

A Study of Functional Outcome of Distal Tibia Fracture Treated With LCP Using MIPPO Technique

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Abstract-Fractures of the distal tibia are one of the most challenging for treatment because of limited soft tissue, subcutaneous location of bone, and reduced vascularity. These fractures are increased frequently with road traffic accidents. Nowadays, these fractures are treated with LCP using minimally invasive percutaneous plating osteosynthesis (MIPPO).

Objective- To evaluate the functional and radiological results of LCP using minimally invasive percutaneous plating osteosynthesis (MIPPO).

Methodology- The present study was conducted in the department of orthopedics, Narayana General Hospital, attached to Narayana Medical College, Nellore. In our study, 15 patients of both males and females included with distal tibia fracture operated by LCP using the MIPPO technique, and they were assessed clinically, functionally, and radiological evaluation. They were followed up at a regular interval of 6 weeks, 3 months, and 1 year. Based on AOFAS, the clinical outcome evaluated

Results- In our study, The mean age was 45.67 ± 7.55 (>18 years of age) with male predominance (60%), average time between injury and surgery is 3-4 days, average duration of surgery was 1 hour to 1 and half hour mean interval period was 8.2 months, average period of consolidation was 24 to 26 weeks, all patients achieved functional range of ankle movements during follow up period of 6 months to 1 year. The functional outcome was measured using the AOFAS score was 88 at the end of 26 weeks. Complications like 1 case of the plate exposed, 2 cases of superficial infections, and 1 case of wound dehiscence and no other complications like compartment syndrome, non-union, implant failure.

Conclusion – LCP using the MIPPO technique is a biologically, friendly, and technically sound method of fixation. While applied subcutaneously, it has many advantages like less soft tissue damage, does not endanger periosteal blood supply, and does not disturb the fracture hematoma, and it results in fewer complications. LCP using MIPPO more suitable at metaphyseal comminution fracture

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I. Introduction

Fractures of the distal tibia are one of the most challenging for treatment because of limited soft tissue, subcutaneous location of bone, and poor vascularity. The fastest growth of technology and urbanization has led to a massive increase in vehicles on the road, and mostly motor vehicle accidents cause long bone fractures, particularly tibia due to subcutaneous location. Mainly these fractures can be managed by various methods like nonoperative treatment, external fixation, intramedullary nailing open reduction with small wire fixation, and plates. However, each of these options has associated with certain complications. In recent times, practices of closed reduction and minimally invasive plate osteosynthesis (MIPO) with locking compression plate (LCP) has emerged as a substitute treatment option for distal tibia fracture. When applied subcutaneously, respect fracture hematoma, LCP does not endanger periosteal blood supply, and also provides a biomechanically stable construct (7). The numbers of earlier clinical studies have established MIPO with LCP as a biologically friendly and technically sound method of fixation for distal tibia fracture. Here we assess the results of the treatment of Distal Tibial Fracture by Minimally Invasive Percutaneous Plate Osteosynthesis using Locking Compression

Plate - a prospective study. The objective of this study was to evaluate the functional and radiological results of LCP using minimally invasive percutaneous plating osteosynthesis (MIPPO) technique in distal tibia fracture.

II. Materials & Methods

This prospective observational study was carried out on patients of the Department of orthopedics at Narayana Medical College & Hospital, Chinthareddypalem, Nellore, Andhra Pradesh from September 2017 to July 2019. A total of 15 subjects of both sexes, of age more than 20 years were included in this study,

Study Design: Prospective observational study.

Study Location: This was tertiary care teaching hospital-based study done in the Department of Orthopedics at Narayana Medical College & Hospital, Chinthareddypalem, Nellore, Andhra Pradesh.

Study Duration: September 2017 to July 2019.

Sample size: 15 patients.

Subjects & selection method: The study population was done on all adults (> 18 years age) who were admitted to Narayana Medical College & Hospital with distal tibia fractures during the period from September 2017 to July 2019. All the adults who will be operated during this period are included in the study. The patients were evaluated clinically and radiologically. All the patients were followed up for an average of 6 months to 1 year. The outcome was assessed using the AOFAS Score

Inclusion criteria –

- 1) Adult patient more than 20 years of age
- 2) Closed fractures and compound -Gustilo & Anderson classification type I and type 2
- 3) Extra-articular – metaphyseal simple, metaphyseal wedge, and metaphyseal comminution

Exclusion criteria–

- 1) patients are not fit for surgery and anaesthesia
- 2) Open fractures
- 3) Pathological fractures
- 4) Partially articular distal 1/3rd tibial fractures
- 5) Intraarticular fracture
- 6) Compound injury-Gustilo and Anderson type 3

Procedure Methodology: All adults more than 18 years of age with distal 1/3rd tibia fractures of tibia admitted at NMCH, Nellore - meeting the inclusion and exclusion criteria were subjects for the study. As soon as the patient was brought to casualty, the patient's airway, breathing, and circulation were assessed and a complete survey carried out to rule out other injuries. Plain radiographs of anteroposterior & lateral views of – leg including knee joints & ankle for tibia to assess the site of the fracture, the extent of comminution & displacement were taken. On admission, detailed history was taken & examination is done and posted for surgery. Routine preoperative precautions are taken. Intraoperative assessment: the length of the plate is chosen, such that each plate should be 3 times larger than fracture. Pre-operative assessment of the length of plate chosen

Diagnostic criteria: Distal tibia fractures: Fracture of the distal 1/3rd of the tibia present 4cms-11cms above the intraarticular distal tibial surface.

Evaluation of Syndesmosis The simplest method is to measure the distance between the medial wall of the fibula and the incisura surface of the tibia. This tibiofibular clear space should be less than 6 mm on both anteroposterior and Mortise views. The tibiofibular overlap of less than 10mm is abnormal and implies syndesmotic injury.

Computed Tomography-The computed tomography (CT) scan helps to delineate bony anatomy, especially in patients with an intraarticular distal tibia injury

Magnetic Resonance Imaging-The magnetic resonance imaging (MRI) may be used for assessing occult cartilaginous, ligamentous, or tendinous injuries.

Pre-operative preparation of the patient for plating

-Preparation of Patients were kept nil by mouth (NBM) for 6 to 8 hours before surgery. --An adequate amount of compatible blood, if needed, was arranged.

whole extremity/ private parts and back was done.

-Written informed consent was taken I.V. antibiotics given one hour before the procedure.

Surgical techniques of MIPPO plating-Patients were operated under aseptic conditions, under spinal/epidural anesthesia in a supine position; tourniquet applied at the proximal thigh.

- The affected limb is scrubbed thoroughly from mid-thigh to foot, with betadine, after that painting with betadine from mid-thigh to foot, draping done. Tourniquet inflated, after the elevation of the affected limb

A small incision of size 5 cm (curvilinear or vertical incision) given at anteromedial region at the level of the distal tibial articular surface and extend proximally along the medial surface taking care, not to injure the saphenous vein and nerve



Subcutaneous tissue incised and elevated with long-handled periosteal elevator and the plate introduced a 4.5 mm system below the tunnel with the help of the locking sleeve, another end of the plate is palpated 3 to 5 cm size incision given. By using 2.5 to 3 mm K-wire for temporary fixation of plate distally and proximally and reduction checked under (IITV) for reduction of fracture fragments and length of plate alignment



- It is appropriate (ap angulations $< 10^\circ$, shortening $< 15\text{mm}$ and varus/ valgus $< 5^\circ$) was considered acceptable criteria for reduction, before applying screw sagging of distal fragment was prevented by putting towel roll under fracture site, distal cancellous screw is fixed, and proximally near the fracture site of proximal fragment one cortical screw in fixed compression osteosynthesis was achieved as hybrid fixation.
- K-wire removed and allowed three locking screws applied on either side of fracture was given with normal saline. Homeostasis achieved. Subcutaneous suturing done with absorbable suture material. Skin sutured with non-absorbable suture material.
- Tourniquet deflated, compression bandage applied below-knee slap applied posteriorly.

POSTOPERATIVE CARE FOR PLATING PATIENTS

- NBM for 4 to 6 hours postoperatively, I.V. Antibiotics and I.M. Analgesics, limb elevation over the pillow, active toe and ankle movements
- Check x-ray of operated tibia full length including knee and ankle joints in both AP and LAT view I.V. Antibiotics for 1st five days of the postoperative period, after that switch to oral antibiotics for 7days. Patients allowed no weight-bearing crutch walking on 1st postoperative day, 2nd and 5th POD dressings, 11th or 12th POD suture removal, only if there is no gaping and surgical wound is healed Partial weight-bearing using walker after 3weeks /depending upon type of fracture and rigidity of fixation, after that every month up to 2months follow up, after 6months after surgery, patient was individually assessed clinically and radiologically

Statistical Method

Frequencies--The Frequencies procedure provides statistics and graphical displays that are useful for describing many types of variables.

Independent-Sample T-Test- The Independent-Samples T-Test procedure used means for two groups of cases. The subjects should be assigned to two groups so that any variation in response is due to the treatment and not to other different factors.

III. Observation & Results

Table 1 Age Distribution

Age in groups(in years)	No; of cases	percentage
25-35	1	6.67
36 -45	5	33.33
46 -55	8	53.33
>56	1	6.67
Total	15	100

Table 2 Mean Age

Mean	45.67
Standard deviation	7.55

Table 3 Sex Distribution

Sex	No; of patients	percentage
Male	9	60.00
female	6	40.00
Total	15	100
Sex ratio	60:40	

Table 4 Plating Procedure

Procedure of plating	No; of patients	percentage
closed	0	-
open	15	100
Total	15	100

Table 5 Mode of Injury

Mode of injury	No: of patients	percentage
Fall from height	1	6.67
RTA	12	80.00
Twisting of ankle	2	13.33
	15	100

Table 6 weight-bearing

Weight-bearing	Number of patients	Percentage%
Delayed	15	100
Immediate	0	0
Total	15	100

Table 7 Knee ROM

KNEE ROM	NUMBER OF PATIENTS	PERCENTAGE%
FULL	13	86.67
NORMAL	2	13.33
NEAR NORMAL	0	0
TOTAL	15	100

Table 8 Ankle ROM

Ankle ROM	Number of patients	Percentage %
Full	7	46.67
Near normal	5	33.33
Midrange	3	20.00
Total	15	100

Table 9 Time for union

	Union in months
Mean	4.47
Standard deviation	0.67

Table no 10 Complications

	Number of cases	Percentage %
Delayed union	0	0
Plate exposed	1	6.772
Superficial infection	2	13.33
Wound dehiscence	1	6.772
Malunion	0	0
Varus/valgus	0	0
Implant failure/non-union	0	0
Total	4	26.874



PRE-OPERATIVE X-RAYS

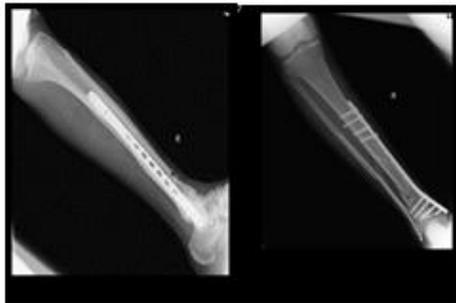
IMMEDIATE POST-OPERATIVE X-RAYS



1-YEAR FOLLOW UP X-RAYS



CLINICAL ANKLE MOVEMENTS



PREOPERATIVE X-RAYS



IMMEDIATE POSTOP X-RAYS



FOLLOW UP OF 6 MONTHS

AFTER 1-YEAR



CLINICAL ANKLE ROM

IV. Discussion

In our study, the distal 1/3rd tibia fractures are more common due to RTA, accounting for 12 cases, fall from height 1 case, and twisting of injury 2 cases. The mean age of patients ranges from 33 to >56 and average age of patients 33.33 years. Mostly 9 male patients (60%) are involved, and 6 female patients (40%) involved, the average sex ratio is 60:40. In our study, mostly all patients have delayed weight-bearing and early mobilization of ankle, and toes movements, and no immediate weight-bearing is seen. Range of movements in the ankle, full range seen in 7 cases (46.67), near to normal in 5 cases (33.33), and midrange of movements in 3 cases (20). In our study, union attained in 4 to 5 months (4.47 months average) due to the preservation of fracture hematoma without disturbing. Distal tibia fractures associated along with soft tissue injury and comminution of metaphyseal and articular fracture fragments of tibial plafond due to high energy trauma. This type of fractures is challenging because of its subcutaneous location, poor vascularity, and limited soft tissues. LCP using MIPPO technique has advantages in treating distal tibia fracture like minimal incision, less iatrogenic soft tissue damage preserving

fracture hematoma and blood supply to bone fragments with minimal complications like superficial infection in 2 cases(13.33),plate exposed in 1 case(6.772), and wound dehiscence in 1 case (6.772)and no compartment syndrome,fat embolism and peroneal nerve palsy seen in our study.All 15 cases operated by open method, no cases are operated under closed techniques like nailing,external fixator.

V. Conclusion And Summary

LCP using the MIPPO technique is an ideal method in treating distal 1/3rdtibia fractures,which provides stable biomechanical construct and biologically friendly, technically soundmethod of fixation.Benefits in this method include minimal incision, less soft tissue damage, preservation of the fracture hematoma, and periosteal blood supply with fewer complications like superficial wound infection, plate exposure, wound dehiscence. Complications like compartment syndrome, fat embolism, peroneal palsy are absent compared to open reduction and internal fixation. In our study LCP using MIPPO results in early union with better cosmetic results and functional and radiological outcome.

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