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A comparative study of extra-articular distal tibia fractures managed by intramedullary nailing vs locking plate

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Abstract
Introduction: Distal tibial fractures are common long bone fractures that occur mainly due to a high velocity trauma. These are difficult to treat because of its subcutaneous location and poor blood supply. Many studies have been published on modalities of treatment of distal tibia fractures. Available options are Intramedullary nails, locking plates and external fixators. The aim of our study was to compare intramedullary interlocking (IMIL) nailing and locking plate (LP) for the treatment of these fractures.
Materials and methods: This is a prospective study consisting data of 20 patients with distal tibial fractures operated for IMIL nailing and LP. Patients were followed up for radiological and clinical outcome using The American Orthopaedic Foot and Ankle Society (AOFAS) score.
Results: The functional outcome was assessed by AOFAS score. Overall 10 patients obtained an excellent result (50%) and 8 obtained a good result (40%) and 2 obtained fair result (10%). IMIL nailing shows lower rate of delayed wound healing and superficial infection and plating may avoid malunion and knee pain.
Discussion: The study suggests superiority of IMIL nailing over LP in terms of less rates of infections, early rate of union, early weight bearing. Whereas LP is better in anatomical and fixed reductions of the fracture and less knee pain. Hence the modality of treatment should be based on the patient's injury pattern, surgeon's expertise and clinical condition.

Keywords: Distal tibia fractures, intramedullary nailing, locking plate

Introduction
Distal tibia fractures represent less than 7% of all tibia fractures. Of all lower extremity fractures less than 10% belongs to distal tibia fractures. It is more common in males in the age group of 25-50 yrs. The spectrum of injuries vary from low energy to high energy injuries.
They are mainly due to road traffic accident, fall from height and twisting of ankle. Fractures around the ankle joint are difficult to manage because of precarious vasculature in nature. In addition tibia is subcutaneously in plane which adds further difficulty in the fracture management. Several methods of treatment are conservative, Intramedullary Nailing, external fixation, open reduction and internal fixation with plates and screws [1].
The aim of treating the fracture is to preserve normal mechanical axis, ensure joint stability and restore a near full range of motion. This is a difficult task to accomplish in each and every case as we face compromised soft tissue condition and variable bone quality. Results of operative treatment are dependent on the severity of the initial injury, the quality and stability of the reduction. The mechanism of injury, status of soft tissues, the degree of comminution and articular damage affect the long term clinical outcome.
The aim of our study was to compare intramedullary interlocking (IMIL) nailing and locking plate (LP) for treatment of these fracture.

Material and Method
The study consisting of 20 patients of distal tibia fracture operate with IMIL nailing and locking plate from June 2017 to June 2019 in Dept of Orthopaedics, D Y Patil Medical College, Kolhapur.

Patients were divided into two groups. One group treated with IMIL nailing and other was treated with Locking plate.

Inclusion Criteria

- Extra articular closed fracture of distal tibia (AO type 43A-1, 43A-2, 43A-3)
- Age between 18 to 60 years
- Fracture line between 4 to 8 cms from tibial plafond

Exclusion criteria

- Age <18 and >60 years
- Open Fractures
- Intraarticular fractures
- Pathological fractures
- Patients with neurovascular injury

The patients were first seen in the casualty. The history taken followed by general and local examination of the patient. Neurovascular status was checked specially for nerve injury. X rays of ankle AP, Lateral and mortise view taken. CT scan was done to rule out articular extension. The fracture was temporarily immobilized with above knee slab. Preoperative planning and investigations were done and the patients were posted for open reduction and internal fixation with plate or closed reduction internal fixation with tip locking nail.

The patients who underwent intramedullary interlocking nailing were operated under spinal anaesthesia with patients supine on standard radiolucent table. Patellar retracting approach was used in all patients. Nailing was done using standard technique and all fractures were fixed with one proximal and two/three distal interlocking screws. The patients who underwent plate osteosynthesis were operated under spinal anaesthesia with patient supine on standard radiolucent table. Most commonly, through anteromedial approach reduction achieved and fixed using plates and appropriate screws under the guidance of image intensifier.

In postoperative period intravenous Antibiotic was continue for 3 days after surgery. Suture or staple removal was done at 12^{th} -14^{th} post operative day. Active Quadriceps exercises are started on the 1^{st} post operative day with active ankle and toe movement as far as the patient is comfortable and free of pain. The patients were made to ambulate from 4^{th} post operative day with or without weight bearing on operated leg on bases of mode of fixation and reduction.

Patients were followed-up for clinical evaluation using The American Orthopedic Foot and Ankle Society (AOFAS) score and Clinico-Radiological evaluation at 6 weeks, 3 months, 6 months and 1 year. At every follow up clinical examination was done to assess status of the surgical wound, pain, tenderness, range of motion of ankle, stability of the fracture and clinical union. Partial weight bearing was allowed after signs of radiological union in AP and Lateral X-ray of ankle. The union is confirmed radiologically when plain X-ray showed bone trabeculae or cortical bone crossing fracture site on at least three surfaces on X-rays.

Fig 1: Bone Trabeculae or cortical bone crossing fracture site on at least three surfaces on X-rays.

Results and Discussion

Table 1: Age wise distribution of patients

Age Group (years)	Nailing		Plating		TOTAL	
	No. of Pt.	Percentage	No. of Pt.	Percentage	No. of Pt.	Percentage
18 – 30	4	40%	3	30%	7	35%
31 – 45	5	50%	5	50%	10	50%
46 – 60	1	10%	2	20%	3	15%
Total	10	100%	10	100%	20	100%

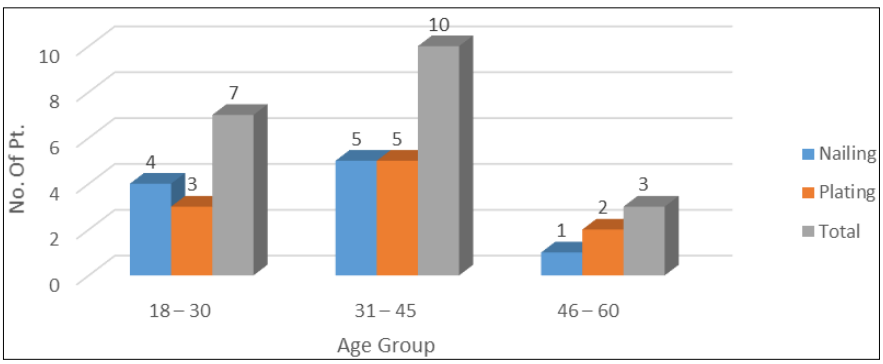

Fig 2: Age Distribution

In both Groups maximum number of patients fall in age group of 18-45 years (85%). This can be explained because of active engagement and exposure to outdoor life, road traffic accidents and industrial misfortune in this active age group. These findings are consistent with almost every series of studies regarding distal tibia fracture for example: Mean age of Jassen *et al.* study [2] mean age was 43.3 years, and Mohammed *et al.* [3], in which mean age of cases was 42 years.

Table 2: Gender wise distribution of patients

Sex	Nailing		Plating		TOTAL	
	No. of Pt.	Percentage	No. of Pt.	Percentage	No. of Pt.	Percentage
Male	9	90	8	80	17	85
Female	1	10	2	20	3	15
Total	10	100	10	100	20	100

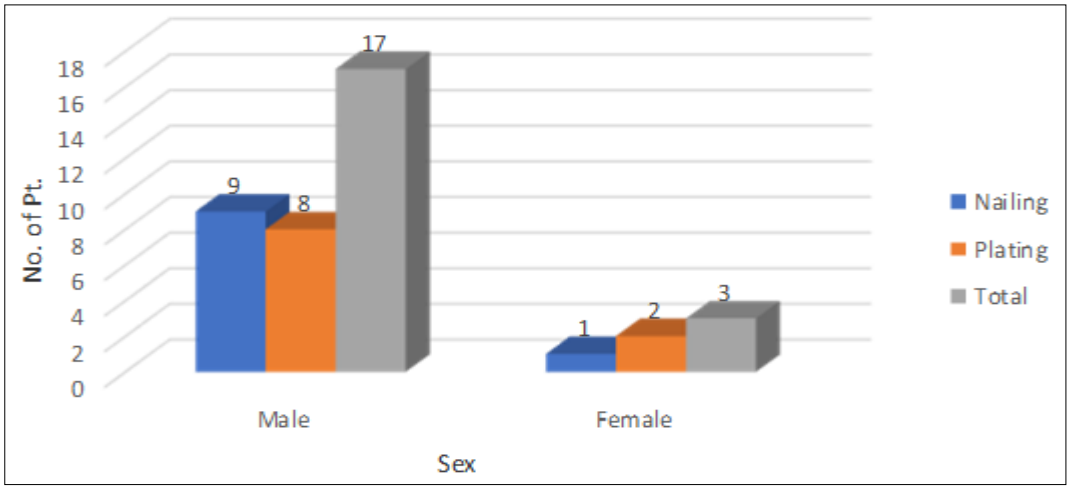

Fig 3: Gender Distribution

Table 3: Mode of Injury

Mode of Injury	Nailing		Plating		TOTAL	
	No. of Pt.	Percentage	No. of Pt.	Percentage	No. of Pt.	Percentage
RTA	7	70	6	60	13	65
Fall from Height	2	20	3	30	5	25
Sports injury	1	10	0	0	1	10
Assault	0	0	1	10	1	10
TOTAL	10	100	10	100	20	100

Table 4: AOFAS outcome

AOFAS Outcome	Nailing		Plating		TOTAL	
	No. of Pt.	Percentage	No. of Pt.	Percentage	No. of Pt.	Percentage
Excellent	6	60	4	40	10	50
Good	3	30	5	50	8	40
Fair	1	10	1	10	2	10
Poor	0	0	0	0	0	0
TOTAL	10	100	10	100	20	100

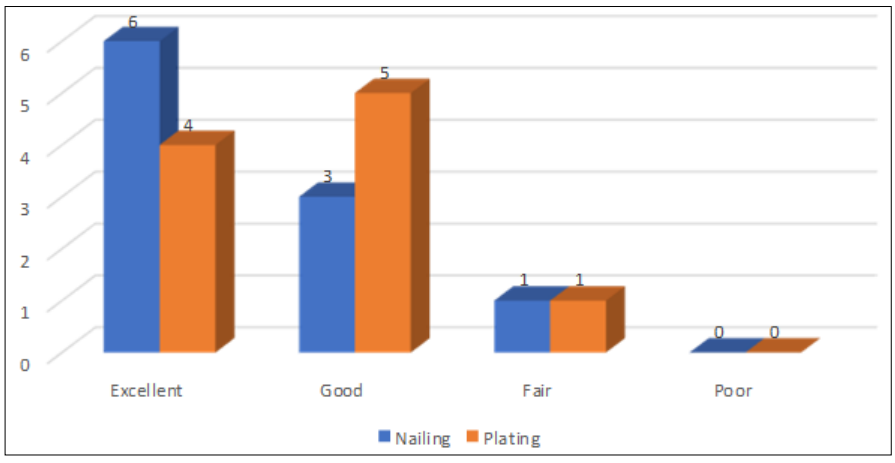

Fig 4: AOFAS Outcome

Table 5: Time taken for full weight bearing

Weight bearing	Nailing	Plating
Immediate	6	0
Delayed	4	10
TOTAL	10	10

Table 6: Complication

Complication	Nailing		Plating		TOTAL	
	No. of Pt.	Percentage	No. of Pt.	Percentage	No. of Pt.	Percentage
Delayed union	3	30	1	10	4	20%
Non union	0	0	0	0	0	0%
Superficial infection	0	0	1	10	1	5%
Wound dehiscence	0	0	3	30	3	15%
Implant Impingement	1	10	6	60	7	35%
Knee Pain	5	50	0	0	5	25%
Ankle stiffness	1	1	4	40	5	25%
Malunion	3	30	0	0	3	15%

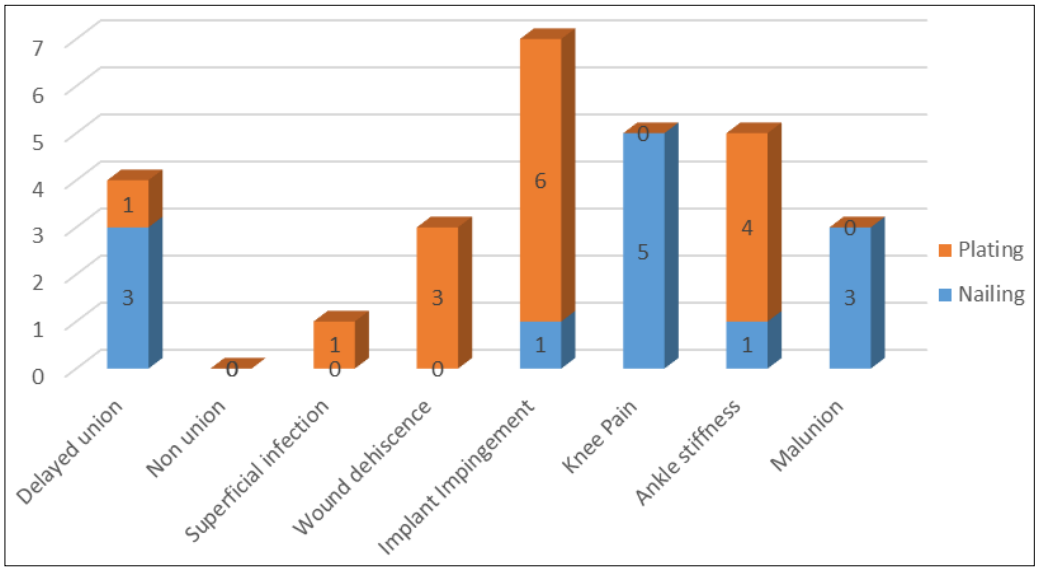

Fig 5: Chart Title

Discussion

Distal metaphyseal fractures are challenging fractures to treat. These fractures are most often high energy fractures resulting from axial and rotational force on distal tibia.

There are multiple studies comparing various modalities of treatment for distal tibial fractures. The various treatment options include plating, Nailing, AO external fixation, Ilizarov fixation to conservative treatment. Although many studies are there already in the literature comparing the efficacy of each surgical methods the optimum treatment remains controversial. Nonoperative treatment is also used in case of stable fractures with severe co morbidities but complications like delayed union, malunion and joints stiffness are very common.

Locking plate fixation gives good rigid construct, anatomical reduction and biomechanically superior to intramedullary nailing, however it results in extensive soft tissue dissection resulting in wound complications and infections. Hardware complications are more with locking plates warranting implant removal more frequently. With use of minimally invasive techniques the complications have significantly reduced.

Tip Locking Intramedullary nails are commonly used for treatment distal tibia fracture where the fracture is away from the plafond allowing two or more distal locking bolts. Though it is less invasive than plating, technically more challenging to achieve and maintain reduction because of anatomic characteristics of distal tibia.

Our study principally compares the results of distal tibial fractures treated with tip locking intramedullary nailing and plate. This study has shown that patients operated with plating have lower rates of nonunion and malunion and lower rate of complication but more healing time than nail.

In Patients undergoing nailing anterior knee pain [4] was seen in five cases. One patients had superficial infection in plating group post operatively which was managed by wound debridement and antibiotic according to culture. The mean radiological healing time in patient operated with plate was 17.30 weeks and in patient operated with nail was 15.43 weeks.

Conclusion

The management of distal tibia fractures with intramedullary interlocking tibia nail gives better results compared to fractures managed with distal tibia locking plate.

Nailing allows better range of motion at ankle joint. Fracture union in nailing was seen earlier compared to fractures managed with distal tibia locking plate. As being load sharing device, early mobilization can be started in patients operated with intramedullary nailing. Plating of distal tibia fractures were associated with high infection rate, implant impingement and prolonged duration of protected weight bearing.

We conclude that intra-medullary interlocking nail is a reliable and satisfactory method for treatment of fractures of distal tibia 43 A type fractures with good functional results and high union rates with comparatively low complications.

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