

**Comparative Prospective Study of Management of Distal Tibia
Extra Articular Fracture with Nailing and MIPO Plating**

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ABSTRACT

Introduction: The tibial fractures are commonly associated with soft tissue injury, if these are not adequately treated, the patient may become seriously disabled. The most frequent cause is high intensity motor vehicle trauma, which is followed by sports injuries, falls, and direct blows. The frequency of fractures of the distal tibia in most series is 0.6%, and it constitutes to about 10%–13% of all tibial fractures. Two widely used and successful techniques, intramedullary interlocking nails (IMLN) and minimally invasive plate osteosynthesis (MIPO), have a history of problems. Following IMLN, malalignment and knee pain are commonly reported however, in certain series, tibial plating has been linked to wound problems and implant prominence. The present study aims to compare the functional outcomes between IMLN and MIPO by locking compression plate in the management of distal tibial fractures.

Methods: The present study was conducted in the department of orthopedics, the study included a total of 50 patients presented with distal tibia fractures based on inclusion and exclusion criteria after taking informed consent. The patients presented with distal tibial fractures were randomly allocated into two groups, IMLN group and MIPO group. The functional outcomes were compared between the two groups.

Results: Postoperative complications were evaluated between the two groups, it is seen that the complications were significantly more in MIPO group in comparison to IMLN group as represented in Table 4. The functional outcomes were evaluated between the two groups, it is found that 14 (56%), 6 (24%) and 5 (20%) had Excellent, Good and Fair outcomes in IMLN group, whereas in MIPO group 10 (40%), 7 (28%), 7 (28%) and 1 (4%) patients had Excellent, Good, Fair and poor outcomes as represented in Table 5.

Discussion and Conclusion: According to our research, the IMLN group is a better option for fixing extra-articular distal tibial fractures because of its shorter surgical timespan, quicker weight bearing and union rate, lower incidence of infection, and decreased risk of implant irritation and failure.

Key-words: tibial fractures, intramedullary interlocking nails, minimally invasive plate osteosynthesis and functional outcomes

Introduction

The tibial fractures are commonly associated with soft tissue injury, if these are not adequately treated, the patient may become seriously disabled. The most frequent cause is high intensity motor vehicle trauma [1], which is followed by sports injuries, falls, and direct blows. The frequency of fractures of the distal tibia in most series is 0.6%, and it constitutes to about 10%–13% of all tibial fractures [2]. Distal tibial metaphysis is defined as by constructing a square, with sides of length defined by widest portion of tibial plafond [3]. Because of its subcutaneous location, poor blood supply and decreased muscular cover anteriorly, complications such as delayed union, non-union, wound infection, and wound dehiscence are often seen as a great challenge to surgeon.

Two widely used and successful techniques, intramedullary interlocking nails (IMLN) and minimally invasive plate osteosynthesis (MIPO), have a history of problems. Following IMLN, malalignment and knee pain are commonly reported [4,5] however, in certain series, tibial plating has been linked to wound problems and implant prominence [6].

The present study aims to compare the functional outcomes between IMLN and MIPO by locking compression plate in the management of distal tibial fractures.

Materials and Methods

The present study was conducted in the department of orthopedics, the study included a total of 50 patients presented with distal tibia fractures based on inclusion and exclusion criteria after taking informed consent.

Type of the study: Prospective comparative study

Sample size: 50 (25 patients per group)

Sampling method: simple random sampling

Inclusion criteria: fractures meeting AO criteria, age more than 18 years those who gave valid consent, presence of distal fragment of at least 3 cm in length without articular incongruity, duration of injury <2 weeks were included in the study.

Exclusion criteria: Patients with open fractures, intraarticular extension, pathological fractures, poor medical health, were excluded from the study.

Data collection and General Physical Examination: A thorough history was taken and a head-to-toe physical examination was performed as soon as the patient was admitted. Radiographs of the affected leg with knee and ankle joint were taken and the leg was immobilized in posterior splint till the surgery and routine preoperative investigations were done. After

anesthetic clearance, the patient was taken up for surgery. A patient who presented within 6 h of injury without gross swelling of leg were operated on the same day or next available day. Limbs with gross swelling were splinted and elevated till swelling subsided, and wrinkles appeared over the ankle joint. Fracture blisters if present managed with puncturing with sterile needle and non-adhesive dressing and observed closely for any sign of secondary infection.

Operative procedure

Under spinal anaesthesia, patients had supine operations on a conventional radiolucent table. A precautionary intravenous antibiotic course was started fifteen minutes prior to the skin incision. In each instance, fluoroscopic guidance was provided by an image intensifier. On a radiolucent table, the patient was positioned supine with the hips flexed 45° and the knees flexed 90°. A 5-cm incision was made from the tibial tubercle in a proximal direction along the patellar tendon's medial border. In order to safeguard the tendon during insertion and reveal the insertion site, the patellar tendon was retracted laterally. Next, the insertion of the awl occurs at the junction where the anterior tibia meets. Utmost care is taken to stay in the extra-articular area because back of the nail may impinge on the femoral condyle. Nailing was done using standard technique and all fractures were fixed with two proximal and two distal locking screws.

The leg was draped loose and prepped circumferentially from the toes to the mid-thigh in MIPO. Over the medial malleolus, a longitudinal incision measuring 3-5 cm in length was created, deep enough to allow screws to be inserted into the distal piece. The saphenous vein and nerve were withdrawn anteriorly and preserved. The blunt tip of the plate was then used to create an epiperiosteal space tunneling toward the diaphysis. Manual traction and manipulation were used to achieve the decrease. The leg was draped loose and prepped circumferentially from the toes to the mid-thigh in MIPO. Over the medial malleolus, a longitudinal incision measuring 3-5 cm in length was created, deep enough to allow screws to be inserted into the distal piece.

The saphenous vein and nerve were withdrawn anteriorly and preserved. The blunt tip of the plate was then used to create an epiperiosteal space tunneling toward the diaphysis. Manual traction and manipulation were used to achieve reduction.

Postoperative protocol

Radiograph with standard anteroposterior and lateral view of the involved leg was taken immediate postoperatively, at 6 weekly intervals till union and at 1 year follow-up. Active range of movements of knee and ankle joint along with quadriceps strengthening exercises were started on the next day of surgery. Weight bearing was started after radiographic

assessment showed signs of union as bridging callus in three out of four cortices and clinically as the absence of tenderness and movement at the fracture site.⁷ This finding suggested the fracture site has sufficiently consolidated so as to allow partial weight bearing which usually occurs by 6–8 weeks. By the end of the 3rd month if there were no signs of callus formation in interlocking nailing group then dynamization was done and advised partial weight bearing and patient was called after 6 weeks for radiological follow-up. A clinical evaluation for the functional assessment of the ankle was obtained at each visit using the American Orthopedic Foot and Ankle Society (AOFAS) score. The final results at the end of 1 year follow-up were evaluated using the “Johner and Wruhs’ Criteria” as excellent, good, fair, and poor [8].

Results

Table 1: Demographic profile of the patients (total no 50)		
	IMLN group (no=25)	MIPO group (no=25)
Age	36.43 ± 3.26	35.64 ± 2.78
Gender		
Male	17 (68%)	18 (72%)
Female	8 (32%)	7 (28%)
Side		
Left	19 (76%)	17 (68%)
Right	6 (24%)	8 (32%)
Mode of injury		
RTA	18 (72%)	20 (80%)
Self-injury	3 (12%)	2 (8%)
Other causes	4 (16%)	3 (12%)

Table 2: AO Classification		
	IMLN group (no=25)	MIPO group (no=25)
Type 43A1	14 (56%)	15 (60%)
Type 43A2	6 (24%)	5 (20%)
Type 43A3	5 (20%)	5 (20%)

Table 3: Comparison of operative time, weight bearing and union time between IMLN and MIPO group		
	IMLN group (no=25)	MIPO group (no=25)
Duration of surgery (in minutes)	58.67 ± 7.86	67.98 ± 6.24
Weight bearing (in weeks)		
Partial weight	5.12 ± 1.04	7.23 ± 1.26
Full weight bearing	11.22 ± 1.24	14.23 ± 1.32
Union time (in weeks)	18.26 ± 2.56	22.64 ± 2.66

Table 4: Comparison of complications between IMLN group and MIPO group		
	IMLN group	MIPO group
Anterior knee pain	4 (16%)	1 (4%)
Knee stiffness	2 (8%)	0 (0%)
Ankle stiffness	1 (4%)	6 (24%)
Superficial infection	0 (0%)	4 (16%)
Deep infection	0 (0%)	2 (8%)
Delayed/Non-Union	1 (4%)	1 (4%)
Implant irritation	0	5 (20%)

Table 5: Functional outcomes between IMLN group and MIPO group		
	IMLN group	MIPO group
Excellent	14 (56%)	10 (40%)
Good	6 (24%)	7 (28%)
Fair	5 (20%)	7 (28%)
Poor	0 (0%)	1 (4%)

Discussion

When an orthopaedic surgeon is faced with an extra articular distal tibial fracture, the therapeutic approach can sometimes be complicated by the soft tissue state and degree of comminution. Obtaining anatomical alignment of the joint surface while offering sufficient stability to permit early motion is the aim of operative treatment. The goal is to reduce treatment-related problems, hence methods that limit osseous and soft tissue devascularization should be used to achieve this.

IMLN has long had an advantage over alternative techniques due to its early weight bearing and union rate as well as lower infection incidence. Percutaneous plating has become a challenge to interlocking nailing with the advent of minimally invasive surgery. This is because locked plate designs function as fixed-angle devices whose stability is supplied by the axial and angular stability at the screw-plate interface rather than depending on the frictional force between the plate and bone, which is believed to maintain the periosteal blood supply surrounding the fracture site [9].

In the present study, the demographics profile shows that the mean age of patients in IMLN and MIPO groups were 36.43 ± 3.26 and 35.64 ± 2.78 years respectively. Number of males and females in IMLN and MIPO groups were 17 (68%), 18 (72%), 8 (32%) and 7 (28%) respectively. In IMLN group 19 (76%) and 6 (24%) had left leg and right leg distal tibial fractures and in MIPO group 17 (68%) and 8 (32%) had left leg and right leg distal tibial fracture respectively. 18 (72%), 3 (12%) and 4 (16%) had RTA, self-injury and other causes of injury in IMLN group. Similarly, 20 (80%), 2 (8%) and 3 (12%) had RTA, self-injury and other causes of injury in MIPO group as presented in Table 1.

AO fractures were classified into type 1-3, in IMLN group it is seen that 14 (56%), 6 (24%), and 5 (20%) belong to type 43A1, type 43A2, and type 43A3 respectively. Similarly, in MIPO group 15 (60%), 5 (20%), and 5 (20%) had type 43A1, type 43A2, and type 43A3 distal tibial fractures respectively, represented in Table 2.

Table 3 shows that the mean of duration of surgery, partial weight bearing, full weight bearing and union time showed significant differences between the two groups. It is evident that the duration of surgery was less in IMLN group, union time, full and partial weight bearing was better in IMLN group as compared to MIPO group.

Postoperative complications were evaluated between the two groups, it is seen that the complications were significantly more in MIPO group in comparison to IMLN group as represented in Table 4.

The functional outcomes were evaluated between the two groups, it is found that 14 (56%), 6 (24%) and 5 (20%) had Excellent, Good and Fair outcomes in IMLN group, whereas in MIPO group 10 (40%), 7 (28%), 7 (28%) and 1 (4%) patients had Excellent, Good, Fair and poor outcomes in MIPO group as represented in Table 5.

Conclusion

According to our research, the IMLN group is a better option for fixing extra-articular distal tibial fractures because of its shorter surgical timespan, quicker weight bearing and union rate,

lower incidence of infection, and decreased risk of implant irritation and failure. Based on the intraoperative reduction of the tibia fracture, the fibula was fixed. Only when considerable misalignment persisted following tibia repair was the choice to treat fibula fracture taken.

Authors declare no conflict of interest

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