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RESEARCH ARTICLE

FACTORS AFFECTING FUNCTIONAL OUTCOME OF DISTAL TIBIA FRACTURES TREATED BY PLATING USING MINIMAL INVASIVE PERCUTANEOUS PLATE OSTEOSYNTHESIS TECHNIQUE

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Abstract

Introduction: Minimally invasive plate osteosynthesis (MIPO) is an established technique for fixation of fractures of the distal third tibia. Minimally invasive plating offers the advantage of fracture fixation without disturbing the soft tissue cover, less chances of infection, early mobilization of patient. Using a locking compression plate reduces the tendency for varus collapse and at the same time affords better stability Our study aimed to manage intra articular and extraarticular fractures of the distal third tibia by the minimally invasive plate osteosynthesis technique and follow them. Clinical and radiological outcomes were studied, and clinical indications & efficacy of the procedure reviewed.

Materials and Methods: An ambispective analysis of 30 patients of closed distal tibial fractures were operated by MIPO technique. Bone and soft tissue healing and complications encountered were analyzed.

Result: It has been a well-known fact that distal tibia fractures have recently been treated by minimally invasive techniques. Literature above says that there is risk of disrupting blood supply with open reduction internal fixation leading to soft tissue healing problems. However, we did not face any of these complications in our patients, infection or wound breakdown with implant exposure.

Conclusion: Distal tibial fractures can successfully be treated by single stage MIPPO plating. Considering a proper surgical timing, respect for soft tissue handling, a good fixation can be achieved. Minimally Invasive Osteosynthesis of distal tibial fracture produced reliable results with acceptable range of movement and resuming early return to activities of daily living.

Introduction:-

Tibia is commonly involved single largest bone fractured in road traffic accidents and industrial mishap because of its location and being subcutaneous most of its length.[1]

The tibial plateau fractures represent 1–2% of all fractures . The treatment aims at reducing fracture, restoration of articular surface congruence, with minimal soft tissue insult.[2]Distal tibia fractures are primarily caused by high-energy bending and rotational forces. Such fractures are inherently un-stable and are commonly associated with potentially catastrophic soft tissue injuries. Despite continuous improvements in surgical treatment of closed distal tibia fractures, determining the optimal surgery technique remains controversial. Plates, intramedullary nails, and

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external fixations are three conventionally used and effective surgical methods. No single method is appropriate for all types of distal tibia fractures.Management of these fractures was shown to involve many complications, including malunion, delayed union, nonunion, and wound infectionMany studies have shown reasonable result with minimally invasive osteosynthesis of distal tibia fractures using plate.[3] Plates have biomechanical properties of internal and external fixators, with superior holding power because of fixed angular stability through head of locking screws, independent of friction fit. [5]

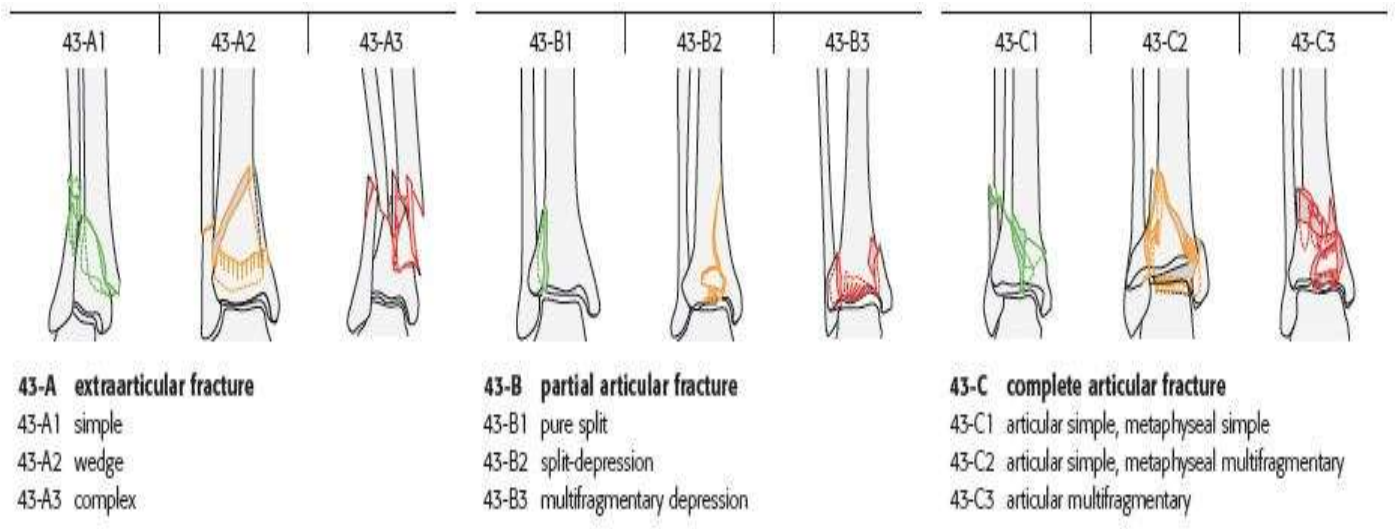
Open reduction and internal fixation (ORIF) with plates for low-energy traumas has been successful, especially in good soft tissue conditions. Regarding serious open tibial fracture associated with vascular or nerve injury, infections, wound complications and implant prominence are frequently reported after plating surgeries. An increased number of subsequent operations and prolonged hospital stay are inevitable.

The result of ORIF in distal leg fractures is jeopardized by relevant soft tissue complications. Minimally invasive percutaneous plate osteo-synthesis (MIPPO) takes care of the soft tissue, further reduces the surgical trauma, and provides an alternative for managing these lesions.

MIPPO is technically feasible and advantageous because it minimizes devascularization of the fracture fragments as well as soft tissue damage.

The results will depend on severity of injury, soft tissue trauma, surgical timing, surgical techniques and comorbid illnesses of the patient.[4]The patients with or without fibular fracture along with distal tibia fractures were included in study.This study is conducted to assess the clinical & demographic factors affecting functional outcome of closed distal tibia fractures treated by using Minimal Invasive Percutaneous Plate Osteosynthesis technique.

Classification
AO Classification



Material and Methods:-

This is an Observational studyof 30 cases of closed distal tibia fractures managed surgically with Minimal Invasive Plate Osteosynthesis technique at Sri Aurobindo Medical College And PG Institute , Indore.

All patient above 18 years and having closed distal tibial extra articular fractures (as per AO Classification 43A, 43B, 43C) were included in the study.

Pathologically or metabolically induced fractures, Open Fractures those associated with other fractures of ipsilateral limb and Patients not giving consent for surgery were excluded from the study.

Fractures were classified according to AO classification. All fractures were fixed in a single stage after swelling subsided. Below/above knee slab and limb elevation was part of initial management.Utmost care was taken to preserve superficial peroneal nerve. Before surgery of Distal tibia fractures by plating using MIPPO technique, a brief pre- operative planning was obtained. This includes the choice of implants, surgical approach with the estimated implant position. The procedure is performed under epidural, spinal or general anaesthesia with the patient placed in a supine position. Preoperative antibiotics should be administered approximately 1hour before skin incision.

All patients were operated by Locking Compression Plate (LCP) done using MIPPO technique. Tourniquet was used.

A vertical or curvilinear incision is made at the level of medial malleolus. Care taken not to injure great saphenous vein and saphenous nerve.

Subcutaneous plane is made without disturbing the fracture hematoma. Indirect reduction of fracture done under C-arm guidance and fixed with LCP plate and screws.

In comminuted, K-wires were used to hold the reduction. In three cases lag screws were used to achieve compression.Sutures were removed on 12th post operative day and radiological follow-up was taken at 3 weeks, 3 months and 6 months.

The fractures was confirmed as healed when an obvious callus was seen bridging the fracture ends on both AP/Lateral views and also when patients were able to bear weight without pain. [6]

Skin incisions, complications related to the soft tissue, wound breakdown and implant exposure were reviewed.

Complications were divided in to major and minor; major complications were those complications that required further interventions such as deep infections and failure of fixation. Events that did not require any further surgical interventions such as superficial skin infections were considered as minor complications.

Cases

52/M- RTA Pre-Operative Xray Immediate Post-Operative Xray

1 month follow-up Xray3 month follow-up Xray

6 month follow-up Xray

6 months follow-up Clinical Images

Results:-

There were 17(56.7%) patients <=45 years, 13(43.3%) patients were in age group >45 years. Mean age was 45.47 years.

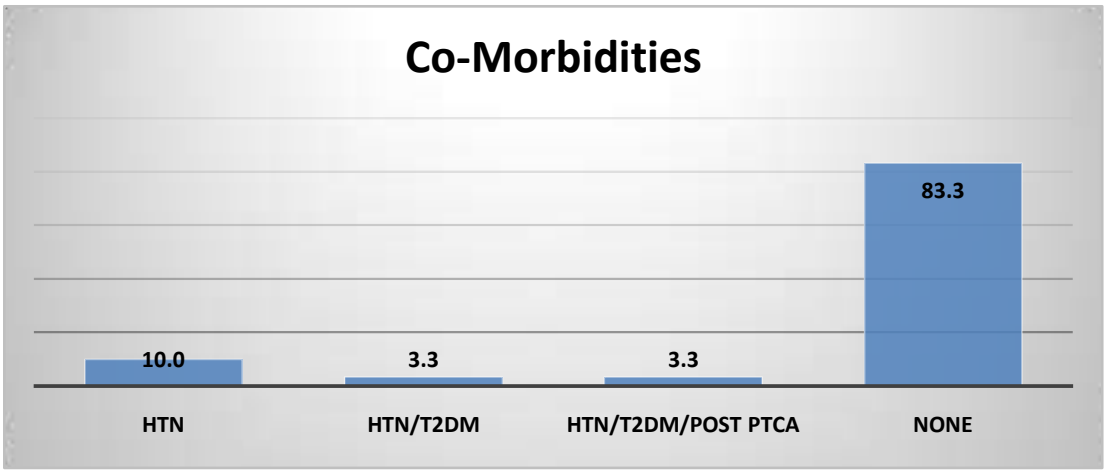
AGE	Frequency	Percent
<= 45 Years	17	56.7
> 45 Years	13	43.3
Total	30	100.0

There were 22 (73.3%) male and 08 (26.7%) female patients in our study showing male preponderance.

SEX	Frequency	Percent
F	8	26.7
M	22	73.3
Total	30	100.0

There were 3 (10%) patients who were hypertensive, 1(3.3%) patient with diabetes mellitus and hypertension, 1(3.3%) with Post PTCA with diabetes mellitus and hypertension and 25(83.3%) with no comorbidities.

Co-morbidities	Frequency	Percent
HTN	3	10.0
HTN/T2DM	1	3.3
HTN/T2DM/POST PTCA	1	3.3
NONE	25	83.3
	Total	30

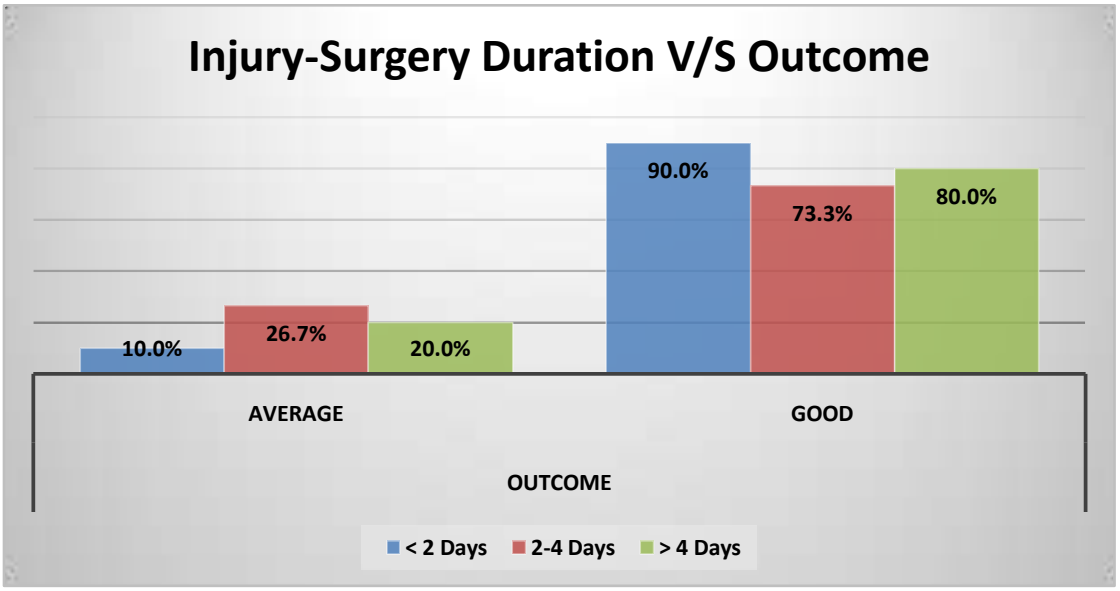


50% of the times surgery duration was less than 2 hours

Surgery Duration	Frequency	Percent
<2 Hrs	15	50.0
>=2Hrs	15	50.0
Total	30	100.0

In 10(33.3%) patients injury to surgery time was less than 2 days, in 15(50%) patients duration was between 2-4 days and in 5(16.7%) patients it was >4 days.

In- Surgery Duration	Frequency	Percent
<2 days	10	33.3
2-4 days	15	50.0
>4 days	5	16.7
Total	30	100.0

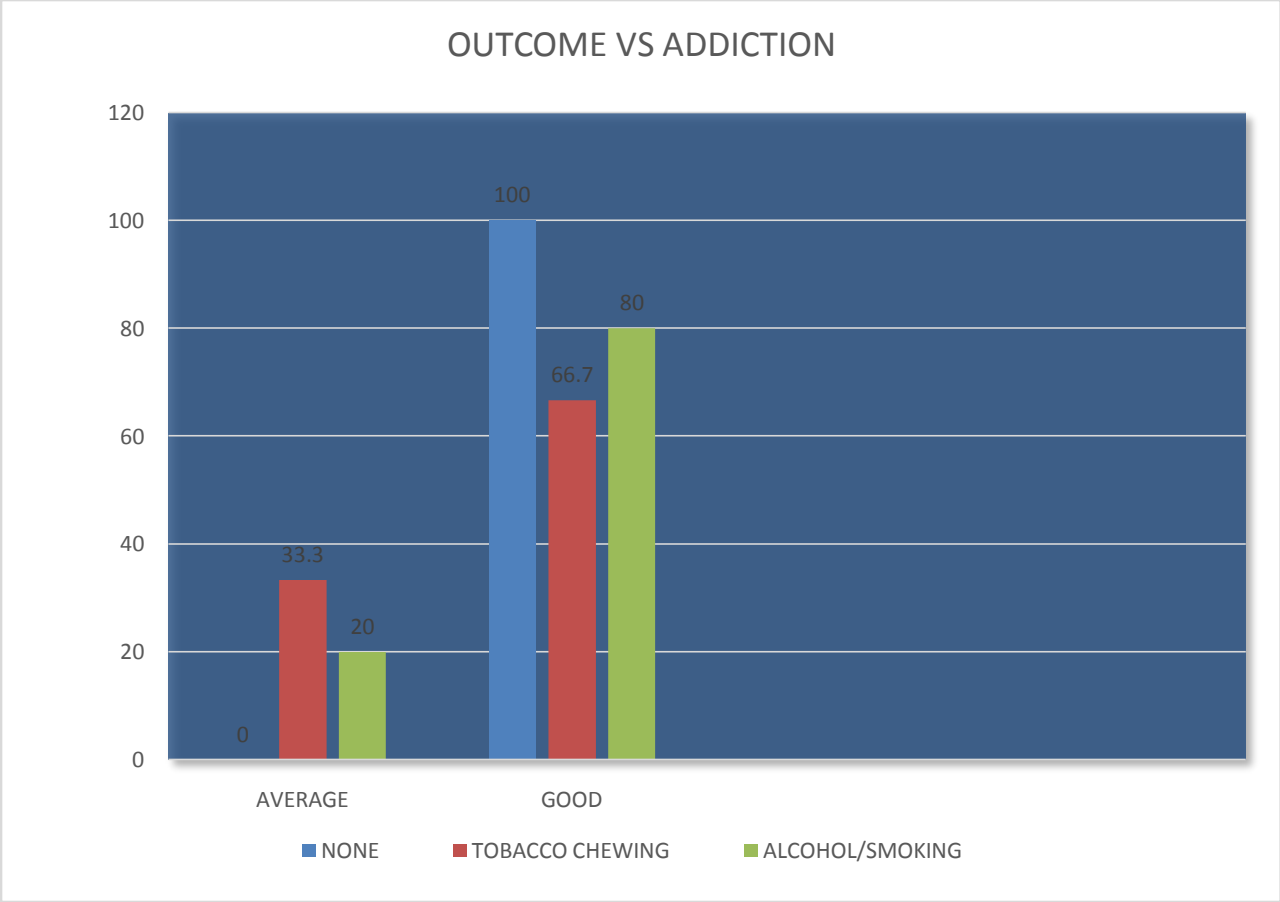


6.7% were addicted to alcohol/smoking, 10% were addicted to smoking and 83.3% were not addicted to anything.

ADDICTION, if any	Frequency	Percent
ALCOHOL/SMOKING	2	6.7
NONE	25	83.3
SMOKING	3	10.0

Total	30	100.0

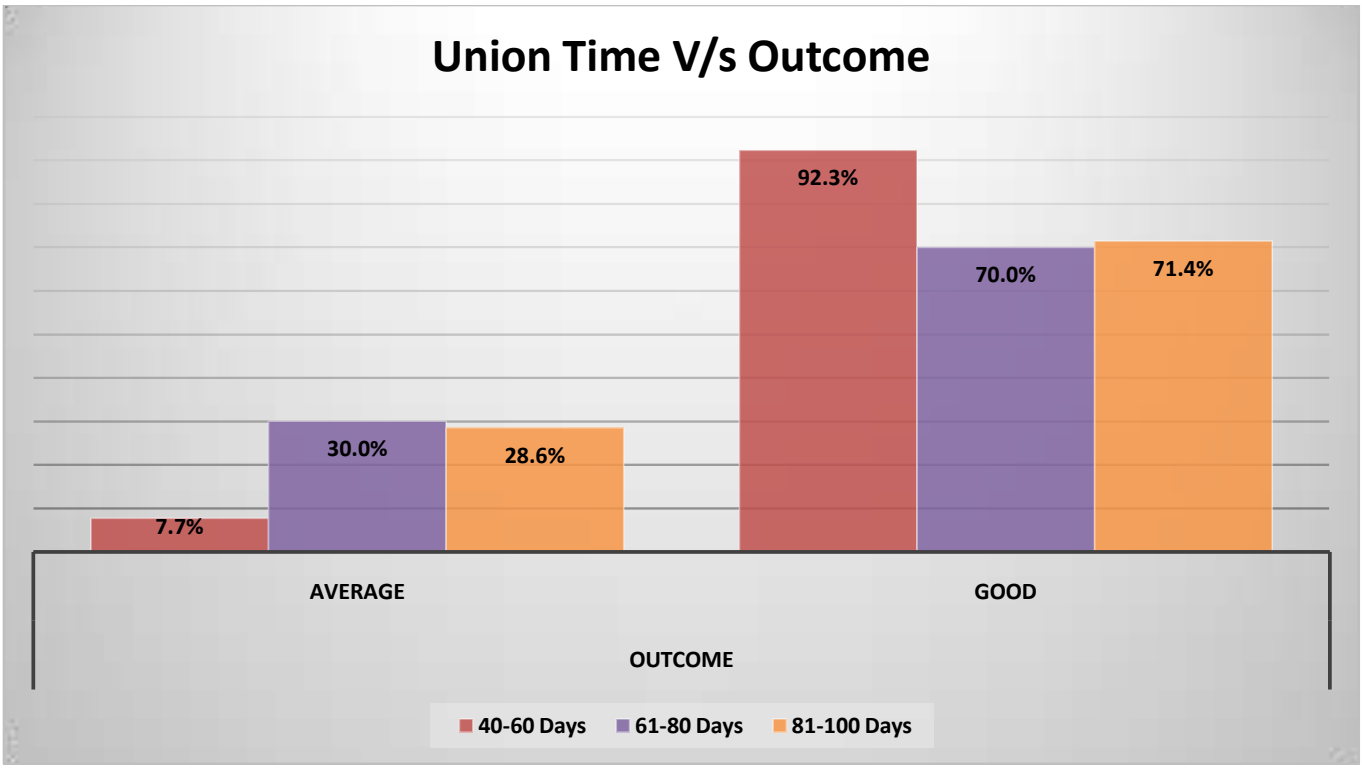
100% of the cases with no addiction had good outcome while 20% of cases addicted with alcohol/smoking and 33.3% with tobacco chewing habits had average outcome.



Union Time for 13(43.3%) was 40-60 days, in 10(33.3%) was 61-80 days and 7(23.3%) was 81-100 days.

Union Time	Frequency	Percent
40-60 Days	13	43.3
61-80 Days	10	33.3
81-100 Days	7	23.3
Total	30	100.0

92.3% of cases with union time of 40-60 days had good outcome while union time of 61-80 and 81-100 days had 70% and 71.4% good outcome respectively.



According to Tscherne's classification of Soft tissue injury 2(6.7%) has GRADE 0, 16(53.3%) had GRADE 1 and 12(40%) had GRADE 2.

Soft tissue injuryTscherne's classification	Frequency	Percent
GRADE 0	2	6.7
GRADE 1	16	53.3
GRADE 2	12	40.0
Total	30	100.0

According to Tscherne's classification of Soft tissue injury GRADE 0 has 100% good outcome while out of 16 GRADE-1 cases one had average outcome and out 12 GRADE-2 cases four had average outcome .

Soft tissue injury_Tscherne's classification			**Outcome**		**Total**
			AVERAGE	**GOOD**	
Soft tissue injury_Tscherne's classification	GRADE 0	Count	0	2	2
		%	0%	100.0%	100.0%
	GRADE 1	Count	1	15	16
		%	6.3%	93.8%	100.0%
	GRADE 2	Count	4	8	12
		%	33.3%	66.7%	100.0%
Total		Count	5	25	30
		%	16.66%	83.33%	100.0%

The outcome was average in 6(20%) and good in 24(80%).

OUTCOME	Frequency	Percent
AVERAGE	6	20.0
GOOD	24	80.0
Total	30	100.0

26(86.66%) had no complications, 1(3.3%) had delayed union and 3(10%) had superficial infection.

COMPLICATIONS	Frequency	Percent

delayed union	1	3.3
NONE	26	86.6
superficial infection	3	10.0
Total	30	100.0

Discussion:-

It has been a well-known fact that distal tibia fractures have recently been treated by minimally invasive techniques. Literature above says that there is risk of disrupting blood supply with open reduction internal fixation leading to soft tissue healing problems. However, we did not face any of these complications in our patients, infection or wound breakdown with implant exposure.[7]

Less damage to the periosteal blood supply has been shown in locking plate thus decreasing the incidence of any delayed union or non-union or loss of any fixation. Thirteen fractures out of 30 in our study united within 60 days with a mean period of 66.63 days.

There are several studies that have reported high complication rates related to soft tissue healing using operative management of tibia fracture. A study by McFerren et al showed the complication rate of 55% that comprise of wound breakdown, deep soft tissue infection, osteomyelitis and superficial wound infection[8]

In order to prevent any soft tissue complication, earlier a 2-stage protocol was recommended that consisted of an initial use of external fixation with or without fibula fixation until the soft tissue envelope recovers sufficiently to allow the definitive fixation .

Higher grade of Tscherne'sclassification had higher frequency of average outcome.

In our surgery we did a stable fixation of fractures with little periosteal damage and minimal soft tissue compromise. We did delay the surgery till the swelling subsided and wrinkles disappeared over the distal tibia.

BMI have become an important factor to be considered in fractures because people with high BMI makes surgical approach challanging and prolongs operative time.

In our study surgery duration was between 1.2 to 2.4 hours with an average time of 1.74 hours. Maximum fractures had In-surgery duration between 2-4 days but in our study we did not find significant relationship in overall outcome with surgery / injury- surgery duration.

In our study overall functional outcome after a period of 6 month was good in most cases howeover the role of Addiction and Comorbidities was significant post operatively and during initial followups.

Conclusion:-

Distal tibial fractures are associated with high risk of post operative wound dehiscence and infection because of less soft tissue coverage and added soft tissue trauma. Therefore, they demand tissue friendly surgical procedures as well as adequate fixation. Comorbidities and addiction was found to have fewer complications in initial stage. Surgery and in -surgery duration had no significant outcome in long run. Excellent results can be expected in patient of younger age group and low BMI. Distal tibial fractures can successfully be treated by single stage MIPPO plating. Considering a proper surgical timing, respect for soft tissue handling, a good fixation can be achieved.Minimally Invasive Osteosynthesis of distal tibial fracture produced reliable results with acceptable range of movement and resuming early return to activities of daily living.

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