



## Functional Outcome Of Medial Distal Tibial Locking Compression Plate Fixation In Distal Tibial Fractures-A Prospective Study.

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### Abstract

**Aim:** The Study Aim To Assess The Functional Outcome Of The Fracture Of Distal Tibia Treated With Medial Distal Tibial Locking Compression Plate.

**Materials & Methods:** In The Current Study, 30 Patients With The Distal Tibia Fractures Underwent Reduction & Internal Fixation By Open & Mippo Technique With The Medial Distal Tibial Locking Compression Plate. The Study Was Conducted From July 2018 To December 2020 At Department Of The Orthopedics In Sree Balaji Medical College & Hospital.

**Results:** All Patients Had Excellent Clinical & Functional Outcome. The Age Of Patient Ranged From 23 - 62 Years With The Fracture Seen Commonly In The 4<sup>th</sup> & 5<sup>th</sup> Decade Of Life. Out Of The 30 Patients, 18 (60%) Were Male & 12(40%) Were Female, Indicating Male Predominance. All The Cases Were Then Evaluated Using The Iowa Ankle Score, Aofas Scoring Periodically & Only Final Follow Up Scores Were Taken For Compilation Of Results. Functional Results Based On Iowa Ankle Score In **Mippo Group** Among 18 Patients, 15 Patients Had Excellent Results With 2 Good And 1 Fair Result. In **Orif Group** Among 12 Patients, 8 Patients Had Excellent Results With 3 Good And 1 Fair Result. Based On Aofas Score In **Mippo Group** Among 18 Patients, 14 Patients Had Excellent Results ,3 Had Good Result, 1 Fair Result And No Poor Result. In **Orif Group** Among 12 Patients, 7 Patients Had Excellent Results With 3 Good Result, 2 Fair Result And No Poor Result. Implant Failures Or Deformity Was Not Seen In Any Cases.

**Conclusion:** The Current Study Provides Ample Stability Of The Fracture & Facilitates Early Motion. It Also Helps In Achieving The Rapid Union & Allows The Preservation Of Blood Supply To The Fragment & Achieve Fracture Reduction. The Biggest Advantage Of Fixation Of The Fracture With Distal Tibial Locking Plate Is That Anatomical Reduction Is Achieved & Added Advantage In Mippo Is Fracture Hematoma Is Not Disturbed. This Study Shows That Lcp With Mipo Technique Provides Better Healing Of Fracture With Good Recovery And Lesser Complications Of Treatment.

### INTRODUCTION

Distal tibial fractures are high velocity injuries mostly seen in RTAs & are very common in males of 30-40 years age. These fractures are also seen in other situations like in falls, collisions or direct blows. Among all the tibial fractures, fractures of the distal tibia constitute less than 7% & lesser than 10% among all lower extremity fractures. Distal tibial fractures are difficult to treat by both conservative & surgical treatment.

Distal tibia fractures are challenging to treat due to the subcutaneous nature of the bone, limited soft tissue cover & poor blood supply<sup>1,2</sup>. The main aim of the treatment is to

realign the fracture, regain the limb length, achieve union & early & good functionality<sup>3</sup>.

Fractures of the distal tibia presents with the Metaphyseal flare which leads to decreased implant contact resulting in less stability & malalignment which in turn leads to alteration in biomechanics of the ankle leading to pain & functional disability. Distal tibial fractures usually have high complication rates both due to injury per se & also due to treatment<sup>4,5</sup>.

Conservative treatment is used in stable fractures with limited shortening, but they are associated with complications like deformity, restricted movements & development of

premature Osteoarthritis of ankle especially in pilon fractures<sup>8,2,9</sup>. External fixator is considered as option in open fractures but can lead to inaccurate reduction, malunions, non-unions & pin tract infections<sup>10,11</sup>.

## **MATERIALS & METHODS**

This prospective study was undertaken at SBMCH Chennai to analyze the functional outcome of Medial distal tibial LCP for the treatment & prognosis of the distal tibial fractures depending on the type of fracture.

The study included Patients presenting to OPD or causality with distal tibia fracture at Department of the Orthopedics in Sree Balaji Medical College & Hospital, Chennai (Tamilnadu) & were treated with medial Distal tibial LCP

### **INCLUSION CRITERIA:**

- Patients willing to participate in the study.
- Skeletally mature patients.
- Only closed fractures.
- Minimum follow up of 6 months.
- Both bone fractures of leg.
- Isolated Distal Tibial Fracture 43Type A& 43 Type C fracture according to AO classification

### **EXCLUSION CRITERIA:**

- Age less than 16 years
- Compound fractures.
- Associated Calcaneum & Talus fractures.
- 43Type B fractures according to AO classification Sever mangled extremity.
- Associated spinal & abdominal injuries.
- Pathological fractures.

The study population included 37 patients of these patients 5 failed to come for further follow up & 2 patients passed away due to unrelated reasons. Hence the study population was 30 patients.

The study was conducted from JULY 2020 to DECEMBER 2022. The study shall be spread over the period of 30 months, but recruitment of new patients shall stop by July 2022, minimum follow up period shall be 6 months. Thus, the study consists of a recruitment period of 24 months & study period will spread over the period of 30 months.

A rapid evaluation of the vital functions will be carried out on receiving the patients inside the casualty & attempts will be made to stabilize the vitals. Any associated injuries like head trauma, chest injuries & abdominal injuries will be taken care by specialty departments respectively.

History of age, sex, injury mode, duration from injury & co- morbid conditions (if any) is taken.

A general examination & detailed clinical examination of the patient will be carried out assessing site of injuries for any wounds, swellings, proximal & the distal joints status, neurovascular status of the limb, will be done A dose of tetanus toxin will be given if any abrasions are present.

Required x-rays are taken & AK slab is applied to immobilize the limb.

The regular investigations & anesthetic workup will be done after the preliminary care & patient would be taken up for surgery as soon as possible.

Patients were treated with either open surgical approach or MIPPO.

### **SURGICAL TECHNIQUE:**

- Complete the preoperative radiographic assessment & prepare the preoperative plan. Determine plate length & instruments to be used.
- Broad spectrum Intra venous antibiotics is given immediate pre- operatively.
- Regional Anesthesia
- Position the patient in supine position on a radiolucentoperating table
- Locking Plate Osteo-synthesis is done either with Open or MIPO technique

#### **Fibula:**

Fibula is exposed using lateral approach & reduced & is fixed with 1/3<sup>rd</sup> tubular plate & 3.5mm cortical screws.

#### **Tibia:**

Using modified anteromedial approach<sup>15</sup>, skin incision is placed nearly 1 cm lateral to tibial crest & along tendon of anterior tibialis. The skin incision extends distally & medially till the distal tip of medial malleoli. Plane of dissection is medial to anterior tibial tendon

Fracture fragments were identified, reduced & held temporarily with K wires & then they are fixed definitively with 3.5 mm medial distal LCP plate with locking screws. After the completion of fixation procedure, thorough wound wash was given, & wound was closed in layers with appropriate sutures & sterile dressing was done & slab was applied.

For the type A AO fractures MIPPO technique was utilized. Incision was placed proximal to medial malleoli & fracture was reduced indirectly & plate was introduced through the incision under guidance of image intensifier & secured with 3.5mm system. Proximally screws were introduced through stab incisions & fixed<sup>9</sup>.

Open reduction and MIPPO were both used in case of fractures of AO type C & fracture fragments were fixed with the LCP plate.

#### POST-OPERATIVE PROTOCOL

- Drain was removed after 48hrs
- Intra-venous antibiotics is given for 5 days & was followed by course of oral antibiotics for 7 days. Analgesics are given as per required
- After post-operative day 12 alternate suture were removed and on 14<sup>th</sup> day all sutures were removed
- Ankle mobilization was started with non-weight bearing walking with walker support after the removal of sutures.
- X-rays were taken at regular intervals & evaluated for the fracture healing, alignment & for any evidence of mal-alignment
- Partial protected weight bearing is started when first sign of callus is noticed in follow up x-rays. Usually after 8 - 10 weeks
- Walking with full weight bearing is started when the union is seen in 3 of 4 cortices.

#### FOLLOW-UP:

Patients will be followed up for the minimum time period of 6months

- 1<sup>st</sup> follow-up: at 4th week
- 2<sup>nd</sup> follow-up: at 8th week
- 3<sup>rd</sup> follow-up: at 12<sup>th</sup> week
- 4<sup>th</sup> follow-up: at 6 months
- All the cases were then evaluated using the

IOWA ankle score, AOFAS scoring periodically & only final follow up scores were taken for compilation of results.

#### RESULTS

The primary objective of the treatment is to achieve sound clinical & radiological union without functional disability. A total number of 30 patients have been examined in this study. All cases were fixed using medial LCP.

#### AGE DISTRIBUTION

The age of patient ranged from 23 - 62 years with the fracture seen commonly in the 4<sup>th</sup> & 5<sup>th</sup> decade of life.

**Table 1: Age Distribution**

Age Group in years	No. of patients(N)	Percentage (%)
20- 30	4	13.3 %
30 -40	5	16.7 %
40-50	12	40.0 %
50-60	7	23.3 %
60-70	2	6.7 %
Total	30	100 %

#### SEX DISTRIBUTION

Out of the 30 patients, 18 (60%) were male & 12(40%) were female, indicating male predominance.

**Table 2: Sex Distribution**

Sex	No. of patients	Percentage
Male	18	60%
Female	12	40%
Total	30	100%

#### DISTRIBUTION ACCORDING TO MODE OF INJURY

In our Study, 18 (80%) of patients suffered injury after RTA & 7 (23.3%) patients suffered injury due to fall, 5 (16.7%) due to other causes. Showing RTA has the most common cause.

**Table 3: Mode Of Injury**

Mode of Injury	No. of Patients	Percentage
RTA	18	60%
Fall	7	23.3%
Other	5	16.7%
Total	30	100%

## DISTRIBUTION ACCORDING TO SIDE OF INJURY

There were 18(60%) patients with right distal tibia fracture & 12 (40%) patients with left distal tibia fractures.

**Table 4: Side Affected**

Side	No. of patients	Percentage
Right	18	60%
Left	12	40%

## FRACTURE PATTERN

The fracture pattern was classified based on AO-OTA system

**Table 5: Fracture Pattern**

A.O. Classification	No. of patients	Percentage (%)
A <sub>1</sub>	2	6.7%
A <sub>2</sub>	4	13.3%
A <sub>3</sub>	3	10%
B <sub>1</sub>	-	-
B <sub>2</sub>	-	-
B <sub>3</sub>	-	-
C <sub>1</sub>	10	33.3%
C <sub>2</sub>	6	20%
C <sub>3</sub>	5	16.7%
Total	30	100%

## Associated Injuries:

16 out of 30 cases studied had an associated fracture of lower third of fibula. 1 patient had fracture of distal radius, one had 2<sup>nd</sup> metacarpal fracture, 1 patient had proximal phalanx fracture & 3 patients had head injury.

All the 30 cases were operated under the spinal anesthesia. Among 30, 18 cases were operated with MIPPO technique & 12 cases were operated with ORIF

**Table 6: Method Of Treatment**

Method of treatment	No. of cases
MIPPO with LCP	18

ORIF with LCP	12
Total	30

## DURATION OF THE FRACTURE UNION:

18 cases were operated by MIPPO with LCP & fractures united with an average of 18.05 weeks. 12 cases operated by ORIF with LCP & in them fracture united with an average of 19.5 weeks. Total average duration of fracture union was 18.7 weeks.

**Table 7: Duration Of Fracture Union**

Time (weeks)	No. of patients
16 <sup>th</sup> week	1
17 <sup>th</sup> week	4
18 <sup>th</sup> week	8
19 <sup>th</sup> week	10
20 <sup>th</sup> week	6
21 <sup>st</sup> week	1

**Table 8: Functional Results (Iowa)**

Results	No. of patients	Percentage
Excellent	23	76.7%
Good	5	16.7%
Fair	2	6.6%

**Table 9: Functional Results (Aofas)**

Results	No. of patients	Percentage
Excellent	21	70%
Good	6	20%
Fair	3	10%
Poor	0	0

## FUNCTIONAL RESULTS ACCORDING TO METHOD OF TREATMENT

### Comparison between MIPPO and ORIF group based on IOWA Ankle Score

In **MIPPO** group among 18 patients, 15 patients had excellent results with 2 good and 1 fair result

In **ORIF** group among 12 patients, 8 patients had excellent results with 3 good and 1 fair result

**Table 14: Comparison between MIPPO and ORIF based on IOWA Ankle Score**

Crosstab					
		IOWA ankle Total score			Total
		Excellent	Good	Fair	
MIPPO	Count	15	2	1	18
	% within				

Modality of Treatment	ORIF	IOWA ankleTotal score	65.2%	40.0%	50.0%	60.0%
		Count	8	3	1	12
		% within IOWA ankleTotal score	34.8%	60..0%	50.0%	40.0%
Total		Count	23	5	2	30
		% within IOWA ankle Total score	100.0%	100.0%	100.0%	100.0%

There is a no significant association between modality of treatment and Iowa ankle score with p-value<0.05[0.67], chi-square value 1.178, df 2.

In **MIPPO group** among 18 patients, 14 patients had excellent results, 3 had good result, 1 fair result and no poor result

In **ORIF group** among 12 patients, 7 patients had excellent results with 3 good result, 2 fair result and no poor result

**Comparison between MIPPO and ORIF based on AOFAS Total score**

**Table 15: Comparison between MIPPO and ORIF based on AOFAS Total score**

		crosstab					Total
		AOFAS Total score					
		Excellent	Good	Fair	Poor		
Method of Treatment	MIPPO	Count	14	3	1	0	18
		% within AOFAS Total score	66.7%	50%	33.3%	0%	60.0%
	ORIF	Count	7	3	2	0	12
		% within AOFAS Total score	33.3%	50%	66.7%	0%	40.0%
Total		Count	21	6	3	0	30
		% within AOFAS Total score	100.0%	100.0%	100.0%	0%	100.0%

There is a no significant association between method of treatment & AOFAS Score with p-value<0.05 [0.65], chi-square value 1.528, df 2.

**Clinical illustrations:**



**PRE-OP**



**POST-OP**



**UNION**



**DORSI FLEXION**



**PLANTAR FLEXION**

**DISCUSSION**

Distal tibial fractures occur due to a range of low to high energy axial-loading injuries. This relatively rare injury (<10% of lower limb fractures) occurs in adults mostly due to RTAs or because of the fall from the height. The soft tissue status, severity of fracture comminution at time of injury will have an impact on long term results. Aim of the surgical treatment is to attain anatomical realignment of articular surface with adequate stability to enable early motion.

Teeny & Wiss<sup>28</sup> studied sixty tibial plafond fractures. 60% of those were secondary to

high energy trauma. They reported 50% poor results when open reduction & the plate fixation was used. When the subsets of 30 Ruedi Type-III fractures was analyzed there were 12 (40%) acceptable outcomes with 37% of them complicated by a skin slough or the deep infections.

Mc Ferranet al<sup>29</sup> reported on 52 tibial plafond fractures treated with ORIF. 40% of these were Ruedi Type III injuries. Overall, 40% of the patients suffered some complications, like osteomyelitis occurring in 43% of fractures & wound breakdown requiring soft tissue cover in the 62% of fractures.

Study	Methods	Acceptable		Not Acceptable	
		IOWA	AOFAS	IOWA	AOFAS
Mastet al <sup>25</sup>	ORIF	78		22	
Bourne et al <sup>30</sup>		44		56	
Teeny & Wiss <sup>33</sup>		50		50	
Im GI et al <sup>24</sup>	ORIF with anatomic plates	88		12	
Gao et al <sup>31</sup>	MIPPO	87		13	
Hazarika et al <sup>23</sup>		87		13	
Ozkaya U. et al <sup>32</sup>		81		19	
Present Study	MIPPO	94	94	6	6
	ORIF	96	83	8	17

NB: The Excellent & good results were considered as Acceptable & the fair & Poor

results were considered not Acceptable for easier understanding.

In our present study there is no significant association between AO type A (group A) & Type C(group C) in IOWA ankle score with p- value>0.05[0.159] & between AO type A(group A) & type C (group c) in AOFAS

total score with p-value>0.05[0.294].

However most of the cases in group A had excellent results & in group C majority had excellent results with few good - fair results

In our present study there is a no significant association between Method of treatment (MIPPO and Open reduction) & Iowa ankle score with the p-value<0.05[0.67] & between Method of treatment (MIPPO and Open reduction)& AOFAS score with the p-value<0.05[0.65]

However, MIPPO group had a greater number of excellent results & in Open group majority had excellent results with few good - fair results

**Helfet et al** in their study had superficial infection rate of 3% & deep infection of 6% in their series of 32 fractures treated with LCP<sup>28</sup>. In our present study we had 3 cases (10%) of superficial infections & 2 cases of wound dehiscence.

Vallier et al.,<sup>34</sup> had 12% delayed & non-union with nailing group. 2.5% non- union with plating group.

Kasper et al.,<sup>35</sup> study mean time of radiographic union was 19 weeks with plate group & 21 weeks with nail group.

In our study mean time for radiological union was 18.7 weeks with no incidence of delayed union & non-union. In a prospective study by Dr, Sunil Kumar p<sup>36</sup>, all about distal tibia fractures treated with IM nail vs Minimal invasive plating which had 53 patients in nailing group (group A) & 55 patients in Plating group( group B),mean radiological union in nail group was 20.1 week & plating group was 17.5 weeks, Functional outcome based on AOFAS score for nailing group was 90.8 & plating group was 96.8,this was comparable with the MIPPO group in our study.

## CONCLUSION

In the Current study, 30 patients with the distal tibia fractures underwent reduction & internal fixation by open & MIPPO technique with the medial distal tibial locking compression plate.

This procedure has resulted in optimum stabilization of such fractures. It provides ample stability & facilitates early motion. It also helps in achieving the rapid union has it allows the preservation of blood supply to the fragment & achieve fracture reduction.

The biggest advantage of fixation of the fracture with distal tibial locking plate is that anatomical reduction is achieved & added advantage in MIPPO is fracture hematoma is not disturbed. It is also helpful for extra articular fractures within 5 cm of the joint because intra-medullary nails may not always provide adequate stability in such fractures because of the wide intra-medullary canal of the distal tibia<sup>74</sup>.

This study shows that LCP with MIPO technique provides better healing of fracture with good recovery and lesser complications of treatment.

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