

Functional outcome of intramedullary interlocking nail versus minimally invasive plate osteosynthesis in extra-articular distal tibial fractures

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Abstract

Background: Distal tibial fractures are the second commonest among all tibial fractures. Management of the distal tibial fractures is most difficult due to its superficial nature. Various risks are associated with the management of such fractures, such as Non-union, Osteomyelitis and Delayed Union. Distal tibia fractures can be treated by means of Closed reduction and casting or surgical interventions such as Closed reduction and Intramedullary Nailing/ Percutaneous Plating, Open Reduction and Internal Fixation with Plating or External Fixators. In our study we have treated the patients with Distal Tibial Extra-articular fractures with Closed Reduction and Internal fixation with Intramedullary Nail and Open Reduction with Minimally Invasive plate osteosynthesis technique. **Objective:** To evaluate the Functional outcome of Intramedullary Interlocking Nail and Minimally Invasive Plate Osteosynthesis. **Methods:** It is a prospective study carried out in the Department of Orthopaedics, GEMS and Hospital, Srikakulam. In our study, 20 patients with Extra-articular Distal Tibial Fractures were included. Among 34 patients 20 patients(Group – 1) were treated with Intramedullary Interlocking Nailing System and 14 patients(Group- 2) were treated with Minimally Invasive Plate Osteosynthesis. **Results:** In my study among 34 Patients, the age of the patients ranged from 19 to 74 years with a mean of 42 years and males were predominantly affected and it was 50%. In the study group of patients 20 (59%) cases are High velocity and 14 (41%) cases are Low velocity. Most common type was T-type of fracture, (16 cases/47 %). The time for union ranged from 3 to 13 weeks with a mean of 7.4 weeks. The range of full ROM was from 2 to 8 with a mean of 4.4. **Conclusion:** Both ILN and MIPO are reliable methods of fixation and are helpful in maintaining most of the osseous vascularity, fracture hematoma which are most useful in providing biological repair. Both are less invasive and in both soft tissue dissection is less.

Keywords: ILN-Interlocking Nail, MIPO-Minimally Invasive Plate Osteosynthesis.

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INTRODUCTION

Rapid technological advancements and urbanisation have resulted in a massive surge of new automobiles on the road. This has led to increase in accidents on road and number of deaths. Globally the mortality in major road traffic accidents is estimated at 1.2million deaths /year while the number injured is as high as 50 million injuries /year. The number of road traffic mortality globally is expected to rise 65 percent between 2000 – 2021 if care is not taken to prevent these injuries. These deaths are predicted to rise by as much as 80% in underdeveloped and developing countries.¹ In our country, more than 1, 00,000 lives are lost because of RTA every year (WHO global safety report 2011). More deaths due to road

accidents during the years were reported in Tamil Nadu (11.6%) followed by Uttar Pradesh (10.9%), Andhra Pradesh (10.8%) and Maharashtra (10.0%). More than half of the road traffic fatalities were in the wage-earning age bracket. It is the sixth greatest cause of death in India. Between 1970 and 2011, there was a 4.4 fold surge in the road traffic accidents. Subsequently the number of deaths has increased by 9.8 folds and the number of injuries by 7.3 folds. To note is that one third of fatalities in India involve the pedestrians and two wheelers who are called as the vulnerable road users. 91.8 percent of DALYs lost worldwide are due to road traffic injuries in developing and under developed countries.^{2,3} Fractures are the most common injury among non-fatal road traffic accident victims, and they most commonly affect the bones of the lower extremity. This could be due to the interaction of gravity force and vehicle velocity during crashes. Because of its subcutaneous location, the long bones, particularly the tibia, are frequently injured in these events. Distal tibia fractures are the second most common type of tibia fracture after tibia diaphyseal fractures.⁴ The distal tibia due to its subcutaneous blood supply and tenuous blood supply pose a challenge to treating surgeons in terms of choosing an appropriate implant to achieve adequate union and return to early pre-injury levels.

Tibial fractures are the most common long bone fractures, as well as the most common open fractures. Distal tibia fractures have the second highest incidence of all tibia fractures, based on the location of the fracture in the bone.⁵ The relatively tenuous blood supply, subcutaneous location of the tibia, mechanism of injury, and use of certain treatment methods contribute to a relatively high incidence of post traumatic complications following tibia fractures.⁶ These complex open fractures which are produced by high energy forces, threaten to pose a challenge to orthopaedic surgeons. Considerable advances in the methods and concepts of internal fixation along with newer innovations in implants help to meet such challenging tasks.

MATERIALS AND METHODS

Study site: Great eastern medical school (GEMS) and hospital, Srikakulam, Andhra Pradesh.

This prospective observational study was conducted for 12 months from January 2022 to December 2022 in the department of orthopaedics on 34 patients with confirmed Extra articular distal tibial fractures.

Inclusion criteria: 1. Patients from 19-74 years of age
2. Extra-Articular fractures.

Exclusion criteria: 1. Intra-articular fractures. 2. Open fractures. 3. Pathological fractures. 4. Vascular Injury

SURGICAL TECHNIQUE

INTRAMEDULLARY INTERLOCKING NAIL:

Patients were operated under spinal anaesthesia in supine position on a standard radiolucent table. Prophylactic intravenous antibiotics were administered 30 min before skin incision. An image intensifier was used in all the cases to provide fluoroscopic guidance. The patient was positioned supine with the hip flexed 45° and the knees flexed to 90° on radiolucent table. A 5-cm incision along the medial border of the patellar tendon was made, extending from the tibial tubercle in a proximal direction. The patellar tendon was retracted laterally to expose the insertion site and protect the tendon during insertion. Then the awl is inserted where the anterior tibia reaches the joint. Nailing was done using standard technique and all fractures were fixed with two proximal and two distal locking screws.



Figure 1



Figure 2



Figure 3

MINIMALLY INVASIVE PLATE OSTEOSYNTHESIS

In MIPO, the leg was prepared circumferentially from the toes to mid thigh and draped free. A longitudinal incision of length 3–4 cm was made bone deep over the medial malleolus adequate enough to put screws in distal fragment. The saphenous nerve and vein were preserved and retracted anteriorly. Then an epiperiosteal space tunneling toward the diaphysis was made using the blunt tip of the plate. The reduction was achieved with manual traction and manipulation. Anatomically, precontoured plate was used and was positioned on anteromedial aspect of distal tibia by passing it through the subperiosteal tunnel. After insertion of plate and achieving the reduction, the plate was temporarily fixed to bone with K-wires and fixed proximal fragment with one locking screw. Distal fragment fixation was done with a combination of locking and cortical screws. Anatomically, precontoured plate was used and was positioned on anteromedial aspect of distal tibia by passing it through the subperiosteal tunnel. After insertion of plate and achieving the reduction, the plate was temporarily fixed to bone with K-wires and fixed proximal fragment with one locking screw. Distal fragment fixation was done with a combination of locking and cortical screws. Depending on fracture pattern and bone quality the decision of inserting the lag screw was made. Insertion of screws in the proximal fragment was done with small stab incisions.

POST-OPERATIVE PROTOCOL

Radiograph with standard antero-posterior and lateral view of the involved leg was taken immediate postoperatively, at 6 weeks, 6 months and at 12 months follow-up. Active range of movements of knee and ankle joint along with quadriceps strengthening exercises were started on the next day of surgery. Functional Outcome has been assessed using Olerud and Molander Scoring System.

OBSERVATIONS AND RESULTS

34 Patients who underwent minimally invasive plate osteosynthesis of their distal tibial extra articular fractures were analysed.

Table 1: Age distribution of patients studied

Age in years	Number of patients	Percentage
16-25	4	11.8
26-35	10	29.4
36-45	8	23.5
46-55	5	14.7
56-65	4	11.8
66-75	3	8.8
Total	34	100

Pattern of fracture	Number of patients	%
Transverse	16	47.1
Oblique	15	44.1
Comminuted	3	8.8
Total	34	100

BAR DIAGRAM AGE DISTRIBUTION OF PATIENTS

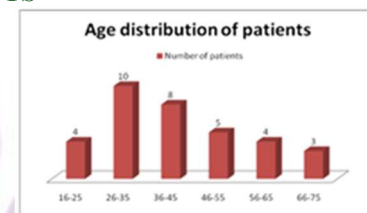


Figure 4

The age of the patients ranged from 19 to 74 years with a mean of 42.3 years and standard deviation (SD) of 15.4 years.

Gender distribution of patients studied

Table 2

Gender	Number of Patients	%
Male	20	59.0
Female	14	41.0
Total	34	100

PIE DIAGRAM FOR GENDER DISTRIBUTION

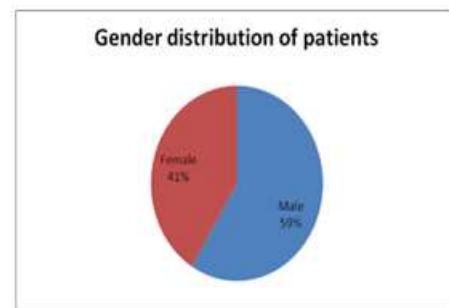


Figure 5

In the study group of patients 20(59%) cases are male and 14 (41%) are female.

Distribution of pattern of tibia fractures

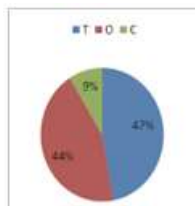


Figure 6

PIE DIAGRAM OF PATTERN OF DISTRIBUTION

In the study group of patients 16 (47%) cases are T-type of fracture, 15 (44%) cases are o-type of fracture and 3(9%) cases are C-type of fractures are observed.

Distribution of operative procedure

Table 3

Operative procedure	Number of patients	Percentage
Nailing	20	58.8
Plating	14	41.2
Total	34	100

PIE DIAGRAM OF OPERATIVE PROCEDURE

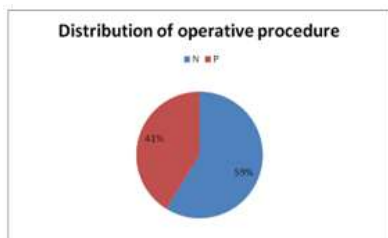


Figure 7

STUDY CASES



Figure 8



Figure 9

The time for union ranged from 3 to 13 weeks with a mean of 7.4 weeks and standard deviation (SD) of 2.5 weeks. The range of full ROM was from 2 to 8 with a mean of 4.4 and standard deviation of 2.0.

FUNCTIONAL OUTCOME



Figure 10

DISCUSSION

Distal tibia fractures which are brought to an orthopedician and are Extraarticular are difficult to manage since the soft tissue condition and degree of comminution complicate the treatment plan. The aim of operative treatment is anatomical reduction and to provide enough stability to allow early motion. This can be achieved by using techniques that can minimise excessive soft tissue dissection and osseous devascularization, which in turn lead to reduction in Iatrogenic complications. Road traffic accidents and fall injuries frequently result in distal tibia fractures. Its administration is still a challenge, with a number of unsolved questions. Many new surgical techniques have developed because of better understanding of biomechanics, biomaterials and biology. Closed reduction and intramedullary nailing, open reduction

and internal fixation with plating, closed reduction and percutaneous plating, or external fixators are all options for treating distal tibia fractures. IMLN has had a leg up on competing procedures for years due to its early weight bearing and union rate, as well as a lower infection rate. Percutaneous plating has become superior to ILN in terms of Stability as it acts as a Fixed angle device providing Axial and Angular Stability at the Screw – Plate Interface which leads to preservation of Periosteal blood supply.⁵¹ (Sivakumar et al.) The advantages of locked intramedullary nailing include a shorter operating time, a lower rate of infection, early weight bearing, and easier implant removal. Intramedullary nailing allows for closed stabilisation while preserving the fracture site's vascularity and the soft-tissue envelope's integrity. Extensive soft tissue dissection occurs after open reduction and internal plate fixation, which can lead to wound problems and infection. Percutaneous plating has recently been a common treatment for treating unstable distal tibia fractures, and it has been advocated as an alternative that reduces the risk of infection and soft tissue complications. The patients in our study ranged in age from 19 to 74 years old, with a mean of 42.3 years and a standard deviation (SD) of 15.4 years. There were 20 boys and 14 females among the 34 patients. IMLN had 18 males and 2 females, whilst MIPO had 5 males and 9 females. Twenty-nine percent (59%) of the patients in the study are male, whereas fourteen percent (41%) are female. Male participation in our study was likely related to more outside activities and harder labour performed by guys in the Indian setting compared to females. The most common cause of these fractures in our analysis was RTA, which was followed by a fall and a sports injury. In the study group of patients, 24 (71%) of the cases were on the right side, whereas 10 (29%) were on the left side. The time for union ranged from 3 to 13 weeks with a mean of 7.4 weeks and standard deviation (SD) of 2.5 weeks. The range of full ROM was from 2 to 8 with a mean of 4.4 and standard deviation of 2.0. In our study, we allowed partial weight bearing after the radiological evidence of callus formation and absence of Tenderness and abnormal mobility of fracture site which has been achieved at 6.8 weeks. In the study group of patients 20(59%) cases are due to High velocity trauma and 14 (41%) cases are due to Low velocity trauma. In the study group of patients 16 (47%) cases are Transverse type of fracture, 15 (44%) cases are Oblique type of fracture and 3(9%) cases are Comminuted-type of fractures are observed. Average union time was faster in the group treated with ILN in our study. Tibial fractures are frequently linked with

fibular fractures, which may influence treatment options and, ultimately, reduction and union. The question of the hour is whether or not to treat the fibular fracture. In our study, fibula fixation was performed in 22 of 34 instances (59.45%). IMLN had eight instances, whereas MIPO had fourteen. In our investigation of fibular fixation, we found two occurrences of delayed union in the IMLN group. Dynamisation was done in two patients where the fracture didn't show any signs of fracture union at the end of 3 months between which one patient required Bone –grafting at 24 weeks and other patient achieved union. Various studies showed that fixation of Fibula leads to anatomic reduction of the tibia; but leads to reduction of strain over Tibial fracture which in turn increases the risk of Delayed and Non union. In our study, we had acceptable alignment in 34 cases, i.e., 58.8%. In ILN group Malalignment was found in 41.2% whereas MIPO group had 14.28% of patients. On one year follow up eight cases which had malalignment evident on immediate postoperative period healed in the same position at follow up without any significant change. Valgus Malunion was found in four cases and One case has Varus Malunion in ILN group.

In MIPO group Two cases had Varus Malunion and One case showed Valgus malunion.

CONCLUSION

Both ILN and MIPO are reliable methods of fixation and are helpful in maintaining most of the osseous vascularity, fracture hematoma which are most useful in providing biological repair. In our study, IMLN group resulted in lesser operation time, earlier weight bearing and Faster union rate, lesser infection rate, implant failure and irritation. So ILN is a preferable choice for treatment of distal tibial fractures which are Extra –Articular Fixation of Fibula was made based on significantly persisting malalignment of Tibia fracture intra-operatively. So, Fixation of Fibula is not routinely recommended as the advantage of ILN and MIPO in the avoidance of soft tissue dissection might be compromised in this way and also reduces strain over the tibial fracture, which increases the risk of delayed healing or non-union. Dynamization, to achieve union, was easy and effective and led to union treated with interlocking nails. In our study the decision to dynamize the nail was taken at 12 weeks. I, acknowledge that accuracy and statistical significance would be more if sample size is more. In our study Number of the patients, duration and follow up was shorter due to limited time period. Proper

assessment of Final Clinical and Functional Outcome requires more time.

REFERENCES

1. Dhillon MS, Rajasekharan S, Sancheti P. Status of Road Safety and Injury Burden:India. J Orthop Trauma. 2014 Jun;28:S434.
2. WHD4RepCovEn_CAG - intro.pdf.
3. Ruikar M. National statistics of road traffic accidents in India. J Orthop Traumatol Rehabil 2013;6:1-6.
4. Court-Brown CM, Caesar B. Epidemiology of adult fractures: A review.Injury.2006Aug;37(8):6917.
5. Court-Brown CM, Rimmer S, Prakash U, McQueen MM. The epidemiology of open long bone fractures. Injury. 1998 Sep;29(7):52934.
6. Trueta J. Blood supply and the rate of healing of tibial fractures. Clin Orthop. 1974;(105):1126.

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