



A STUDY ON OUTCOME OF MINIMALLY INVASIVE PLATE OSTEOSYNTHESIS (MIPO) IN EXTRA ARTICULAR FRACTURE OF DISTAL 1/3RD TIBIA.

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ABSTRACT

BACKGROUND: Fractures of the distal tibia can be challenging to treat because of the limited soft tissue, the subcutaneous location, and poor vascularity. There is a considerable debate regarding the best method for treating distal tibial fractures. In present study we have treated distal tibial fractures using MIPO technique

OBJECTIVES: To evaluate the functional outcome following use of MIPO technique in lower 1/3rd fractures of tibia.

MATERIAL AND METHODS: This is a longitudinal follow up study. In this study a total of 30 patients with fracture distal 1/3rd tibia admitted to CMRI hospital will be selected for treatment with MIPO technique according to inclusion and exclusion criteria. All patients were reviewed in CMRI Hospital and radiographs (Tibia AP and lateral views) obtained after surgery and then at 1 month, 3 months and finally at 6 months. From 5 weeks onwards symptoms and functions will be assessed using the scoring system of Olerud and Molander(1984). Statistical analysis of categorical variables was expressed as number of patients and percentage of patients and continuous variables are expressed as descriptive statistics. The statistical software SPSS version 20 has been used for the analysis.

RESULTS: The age of patients ranged from 22-65 years. Fracture was most common in 4th and 5th decade of life. Average mean age was 44.03 ± 10.74 yrs. In this study majority of 17(56.7%) patients were male and there were 13(43.3%) were female. Road Traffic accident (RTA) was the main cause to produce lower end tibia fractures (83.3%) in our study. In this study right side (60%) was involved more than left (40%). In this study only 3 (10%) patients had open grade 1 injury. Majority of patients 27 (90%) had closed injury. In our study 66.67% (20) of patients had associated injuries and 33.33% patients had no associated injury. Average injury operation interval in this study was 3.27 ± 1.53 days. Average no. of plate holes were 10.50 ± 1.72 . Average duration of hospital stay in this study was 10.07 ± 2.75 days. Average duration of surgery in this study was 88.03 ± 16.36 minutes. In this study 26 patients (86.7%) had no early post-op complications and 4 (13.3%) had complications. 3 patients (10%) had delayed wound healing and 1 patient (3.3%) had superficial infection of suture lines. There was 1 non-union and majority of patients 21(70%) took 20-25 weeks for union. 7(23.4%) patients took less than 20 weeks and 1(3.33%) patient took more than 25 weeks. Average time of union in this study was 21.17 ± 2.17 weeks. Average time of weight bearing was 17.72 ± 1.91 weeks in this study. Most frequent late complication seen was swelling with frequency of 7 followed by stiffness and pain. 1 patient had malunion and 1 patient had non-union. In this study there were 28(93.3%) patients which showed union, 1 (3.3%) patient showed coronal malunion and 1(3.3%) had non-union. There were 21 patients (70 %) with excellent result, 7 patients (23.3%) with good result and 2 patients (6.7%) with fair result in our cases of study. Average clinical Olerud & Molander score was 81.17 ± 16.07 in this study.

CONCLUSION: The satisfactory functional results and lack of soft tissue complications suggest that this method should be considered in peri-articular fractures. Biological fixation of complex fractures gives stable as well as optimal internal fixation and complete recovery of limb function at an early stage with minimal risk of complications.

KEYWORDS :

INTRODUCTION:

Amongst all the fractures in the body, tibia is the single largest bone that is commonly involved in injuries. Owing to the increase in vehicular accidents and industrial mishaps, high velocity trauma produces tibial fractures in increasing numbers. By its location and being subcutaneous in most of its length tibial fractures tend to be open very commonly. Fractures of the distal tibial metaphysis with or without intra-articular extension can present a management challenge because of their inherent instability, scarcity of soft tissues, subcutaneous nature and poor vascularity of bone. Treatment modality is dictated by the fracture displacement, comminution, intra-articular extension and injury to the soft-tissue envelope.¹

Selection of a treatment in cases of unstable distal tibial fractures that do not extend over the joint is still a matter of discussion.^{2,3} Various treatment methods such as external fixation, intramedullary (IM) nailing and plate osteosynthesis are described for distal tibial fractures.^{3,5} Locked IM nailing is accepted as golden standard in tibial shaft fractures.^{2,4} However, there are concerns about using IM nailing in the distal tibia including the difficulty of fixation of nail in the tibia because of the dimensional change in between the diaphysis and the metaphysis and the risk to advance to the ankle.³ As a result of open reduction and internal fixation with wide soft tissue dissection and potential periosteal injury, there may be high infection rate, delayed union and non-union.^{2,5}

Conservative treatment of these fractures quite often results in a number of complications including malunion, nonunion and ankle stiffness.^{6,7}

External fixation can be used as either a temporary or definitive method of treatment, especially in fractures with severe soft tissue injury, Immediate stabilization has produced good short term results in wound healing but gradually complications like pin tract infections, fixator frame failure, mal-union, non-union, compartment syndrome, chronic osteomyelitis, joint stiffness, and necessity of secondary procedures and other complications have diverted many of the treating surgeons to find other biological methods of fixation.^{8,9}

Indirect reduction was introduced in the 1988 by **Mast et al. and others**. It was an attempt to decrease surgical dissection by relying on ligamentotaxis, blind repositioning of fragments, reduction aids such as the distracter and other methods to maintain soft tissue integrity and preserve bony perfusion.¹⁰

In the 1990s, **Krettek et al.** popularized Minimally Invasive Plates Osteosynthesis Techniques Using conventional implants placed through small incisions and submuscular (subcutaneous) tunnels. With MIPO method rate of delayed union and infection rate has come down.¹¹

As a part of the continued development of Biologically Friendly Plating and to facilitate Minimally Invasive Plating Technique, the use of plates that allow screws to lock into plate to create a fixed angle construct is gaining popularity nowadays. Therefore minimally invasive osteosynthesis, if possible, offers the best possible option as it permits adequate fixation in a biological manner.^{2,12} Compared with a conventional plate, a locking plate imparts a higher degree of stability and provides better protection against primary and secondary losses of reduction and minimization of bone contact.¹³⁻¹⁴ Locking plates (LPs) have the biomechanical properties of internal and external fixators, with superior holding power because of fixed angular stability through the head of locking screws, independent of friction fit.¹⁵

This study will help to evaluate the use of MIPO technique in distal 1/3rd Tibia fracture and their results with regards to union and functional outcome of lower limb.

Aim: To evaluate the functional outcome of MIPO technique in lower 1/3rd fractures of tibia.

Objectives:

- (1) Functional outcome will be assessed using the scoring system of Olerud and Molander (1984).
- (2) To evaluate the sign of union (x-ray finding- formation of callus), duration of surgery (in minutes), duration of hospital stay (in days), post-operative skin complication, time of weight bearing (after how many weeks of surgery).

Material And Methods:

This is a longitudinal follow-up study. Study was done from May 2017 to May 2018 that is one year. This study was carried out in Orthopedics Department of Calcutta Medical Research Institute, Kolkata. In this study a total of 30 patients with fracture distal 1/3rd tibia admitted to CMRI hospital were selected for treatment with MIPO technique.

Inclusion Criteria: Patient with age > 18 years having distal 1/3 tibia fracture, closed or Gustillo Anderson type 1 open fractures with mild to moderate degree of comminution

Exclusion Criteria: 1) Distal intra-articular fracture tibia, 2) Old untreated fractures of distal 1/3 Tibia, 3) Proximal or middle shaft fractures or segmental fractures, 4) Patients with compartment syndrome, pathological fractures, fracture with neurovascular injury, 5) Patients younger than 18 years were excluded from study.

After obtaining approval from our institutional scientific and ethical committee and informed consent form getting duly signed, 30 patients with extra articular distal 1/3rd tibia fracture were included in the study following the inclusion and exclusion criteria for MINIMALLY INVASIVE PLATE OSTEOSYNTHESIS (MIPO). As soon as the patient with suspected distal 1/3rd tibia fracture were attended, necessary clinical and radiological evaluation was done and admitted to ward after necessary resuscitation and splintage.

- The following Investigations were done routinely on all these patients preoperatively.

Blood	Hb%,TC, DC, blood urea, serum creatinine, sodium, potassium, calcium, PT, aPTT, INR, fasting sugar and Post prandial sugar, viral markers (HBsAg, AntiHCV-Ab, HIV-1 & 2).
X-Ray	Tibia (AP and lateral view), Chest X ray PA view
Other investigations	ECG 12 leads, 2D Echocardiography in necessary patients.

All the necessary clinical details were recorded in proforma prepared for this study. After the completion of the hospital

treatment, patients were discharged and called for follow up at out-patient level, at regular intervals for serial clinical and radiological evaluation.

Operative Procedure:

After obtaining anesthesia fitness, patient was posted for surgery. The patient placed supine on a radiolucent operative table. A pneumatic tourniquet was applied to the thigh and leg placed on a pad. The affected limb was scrubbed and prepared with Beta scrub and Spirit. Painting and draping was done under aseptic and antiseptic conditions. Draping was done in such a manner that the area from knee to lower leg was exposed for proper recognition of anatomical landmarks. An image intensifier was positioned on the opposite side of the operated leg.

Surgical Approach: Indirect fracture reduction by manual traction. Incision for plate insertion was made beginning at the level of the tibial plafond and extending proximally along the postero-medial border of the distal tibia. Attempt was made to keep incision minimum at the distal site, straight or slightly curved skin incision on the medial aspect of the distal tibia was taken. Length of the incision varied from 3-5 cm. Proximally small incisions over the holes were taken directly either by clinical palpation or after confirmation under image intensifier or a single incision to expose and hold the plate.

Figure 1: Distal tibia locking plate (pre-contoured)

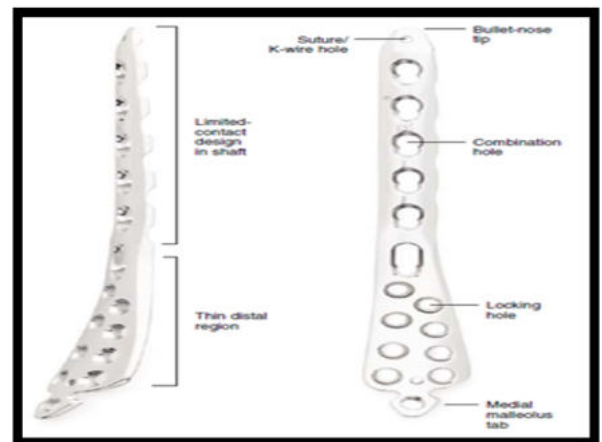


Figure 2: Surgical Technique.

Post-Operative: Patients were given compressive crepe bandage dressing, foot end elevation and injectable antibiotics and analgesics. Static and dynamic quadriceps exercises and ankle mobilization was started as soon as patient's general condition and pain permitted, usually from second postoperative day. Non weight bearing walking was permitted except when there was other contraindication like head injury, bilateral lower limb injury, or associated upper limb injury. Suture removal was done on postoperative day

fourteen.

FOLLOW UP: All patients were reviewed in CMRI Hospital and radiographs (Tibia AP and lateral views) were obtained after surgery and then at 1 month, 3 months and finally at 6 months. At 3 and 6 months symptoms and functions were assessed using the scoring system of Olerud and Molander(1984). X-Ray of tibia (AP and Lateral view) was looked for: Signs of union, failure of fixation, failure of implant and reaction to metal.

Table 1: Scoring system devised by Olerud and Molander (Maximum 100 points)

PARAMETER	DEGREE	SCORE(maximum)
1. PAIN	None	25
	While walking on uneven surface	20
	While walking on even surface outdoors	10
	While walking indoors	5
	Constant and severe	0
2. STIFFNESS	None	10
	Stiffness	0
3. SWELLING	None	10
	Only in Evening	5
	Constant	0
4. STAIR CLIMBING	No problems	10
	Impaired	5
	Impossible	0
5. RUNNING	Possible	5
	Impossible	0
6. JUMPING	Possible	5
	Impossible	0
7. SQUATTING	No Problems	5
	Impossible	0
8. SUPPORTS	None	10
	Taping, Wrapping	5
	Stick or Crutch	0
	Walking	0
9. WORK, ACTIVITIES OF DAILY LIFE	Same as before injury	20
	Loss of tempo	15
	Change to simpler job	15
	Severely Impaired work capacity	0

Excellent – If Score More Than 75 Points

Good – Between 51 -75

Fair- Between 31 -50

Poor- Below 30

Statistical Analysis was done using statistical software SPSS version 20.

RESULTS:

- The age of patients ranged from 22-65 years. Fracture was most common in 4th and 5th decade of life. Average mean age was 44.03 ± 10.74 yrs.
- In this study majority of 17(56.7%) patients were male and there were 13(43.3%) were female.
- Road Traffic accident (RTA) was the main cause to produce lower end tibia fractures (83.3%) in our study. Other causes were domestic fall (3.3%), fall from height (6.7%), fall from ladder (3.3%) and injury while playing football (3.3%).
- In this study right side (60%) was involved more than left (40%).
- In this study only 3 (10%) patients had open grade 1 injury. Majority of patients 27 (90%) had closed injury.
- In our study 66.67% (20) of patients had associated injuries and 33.33% patients had no associated injury. 4 cases had head injury, 1 had humerus fracture, 1 had radius-ulna fracture and 16 patients had associated fibular fracture.

- In this study 4 patients had diabetes mellitus, 6 patient had hypertension and 23(76.7%) had no associated co-morbidities.
- Average injury operation interval in this study was 3.27 ± 1.53 days. Majority of the patients were operated within 5 days of admission (90%). 2 patients were operated within 24 hours of admission. Remaining 10% patients were operated after 5 days and the factors responsible for delayed surgery were:
 - open injury
 - systemic illness
 - swelling over ankle, blisters and associated injuries.
- Average no. of plate holes were 10.50 ± 1.72 .
- 3 patients were discharged within 7 days. Majority of patients 25 (83.34%) were discharged between 7-14 days while 2 were discharged after 14 days. Average duration of hospital stay in this study was 10.07 ± 2.75 days.
- Out of the 30 cases, 17 (56.66%) cases took 61-90 minutes, 11 (36.66%) took 91-120 minutes, 1 (3.34%) took 60 minutes and 1(3.34%) took more than 120 minutes. Average duration of surgery in this study was 88.03 ± 16.36 minutes.
- In this study 26 patients (86.7%) had no early post-op complications and 4 (13.3%) had complications. 3 patients (10%) had delayed wound healing and 1patient (3.3%) had superficial infection of suture lines.
- In this study there was 1 non-union and majority of patients 21(70%) took 20-25 weeks for union. 7(23.4%) patients took less than 20 weeks and 1(3.33%) patient took more than 25 weeks. Average time of union in this study was 21.17 ± 2.17 weeks.
- Majority patients took 16-20 weeks for weight bearing in our study while 3 patients took 15 weeks and less. 2 patients took more than 20 weeks. Average time of weight bearing was 17.72 ± 1.91 weeks in this study.
- Total of 7 patients had late post-operative complications. Amongst 7 patients 5 had more than 1 complication. Most frequent complication seen was swelling with frequency of 7 followed by stiffness and pain. 1 patient had malunion and 1 patient had non-union.
- In this study there were 28(93.3%) patients which showed union, 1 (3.3%) patient showed coronal malunion and 1(3.3%) had non-union.
- There were 21 patients (70 %) with excellent result, 7 patients (23.3%) with good result and 2 patients (6.7%) with fair result in our cases of study. Average clinical Olerud & Molander score was 81.17 ± 16.07 in this study.

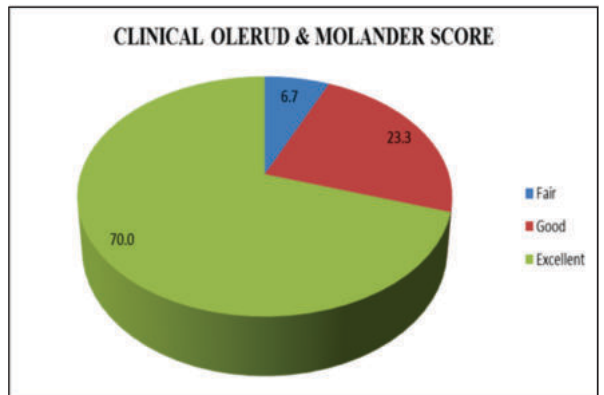


Figure 3: Graph showing Clinical score

Table 2: Overview of Study

	N	Minimum	Maximum	Mean	Std. Deviation
AGE(YRS)	30	22	65	44.03	10.74
INJURY-OPERATION INTERVAL	30	1	7	3.27	1.53
No. OF PLATE HOLES	30	7	13	10.50	1.72

DURATION OF SURGERY(MINS)	30	60	124	88.03	16.36
HOSPITAL STAY(DAYS)	30	5	18	10.07	2.75
TIME OF UNION(WEEKS)	29	18	26	21.17	2.17
TIME OF WEIGHT BEARING(WEEKS)	29	15	22	17.72	1.91
CLINICAL OLERUD & MOLANDER SCORE	30	40	100	81.17	16.07

DISCUSSION:

Distal tibia fracture is one of the difficult fractures to manage. None of the treatment options available perfectly fulfill requirements of fracture characteristics of distal tibia. Distal tibia has got circular cross sectional area with thinner cortex as compared to triangular diaphysis with thicker cortex. So, intramedullary nail which is designed for tight interference fit at diaphysis cannot provide same stability at distal fracture.

With the development of technique of MIPO which preserve extraosseous blood supply and osteogenic fracture haematoma, which are biologically friendly and obtain stable fixation can be obtained for distal tibia fracture. Indirect reduction method and sub-cutaneous tunneling of the plate and application of locking screws with small skin incisions in MIPO technique prevents iatrogenic injury to vascular supply of the bone. Unlike conventional plates, LCP is a friction independent self-stable construct which provides both angular and axial stability and minimizes risk of secondary loss of reduction through a threaded interface between the screw heads and the plate body.

The disadvantage of MIPO is more radiation exposure to the operating team compared with ORIF as it uses indirect reduction under fluoroscopy. However, the advantage of MIPO is soft tissue preservation under treatment. In ORIF stripping of periosteum is done which is also not an ideal method as tibia is a superficial bone and periosteum provides 2/3rd of blood supply. Similarly external fixators as a definitive method of treatment for distal tibia fracture are also reported with higher rate of infection, implant failure and malunion or non-union and hence recommended only for temporary method of stabilization in open fracture with severe soft tissue injury. In present study:

Age:

STUD Y	Redfer n DJ et al (2004) ³	Hazari ka S et al (2006) ¹²	Muzaff ar N et al (2013) ¹⁶	Bingol I et al (2015) ⁷	Ravindr an S et al (2016) ¹⁸	Raghu JK et al (2017) ⁹	Donim ath VS et al (2018) ²⁰	Pres ent Stud y
Mean Age (yrs)	38.3	44.7	41.16	44.26	35	38.95	40.3	44.03 ± 10.74

Kundu AK et al (2015) have not given mean average age. In their study range of age was 23-65 years and most common age group was 4th and 5th decade.²¹

- Sex: In present study majority patients were male 17(56.7%) and there were 13(43.3%) females amongst 30 patients studied. The preponderance of males is because
 - Males are more outgoing, hence more vulnerable to vehicular accidents.
 - Due to usual society practice, certain tasks which involve high risk are done by males e.g. working at height, driving, labour and travelling.

Similar finding were observed by Bingol I et al (2015)¹⁷, Kundu AK et al (2015)²¹, Muzaffar N et al (2013)¹⁶, Ravindran S et al

(2016)¹⁸, Raghu JK et al (2017)¹⁹, Donimath VS et al (2018)²⁰.

- Mode of Injury: Road Traffic accident (RTA) was the main cause to produce lower end tibia fractures (83.3%) in our study. Other causes were domestic fall (3.3%), fall from height (6.7%), fall from ladder (3.3%) and injury while playing football (3.3%). Similar finding were observed by Kundu AK et al (2015)²¹, Ravindran S et al (2016)¹⁸, Raghu JK et al (2017)¹⁹, Donimath VS et al (2018)²⁰.
- Side Involved: In this study right side (60%) was more involved than left side (40%). Similar findings were seen in Raghu JK et al (2017)¹⁹ study showing 57% right side and 43% left side involvement. In our study most of the trauma occurred due to road traffic accident; the results showed non-significant involvement on right side.
- Type of Injury – Open or Closed: In this study majority patients 27(90%) had closed injury and 3(10%) had open grade 1 injury. This was similar to findings by Bingol I et al (2015)¹⁷ in which 2 out of 30 patients (6.6%) had open grade 1 fracture and rest had closed.
- Associated Injuries: In this study 66.67% of patients had associated injury and 33.33% had no associated injuries. 4 patients had head injury and rest 16 patients had other associated bony injuries. In this study fibular fracture was fixed when the fracture was within 5 cm from syndesmosis. In Hazarika et al (2006) study 9 (56.25%) patients presented with associated injuries where 2 patients were having head injury and 7 patients were having other bony injuries.¹²
- Associated co-morbidities: In this study 4 patients had diabetes mellitus, 6 patient had hypertension and 23(76.7%) had no associated co-morbidities. Patients with co-morbidities had delayed healing.
- Injury Operation Interval: Majority of the 18 patients were operated within 5 days of admission (90%). Remaining 10% patients were operated after 5 days and the factors responsible for delayed surgery were:
 - open injury
 - associated medical co-morbidities
 - presence of swelling over ankle, blisters and associated injuries.

2 patients were operated within 24 hours of admission. Mean average injury to operation interval was 3.27±1.53 days. Similar results were found in:

STUD IES	Kundu AK et al (2015) ²¹	Ravindr an S et al (2016) ¹⁸	Bingol I et al (2015) ¹⁷	Donimath VS et al (2018) ²⁰	Shresth a D et al (2011) ²²	Prese nt Study
Avera ge Time (days)	12	4.5	17 patients in 1 day 10 patients in 3 days	17 patients in 3-7 day 1 patient in 2 days	4.45	3.27 ± 1.53

- Hospitalization Duration: In our study the average period of hospitalization was 10.07±2.75 days. 25 patients were discharged between 7-14 days (83.34%) , 3 patients were discharged within 3 days (10%) of hospitalization and 2 patients were discharged after 14 days (6.67%). The difference in hospitalization period in our study was due to
 - Delay in surgery due to leg swelling
 - High number of associated bony injuries
 - Head injury and systemic injury
 - Associated Open fractures

In Bingol I et al (2015)¹⁷ study in the average hospital stay was 4.6±1.42 days.

- Duration of Surgery: In present study out of the 30 cases, 17 (56.66%) cases took 61-90 minutes, 11 (36.66%) took 91-120 minutes, 1 (3.34%) took 60 minutes and 1(3.34%) took more than 120 minutes. Average duration was 88.03±16.36 minutes. In Ravindran S et al (2016) study the average

operative time was 60 min with a range of 70-120min. The majority of the fractures were operated within 100 min of operative time (90.0%).¹⁸

In Raghu JK et al (2017) study the average duration of surgery was 55.5 minutes (range 41-70 minutes).¹⁹

Time of Union in Weeks:

STUDY	Redfern DJ et al (2004) ²	Collinge C et al (2007) ²³	Muzaffar N et al (2013) ¹⁶	Bingol I et al (2015) ⁷	Ravindran S et al (2016) ¹⁸	Raghu JK et al (2017) ¹⁸	Donimath VS et al (2018) ²⁰	Present Study
Average Time (weeks)	23	35	16.8	19.8 ± 2.99	23.75	19.14	22.6	21.17 ± 2.17

Kundu AK et al (2015) study showed Radiologic union in 13-16 weeks in 75% of cases while in 25% it was seen in 17-20 weeks.²¹

- **Time of Weight Bearing in Weeks:** In this study majority patients 24 (80%) took 16-20 weeks while 3 patients (10%) took 15 weeks and less. 2 patients (6.67%) took more than 20 weeks. Mean average time of weight bearing was 17.72±1.91 weeks. Similar findings were also observed by Redfern DJ et al (2004)², Hazarika S et al (2006)¹⁷, Bingol I et al (2015)⁷, Kundu AK et al (2015)²¹.
- **Radiological Result:** In our study 93.3% (28 patients) showed union, 1 patient (3.3%) each had coronal malunion and non-union.
- **Post-Operative Complications:** In present study 26 patients (86.7%) had no early post-op complications and 4 (13.3%) had complications. 3 patients (10%) had delayed wound healing and 1 patient (3.3%) had superficial infection of suture lines, which resolved with antibiotic and local wound care.

Total of 7 patients had late post-operative complications. Amongst 7 patients 5 had more than 1 complication. Most frequent complication seen was swelling with frequency of 7 followed by stiffness and pain. 1 patient had malunion and 1 patient had non-union.

Dhakar A et al (2016) study post-operatively 2 patients developed superficial skin infection, 2 patients developed deep infection and 3 patients developed ankle stiffness due to loss of postoperative protocol and 4 patients had implant failure in form of screw breakage.²⁴

In Muzaffar N et al (2016) there were 2 cases of superficial and 2 cases of deep infection, and deep infections required removal of hardware for cure. There were 4 cases of ankle stiffness, most of them occurring in intra-articular fractures, 3 cases of palpable implant, 3 cases of malunion, 1 case of loss of reduction and 1 patient required reoperation.¹⁶

In Raghu JK et al (2017) 3 patients developed superficial skin infection. Ankle stiffness was present in 3 cases. 2 fractures went for delayed union which united by 24 weeks.¹⁹

Clinical Results: In present study there were 21 patients (70 %) with excellent result, 7 patients (23.3%) with good result and 2 patients (6.7%) with fair result in our cases of study. Average clinical Olerud & Molander score was 81.17±16.07 in this study. In various other studies AOFAS score and other functional score have been used.

STUDIES	Clinical Result (Ankle and Functional Outcome)
Collinge C et al (2007) ²³	Good to fair results in most cases with limitation of physical activities

Mushtaq A et al (2009) ²⁴	17 patients out of 21 healed with good functional outcome.
Bingol I et al (2015) ¹⁷	Mean AOFAS score was 88.3±10.8 (range, 54-98). There were 18 (60%) excellent, 7 (23.3%) good, 3 (10%) fair and 2 (6.7%) bad results
Kundu AK et al (2015) ²¹	75% excellent results, 10% good results, 10% fair results and 5% with poor results.
Muzaffar N et al (2016) ¹⁶	Average AO foot and ankle score was 83.6.
Ravindran S et al (2016) ¹⁸	Average AOFAS score was 90.25
Raghu JK et al (2017) ¹⁹	71% of excellent and 14% good results.
Donimath VS et al (2018) ²⁰	Mean ankle evaluation score at the end of one year using Iowa ankle score by Merchant and Dietz was 78. 77.78% good results and 22.22% fair results
Present Study	21 patients (70 %) excellent, 7 patients (23.3%) good and 2 patients (6.7%) with fair result. Average clinical Olerud & Molander score was 81.17±16.07

CONCLUSION:

Fracture of distal tibia is difficult owing to it being involved in wound complication and infections. There are constant controversies of fracture fixation in this bone because of it being involved in weight bearing and fractures are commonly associated with compromised soft tissue, also any form of abnormality in fracture fixation can result in functional impairment. As against western culture, in India where activities like squatting and cross legged sitting are common distal tibia requires anatomical reduction and fixation. Vigilant preoperative planning is required to minimize complications related to soft tissue and bone. Management of these fractures is not without complications such as infection and delayed union; hence these complications should be looked for at the earliest and treated accordingly. Union problem with this technique was negligible. The rate and type of complications such as implant failure, wound gaping has not been observed. Acceptable range of movement and resuming back to activities of daily living was observed in our study. In cases of polytrauma, fracture fixation of difficult comminuted fracture with MIPO technique had less surgical trauma, less blood loss, and faster union as it does not interfere with fracture healing biology. It could hence be inferred that MIPO (Minimally Invasive Plate Osteosynthesis) or Biological plating preserves vascularity and hence has less complications, less union problems with early recovery in the form of joint movement.

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