

Original research article

Assessment of Outcome of MIPPO in Distal Tibia Fractures Using Locking Compression Plate - A Retrospective Study**Dr. Sijo Joseph Pakalomattom¹, Dr. Venatius Varghese², Dr. A M Georgekutty³, Dr Faizal Ali A A⁴, Dr. Mohammed Salil⁵****¹ Associate Professor, Department of Orthopaedics, Government Medical College, Ernakulam, Kerala, India.****² Senior Resident, Department of Orthopaedics, Government Medical College, Ernakulam, Kerala, India.****³ Professor, Department of Orthopaedics, Government Medical College, Ernakulam, Kerala, India.****⁴ Associate Professor, Department of Orthopaedics, Government Medical College, Ernakulam, Kerala, India.****⁵ Senior Resident, Department of Orthopaedics, Government Medical College, Ernakulam, Kerala, India.****Corresponding Author: Dr. Venatius Varghese.****Email: venown@gmail.com****Abstract**

Background: Distal tibial fractures are one of the most complex injuries around the ankle joint, accounting for approximately 7% of all tibial fractures. Fractures of the distal tibial metaphysis with or without intra-articular extension can present a management challenge because of their inherent instability, scarcity of soft tissues, subcutaneous nature and poor vascularity of bone

Methods: This was a retrospective study of 30 patients to evaluate the functional and radiological results of Locking Compression Plate (LCP) osteosynthesis in distal tibial fractures using Minimal Invasive Percutaneous Plate Osteosynthesis Technique (MIPPO).

Results: There were 30 patients in the study including 10 males and 20 female of mean age 45 years. The mean follow up period of our patients varied ranging from 10 months to 24 months (average– 18 months). All fractures united at an average of 18 weeks (range- 16 to 24 weeks) except two cases of delayed union(>20 weeks). There were 2 superficial wound infections and one case of deep infection which were treated with oral antibiotics and progressed to union and there were no failures of implant. No other complications like deformities, compartment syndrome, non-union, implant irritation/skin impingement or implant failure were seen in our study. There was full range of motion patient except for two patients with restriction of plantar flexion. Two patients had mild pain on walking.

Conclusions: The above study shows that MIPO technique is a safe, effective method to treat distal third tibia fractures with good radiological and functional outcome. The use of indirect reduction techniques and small incision is technically demanding as it is effective, minimally invasive, optimises the operation time, promotes early healing and reduces the incidence of infections

Keywords: MIPPO, distal tibia fracture, locking compression plate

Introduction

Distal tibial fractures are one of the most complex injuries around the ankle joint, accounting for approximately 7% of all tibial fractures. Fractures of the distal tibial metaphysis with or without intra-articular extension can present a management challenge because of their inherent instability, scarcity of soft tissues, subcutaneous nature and poor vascularity of bone(1). A better understanding of the injury patterns, availability of better implants, the concept of early surgical fixation, and early post-operative mobilization of joint all have convincingly improved the functional outcome of the patient to a large extent^(2,3). Surgical fixation is considered for most distal tibia fractures which require meticulous preoperative planning. Available options for stabilizing fractures are external fixators, interlocking nails and locking plates. The factors determining the fixation methods are pattern of fracture, quality of bone and condition of soft tissues^[4-7]. Although intramedullary nailing minimizes surgical trauma to already traumatized soft tissues envelop, but is generally not considered suitable for distal tibial fractures because of lack of biomechanical stability of fixation and subsequent risk of malunion. Conventional plating results in extensive soft tissue dissection and periosteal injury, further compromising the blood supply to already traumatized soft tissues. External fixators are effective in managing compound fractures and fractures associated with extensive soft-tissue injury, but are also not free of complications, and are associated with a high incidence of pin tract infection, loosening and malunion⁽⁸⁾. A mechanically stable fracture-bridging osteosynthesis can be obtained without significant dissection and surgical trauma to the bone and surrounding soft tissues by minimally invasive percutaneous plate osteosynthesis (MIPPO)⁽⁹⁾. In our study we evaluate the radiological and functional outcome of MIPPO with locking compression plate by retrospective method .

METHODS

This retrospective study was conducted in the Department of Orthopaedics, Government medical college, Ernakulam after the institutional research committee and ethics committee approval . The study group was patients who presented to the Department of Orthopaedics, Government medical college, Ernakulam with distal tibia fractures from July 2017 to July 2019. Inclusion criteria: All patients above the age of 18 years of either sex with closed or compound fractures of distal tibia up to Grade II or patients with osteoporotic bones.

Exclusion criteria: head injury, chest injury, pathological fractures, ASA criteria >3, and patients with Gustilo Type III compound injuries or previously treated fractures. We found 30 patients who met the criteria. All patients who were operated for distal tibia fractures (closed/upto Gustilo Anderson type 2/osteoporotic) with locking compression plate MIPO from July 2017- July 2019 in Government medical college Ernakulam .Follow-up data that was taken routinely for all patients at 2 weeks, 6 weeks, 12 weeks, and 6 months postoperative will be collected from the patient's case sheets and documents. The follow up data which includes serial leg x-rays and clinical examination data will be used to assess the radiological and functional outcome respectively. The fracture was designated as united, when there was periosteal bridging callus at the fracture site at least in three cortices in the anteroposterior and lateral views. Post op complications of implant breakage , surgical site infection , non union , malunion was assessed .The functional outcome was assessed with clinical features including pain, range of motion , deformity.

RESULTS

In this study, thirty cases with thirty fractures of lower one-third fractures of tibia in adults were surgically managed by closed reduction and internal fixation using minimally invasive percutaneous plate osteosynthesis (MIPPO) with LCP from July 2017 to July 2019 at

ernakulam medical college. Of this group twenty were females and ten were males which was 66% and 34 % respectively(table1). Right leg was involved in 18 cases and 12 cases involve left leg .The average period of follow was 8 months which varies from 5 months to 1.5 years. The age of the patient in this study, ranged from 22 years to 70years average being 45 years(table 2). Of 30 patients 20 were closed fracture and 10 were type 1 open fracture. • 10 cases sustained fracture following road traffic accident (high energy trauma) and 20 cases sustained fractures following self-fall (low energy trauma). The fractures united in 26 patients with 4 case of delayed union, which took 20 weeks of time period for the radiological signs of callus formation(table 3) with mean time of 18 weeks . The fracture was additionally supported by an above knee plaster of Paris slab postoperatively for 10 days and later converted to complete below knee walking cast and patient was made to walk with restricted weight bearing over operated limb. Post operatively patients after 4 to 6 weeks depending on the check x ray patients were allowed full weight bearing. Post-operatively, 2 patient developed superficial skin infection and 2 patients developed ankle stiffness which was improved with antibiotics and physiotherapy respectively. One case of deep infection was treated with wound debridement and intravenous antibiotics. Serial follow up at 6 weeks , 3 months , 6 months showed improved range of motion ankle joint . Good amount range of mobility of ankle joint was present in almost all patients except for two patients with restriction of plantar flexion. . There was two cases of mild pain on walking . There was no case of deformity after fracture healing.

TABLE 1: GENDER DISTRIBUTION OF STUDY

GENDER	No. OF PATIENTS	PERCENTAGE
FEMALE	20	66%
MALE	10	34%
TOTAL	30	100%

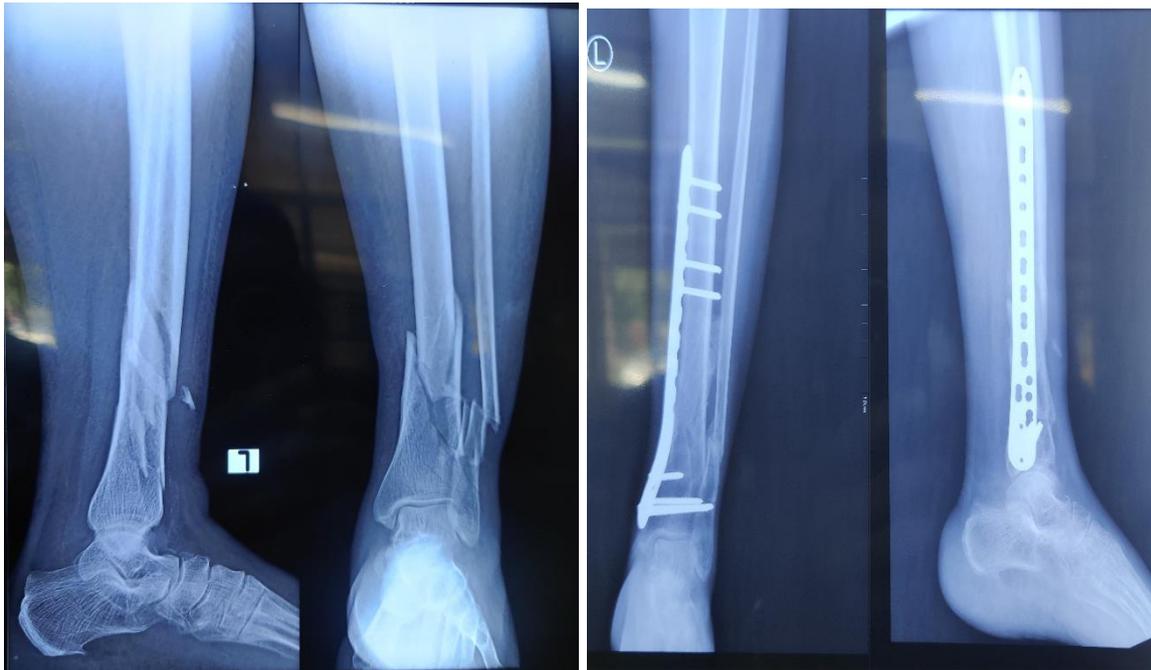
TABLE 2: AGE DISTRIBUTION OF STUDY

AGE	No. OF PATIENTS	PERCENTAGE
< 30	3	10%
40-50	10	33%
50 -60	11	37%
>60	6	20%
TOTAL	30	100%

TABLE 3: DURATION OF UNION OF FRACTURE

DURATION IN WEEKS	No. OF PATIENTS	PERCENTAGE
16 WEEEEKS	6	20%
20 WEEKS	20	66%
24 WEEEEKS	4	14%

RADIOLOGICAL ILLUSTRATIONS



PRE OP XRAY

6 MONTHS FOLLOW

CLINICAL PHOTOS



DISCUSSION

Multi-fragmentary distal tibial fractures are challenging to manage because of thin soft tissue coverage and easily compromised blood supply (10,11). The goal of the techniques is to apply stable fixation while maintaining the fracture biology and minimizing the soft tissue problems(12-14). Open reduction and internal fixation leads to increased risk of infection and non-union (6,7). Results of operative treatment depend on the severity of the initial injury, the quality of bone and soft tissue, stability of the reduction, the degree of comminution and articular incongruity. With the development of technique of MIPPO with LCP, which preserve extra osseous blood supply, respect osteogenic fracture hematoma, biologically friendly and stable fixation method is available for distal diaphyseal tibia fracture. Indirect reduction method and sub-cutaneous tunneling of the plate and application of locking screws with small skin incisions in MIPPO technique prevents iatrogenic injury to vascular supply of the bone.

Unlike conventional plates, LCP is a friction independent self-stable construct, which provides both angular and axial stability and minimizes risk of secondary loss of reduction through a threaded interface between the screw heads and the plate body.

Hazarika et al treated 20 patients who had open and closed distal tibia fractures with minimally invasive locking plate osteosynthesis (7). In our study we have 30 patients who underwent MIPPO for distal tibia fracture which includes open fracture too. We have done a retrospective study in our institute for above cases. Paramesh et al (15) had more percentage of males compared to females. In our study 66% were females and rest were males. The mean age of study patients was 45 years compared to 40.5 years paramesh et al(15). All 20 patients were closed fracture in Paramesh et al(15) study but in our study 10 cases were open type 1 fracture and 20 cases were closed fracture. Right leg was involved in 18 cases and 12 cases involve left leg in our study. 10 cases sustained fracture following road traffic accident (high energy trauma) and 20 cases sustained fractures following self-fall (low energy trauma). Paramesh et al (15) had more percentage of high energy trauma causing fracture compared to our study.

In spite of use of mipo with LCP as internal external fixators, anatomical reduction of the fracture by using indirect reduction maneuvers before applying the plate is very important surgical step(16). We reduced fracture under arm with help of K wires and manual traction. Though a few authors advocate fixation of fibula before fixation of the tibia to achieve a better alignment and to prevent valgus/varus malalignment, no clear-cut indication/ protocol exists as far as fibula fracture fixation is considered. No routine fixation of the fibula fracture was done in the present study. No secondary procedures like percutaneous bone marrow injection /bone grafting were done for delayed union.

Redfern et al (6) study with 20 patients of distal tibia fracture showed mean union time of 23 weeks which more compared to over study with average union time of 18 weeks (range 16-24 weeks). study with 54 patients showed average union time of 17.5 weeks which was comparative study on outcome of closed intramedullary nailing with minimally invasive plate osteosynthesis using a percutaneous locked compression plate in patients with a distal metaphyseal fracture. Borg *et al.* (18) study showed an average union time of 20 weeks with sample size of 21 patients. Hasenboehler et al(19) with 32 patients sample size showed 75% at 6 m, 84% at 9 union rate.

There was 10% of cases of surgical site infection our study compared to Borg *et al.* (18) with 14% and Redfern et al (6) with 5%. Hasenboehler et al(19) had 3% of infection post operatively of 32 patients operated and Williams et al.(20) had 10.5 % cases of infection with a sample size of 20. Minimal soft tissue damage and smaller incision has decrease the chance of infection.

Borg *et al.* (18) had a 19% of delayed union compared to our study with 14% with similar sample size. Williams et al.(20) had 31% of delayed /non union in their study with same sample size which is double the size of our study. Ronga et al.(21) study with 21 patients had delayed /non union of 4.8%. 17.2 % of delayed/non union was present in Hasenboehler et al(19) study with 32 patients. There was no case of non union in our study. There was no case of implant breakage or loosening in our study. Serial follow up at 6 weeks, 3 months, 6 months showed improved range of motion ankle joint. Good amount range of mobility of ankle joint was present in almost all patients. There was two cases of mild pain on walking. There was no case of deformity after fracture healing. Our study shows MIPPO for distal tibia fracture has good radiological and functional outcome although our study sample is small.

CONCLUSION,

Minimal invasive was used for definitive fixation of high energy, open and closed, peri-articular distal tibia fractures. The advantage with MIPPO is that fracture haematoma is not disturbed much. This approach aims to preserve bone biology and minimise surgical soft tissue trauma. The use of indirect reduction technique and small incision is technically demanding as it is effective, minimally invasive, safe. Although, a larger sample of patients and longer follow up are required to fully evaluate this method of treatment, we recommend fixation of distal third tibia fractures with LCP using MIPO technique.

DECLARATIONS

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Ethical approval: IRB approval was obtained for the submitted work at our institution.

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