



Original Research Article

Comparison between outcome of various modalities of management of distal tibia fractures

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ABSTRACT

Introduction: Fractures of distal tibia are usually due to high velocity injuries with extensive damage to the soft tissue. The best modality of method of management for distal tibial fracture is one that achieves a good reduction and stability and minimizes soft tissue compromise as well as devascularization of the bony fragments. The aim of our study is to compare, analyse and individualize the best modality of treatment for management of distal tibial fractures.

Materials and Methods: This study of 30 patients of distal tibial fractures, was conducted at Dr. D.Y. Patil Medical College and Research Center, Pimpri, Pune, from September 2018 - August 2020. Required consents from all the patients and ethical committee clearance was taken before conducting the study. Necessary data was collected from all the patients during their hospital stay and regular follow-up was recorded.

Results: Patients treated with Intra-Medullary Nail had mean AOFAS (American Orthopaedic Foot and Ankle Society) score of 75.2, while patients treated with External Fixator and MIPO (Minimally Invasive Percutaneous Osteosynthesis) had mean AOFAS (American Orthopaedic Foot and Ankle Society) score 71.5 and 87.1 respectively.

Conclusion: In our study, we have analysed overall results including functional recovery, radiological assessment in terms of malalignment and complications related to different modalities of treatment of distal tibial fractures.

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1. Introduction

In non-fatal road traffic injuries, fractures are the commonest injuries. Bones of the lower extremity are commonly involved in road traffic accidents. Gravitational force and velocity of the vehicle at the time of trauma has shown to play a major role in such types of injury.

The commonest long bone fractured and most common open one is tibia. According to the location in the tibia bone; distal tibia has 2nd highest incidence of the fracture.¹

Fractures of distal tibia are usually due to high velocity injuries with extensive damage to the soft tissue. Surgeons face a dilemma over whether to give importance to soft tissue healing or to anatomic reduction and articular congruity while managing these fractures.

Orthopaedicians have been challenged with problems like mal-union, delayed union, non-union and wound dehiscence due to poor soft tissue coverage, reduced vascularity of distal tibia region and associated soft tissue injury.

Anatomic reduction of the articular surface, restoration of fracture alignment, proper soft tissue handling and early ankle mobilization has shown effective results in managing

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distal tibial fractures.

Ruedi and Allgower² presented their landmark paper in 1969, in which at 4 years follow up 74% patients had good functional outcome, revolutionized the treatment protocol of distal tibia fractures.

Then, the decades of 1970's and 1980's saw extensive use of the principles of open reduction and internal fixation in the treatment of distal tibia fractures but shockingly it was associated with high rate of complications like non-union, superficial infection, osteomyelitis, arthrodesis, below knee amputation, post-traumatic osteoarthritis, and malunion.^{3,4}

Due to these complications Surgeons realised the importance of soft tissue management in distal tibial fractures. In another analysis⁵ by Ruedi and Allgower in which they showed good results at 9 years of follow up, but most of the patients they studied had low-energy injuries so standard protocol for these types of injuries could not set.

In 1979 Ruedi and Allgower came up with another study in which patients had high energy injuries and came to the conclusion that the overall results were better in low energy injuries compared to high energy injuries.⁶ Appropriate soft tissue management along with fixation of fracture gave better results.^{7,8}

Open reduction and internal fixation, joint spanning external fixator, hybrid external fixator, ilizarov fixator application, closed reduction and internal fixation with intra medullary nailing, biological minimally invasive plate osteosynthesis (MIPO) are the various modalities of treatment in these types of fractures.

Method selected for stabilization should be sufficient enough to maintain the reduction.

The best modality of method of management for distal tibial fracture is one that achieves a good reduction and stability and minimizes soft tissue compromise as well as devascularization of the bony fragments.

Choosing a modality of treatment method for distal tibia fracture remains difficult and controversial because the final results depends upon multiple factors like the status of soft tissue, degree of comminution and involvement of articular surface. We aimed to attain anatomic reduction of articular surface and at the same time providing stability to the fracture. This aim should be attained using methods which decreases bone and soft tissue devascularisation.

Usually distal tibial fractures occur due to high velocity trauma and it presents with extensive soft tissue damage. So, it creates a dilemma whether to give priority to soft tissue or articular congruity and anatomic reduction.

Advanced surgical methods have developed over the years with improvement in understanding of biomechanics, biology and biomaterials which have finally led to better functional outcome for patients. Initially more weightage was given to anatomical reduction and rigid fixation to attain stability. Damage to soft tissue surrounding the fracture site has led to increased rate of delayed union and non-union

making this method discouraging.

Thus, technique which gave more weightage to biology than stability emerged and evolved with the time.

The aim of our study is to compare, analyse and individualize the best modality of treatment for management of distal tibial fractures.

2. Materials and Methods

This study of 30 patients of distal tibial fractures, was conducted at Dr. D.Y. Patil Medical College and Research Center, Pimpri, Pune, from September 2018 - August 2020. Required consents from all the patients and ethical committee clearance was taken before conducting the study. During above mentioned period total 30 patients were treated for distal tibial fracture using different modalities according to the fracture pattern and skin condition. Necessary data was collected from all the patients during their hospital stay and regular follow-up was recorded.

2.1. Inclusion & exclusion criteria

Patient presenting with distal tibia fracture, patients with age group of 15-64 years and

patients who were fit for the surgery were included in the study while patients below 15 years and above 65 years, patients with crush injuries having neurovascular impairment and pre-existing deformity of concerned part were excluded.

2.2. Factors considered for choosing different treatment modalities

IM nail as a fixation method was chosen in cases where there was minimal soft tissue injury, less comminution and no articular involvement. MIPO technique was preferred in cases with minimal soft tissue injury, severe comminution and fracture location above the articular surface. External Fixation was chosen in cases with extensive soft tissue damage and extended articular comminution.

2.3. Functional outcome estimation

To estimate the functional outcome in our study we have used The American Orthopaedic Foot and Ankle Society score.

2.4. Post-operative protocol

On Post-Operative day 12 or 14th depending upon the status of the wound, sutures were removed. And weight bearing was started once the radiographic evidence of bone union was seen and then then weight bearing was progressed as tolerated by the patients. Average time of starting partial weight bearing was 8-10 weeks except in cases with MIPO plating where it was delayed and started by 12-14 weeks. On

average partial weight bearing was started by 8-10 weeks except in cases treated with MIPO where weight bearing was delayed and started by 12-14 weeks.

3. Observations and Results

Table 1: Number and percentage of patients belonging to different age groups

Age group	Number	Percentage
11-20	1	3.3
21-30	8	26.7
31-40	7	23.3
41-50	5	16.7
51-60	6	20.0
>60	3	10.0
Total	30	100.0

Table 2: Shows prevalence of Gustilo Anderson (GA) type of fractures among the patients

Type	Number	Percentage
1	4	13.3
2	1	3.3
3A	5	16.7
No GA type	20	66.7
Total	30	100.0

Table 3: Shows distribution of the patients according to AO classification

AO classification	Number	Percentage
A1	8	26.7
A2	2	6.7
A3	15	50.0
B1	1	3.3
C1	1	3.3
C2	1	3.3
C3	2	6.7
Total	30	100.0

4. Discussion

In our study around 33.3% of the patients had open injuries which delayed the definitive surgical procedures and managed initially by calcaneal pin traction till the healing of the wound. Calcaneal pin traction procedure has been immensely helpful to us in our set up to temporary stabilization of the fracture while we await soft tissue to be healed before going for a definitive surgery.

In between September 2018-August 2020 we treated total 30 patients from which 30% of patients (9 patients) were with IM nail, while 20% patients (6 patients) were treated with external fixator and 50% of patients (15 patients) were treated with MIPO. The average age of

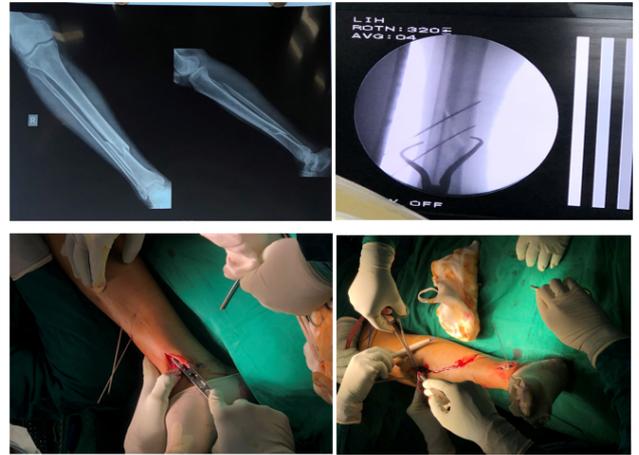


Fig. 1: Case 1



Fig. 2: Case 1



Fig. 3: Case 2

Table 4: Number and percentage of different modalities in different AO type of fracture among the patients

AO Type	IM Nail		Ext.Fix		MIPO		p -value
	Number	%	Number	%	Number	%	
A1	6	75.0	0	0	2	25.0	<0.001
A2	2	100.0	0	0	0	0	
A3	1	6.7	2	13.3	12	80.0	
B1	0	0	0	0	1	100.0	
C1	0	0	1	100.0	0	0	
C2	0	0	1	100.0	0	0	
C3	0	0	2	100.0	0	0	
Total	9		6		15		

(IM nail- Intramedullary Nail, Ext.Fix – External Fixator, MIPO-Minimally Invasive Plate Osteosynthesis)

Table 5: Mean score of American Orthopaedic Foot and Ankle Society (AOFAS) according to the chosen modality for the management

Management	Mean score	SD	p -value
IM Nail	75.2	8.3	<0.001
Ext. Fix	71.5	5.9	
MIPO	87.1	7.4	

*Oneway ANOVA test, p value<0.05-statistically significant

Table 6: Number and percentage of the complications in different modality of treatment

Complications	IM Nail		Ext.Fix*		MIPO		p -value
	Number	%	Number	%	Number	%	
Ankle stiffness	1	100	2	40.0	3	100	0.308
Non-Union	0	0	1	20.0	0	0	
Wound discharge	0	0	2	40.0	0	0	
Total	1	100	5	100.0	3	100	

*One patient with Ext.Fix had both wound discharge and ankle stiffness

Percentages are calculated for each column

Table 7: Number and percentage of Varus and Valgus deformity in different modality of treatment

Complications	IM Nail		Ext Fix*		MIPO		Total;	p -value
	Number	%	Number	%	Number	%		
Varus deformity	2	22.2	1	16.7	0	0	3	0.178
Valgus deformity	2	22.2	4	66.7	2	13.3	8	0.042

Percentages are calculated for each column

patients with such injuries in our study was 40.5 years (Range 18 to 64 years) which is comparable to that of other studies and around 66% patients being in the range of 21 to 50 years which suggest high energy trauma as a leading cause for such fractures. This is comparable with a study conducted by Cory Colling et al.⁹ in his study the average age of patients with was 43, ranging from 17 to 62 years and Vallier et al.¹⁰ had patients with average age of 39.1 year ranging from 16 to 77 years.

Our Study had 33.3% patients with open injuries and 66.7% with closed injuries. This was comparable with the studies done by Heather A Vallier et al; his study had 30% open injuries and 70% closed injuries. Study conducted by Hazarika et al¹¹ had 40% open fractures and 60% closed fractures.

Patients treated with IM nail had mean AOFAS score of 75.2, while patients treated with External Fixator and MIPO

had mean AOFAS score 71.5 and 87.1 respectively. This AOFAS score was comparable to study conducted by Pierre Joveniaux et al.¹² where mean AOFAS score of external fixations and limited internal fixation (MIPO) was 67.7 and 85.2 respectively.

5. Conclusion

In our study treatment was individualized based on the type, nature of the wound, time of presentation, associated injury and the available facilities of treatment.

In our study we have found that choosing a treatment method which considers soft tissue status and fracture pattern yields better results.

In cases where soft tissue injury is minimal, less comminution is present and when there is no articular involvement; IM nail gives better result and it has advantage



Fig. 4:



Fig. 5: Case 3



Fig. 6: Case 3

in restoration of ankle motion and reduced wound problems.

MIPO technique was preferred in cases with minimal soft tissue injury, severe comminution and with fracture location above the articular surface. MIPO technique can restore the alignment better and has advantage in preserving biology of the fracture.

External fixation was chosen in cases where extensive damage to soft tissue was present and when there was extended articular comminution.

Functional AOFAS score was higher in patients treated with MIPO followed by IM nail and External fixation.

To conclude we would like to state that we have analysed overall results including functional recovery, radiological assessment in terms of malalignment and complications related to different modalities of treatment of distal tibial fractures and we have learnt that soft tissue status, location of fracture and involvement of articular surface play a major role in individualising a treatment method.

6. Limitations

Inclusion of small group of patients and conduction of study at single centre was major limitation of our study. Another limitation was shorter period of follow up. Being a single centre study and with a small group of patients we believe that more elaborate study is necessary in order to evaluate and individualized a treatment modality for a specific fracture pattern.

7. Source of Funding

None.

8. Conflict of Interest

None.

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