

Comparative study of outcome of multidirectional locked nailing and plating for distal tibial fractures

Rishabh Kumar^{1*}, Satendra Kumar Sinha², Anand Shankar³, Satyendra Kumar⁴

¹Senior Resident, ²Professor & HOD, ³Post Graduate trainee, Department of Orthopaedics, Nalanda Medical College and Hospital, Patna, Bihar, INDIA.

³Consultant, Patna Bone and Spine Hospital, Patna, Bihar, INDIA.

Email: drrishabh2005@gmail.com

Abstract

Background: Distal tibial fractures are very commonly encountered by orthopaedic surgeons. Our aim is to study and compare clinical and radiological outcome in extra articular fractures of distal tibia treated by multidirectional interlocking intramedullary nails and anterolateral locking compression plates with reference to rate of healing, functional outcome and complications. **Material and Methods:** In this study 24 patients with distal tibia extra-articular fractures, AO type 43 A1,43A 2,43A3 were randomly selected and 12 of them were operated with multidirectional interlocking nailing and remaining 12 with anterolateral locking compression plate. The patients were regularly followed up for a period of one year and were evaluated clinically and radiologically with respect to tenderness at fracture site, abnormal mobility, infection, pain on movement of knee, ankle joints and anteroposterior and lateral radiographs of the leg for union of the fracture. **Results:** In multidirectional Interlocking intramedullary group average time for union was 4.5 months compared to 6.4 months in plating group which was significant (p value <0.00). Also the average time required for partial and full weight bearing in the nailing group was 4.2 weeks and 9.6 weeks respectively which was significantly less (p value <0.00) as compared to 7.12 weeks and 13.42 weeks in the plating group. Lesser complications in terms of implant irritation, ankle stiffness and infection (superficial and deep) were seen in interlocking group as compared to plating group. **Conclusion:** We concluded that due to early weight bearing, early union of the fracture and decreased implant related problems and closed intramedullary interlocking nailing is preferable in treatment of distal tibia fractures. We recommend fibular fixation whenever intramedullary nailing or locking plate fixation is used in distal tibiofibular fractures.

Keywords: Distal Tibia Fractures, Fibular Fixation, Locking Plate, Interlocking Nailing.

*Address for Correspondence:

Dr. Rishabh Kumar, Senior Resident, Department of Orthopaedics, Nalanda Medical College and Hospital, Patna, Bihar, INDIA.

Email: drrishabh2005@gmail.com

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INTRODUCTION

Distal tibial fractures represent less than 7%^{1,2} of all tibial fractures. Of all lower extremity fractures less than 10%^{3,4} belongs to distal tibial fractures. It is more common in

males in the age group⁵ of 30-50 years. The spectrum of injuries vary from low energy to high energy injuries. The low energy distal tibial fractures are mainly seen in older age group, usually due to rotational forces.⁶ The spiral fracture with or without intra articular extension is commonly encountered in these mechanism of injuries. In high energy distal tibial fractures younger age groups are involved due to road traffic accident and fall from height.⁷ Axial loading, compression and torsional forces^{8,9,10} are involved in the mechanism of injury. The distal tibial fractures 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 the tibia is subcutaneously in plane which adds further difficulty in

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the fracture management. Internal fixation devices such as locking compression plates, intramedullary nails are used for the fracture fixation of distal tibia. It is critical to understand the fracture pattern occurring in the distal tibia and the form of fixation available. 85% distal tibial fractures was associated with the fibula fractures. The fixation of fibula is a debate according to many literature.⁷ In case of rigid fixation like multidirectional interlocking nailing the fibular fracture need not be fixed, but for better reduction the fibula fracture may be fixed. The comorbid conditions like diabetes mellitus, peripheral vascular diseases, smoking and alcoholism complicates this delicate situation.⁷ In 1980, Ruedi *et al* made a gold standard decision to fix all distal tibial fractures by means of internal fixation by plate osteosynthesis. High complications like wound dehiscence, sepsis, chronic osteomyelitis associated with open reduction and internal fixation with plating were noted in high energy fracture pattern. About 40 to 50% complication rate was attributed in internal fixation device and extensive surgical procedure due to soft tissue injury. In 1990, the ankle spanning external fixation became popular to maintain the articular surface of tibia with minimal internal fixation. To maintain the length and axial alignment the fibular fractures were fixed with plate osteosynthesis. Monolateral external fixator was replaced by hybrid external fixators due to the advantage of the early weight bearing and stability. Management of open distal tibial fractures with external fixators as a definitive procedure has its own complication like ankle stiffness, pin tract infection, secondary loss of reduction and stability. With the better understanding the management of soft tissue injury and the poor outcome results in the external fixation technique, makes to reconsidered that, after the soft tissue recovery open reduction and internal fixation can be done. Non surgical management^{11,12,13} have a limited role in medically unfit patient. For those patient the treatment modalities are traction or plaster of paris but the complication rate is higher like shortening, malunion, secondary osteoarthritis of the ankle and limited range of movements. In addition to the long bed ridden patient are more prone for pneumonia, deep vein thrombosis and pressure sores are encountered. Tscherne classification of soft tissue injury was accepted by the AO group to grade and evaluate each component the skin, neurovascular tissue and the musculotendinous structure gave way for reconsideration of open reduction and internal fixation of distal tibial fractures. For distal tibial fractures various modalities of internal fixation have been described. They are anterior plating using tplates, AO medial plating using medial buttress plate, cloverleaf plate and dynamic compression plates. Each plate osteosynthesis has their own advantages and their complications. One of the major disadvantage of

AO medial buttress plating is the wound dehiscence over the sub cutaneous border, lead on to flap cover by the plastic team and this procedure limits the lateral surgical approach for the fixation of the fibular fracture.

The locking compression plates with the anatomical contoured version is now available for better reduction of the distal tibia fracture. Use of low profile medial locking compression plate still address the problem of wound dehiscence and deep infection with low complication rate than the standard AO plating. In the Minimally Invasive Percutaneous Plate Osteosynthesis technique (MIPPO), the surgeons address minimal soft tissue injury in the management of distal tibial fractures. The union rate ranges from 80 to 100% in the MIPPO technique. In MIPPO procedure the surgical trauma to the soft tissue is minimised and it provides the biological environment for fracture healing. The complication like hard ware failure, non union, angular deformity, malreduction has been reported. Anterolateral approach¹⁴ described in the past was not popularized in the late century, anteroplatting on the lateral surface of the tibia becoming popular for the fixation of distal tibial fractures and improved soft tissue coverage and low rate of wound. Hey-Groves used solid metal rods for femur fractures and achieved healing at appropriate time, preservation of soft tissues, and periosteum as well as abolition of prolonged plaster cast immobilization. Rush brothers presented their technique with multiple flexible intramedullary pins in 1927. The most important contributions to intramedullary fixation, however, came from Gerhard Küntscher (1900-1972) who performed a number of animal experiments and explained not only the nailing technique but also the implant shape and design. He suggested a tight fit between nail and bone to achieve a higher stability. To extend the area of contact within the medullary cavity, he started to ream the canal in order to insert thicker, longer, and slotted cloverleaf nails. In 1950, Herzog *et al* introduced the tibia nail with a proximal bend and lateral slots at the distal end to accept antirotational wires. Klemm and Schnellmann in Germany and Kempf *et al.* in France further developed the idea and were precursors to today's interlocking nails. In 1958 the AO/ASIF (Association for the study of internal fixation) formulated the four basic principles which have become the guidelines for the internal fixation. In general, in particular to the intramedullary nailing they show anatomic reduction, stable fixation, preservation of blood supply and early mobilization.

MATERIALS AND METHOD

The present study was conducted between November 2017 to January 2019 in the Department of Orthopaedics, Nalanda Medical College and Hospital, Patna by retrospectively and prospectively.

Selection Criteria:-

- 1) Adult patient more than 18 years of age and less than 70 years of age.
- 2) Closed fractures and grade I compound fractures of distal tibial fractures(43-A1,43-A2,43-A3 OF AO type) without intra articular extension.

Exclusion Criteria:-

- 1. Age less than 18 years and more than 70 years
 - 2. Grade II ,III Compound fractures of distal tibia.
 - 3. Fractures with intra articular extension.
- A total of 24 cases (12 males and 12 females) with distal tibial fractures were used for our study.

Statistical Method: We used SPSS 16.01 Version, paired sample t test, Mc Nemar Chi Square statistical methods for data analysis and statistical significance was accepted when P value is <0.05.

RESULTS AND OBSERVATION

Table 1: Age distribution

Age group in years	Nailing		Plating	
	No. of Pt.	%	No. of Pt.	%
25-35	3	25	1	8.3
36-45	4	33.3	4	33.3
46-55	5	41.70	5	41.70
>55	0	0	2	16.70
Total	12	100	12	100

Table 2: Sex distribution

Sex	Nailing	Plating
Male	5	7
Female	7	5
Total	12	12
Sex ratio	42:58	58:42

Table 3: Nailing and plating

Status	Nailing	Plating
Closed	9	
Open	3	12
Total	12	

Table 4: Mode of Injury

Mode of injury	Nailing	Plating
Fall From Height	2	1
Road Traffic Accident	10	9
Twisting of Ankle	0	2
Total	12	12

Twisting of ankle is the cause for distal tibial fractures in the old age and it is about 16.70 % in the plate group and zero percent for nail group. The sex ratio for the nailing is 42:58 and for plating is 58:42

Table 5: Weight Bearing

Weight bearing	Nailing	Plating
Delayed	3	12
Immediate	9	0
Total	12	12

Table 6: ROM ankle

ROM ankle	Nailing	Plating
Full	8	6
Near Normal	4	3
Mid Range	0	3
Total	12	12

Table 7: ROM knee

ROM knee	Nailing	Plating
Full	8	12
Near normal	4	0
Total	12	12

The time for union for nail group is shorter than the plate group . Hence the nail group is better than the plate group.

Ankle Score: -The ankle score for both the nail and plate group range from excellent to fair group. In the nail group the ankle score was good to excellent. In the plate group the the ankle score was fair to good. The t-valve is 8.75 and the p-value is 0.0 and it is significant.

Knee Score:-The knee score for the nail and the plate group range from 60 to 90 out of 100. The nail group range from 60 to 80 and the plate group range from 70 to 90. The mean for nail group was 70.73 and the mean for plate group was 82.92. the t-valve is 4.76 and the pvalue is 0.0 and it is significant for plate group.

The knee score the plate group was better than the nail group.

Table 8: Complications

Complications	Nailing	Plating
Delayed Union	2	0
Implant failure and non union	0	1
Plate exposure	0	1
Superficial infection	1	2
Wound dehiscence	0	3
Malunion	3	0
Total	6	7

CONCLUSION

Distal tibial fractures can be effectively treated by interlocking intra medullary nails with multi directional locking options with excellent results. The operative technique was simple and short. Very minimal complications were encountered in our study. No cases of non-union were found. The post operative infection rate was low. Wound healing problems were not encountered. As nails are weight sharing devices, immediate weight bearing could be initiated. The post operative outcome as measured by ankle and knee scores and range of

movements were good to excellent. Fibular fixation can be combined with nailing in indicated cases for excellent results. Hence, interlocking intra medullary nailing combined with multi directional locking can be considered a very effective modality of treatment of indicated distal tibial fractures

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