tibia fractures using anteromedial approach. A 2-3 cm incision was made starting at level of tibial plafond and extending proximally along medial surface of tibia. A subcutaneous tunnel was created along medial aspect of tibia by blunt dissection. A small incision was given at proximal end of plate. The plate was placed on anteromedial aspect of distal tibia and position of plate was checked using image intensifier in anteroposterior and lateral views. The distal end of plate was at the level of tibial plafond and proximal end extended at least three screw holes beyond extend of fracture. The plate was then fixed temporarily with either k wires or with cortical screw at the most distal and proximal plate holes. One locking head screw was inserted in the metaphyseal fragment at the distal part of plate close to the joint line and another was inserted in other plate end. Fixation was completed with insertion of appropriate screws in the midsection of plate. For safety purpose, a minimum of three screws were inserted on each side of fracture. We fixed fibula with plate in 10 patients (33.3%), intramedullary device in 9 patients (30%) and did not fix fibula in 11 patients (36.7%). (2 patients had no associated fracture ipsilateral fibula).

Postoperatively we applied below knee slab till removal of sutures. Limb was kept elevated to avoid swelling.

After removal of sutures, patients were called for monthly review and a plain x ray of distal tibia in anteroposterior and lateral plane was taken and clinical outcome was assessed. We evaluated our results using American Orthopaedics Foot and Ankle Score (AOFAS) Ankle-Hindfoot scale. We graded score as excellent (90-100), good (75-89), fair (50-74) and poor <50.


**Fig 1:** Preoperative x ray and postoperative union x ray

**Fig 2:** Steps of Surgery

## 3. Results

In this study, we operated 32 patients with distal tibia fractures. 20 patients were male while 12 were female with mean age 48.03 years (range 16-72). Road traffic accident was major cause of injury. In this study 30 patients had associated fracture ipsilateral fibula.

In the present study, the range of dorsiflexion was $10^0$ to $20^0$ with mean $18.4^0$ and plantar flexion was $40^0$ to $50^0$ with mean $47.8^0$, mean eversion $16.9^0$ (range $13^0$-$20^0$) and mean inversion was $17.4^0$ (range $14^0$-$20^0$). The average time for union was 18 weeks (range 15-23 weeks). Average time for complete weight bearing was 20 weeks (17-22 weeks). Mean follow up period was 11.2 month (range 4-25). We analysed our results using American Orthopaedic Foot and Ankle Score. Out of 32 patients, 30 (93.8%) patients had excellent results while 2 (6.2%) patients had good results. Mean AOFAS score was 94.4 with minimum 77 and maximum 99.

In this study, we faced superficial infection in 1 case which subsided with antibiotics while 1 patient had deep infection which was treated with implant removal after union of fracture and antibiotics. One patient had complication of bending of plate and soft tissue injury with valgus malalignment of fracture due to fall in early postoperative period. This patient was treated with closed reduction of tibial fracture and CRIF with intramedullary device in fibula. One patient complained implant impingement for which plate was removed after fracture union.

**Fig 3:** Complications

## 4. Discussion

Fractures of the distal tibia or pilon fractures are often associated with significant soft tissue injury. The key point in management of this injury is to recognise the importance of the soft tissue component. Definitive fixation is only advisable when the soft tissue allows it, when the 'wrinkle sign' is evident [8].

Previously published infection rates in management of this injury range from 0%-50%. [4, 9-11]. ORIF has been shown to have the highest infection rates compared to other methods of treatment [12]. Deep infection and wound dehiscence are the major soft tissue complications. Wound debridement, antibiotics, skin grafting, myocutaneous flap and even arthrodesis have a role to play in management [13] Infection rates in MIPPO studies are less as compared to ORIF studies. In our study, 3.1% is superficial infection and same percentage of deep infection is present.

Intramedullary naling is associated with low risk of infection but the technique is associated with complications like malunion, fat embolism, compartment syndrome and anterior knee pain [14, 15]

In present study, we treated tibial fracture with locking compression plate. Locking compression plating (LCP) provides an angular stability for fixation. Locked screws prevent the plate from pressing the bone, preserving periosteal blood supply. This system stimulates callus formation due to flexible elastic fixation. The anatomic shape of the plate prevents malalignment of the fracture and provides a better axial and angular weight distribution [16].

In present study, we fixed fibula with plate in 10 patients (33.3%), intramedullary device in 9 patients (30%) to restore fibular length and did not fix fibula in 11 patients (36.7%). We did not fix fibula in 11 patients as fracture was stable and fibular length was maintained and intraoperatively reduction of tibial fracture was stable and acceptable. Many agree that fibular fractures associated with syndesmotic or ankle mortise instability should be stabilised as malreduction of the ankle mortise has been shown to be a factor in poor functional outcomes, but there is no consensus over the role of fibular fixation in extra-articular fractures of the distal tibial metaphysis [17].

Implant impingement or discomfort can be a potential problem while treating distal tibial fractures with MIPPO technique. Lau *et al*, described removal of implants in 52% of their patients die to implant impingement or discomfort around medial tibial shin. I present study, one patient complained of implant impingement and insisted for implant removal, for which implant was removed after fracture union.

We analysed our results using American Orthopaedics Foot and Ankle Score (AOFAS), Ankle-Hindfoot scale which takes into account pain, function and alignment. Our mean AOFAS score was 94.4 (77-99). 30 patients had excellent score while 2 patients had good score. The AOFAS score in our study is comparable to other studies using MIPPO technique for treatment of distal tibia fractures [8, 18-20].

We didn't observe complications like malunion, nonunion, saphenous nerve injury and vein injury. Injury to saphenous nerve and great saphenous vein has been reported in cadaver studies and can be avoided with careful attention toward selection of skin incision site, dissection of vein, dissection with stab incision upto bone and atraumatic placement of drill sleeves [21].

Limitation of MIPPO is that, it does not allow direct visualisation of the fracture and surgeon is dependent on intraoperative fluoroscopy to confirm that an adequate reduction is achieved. Additional radiation exposure during application of the plate and screw fixation and therefore extended operating time are challenging problems of this technique [22].

In spite of this, percutaneous plating techniques offer surgeons a good method of bone stabilisation in patients with complex tibial shaft fractures, fractures with severely compromised soft tissues and injuries with intraarticular or periarticular extension. Percutaneous plating minimizes soft tissue stripping, preserves vascular pedicles and allows the osteogenic hematoma to remain essentially undisturbed. This technique seems to cause no increase in the risk of infection or soft tissue damage, and allows for rapid mobilization of the limb and patient.

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