



## Comparitive Study Between The Functional And Clinical Outcome Of Distal Tibia Fixation-Mippo

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### Abstract

#### Back Ground And Objective

To evaluate the results of Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) in treatment of distal tibial fractures. To study the surgical difficulties encountered during the procedure. To study the efficacy of minimally invasive percutaneous plate osteosynthesis in treating distal tibial fractures in terms of: Time required for the union of fracture. Rate of malunion and non-union and rate of infection.

#### Methods:

The present study was undertaken at the department Orthopaedics, Sree Gokulam Medical College. This study involved both male and female patients with distal tibia fractures, who presented to Gokulam Medical College. 30 patients who had distal tibia fractures who met the selection criteria were treated with minimally invasive percutaneous plating during the period from May 2017 to November 2018 were included in the study

#### Results:

The age of the patients ranged from 20 to 50years with mean age of 35years. Most of the patients were in the age group of 20-50years. The mode of injury in the majority of the patients was road traffic accidents. The majority of the fractures operated in our study were extra-articular fractures, i.e. AO/OTA 43-A (100%). 5 patients (25%) had a both bone leg fracture, with majority of the fibular fractures occurring at the level of the tibial fracture, suggesting a bending mechanism. Out of the 5 patients with an associated fibular fracture, only 1 patients needed fixation of the fibula (5%), and is fixed with one third tubular plate. We attained 90% of the excellent result using MIPPO technique.

#### Conclusion:

The MIPPO technique is a reliable fixation approach to fractures of the distal tibia, preserving most of the osseous vascularity and fracture haematoma and thus providing for a more biological repair. This technique can be used in fractures where locked nailing could not be done like distal tibial fractures with small distal metaphyseal fragments, vertical split and markedly comminuted fractures. Due to preserved vascularity, there is low incidence of delayed union and non-union. There was reduced incidence of infection due to limited exposure. Infection was also prevented by careful handling of soft tissues and by minimising the operating time.

**Keywords:** TIBIA, FRACTURE, MIPPO

#### Introduction

Fractures of the distal tibia are unique in that the bone is subcutaneous with decreased muscular cover; the consequent decreased vascularity leads to

complications like delayed bone union, wound complications such as dehiscence and infection. These fractures can be managed with various techniques like IMIL nailing, external fixators,<sup>1-3</sup> and

Open reduction and plating,<sup>4,5</sup> with varying results. In current orthopaedic practice, minimally invasive percutaneous plating osteosynthesis (MIPPO) and interlocking nailing are the preferred techniques for fractures of the distal tibia. The intramedullary nail spares the extraosseous blood supply, allows load sharing, and avoids extensive soft tissue dissection.<sup>6,7</sup> However, proximal and distal shaft fractures can be difficult to control with an intramedullary device, increasing the frequency of malalignment.<sup>8</sup> Concerns regarding difficulties with reduction/loss of reduction, inappropriate fixation in fractures with articular extension, anterior knee pain<sup>9</sup> and hardware failure have slowed the acceptance of intramedullary nailing as a treatment of fractures of the distal tibia. 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>6,8,10</sup> Minimally invasive percutaneous plate Osteosynthesis (MIPPO) technique can address several of the issues associated with intramedullary nailing, while amalgamating all biological benefits of closed reduction and fixation.<sup>11,12</sup> We reviewed the clinical indications and efficacy of MIPPO in distal tibia. Borrelli et al studied the effects of various methods of plating in tibia in human cadavers. They found that Open plating of the medial aspect of the distal tibia caused a statistically significant greater disruption of the extra osseous blood supply of the metaphyseal region than did percutaneously applied plates. They concluded that disruption of these extra osseous vessels following fracture and subsequent operative stabilization may slow healing and increase the risk of delayed union and non-union. These findings support current efforts to develop less invasive methods and implants for operative stabilization of distal tibia fractures<sup>13</sup>. In 1968 Reudi published a paper on this topic, describing the fracture, principles of treatment and a classification system. His experience with immediate fixation of tibial fractures demonstrated durable results and few complications<sup>14</sup>.

## Material And Method

The present study was undertaken at the department Orthopaedics, Sree Gokulam medical college. This study involved both male and female patients with distal tibia fractures, who presented to Gokulam

Medical College. 30 patients who had distal tibia fractures and met the selection criteria were treated with minimally invasive percutaneous plating during the period from May 2017 to November 2018 were included in the study. All the cases were fresh fractures and were traumatic in nature. On admission general condition of the patient was assessed with regards to hypovolemia, associated orthopaedic or other systemic injuries and resuscitative measures were taken accordingly. A thorough clinical examination was performed including detailed history relating to age, sex, mode of injury, past and associated medical illness. Routine investigations were done for all the patients. All patients were evaluated clinically and radiologically to assess for any other injuries. Radiographs were taken in two planes, AP and Lateral views. Patients were operated as early as possible, once the general condition of the patients was stable and patients were fit for surgery. Inclusion Criteria was Age >20 years (skeletally mature patients), Known case of diabetes, Hypertension, Peripheral vascular disease, Past history of smoking/Alcohol/Tobacco, Fractures distal third tibia, Closed displaced unstable fractures.

## Analysis And Results

The present study includes 30 distal tibial fractures treated with minimally invasive percutaneous plate osteosynthesis from May 2017–Nov 2018 in the Department of Orthopaedics, Sree Gokulam Medical College. The patients were followed up for an average of 12 months. All the patients were available for follow up. Thirty patients who had distal tibial fractures were included in our study group. The duration of follow-up ranged from 6 weeks to 12 months. There were 25 men and 5 women, ranging in age from 20 to 50 years old, with an average age of 35 years. In our study there were 20 right sided and 10 left sided distal third tibia fractures. Most of the patients in our study group were below 50 years, and the most common mode of injury was Road Traffic Accidents. Majority of the patients were male (70%) and only 30% were females. The major cause of fracture in our study was Road Traffic Accidents (80%). All the fractures in our study were closed. Majority were of A1 type (40%) followed by A2 type (30%). Most of our cases were uneventful and the only complication of superficial wound infection was noted in 3 cases (15%) which subsided on treatment with regular dressing and intravenous antibiotics. It is

clear that MIPPO results in less surgical trauma to the soft tissues and less operative time. The time of partial weight bearing was decided on the type of fracture, adequacy of fixation and the radiological picture at the time of follow up. Most patients started partial weight bearing around 7-8 weeks post-surgical fixation. The time of full weight bearing was usually between 7-14 weeks with an average time of full weight bearing of 10.2 weeks in our study group. Union was defined as the presence of bridging callus on two radiographic views and the ability of the patient to bear full weight on the injured extremity. All the fractures united. The time to union was between 17 to 30 weeks with an average of 23.75 weeks in our study group. A malunion was defined as angulation in coronal plane (Varus–valgus) of more

than 5 degrees, in the saggital plane (Anterior–posterior) angulation of >10 degrees, or more than 10mm of shortening. None of the patient with distal tibia fracture had a valgus or varus malalignment of more than 5 degrees. None of the patients had more than 10degree of angulation in saggital plane and none had a shortening of more than 10mm. Detailed analysis of function of the patients with distal tibia fractures was done on the basis of Ankle evaluation scoring system –AOFAS [American Orthopaedic Foot and Ankle Society Ankle–Hind foot Scale]. In our study of patients with fractures of distal tibia treated with MIPPO, 10% patient had Fair result, 10% patient had good results, 80% patients had excellent results.

**Tables And Graphs**

**Table 1 : Mean Age**

Statistics		Age
N	Valid	30
	Mean	41.41
	Median	45.00
	Std. Deviation	9.225
	Minimum	21
	Maximum	55

**Table 2 : Frequency Distribution**

	SEX	Percent
F	5	17.2
M	25	82.8
<b>Total</b>	30	100

**Table 3 : Mode Of Injury**

	MODE OF INJURY	Percent
ASSAULT	2	6.9
FALL FROM HEIGHT	6	20.7

<b>RTA</b>	22	72.4
<b>Total</b>	30	100

**Table 4 : Type Of Injury**

	<b>TYPE OF INJURY</b>	<b>Percent</b>
<b>TYPE A1</b>	28	94
<b>TYPE A2</b>	02	06

**Table 5 : Co-Morbid Factors**

	<b>CO-MORBID FACTORS</b>	<b>Percent</b>
<b>DM</b>	3	10.3
<b>DM &amp;HT</b>	1	3.4
<b>HT</b>	3	10.3
<b>NO</b>	22	72.4
<b>PVD</b>	1	3.4
<b>Total</b>	30	100

**Table 6 : Addiction**

	<b>ADDICTION</b>	<b>Percent</b>
<b>NO</b>	13	41.4
<b>SMOKER</b>	10	34.5
<b>TOBACCO</b>	7	24.1
<b>Total</b>	30	100

**Table 7 : Follow 6 Weeks, 3 Months, 6 Months And 12 Months**

<b>CALLUS</b>	<b>6WEEKS</b>	<b>Percent</b>
<b>PRESENT</b>	30	100

<b>CALLUS</b>	<b>3MONTHS</b>	<b>Percent</b>
<b>NOT SUFFICIENT</b>	2	6.9
<b>PRESENT</b>	28	93.1
<b>Total</b>	30	100

	<b>6MONTHS</b>	<b>Percent</b>
<b>INFECTION, NONUNION</b>	1	3.4

<b>MALUNITED</b>	2	6.9
<b>NONUNION</b>	2	6.9
<b>UNITED</b>	25	82.8
<b>Total</b>	30	100
	<b>12MONTHS</b>	<b>Percent</b>
<b>INFECTION, NONUNION</b>	2	6.9
<b>NONUNION</b>	1	3.4
<b>WB MOBILIZATION</b>	27	89.7
<b>Total</b>	30	100

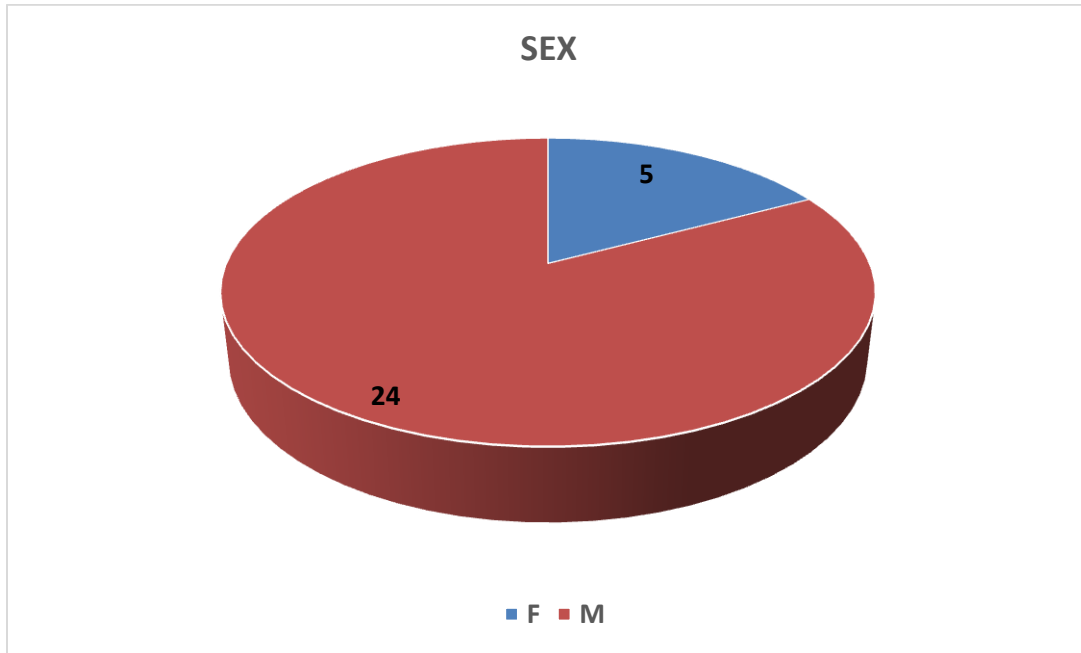
**Table 8 : Wound**

	<b>WOUND</b>	<b>Percent</b>
<b>HEALED</b>	27	89.7
<b>POOR HEALING</b>	3	10.3
<b>Total</b>	30	100

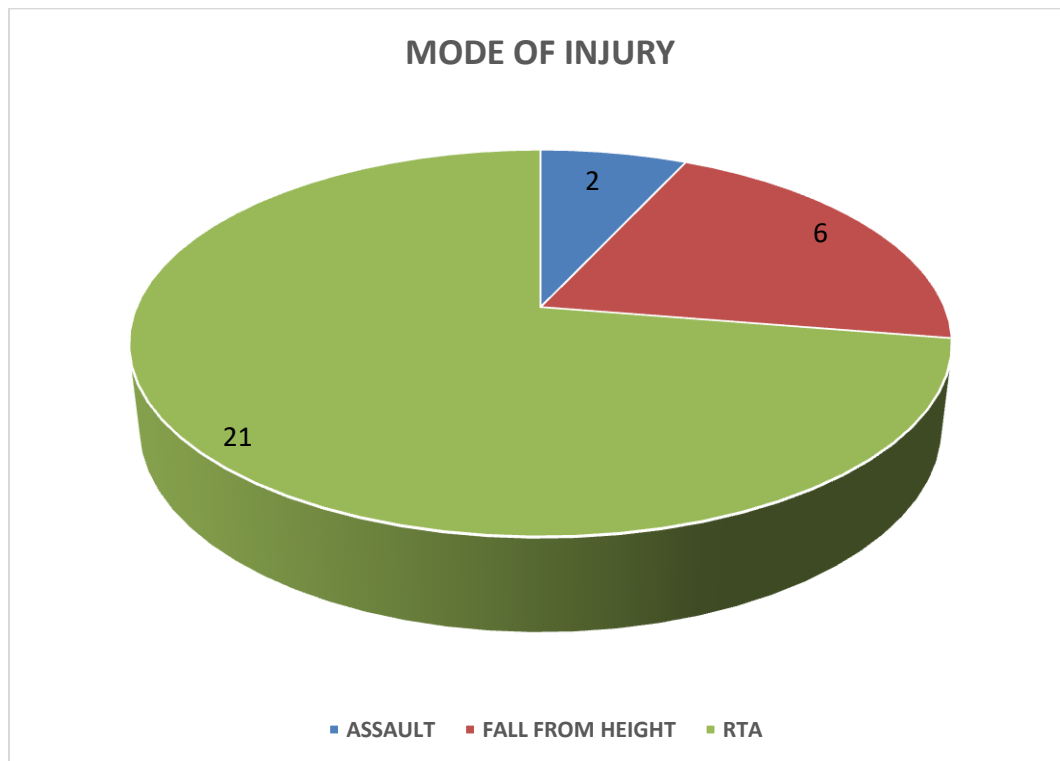
**Table 9 : Result S**

	<b>RESULTS</b>	<b>Percent</b>
<b>BAD</b>	1	3.4
<b>EXCELLENT</b>	25	82.8
<b>VERY GOOD</b>	2	6.9
<b>GOOD</b>	2	6.9
<b>Total</b>	30	100

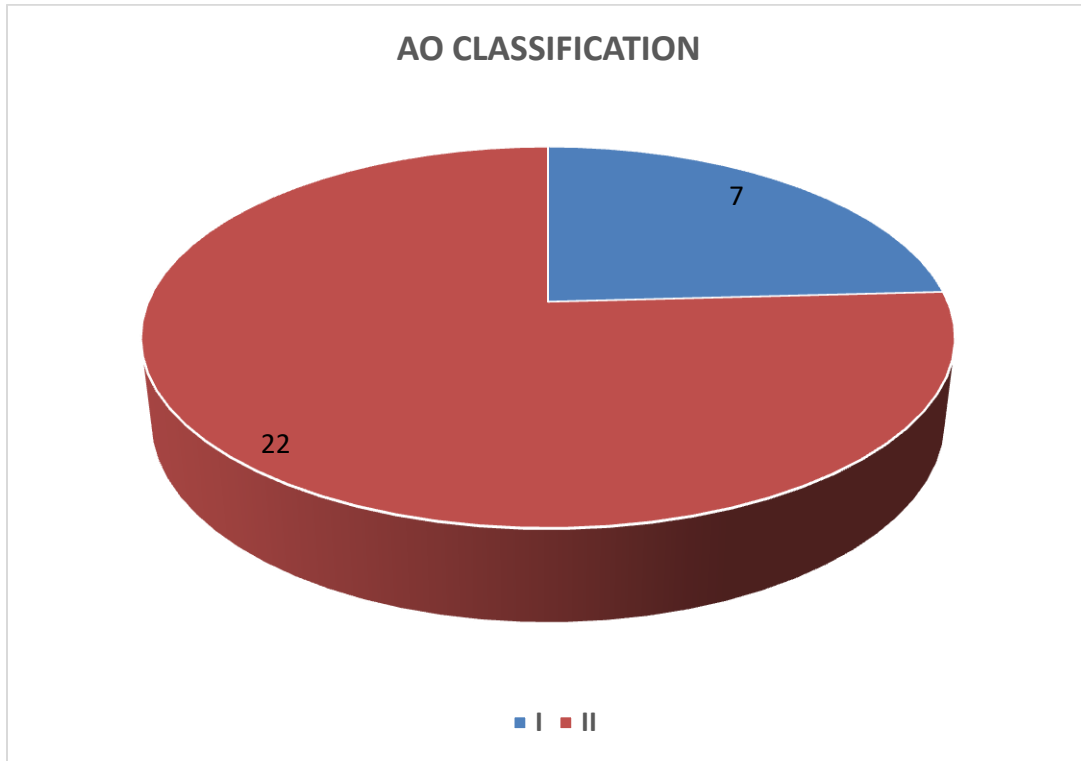
Graph 1: Sex distribution



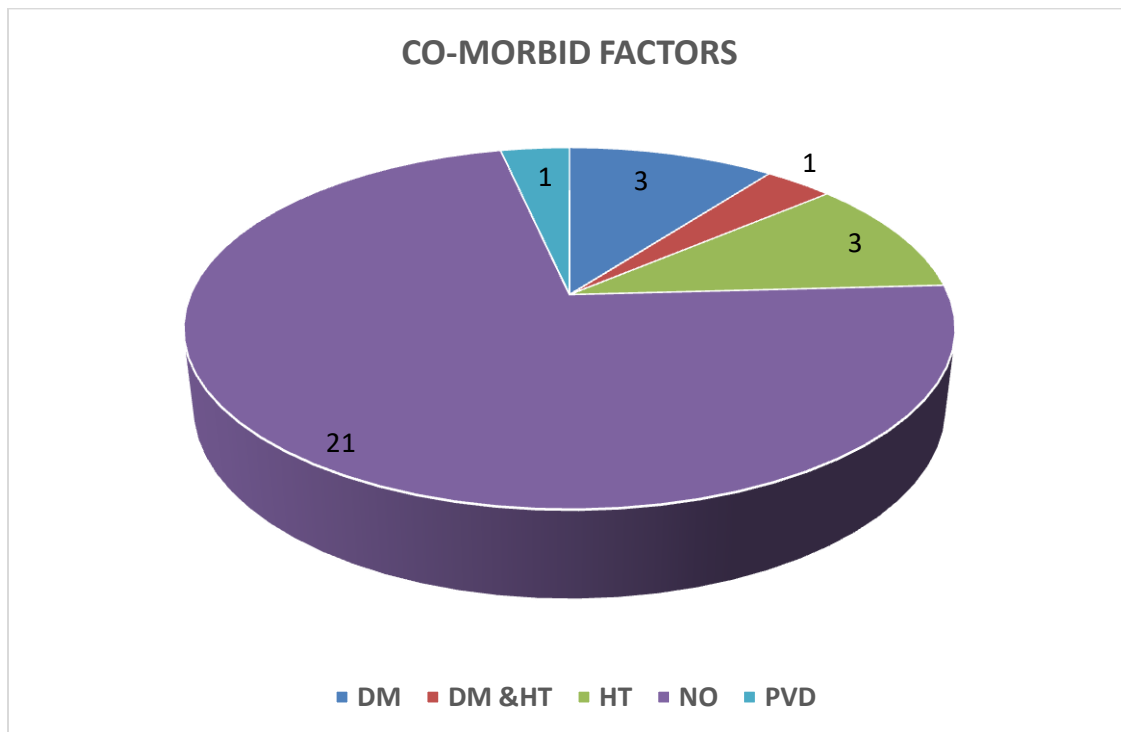
Graph 2 : Mode of injury



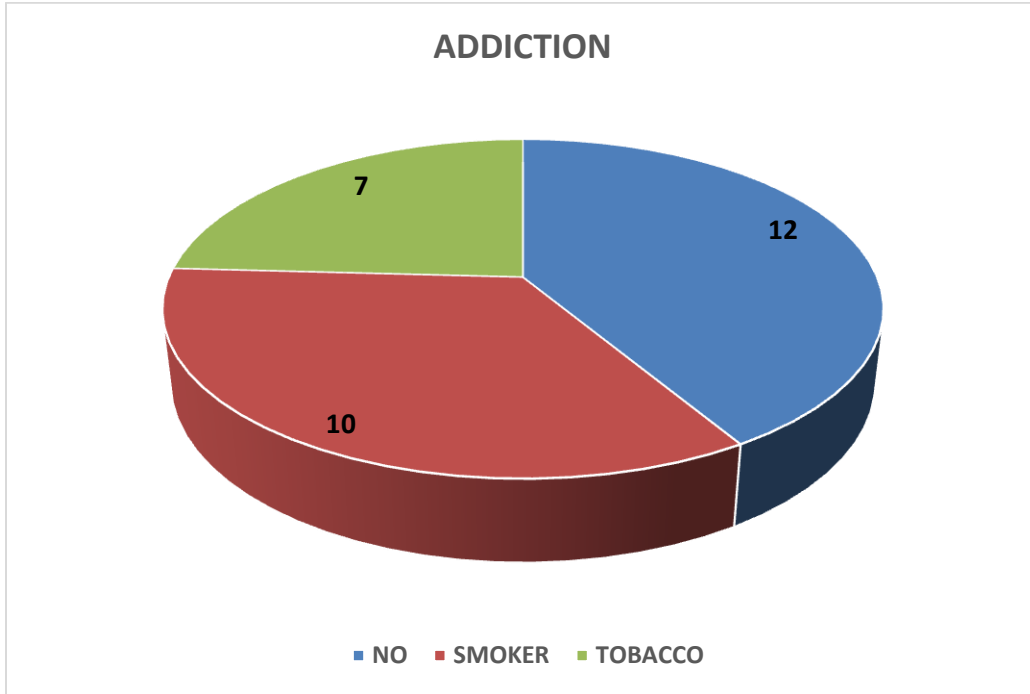
Graph 3 : AO classification



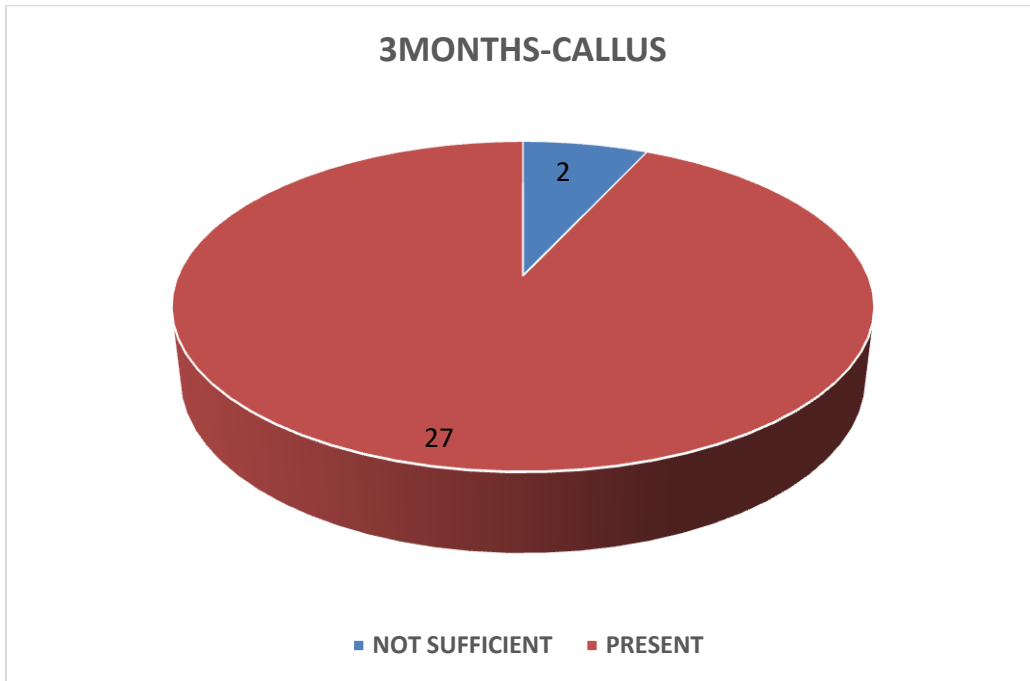
Graph 4 : Co-Morbid Factors



Graph 5 : Addiction

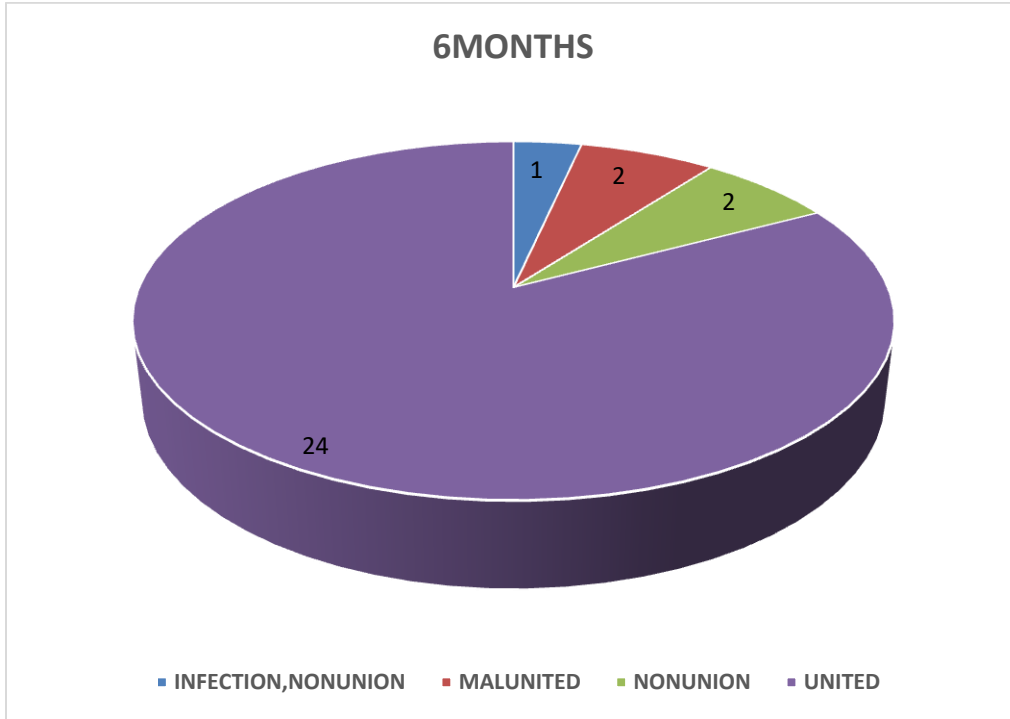


Graph 6 : 3 months-Callus

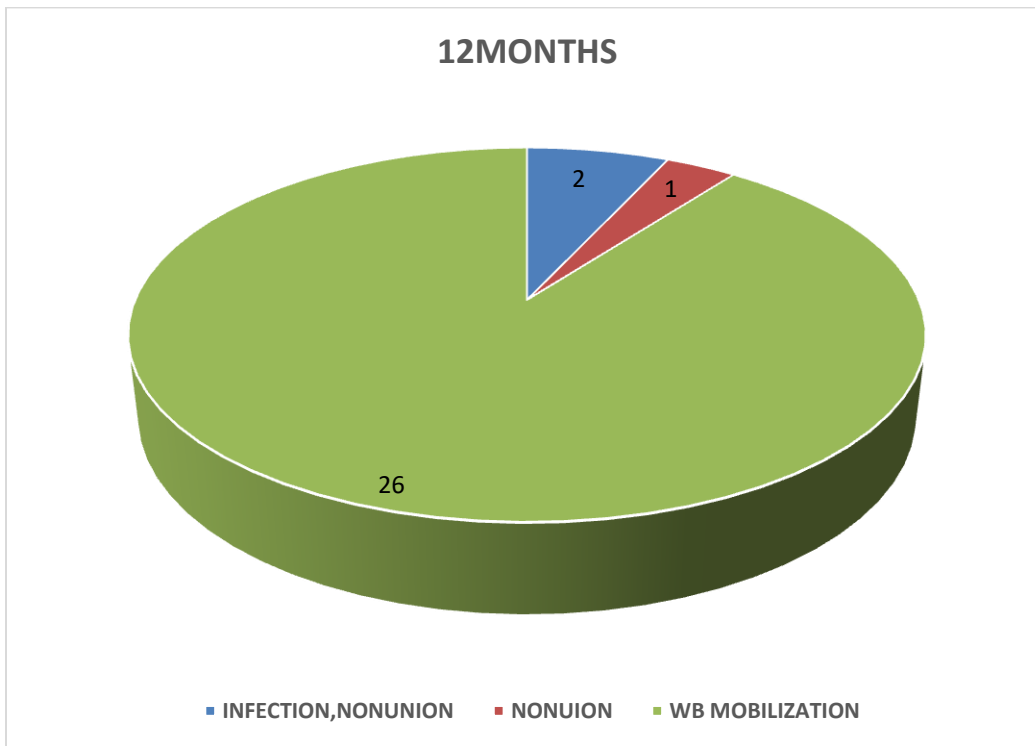




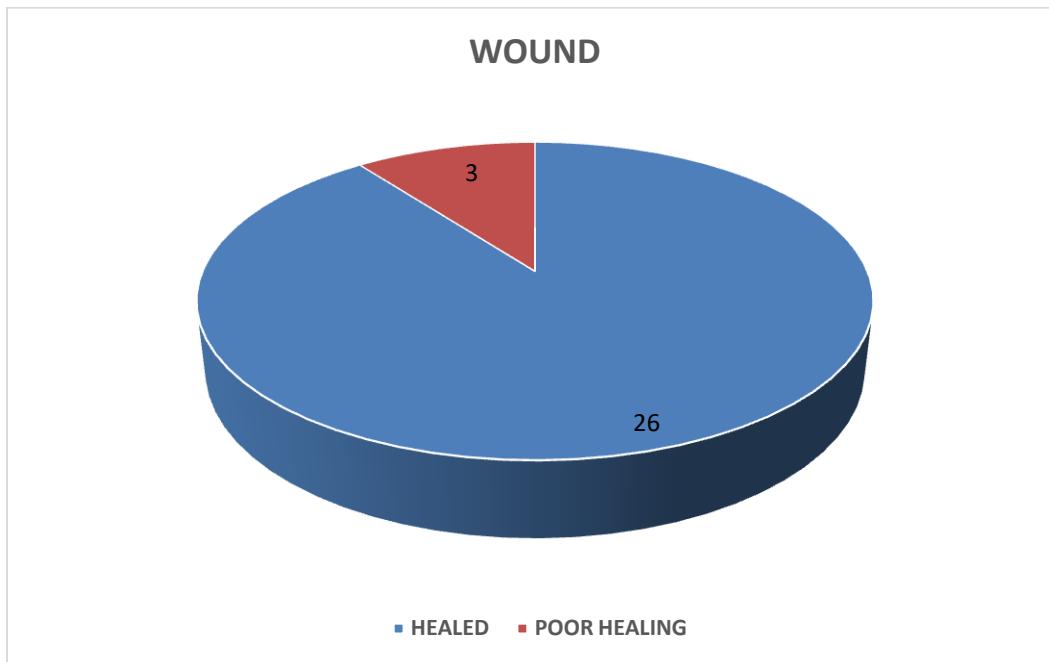
Graph 7 : 6 months-Callus



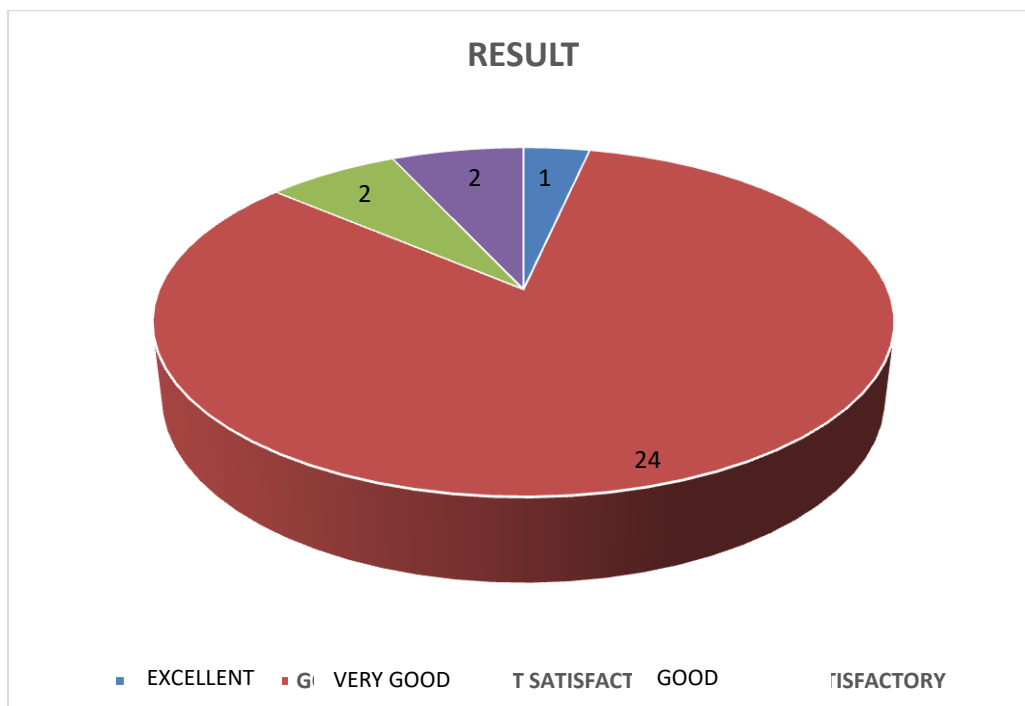
Graph 8 : 12 months-Callus



Graph 9 :Wound



Graph 10 : Result



### Discussion

Distal tibial fractures remain one of the most substantial therapeutic challenges that confront the orthopaedic traumatologist. Though conservative management of these fractures has been described

these methods have been largely superseded by operative techniques for displaced or irreducible fractures, and fractures with intra-articular extension. MIPPO is by now an established technique of management of fractures of the distal tibia. Minimally invasive percutaneous plating techniques

reduce the iatrogenic soft tissue injury and damage to bone vascularity, and also preserve the osteogenic fracture hematoma. Minimally invasive techniques are based on principles of limited exposure, indirect reduction methods and limited contact between bone and implant. As a result of these principles this technique, as seen in present study, avoided major soft tissue complications and shortened the length of the patient's stay in the hospital. Biological fixation of distal tibia fractures is beneficial and technically feasible. The advantages are: It minimises soft tissue injuries, it does not compromise bone vascularisation and presents a low complication rate, especially when compared to open reduction and internal fixation. The present study was undertaken to evaluate the results of Minimally Invasive Percutaneous Plate osteosynthesis (MIPPO) in treatment of distal third tibial fractures. Thirty patients with closed distal third tibial fracture with or without intra articular extension (AO classification: 12 type 43A1, 7 type 43A2, 1 type 43A3, treated with MIPPO with LCP were prospectively followed for average duration of 12 months (Range 8-12 months). We evaluated our results and compared them with those obtained by various other studies utilizing different modalities of treatment, our analysis is as follows:

**Age distribution:** Our study revealed the average age of patients with such injuries to be 35 years (20-50).

**Sex Distribution:** The sex distribution in our study in the treatment of distal tibial fractures with MIPPO showed that there were 25 men and 5 women.

**Nature of Violence:** Majority of the cases sustained fractures from road traffic accidents i.e. 16 cases (80%). 4 patients had sustained fracture after a fall. R.T.A was most common mode of injury in present series.

**Results:** The age of the patients ranged from 20 to 50 years with mean age of 35 years. Most of the patients were in the age group of 20-50 years. The mode of injury in the majority of the patients was road traffic accidents. The majority of the fractures operated in our study were extra-articular fractures, i.e. AO/OTA 43-A (100%). 5 patients (25%) had a both bone leg fracture, with majority of the fibular fractures occurring at the level of the tibial fracture, suggesting a bending mechanism. Out of the 5 patients with an associated fibular fracture, only 1 patient needed fixation of the fibula (5%), and was fixed with one third tubular plate. The average

duration between trauma and surgery was 4.5 days with a range of 3-7 days. Most of the cases were operated upon within 4 days of injury (86%). The average operative time was 60 min with a range of 70-120 min. The majority of the fractures were operated within 100 min of operative time (90.0%). Operative time was longer in fractures in which needed fixation of the fibula. The average fluoroscopy time was 50 sec with a range of 34 sec-60 sec. Post operatively the limb was elevated and a removable below knee slab was given. Toe touch weight bearing and knee range of motion was started on the 2nd postoperative day. Sutures were removed at 11th postoperative day, slab was continued for 4 to 6 weeks. Weight bearing was increased depending on the progress of clinical and radiological fracture healing. Full weight bearing was allowed at fracture union, which was defined as union in 3 cortices and painless weight bearing. The mean time for radiological union was 23.75 weeks with a range of 34 to 60 weeks. On union, all of the 12 patients had an AOFAS score of 90 or greater out of a possible 100 points. The mean score was 90.25. We encountered superficial infection in one of our patient which was managed with dressings and appropriate antibiotics. As the study progressed we realised that the key to preventing infection was gentle handling of the soft tissues. On long term follow up of the patient's the superficial infection healed well. The infection rate using MIPPO (5%) is favourable compared with ORIF with plates (15-35 % deep infection rates) and also with external fixation (20-50% pin track infection). A malunion was defined as angulation in a coronal plane (Varus -valgus) >5 degrees, saggital plane (Anterior -posterior) angulation of >10 degrees or > 10 mm of shortening. In our series, none of the patients had more than 10 degree of angulation in saggital plane and none had a shortening of more than 10mm. These results are comparable with the results of similar studies where in the malunion rate is reported to be 2-5%. In our series no patient had implant failure. This is also comparable to other similar studies, Bonker et al which have reported a 0-10 % incidence of plate exposure, most commonly at the distal insertion site. In most of the other studies the implant distal tibial locking plate removal is mainly due to symptomatic skin impingement over the medial malleolus. In our series, no patient developed fat embolism, compartment syndrome,

peroneal nerve palsy or reflex sympathetic dystrophy. All patients were happy with the cosmetic results because very little residual swelling was noted and the surgical wounds were rather small and healed without much scarring.

### Conclusion

The MIPPO technique is a reliable fixation approach to fractures of the distal tibia, preserving most of the osseous vascularity and fracture haematoma and thus providing for a more biological repair. This technique can be used in fractures where locked nailing could not be done like distal tibial fractures with small distal metaphyseal fragments, vertical split and markedly comminuted fractures. Due to preserved vascularity, there is low incidence of delayed union and non-union. There was reduced incidence of infection due to limited exposure. Infection was also prevented by careful handling of soft tissues and by minimising the operating time. Minimal hospital stays and early returns to activities. Following were the other post operative benefits such as Simpler and lesser follow-up, lesser check radiographs leading to lesser radiation exposure, Cost effective as less in hospital stay, lesser outpatient care, earlier return to work

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