

Research Paper

## A Prospective Study to Evaluate the Results of Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) in Treatment of Distal Tibial Fractures

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**Abstract**

**Background and Aim:** *the treatment of distal tibia fracture is very challenging due to limited soft tissue, subcutaneous location of large portion of tibia and precarious blood supply. The main aim of treatment of distal tibia fracture is to maintain normal alignment and articular surface. Closed reduction and mippo with distal tibia locking plate has emerged as a new treatment option in treatment of distal tibia fracture. This study was to evaluate the results of mippo technique with distal tibia locking plates.*

**Methods:** *30 patients with distal tibia fracture with or without intra articular extension were treated in our department, Govt. Medical College and Hospital, Amritsar with MIPPO with DTLP and were prospectively followed for average duration of 6 months. The outcome was evaluated using American Orthopedic Foot and Ankle Society (AOFAS) score.*

**Results:** *There were TOTAL 30 patients in the study including 24 males and 6 females of mean age 38.04 years. The mean follow up period of our patients was 6 months. All fractures united at an average of 18.13 weeks (range 16-24 weeks) except two cases of Acceptablemalunion, 1 case of non-union and 1 case of deep infection.*

**Conclusions:** *Minimally invasive percutaneous plate osteosynthesis (MIPPO) is an excellent method for treatment of distal tibia fracture. The use of a small incision, indirect reduction technique, time of operation, early healing and decrease incidence of infections have the advantage over the conventional osteosynthesis.*

**Keywords:** *Distal tibia fracture, MIPPO, AOFAS.*

**Introduction**

Distal tibial fractures are a big challenge to an orthopaedic surgeon as far as management of these injuries are concerned. Various problems associated with these fractures are:- subcutaneous

location of the bone with associated soft tissue trauma, high incidence of compound fractures combined with poor vascularity which many a times lead to delayed union or non-union. Achieving and maintaining anatomical axial and

rotational alignment of limb and getting a good functional outcome with minimal soft tissue damage are the main factors that make the management of these fractures all the more difficult.

As far as classification of distal tibial fractures are concerned two classifications system are mainly in use

- Reudi and Allgower's classification<sup>1</sup>

-AO/OTA classification<sup>2</sup> – more comprehensive and complete classification

Main aim of management of these fractures are to achieve and maintain proper axial and rotational alignment of limb till union, minimal soft tissue damage, accurate restoration of articular surface whenever required and a sound functional outcome.

Different management methods for these fractures are - close reduction and POP cast application, use of external fixator or distractors, nailing and open reduction and internal fixation (ORIF) with plating.

Each method has its own advantages and disadvantages. However there is a general consensus that operative treatment is the treatment of choice for such fractures to achieve almost a perfect bony union and excellent functional outcome.

External fixators are quite useful in compound injuries especially with severe soft tissue trauma. However pin related problems, joint contractures and stiffness, delayed union and poor patient compliance are the main issue associated with it. Intramedullary nailing is quite effective as it preserve the fracture biology and allow early joint motion. However, as the fracture tends to be more distal including intra-articular, it is difficult to get a mechanically stable construct with nail. ORIF with traditional plating system requires extensive soft tissue stripping with associated soft tissue and bony problems leading to more devascularisation lead to higher incidences of delayed union and non-union with poor functional outcome.

All these factors have lead to development of concept of biological osteosynthesis using locking

plates. These locking screws provide angular and axial stability thereby decreasing the chances of loosening and the whole construct act as an internal splint. This technique is very useful especially for distal tibial, comminuted fractures where-in an indirect reduction is done and the locking plates are mainly used by minimal invasive percutaneous plate osteosynthesis (MIPPO), technique bridging the comminuted segment minimising soft tissue dissection and devascularisation of bony fragments without much compromise on stability. The present study was also carried out mainly to assess the clinical outcome of minimal invasive percutaneous plate osteosynthesis in management of distal tibial fractures.<sup>3</sup>

### Material and Methods

This was prospective study of 30 cases of either sex of distal tibial fractures treated in a tertiary care centre (Govt. Medical College and Hospital, Amritsar). All closed/open type 1 and 2 (as per Gustillo and Anderson classification) without or with (non-comminuted) joint involvement were included in the study. However type 3 compound fracture and fracture's (AO B3 and C3) with grossly comminuted articular involvement and those with evidence of infection were excluded from the study. After initial resuscitation in the emergency department and thorough examination to rule out associated injuries, patient was then subjected to surgery after thorough investigation and pre-anesthetic clearance. Informed consent was taken of every patient. Under spinal/ epidural anaesthesia patient operated in supine position on radiolucent table under all aseptic conditions. Indirect reduction was done with the help of manual traction-counter traction or femoral distractor. In case of intra-articular fracture minimal open reduction of fracture was done. Reduction was verified under C-ARM and when found accepted, stabilised using minimally invasive technique. In this technique an oblique incision was made at the tip of medial malleolus and extended proximally to create easy passage.

The proximal position of the plate was checked to ensure central placement on the tibial shaft using the C-ARM. Minimum of 3-4 screws were used in each main fragment. Immediate post-operative and then regular radiograph was taken at monthly

interval to assess the union and functional outcome according to AOFAS (American Orthopaedics foot and ankle society). AOFAS score based on 3 categories, pain (40 points), function (50 points) and alignment (10 points).

## Observations and Results

### Pre-operative parameters

Sr. No	Parameters	Number	Percentage
1	Age (years)		
	20-30	9	30%
	31-40	12	40%
	41-50	6	20%
	51-60	3	10%
	61-70	0	0
2	Sex		
	Male	24	80%
	Female	6	20%
3	Mode of injury		
	RTA	21	70%
	Fall from height	9	30%
4	AO Classification		
	Type A	21	70%
	Type B	6	20%
	Type C	3	10%
5	ASSOCIATED INJURIES		
	HEAD INJURY		
	Chest injury	4	13.33%
	Patella fracture	1	3.33%
	Nasal bone fracture	2	6.67%
	Fracture ulna/radius	1	3.33%
	Avulsion over opposite leg	3	10%
No associated injury	1	3.33%	
		18	60%

### Post-operative parameter

Sr. No	Parameters	Number	Percentage
1	Complications		
	Fever	3	10.00%
	Skin necrosis	1	3.33%
	Superficial Infection	3	10.00%
	Malunion	2	6.66%
	Non-union	1	3.33%
	Deep infection/Implant removal	1	3.33%
2	Time of radiological Union		
	16 Weeks	9	30%
	20 Weeks	15	50%
	24 Weeks	4	13.33%
	Non-union	1	1%
3	Pts. Mobilized on walker		
	Day 1	3	10%
	Day 2	6	20%
	Day 3	21	70%
4	Full weight bearing[weeks]		
	8-10	3	10%
	11-13	8	26.66%
	14-16	15	50%
	17 and above	2	6.67%
5	Final ankle R.O.M		
	<30*	6	20%
	>30*	24	80%
6	AOFAS Total score		
	0-30	0	0%
	30-70	3	7.3%
	70-100	27	82.5%



Fig 1- Pre operative Radiograph



Fig 2



Fig 3- Minimally invasive approach



Fig 4 Post-operative Radiograph



Fig 5 Radiograph at 6 months showing union



**Fig 5-** Clinical photograph showing final functional outcome

### Discussion

Treatment of distal tibial fracture have always posed a challenge because of associated soft tissue injury and comminution. The main aim of managing these fracture is to achieve bony union in proper alignment and good functional outcome. Present study enrolled 30 patients with fracture of distal end tibia using locking plate by MIPO technique.

In our study it was found that distal tibial fractures were common in middle age group (20-70) with mean age 38.04 years. As this is the age group which indulge in more outdoor activities, so they were prone to accident with vehicular accident. Male predominance (72%) was seen. Similar

results were reported by Hazarika et al<sup>4</sup> and Mushtaq et al<sup>5</sup> in there studies.

Most common mode of injury was road traffic accident (70%), fall from height (30%). Hence distal tibia fracture most commonly occure after high energy trauma especially RSA so soft tissue insult is also quite high, here lies importance of appropriate management of such fracture. Similar observations were made in studies conducted by Gupta et al<sup>6</sup> and Leung et al<sup>7</sup>.

We used AO/ATO classification system. Most common fracture type was Type-A (70%) Type-B (20%) and Type-C(10%). Studies conducted by Leung et al<sup>7</sup> and Ronga et al<sup>8</sup> has similar pattern of fracture's.

Out of 30 distal tibial fracture 28 fracture (93.33%) united primarily after fixation; of these 9(30%) united by 16 week, 15 (50%) by 20 weeks and 4(13.33%) fractures healed by 24 weeks. Average time of union was 18.13 weeks. Fracture non-union was observed in 1 patient (3.33%) at 6 months. In ONE patient implant removal was done before union, due to development of deep infection. Similar union rate and time was also reported by Mushtaq et al<sup>5</sup>, Ronga et al<sup>8</sup>, Bahari et al<sup>9</sup>, Zha et al<sup>10</sup>.

We have 3 superficial infections in our study using MIPPO, all of them heal with oral medications. 1case had early scar breakdown which was managed by debridement and dressings till the granulation tissue was formed and later wound closure was done. Gupta et al<sup>6</sup>, Hazarika et al<sup>4</sup> and Mushtaq<sup>5</sup> et al also have similar share of complications in there series.

Malunion was observed in 2 patients. Valgus mal alignment was observed on immediate post operative radiographs of this patient which healed with no change in alignment. The other patient had varus malunion at 6 month follow up. Such observations are comparable to the study conducted by Protzman et al<sup>11</sup>.

In present study, AOFAS score was used to analyse the functional outcome of the cases. It was observed that final average AOFAS score at 6 month was 85.11. similar results were reported by Bahari et al<sup>9</sup>, Jha et al<sup>10</sup> and Collinge et al<sup>12</sup>.

### Conclusion

MIPPO with DTLP is a reliable fixation approach to fractures of the distal third tibia when used in conjunction with locked plates, preserving most of the osseous vascularity and fracture haematoma and thus providing for a more biological repair. The bone healing, though slightly delayed, was universal with this type of fixation. this technique can be used in fractures where locked nailing cannot be done like distal tibia fractures with small metaphyseal fragments, vertical split and markedly comminuted fractures. due to preserved vascularity, there is lesser incidence of delayed

union and non union. There was reduced incidence of infection due to limited exposure, meticulous intraoperative handling of soft tissues and by minimising the operative time.

**Conflict of interest-** Nil

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