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Original Research Article

Study to Evaluate the Functional Outcome of Intramedullary Interlocking Nail and Minimally Invasive Plate Osteosynthesis

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Abstract

Aim: The aim of the present study was to evaluate the Functional outcome of Intramedullary Interlocking Nail and Minimally Invasive Plate Osteosynthesis.

Methods: The present study was conducted in the Department of Orthopaedics, Shri Ramkrishna Institute of Medical Sciences and Sanaka Hospitals, Durgapur, West Bengal, India and 100 patients with confirmed Extra articular distal tibial fractures were included in the study.

Results: 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. Majority of the patients belonged to 36-45 years of age and 60% were male. 48% had transverse fracture followed by 44% oblique. 58% underwent nailing and 42% underwent 42%. 48% had transverse fracture followed by 44% oblique. 58% underwent nailing and 42% underwent 42%. The average time for full weight bearing was 10.09 ± 1.41 weeks which was statistically significant ($P < 0.0001$). The average time of union was 18.26 ± 2.49 weeks (range 15–24 weeks) which comes out to be very significant ($P < 0.0001$).

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

Distal tibia fractures classically include the site in the distal tibia between 4 cm and 12 cm from tibia plafond. [1] Because of its unique anatomical characteristics of subcutaneous location, poor blood supply and paucity of muscular cover anteriorly, the treatment of distal tibia fractures becomes challenging with numbers of complications such as delayed union, nonunion, wound infection, and wound dehiscence. [2] There are numbers of methods for treatment of distal tibia fractures including open reduction and internal fixation (ORIF) with plating, minimally invasive percutaneous plate osteosynthesis (MIPPO) technique, intramedullary interlocking (IMIL) nailing and external fixation; however optimal management remains controversial. [3,4]

Even though ORIF with plating provides anatomical reduction and early mobilization, because of extensive soft tissue injury, it cannot be considered as first line option for distal tibia fractures. IMIL nailing technique is another option which avoids soft tissue insult, preserves biological environment around the fracture and provides relative stability to enhance the fracture healing; however high rates of malunion and knee pain cannot be underestimated. [5,6] Recently MIPPO has emerged as a good alternative option for distal tibia fractures because it does not disrupt the periosteal tissue and hematoma around fracture, thus maintaining the biological environment and providing a stable biomechanical construct. Nevertheless, it is not free of some shortcomings like wound problems and implant prominence. [7,8]

Distal tibia fractures are one of the commonest fractures that present in the emergency department. There is always a dilemma about treatment. Surgeons treat these fractures with a closed intramedullary interlocking nail (IMIL), open reduction and internal fixation with dynamic

compression plate, external fixation, and minimally invasive plate osteosynthesis (MIPO). [9,10] The aim of treating a fracture is to produce a stable construct which allows early mobilisation and weight-bearing, but with minimal complications. [11] Post-operative axial rotational malalignment and distraction is usually more common in the IMIL group, leaving patients dissatisfied even when the degree of displacement is within the acceptable range. The overall outcome of both treatment groups is the same.

The aim of the present study was to evaluate the Functional outcome of Intramedullary Interlocking Nail and Minimally Invasive Plate Osteosynthesis.

Materials and Methods

The present study was conducted in the Department of Orthopaedics, Shri Ramkrishna Institute of Medical Sciences and Sanaka Hospitals, Durgapur, West Bengal, India for one year and 100 patients with confirmed Extra articular distal tibial fractures were included in the study.

Inclusion Criteria: 1.Patients from19-74 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.

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.

Results

Table 1: Age and gender distribution

Age groups in years	N	%
16-25	12	12
26-35	30	30
36-45	24	24
46-55	14	14
56-65	12	12
66-75	8	8
Gender		
Male	60	60
Female	40	40

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. Majority of the patients belonged to 36-45 years of age and 60% were male.

Table 2: Pattern of fracture and operative procedure

Pattern of fracture	**N**	**%**
Transverse	48	48
Oblique	44	44
Comminuted	8	8
Operative procedure		
Nailing	58	58
Plating	42	42
Weight bearing weeks ±SD		
Partial weight bearing	4.95±1.07	
Full weight bearing	10.09±1.41	
Union time	18.26±2.49	

48% had transverse fracture followed by 44% oblique. 58% underwent nailing and 42% underwent 42%. The average time for full weight bearing was 10.09 ± 1.41 weeks which was statistically significant (P < 0.0001). The average time of union was 18.26 ± 2.49 weeks (range 15–24 weeks) which comes out to be very significant (P < 0.0001).

Discussion

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. [12]

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. Majority of the patients belonged to 36-45 years of age and 60% were male. Predominant male involvement in our study was probably due to more outdoor activities and heavier labor undertaken by males as compared to females in the Indian set up. The result were comparable to that of Kumar et al [13], Ram et al [14], Li et al [15] and Vallier et al. [16] 48% had transverse fracture followed by 44% oblique. 58% underwent nailing and 42% underwent 42%. 48% had transverse fracture followed by 44% oblique. 58% underwent nailing and 42% underwent 42%. The average time for full weight bearing was 10.09 ± 1.41 weeks which was statistically significant (P < 0.0001). The average time of union was 18.26 ± 2.49 weeks (range 15–24 weeks) which comes out to be very significant (P < 0.0001). In our study, we allowed partial weight bearing only after signs of the union in form of bridging callus on at least three cortices out of four cortices on radiograph and clinically as the absence of tenderness and movement at the fracture site [17] which was usually by 6–8 weeks. The majority of the cases, having fulfilling above criteria around 6–8 weeks and were allowed partial weight-bearing on the affected limb.

There are numbers of other conflicting studies regarding the comparison of IMIL nailing and MIPPO technique. Vallier et al [18] reported that IMIL nailing has higher incidence of malunion compared with plate fixation. This may be due to technical and implant related problems like poor quality surgical reduction, inadequate distal locking screws and more distal location of fracture itself. Since anatomical reduction and stable fixation are the effective measure to avoid the malunion of distal tibia fractures, they are achieved better by plating than nailing. [19] Bong et al [20] mentioned that plates have better torsional and bending strain than intramedullary fixation in terms of biomechanics because of spacious medullary cavity of distal tibia and lack of adequate distal locking for intramedullary nail that leads to loss of reduction and malunion. However with the introduction of newer generation nail and adjunctive techniques like angle stable multidirectional distal locking screws as well as polar screws, maintenance of reduction can be better achieved nowadays. [21] Ali et al [22] reported shorter operation time and faster fracture healing time in reamed IMIL nailing compared with MIPPO. Nevertheless, some studies reported that with the development of biologic techniques, plate fixation provides stable fixation and a low rate of infection for distal tibial fractures. [23]

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.

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