

A Prospective Study on the Assessment of Functional Outcome by Modified OMAS Score in Distal Tibial Diaphyseal - Metaphyseal Fracture Treated by Expert Tibia Nail or Plate Osteosynthesis

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Abstract: ***Introduction:** To study the functional outcome by using modified Olerud and Molander scoring system (OMAS) of distal tibial diaphyseal-metaphyseal fractures treated by Expert Tibia nail (ETN) or plate osteosynthesis. **Methodology:** Study Centre-Ravindra Nath Tagore Medical College & Maharana Bhupal Government Hospital, Udaipur in Department of Orthopaedics & Traumatology. Study Type-Prospective, **Inclusion Criteria:** Age group (20-60) years both male and female with Distal 1/3rd tibia fracture (AO Classification 43A1, A2, A3) with Tshere and Oster grade 0 and grade 1, Closed or Gustilo grade-I or grade-II open fractures, Early failure of conservative management. Patients willing to give consent and willing for follow-up. **Exclusion Criteria:** Patients aged below 20 years or above 60, Patients medically unfit for surgery, Open fractures (Gustillo -Anderson Grade-3) associated with vascular injuries., Intraarticular fractures (AO 43B, and C), Patients not willing for surgery. Sample Size – 40 **Results:** 40 cases were operated and followed up. After 9 months of follow up to 18 (45%) having excellent grade, 20 (50.00%) had good grade. Only 2 patients (5.00%) had fair grade due to delay in union and stiffness in muscles, which was improved with physiotherapy. ETN groups (20) about 95% showed Excellent to Good results, Medial LCP group (10) showed 100% Excellent to good results and Anterolateral group (10) showed 90% Excellent to good results. **Conclusion:** For distal tibial metaphyseal fractures without involving articular surface, IM nailing with ETN and plate osteosynthesis provides adequate stability at fracture site and aids in achieving earlier fracture union and earlier return to work*

Keywords: OMAS, ETN, AO, IM, LCP.

1. Introduction

Distal tibial metaphyseal-diaphyseal fractures are a common consequence of road traffic accidents, falling injuries and other high-energy trauma and usually involve a severe soft-tissue injury. These fractures generally require surgical management, such as reduction and internal or external fixation. Surgical treatment for distal tibial metaphyseal-diaphyseal fractures is still a challenge because extensive soft-tissue injuries often disrupt the vascular supply to the fracture site and increase the risk of infection and delayed union or nonunion.¹

The construction of IM nails has improved greatly. The indications for their use have been extended to fractures closer to distal segments.²⁻⁴

The Expert Tibia Nail (ETN, Synthes) is a new kind of low, multidirectional locked tibial intramedullary nail; its interlocking system was developed to attain increased angular stability and to enhance the axial and lateral stability of fracture fragments. Because of the increased stability attained by the nail fixing of proximal or distal tibial fractures, the indications for use of the nail were expanded. The nail currently represents an effective approach to the treatment of complex tibial fractures such as distal tibial metaphyseal-diaphyseal fractures.⁵

In Plate osteosynthesis for fractures of the distal tibia is often associated with delayed healing, infection, and hardware problems.⁶

Nonoperative treatment of these fractures can be technically demanding on an account of small of fragment with poor hold in plaster. There may be associated joint stiffness, shortening and rotational malunion. In addition, there is variable incidence of nonunion which is difficult to manage at a later stage on an account of osteoporosis.

The surgical treatment of fracture has evolved a great deal since the development of the original “open reduction and internal fixation” technique by the AO group. To obtain maximal mechanical stability in order to achieve primary (endosteal) bone healing, exact anatomical reduction and strict rigid fixation were emphasized in the beginning. This however can rarely be obtained without significant dissection of the fracture and the surrounding soft tissue. Well known complications like infections and delayed or non union are frequently attributed to the devitalization of bony fragments and additional damage to soft tissue.

New insight in reduction techniques and fracture healing are leading to the development of a “minimal invasive percutaneous plate osteosynthesis” promoted by AO group and others. The emphasis now lies on indirect reduction, axial alignment and stable fixation without disturbing the fracture environment and thus preserving the most of the

vascularization and fracture hematoma, containing all necessary growth factors for bony healing.

There has been increasing trend towards the use of the locking compression plate (LCP) for fracture fixation. The device allows the screws to lock to the plate, therefore creating a stable and fixed angle device. Precise anatomical contour of this plate is no longer necessary because the plate does not need to be pressed on the bone to achieve stability, thus preventing the loss of primary reduction of fracture fragments caused by inadequate contouring of the plate.

Objectives

- 1) To discuss the management of fractures of distal tibia
- 2) To evaluate clinical and functional outcomes after intramedullary interlocking tibia nailing using Expert tibia nail.
- 3) To evaluate clinical and functional outcomes after plate osteosynthesis using distal tibial locking compression plates, Anterolateral and Medial LCP.

2. Materials and Methods

Study Type: A Hospital based, descriptive Cross-sectional study.

Study Area: Orthopedic Wards of RNT Medical College and MB Hospital, Udaipur.

Study Duration: study was conducted from January 2022 to December 2022 for 12 months.

Study Population: All Patients who attended OPD Or Emergency with Distal 1/3rd Diaphyseal- Metaphyseal Tibia fractures (AO Type 43A) meeting the inclusion criteria, who got treated at MBGH from November 2021 to December 22 and operated with Expert Tibia Nail and Distal Tibia plate (Anterolateral and Medial) osteosynthesis was observed for outcomes at 3months, 6 months and 9 months respectively.

Inclusion Criteria

- Adults (aged 20-60 years), both male and female with Distal 1/3rd tibia fracture (AO Classification 43A1, A2, A3) with Tshere and Ostern grade 0 and grade 1.
- Closed or Gustilo grade-I or grade-II open fractures.
- Early failure of conservative treatment.
- Patients willing for treatment and given-informed written consent.

Exclusion Criteria

- Patients aged below 20 years or above 60.
- Patients medically unfit for surgery.
- Open fractures (Gustillo -Anderson Grade-3) associated with vascular injuries.
- Patients not willing for surgery.
- Intraarticular fractures (AO 43B, and C)

Sampling Technique: Purposive Sampling, a type of non-probability sampling

Ethical Considerations - This study was undertaken after the approval of the ethical committee. A prior informed

consent was taken and only patients who gave written consent to participate in the study was the study subjects. Data confidentiality was maintained. Personal details of patients were not disclosed in any circumstances.

Statistical analysis - All collected data entered in MS Office Excel 2007 and analysis by SPSS V 20.0. For quantitative data mean & SD will be calculated and "t" test use for statistical inference while for qualitative data percentage will be calculated and chi square test was used for statistical inference.

P Value <0.05 considered as statistical Significance.

3. Discussion

Distal tibial fractures in metaphyseal region are resulted from axial and rotational forces. Distal tibia fractures continue to pose problems for surgeons in choosing the apt treatment protocol. Major challenges for surgeons treating this type of fractures are its anatomical location, soft tissue injury, high degree of comminution and vascularity in this region.

The treatment principles for distal metaphyseal extra articular fractures are different and it must be differentiated from those for intra articular pilon and diaphyseal fractures. The primary Goal of surgical management of this type fractures is to maintain fracture alignment within acceptable range and to achieve adequate stability at fracture site to allow for fracture union and early mobilization.

When distal tibial fractures are treated with internal fixation with plates, complications like skin necrosis, deep infections, delayed union and refractures may occur³⁵.

Intramedullary nailing provides better option for treating these type fracture by providing load sharing property, without disturbing fracture hematoma results in faster union and aids in early mobilization.

The conventional intramedullary tibia nail offers better option for treatment of metaphyseal fractures but problems with conventional nails are-difficult manipulation of fractures in metaphyseal regions with these nails, single plane locking screws in majority of nails, lower level of Herzog bend and the distal locking screw holes are not present at nail tip.

Fracture fixation using plate osteosynthesis is a demanding procedure and the success is related to the surgical technique used⁴³. A decade ago, more importance was placed on anatomical reduction and rigid fixation to achieve stability. The results were not so encouraging (i.e. increased incidence of delayed union and non union) due to violation of the soft tissue envelope around the fracture site. This led to evolution of newer technique which gave more importance to biology of optimal rather than maximal stability

Pascarella R et al cut/sawed the distal tip of nail so that the distal locking screws should cross the fracture site⁴⁴. Ricci WM et al used poller screws to prevent nail translation in distal segment⁴⁵.

These difficulties are overcome by use of ETN as it has multiplanar interlocking options and locking holes in close proximity to nail tip provides angular stability despite short distal segment, also has provision for compression, and it has optimum Herzog's bend. All the above features make ETN an ideal implant of choice for metaphyseal fractures especially in distal tibia⁴⁶.

Mean age in our study was 34.9 years with maximum patients (40%) in 20-29 age group. Gregory and Sanders⁴⁷ in their series has mean age of 30 years and in series by Duwelius et al⁴⁸ the mean age was 40.5 years.

Study	Mean age in years
Gregory and Sanders ⁴⁷	30
Duwelius et al ⁴⁸	40.5
Present Study	34.9

High energy trauma is the most common cause for this type of fractures accounting for about 62.50% which were comparable to studies by Gregory and Sanders⁴⁷ (85.10%) and Krettak et al⁴⁹ (71%).

High energy injury	Percentage
Gregory and Sanders ⁴⁶	85.10
Krettak et al ⁴⁹	71
Present study	62.5

The mean time for radiological union in our study is 19 weeks with range from 15 to 28 weeks. Other studies in literature shows radiological union after IMN and plating for tibia ranging from 17 to 22.6 weeks⁵⁰ was comparable to our study. Additional procedures like Dynamization were done in one patient (5%) for delayed union and subsequently fracture united and bone grafting not performed in any cases. Managing severely comminuted distal tibia fractures is a challenging task. The aim of this study was to assess the efficacy of minimally invasive plate osteosynthesis in the management of these injuries. Fracture fixation using plate osteosynthesis is a demanding procedure and the success is related to the surgical technique used⁵⁰. The results were not so encouraging (i.e. increased incidence of delayed union and non union) due to violation of the soft tissue envelope around the fracture site. This led to evolution of newer technique which gave more importance to biology of optimal rather than maximal stability.

MIPO has gained wide application in the treatment of periarticular fractures of the tibia.

MIPO allowed uneventful healing in 83.50 % of our cases. Consistent with the literature, a high percentage of our patients resumed to their preinjury level of working activities with general restoration of lower leg function. However, complications occurred in a substantial portion of patients, which may be divided into three groups: disturbances of fracture healing (2.50%), infection (both immediate post operative and late) (5.00%), and hardware problems (9.00%).

High energy and comminuted fracture patterns took a long time to heal which is consistent with results of Collinge et al⁵¹.

Milner et al⁵² studied 164 fracture tibias with a long-term follow-up of 30 years and concluded that there were no significant univariate associations between malunions of the tibia and the development of osteoarthritis of the knee or ankle. In no patients in this 40 cases did we observe valgus or varus malalignment more than 5°.

Primary bone grafting is contraindicated if soft tissue dissection has to be done to place the graft⁵³. We have not done primary lone grafting in any of the cases. Bone grafting may be indicated if the healing is not progressive as assessed radiologically. The explosion of technology and better understanding of the fracture healing help us to attain the optimal balance of stability and fracture healing.

In our study we used a single-stage fixation of all distal tibial fractures. We used medial distal tibial locking compression plate for all cases. This plate is a low-profile plate of 3.5 mm system. The Medial distal tibial plate is a precontoured plate to that of the distal tibia and thus allows placement of the plate without disruption of fractures fragments. The thread holes in the plate locks to that of the screw head and minimize plate-bone interface and maintain the vascularity at the fracture site.

Mast et al⁵⁴ recommended primary definitive internal fixation if the patient was presented early within 8 to 12 hours following injury. They advocated a delay in the definitive procedure for about 7 to 10 days for soft tissue to heal, if the patient presented late. In our study the average duration of delay in the definitive treatment was about 3 to 12 days.

Bahari et al⁵⁵ observed one case of delayed union and two of superficial infection. There was one case of deep infection. Three patients had metalwork removal due to plate impingement. In our study we had 27.5% of excellent functional outcome, 47.5% had good results and 22% had fair result in a average follow up of 9 months. We observed 2 case superficial infection (5%), No case deep infection which was acceptable when compared to the above studies. Mario Ronga MD⁵⁶ et al and Nicola Maffulli MD et al in their study of minimally invasive locked plating of distal tibial fractures, they had the following outcomes – of the 21 cases they achieved union in 20 cases and one case went in for non-union. They had 3 cases of angular deformities all less than 7° and no patient had a leg-length discrepancy. Compared to their study, in our study all cases went in for union in mean duration of 12 weeks. Two cases had delayed union.

4. Results

When outcome was recorded according to modified OMA Ankle scoring system at various time interval postoperatively, at the first quarter i.e. after 3 months postoperatively majority of patients 36 (90%) had fair grading, 2 (5%) good and 2 (5%) had poor grade. None had excellent outcome.

The results improved in the second quarter i.e. after 6 months postop to 18 (45%) having good results, 21

(52.50%) had fair, and only 1 (2.50%) had poor grade due to delay in union.

These results improved significantly after 9 months of follow up to 18 (45%) having excellent grade, 20 (50.00%) had good grade. Only 2 patients (5.00%) had fair grade due to delay in union and stiffness in muscles, which was improved with physiotherapy.

In our series, we had 45% excellent, 50% good, 5%, fair and no poor result. Patients, who obtained excellent results, had no residual deformities or pain. Range of motion was within the normal functional range. They had no arthritic changes or other complications. They were co-operative to physiotherapy. Patients with good results had minimal residual deformities, pain and slight limitation. Rest of their findings was within acceptable parameters.

More over among ETN groups (20) about 95% showed Excellent to Good results, Medial LCP group (10) showed 100% Excellent to good results and Anterolateral group (10) showed 90% Excellent to good results.

For AO type A1 fractures treated with ETN and Plate osteosynthesis gave comparable outcome. ETN group showed good results (75%) and Excellent (20%) results. Medial plating Group (66%) Excellent results and Anterolateral groups gave (50%) excellent result.

AO Type A2 Medial Plate gave best results. (90% Excellent to Good) and for ETN group (10%) Excellent results

AO Type A3 fractures Plating Groups gave better results 50% Excellent and 50% good results

ETN group (40%) Excellent and (40%) Good results.

Higher the Grade More the level of comminution, Plating groups gave better functional outcome than ETN groups.

Table 1: Ankle OMA Scoring System and AO Classification at 9 Months ETN and plating Groups Follow-up

Procedure	Excellent		Good		Fair		Poor	
	No.	%	No.	%	No.	%	No.	%
ETN(20)	4	40.00%	15	40.00%	1	20.00%	0	0.00%
Medial LCP(10)	7	50.00%	3	50.00%	0	0.00%	0	0.00%
Anterolateral (10)	5	50.00%	4	50.00%	1	0.000%	0	0.0%

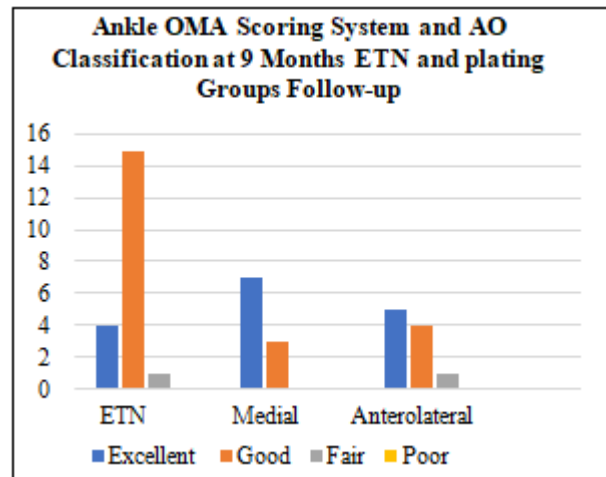
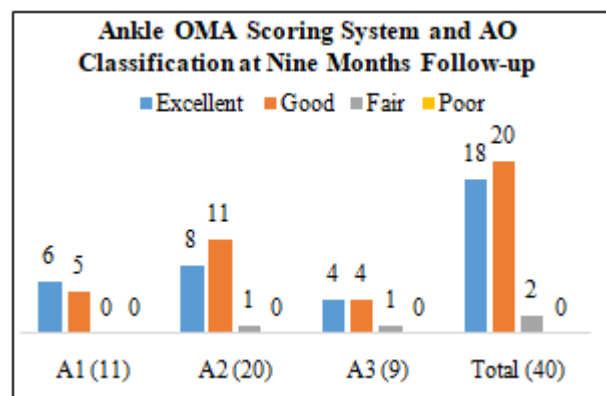


Table 2: Ankle OMA Scoring System and AO Classification at 9 Months Follow-up

AO Class	Excellent		Good		Fair		Poor	
	No.	%	No.	%	No.	%	No.	%
A1 (11)	6	15.00%	5	12.50%	0	00.00%	0	0.00%
A2 (20)	8	20.00%	11	27.50%	1	2.50%	0	0.00%
A3 (9)	4	10.00%	4	10.00%	1	2.50%	0	0.0%
Total (40)	18	45.00%	20	50.00%	2	5.00%	0	0.00%



5. Conclusion

From our study it is further proved that the effectiveness of Expert Tibia nail and plate osteosynthesis as it has given Excellent/Good functional out come in most of our cases. For distal tibial metaphyseal fractures without involving articular surface, IM nailing with ETN and plate osteosynthesis provides adequate stability at fracture site and aids in achieving earlier fracture union and earlier return to work. The maintenance of short distal segment within acceptable alignment while fixing fracture is necessary for good functional outcome. Recognition of inherent stability of distal fragment is necessary to enable adequate stable fixation and avoiding loss of reduction on follow up.

Present study has shown excellent results with minor complications in various fractures of younger group of patients with good bone stock. However longer follow up is required to see long term effects of these implants. Hence, we conclude that assessment of functional outcome by OMA score in extra-articular distal tibial diaphyseometaphyseal fracture managed by plate osteosynthesis and ETN nailing gives an excellent to good scoring system to assess outcome of comminuted extrarticular distal tibial fractures with reference to function of the individual. Also it will help to predict the likely functional outcome in relation to fracture pattern of distal tibia.

AO type A1 fractures treated with ETN and Plate osteosynthesis gave comparable outcome. ETN group showed good results (75%) and Excellent (20%) results. Medial plating Group (66%) Excellent results and Anterolateral groups gave (50%) excellent result.

AO Type A2 Medial Plate gave best results. (90% Excellent to Good) and for ETN group(10%) Excellent results AO Type A3 shows slight better outcome in Plating groups than ETN. Plating Groups gave 50% Excellent and 50% good results ETN group (40%) Excellent and (40%) Good results. Hence higher the Grade more the level of comminution, Plating groups gave better functional outcome than ETN groups.

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