National Journal of Clinical Orthopaedics

ISSN (P): 2521-3466
ISSN (E): 2521-3474

www.orthoresearchjournal.com
2021; 5(3): 157-160
Received: 13-05-2021
Accepted: 15-06-2021

Dr. Pradyot Basak
Assistant Professor, Tripura Medical College & Dr Bram Teaching Hospital, Hapania, Agartala, Tripura, India

Dr. Rajib Debnath
Assistant Professor, Tripura Medical College & Dr Bram Teaching Hospital, Hapania, Agartala, Tripura, India

Dr. Abhijit Sarkar
Professor & Hod, Tripura Medical, College & Dr Bram Teaching Hospital, Hapania, Agartala, Tripura, India

Dr. JM Datta
Senior Resident, Tripura Medical College & Dr Bram Teaching Hospital, Hapania, Agartala, Tripura, India

Corresponding Author:
Dr. Rajib Debnath
Assistant Professor, Tripura Medical College & Dr Bram Teaching Hospital, Hapania, Agartala, Tripura, India

Evaluation of functional outcome of distal tibial fractures managed with locking compression plate using minimally invasive plate osteosynthesis (MIPPO) technique

Dr. Pradyot Basak, Dr. Rajib Debnath, Dr. Abhijit Sarkar and Dr. JM Datta

DOI: https://doi.org/10.33545/orthor.2021.v5.i3c.309

Abstract
Background: Treatment of distal tibial fracture is challenging, because of precarious blood supply leading to poor healing. Various modality of surgical treatment such as closed intramedullary nailing, Open Reduction and internal fixation with conventional plate osteosynthesis and external fixation has been tried so far. But this modalities doesnot give better functional outcome and had high complication rate. The newer technique of distal tibia fractures fixation using MIPPO (minimally invasive percutaneous plate osteosynthesis), involves less soft tissue handling and minimal periosteal stripping resulting in low infection rate and faster healing.
Aim of the Study: To evaluate clinical, functional and radiological outcomes after minimally invasive plate osteosynthesis using distal tibial locking compression plates.
Materials and Methods: In this study, 30 patients with distal third tibial extra articular Metaphyseo diaphyseal fractures with or without associated fibula fractures were treated with MIPPO. The present prospective study was conducted in the department of Orthopaedics at Tripura Medical College, between August 2020 to July 2021.
Results: All fractures had a good clinical and radiological union. The fractures were stabilized with MIPPO, at an average of 6.27 days post- trauma, with an average operative time of 66.25 minutes. Functional outcome evaluation was done using Olerud-Molander ankle score, at the end of 1 year. Average radiological union time of 17.6 weeks and there were one delayed union and one nonunion. None of the cases had implant failure or any significant deformity with good to excellent results in 86.66% cases.
Conclusion: It is concluded that locking plate fixation by minimally invasive percutaneous plate osteosynthesis technique (MIPPO), is the most effective procedure for closed extra-atricular distal tibial Dia-metaphyseal fractures.

Keywords: distal tibial fracture, minimally invasive percutaneous plate osteosynthesis (MIPPO), distal tibial locking compression plates, distal tibial fractures

Introduction
Treatment of distal tibial fracture with or without articular involvement is challenging because of its anatomical characteristics which are unique like, subcutaneous location with precarious blood supply and its close proximity to the ankle joint [1].
Increased incidence of Road Traffic Accidents claims most of human mortality and morbidity in the current age. Hence, it forms the major epidemic of Modern world. Fractures of distal tibia have been difficult to treat.
Orthopaedic Surgeons goal is to restore the tibial anatomy and to avoid complications [2].
Tibial pilon fracture represents 5-7% of all the tibial fractures [3]. These are usually the result of high energy axial compression and rotation forces. They are usually associated with severe soft tissue compromise.

The difficulties in the treatment of distal tibia fractures are
1. 1. Tendency to re-displacement of fracture fragment following subsidence of swelling

specially in oblique, spiral and comminuted fractures when treated by cast.
2. Delayed union due to the precarious vascularity in distal tibia.
3. Functional and cosmetic deformation if rotational or alignment position of the fragment is not achieved, as it is important because knee and ankle joints are in same parallel axis.
4. Bone loss

Closed intramedullary interlocking nailing of distal tibia fracture can be a good option but attaining anatomical reduction is challenging resulting in rotational and angular malalignment. External fixation used as temporary stabilization in severe soft tissue injury cases. Pin tract infection, malreduction and joint stiffness are the drawbacks of external fixation.

The newer technique of distal tibia fractures fixation with MIPPO (minimally invasive percutaneous plate osteosynthesis), involves less soft tissue injury and minimal periosteal stripping resulting in low infection rate and faster healing. The Precontoured anatomical locking plate used on the medial aspect prevents the Varus collapse, implant failure and also secure the fracture reduction without further displacement. This present study describes the minimally invasive technique and its effectiveness in distal tibial fractures.

Materials and Methods

This prospective study was conducted in the department of Orthopaedics, Tripura Medical College between Aug 2020 and July 2021. 30 consecutive patients who all met the inclusion and exclusion criteria were included in this study for minimally invasive plating osteosynthesis using locking compression plates. Closed Distal tibia extra articular Metaphyseo-diaphyseal fractures in the age group of 20 to 80 years were included in the study. Inclusion and exclusion criteria were

Inclusion Criteria

1. Age >/= 20 years
2. Closed, unstable fractures of distal tibia
3. Grade I & II compound distal tibia fractures
4. Fractures in which acceptable closed reduction can be achieved.

Exclusion Criteria

1. Grade III Open fractures

On admission all patients were evaluated clinically and radiologically and were stabilized hemodynamically. Radiographs of ankle with leg AP & Lateral were taken. Splinting of fractured limb was a preliminary measure. Routine laboratory surgical profile was done for all patients and were obtained fitness for anaesthesia and surgery. Patients were operated as early as possible using MIPPO (minimally invasive percutaneous plate osteosynthesis), using locking plates. Informed consent was taken from all patients before undergoing surgery. Follow up was done at 3week.6 week. 3 months. 6 months.

Results and Analysis

30 cases of distal tibia meta-diaphyseal fractures were treated with MIPPO where the mean age of the patients ranged from 23-70 years and an average age of 45 years. The youngest being 22 years and the eldest being 73years. Most of the patients are found to be between the age group of 31 to 40 years (Table 1 and Figure 1). Out of 30 cases male patients were 21 (70%) and female cases were 9 (30%) (Table 2). Male cases were more than female cases. In this series, road traffic accidents or automobile accidents are the major cause for injury leading to tibia fracture, up to the extent of 80% (Table 3). Among all the fractures, majority were found to be of AO type 43A-1 about 19 patients (63.33%). There are 4 (13.33%) patients with AO type 43 A-2 and 7 cases (23.33%) with AO type 43 A-3 (Table 5). Around 63% right sided and 33.33% left sided cases were operated in this study (Table 4).

In this study 83.33% cases were operated within a period of 1 to 7 days and 16.66% cases were operated around 8 to 14 days after getting fitness and after treating their primary morbid conditions (Table 6).The operative time for 6 cases (11.5%) took 45 to 60 minutes, 16 cases (30.8%) took 60 to75 minutes, 22 cases (42.3%) took 75 to 90 minutes, 6 cases(11.5%) took 90 to 105 minutes, 2 cases (3.9%) took 105 to 120 minutes. Average operating time in our series was 76.5 minutes. Time taken for fracture union were 6 cases (20%) between 12 to 16 WKS, 15 cases (50%) took 16 to 20 WKS, 9 cases (30%) took 20 to 24 weeks, with mean time for radiological union of fracture was 19.6 weeks (Table 7 and Figure 2). Among 30 cases complications are seen in 3 cases (10%) who had superficial infection, 3 cases had ankle stiffness (10%), 2 cases had Varus angulation (6.66%) less than 5 degrees. 1 case had (3.33%) delayed union and 1 case(3.33%) had nonunion (Table 9). Functional evaluation was done using Olerud-Molander-Ankle Score (Table 8). At the end of 1 year, 26 cases (86.66%) had well to excellent results and fair results were observed in 4 cases (13.33%) as shown in Figure 3, 4, 5.

Table 1: Age distribution

Age	Cases	Percentage
21-30	4	13.33
31-40	8	26.66
41-50	4	13.33
51-60	7	23.33
>60	7	23.33

Fig 1: Pre op x-ray showing distal tibia

Table 2: sex distribution

Sex	Cases	Percentage
Male	21	70
Female	9	30

Table 3: Mode of injury

Injury	Cases	Percentage
RTA	24	80
Accidental fall	6	20

Table 4: side distribution

Side	Cases	Percentage
Right	19	63.33
Left	11	36.66

Table 5: AO/OTA classification

AO/OTA classification	Cases	Percentage
43 A1	19	63.33
43 A2	4	13.33
43 A3	7	23.33

Table 6: time interval between injury and surgery

Time interval	Cases	Percentage
1-7 days	25	83.33
8-14 days	5	16.66

Table 7: Time taken for fracture union

Time	United cases	Percentage
12-16week	6	20
16-20 week	15	50
20-24week	9	30

Fig 2: A subcutaneous tunnel was made using a specialized elevator; the selected locking plate was applied based on the fracture pattern and body habitus of the individual as shown

Fig 3, 4: Post op X-ray showing fixation by Pre-contoured LCP-AP & lat view

Table 8: Clinical results

Olerud molander score	Cases	Percentage
Good to excellent	26	86.66
Fair	4	13.33
Poor	0	0

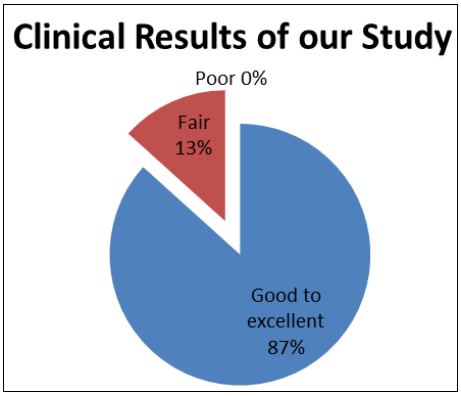

Fig 5: Clinical Results of our Study

Table 9: Complications

Complication	Cases	Percentage
Superficial infection	3	10
Ankle stiffness	3	10
Varus angul; ationless than 5 degree	2	6.66
Delayed union	1	3.33
Non union	1	3.33
No complication	20	66.66

Discussion

Distal tibial fractures are one of the complex injuries associated with significant soft tissue damage because of subcutaneous natures of bone. Management principles mainly is to provide stable fixation, prevention of further soft tissue damage, infection, non-union and wound dehiscence [4]. When soft tissue damage is significant, bridging external fixator is considered as superior option as it decreases the excessive soft tissue stripping and provides a temporary stable fixation to skeletal component. Definitive fixation can be planned after resolution of edema and wrinkling of skin is evident. In cases of open fractures primary care is to provide proper wound debridement, tetanus immunization and broad ~ 833 ~ International Journal of Orthopaedics Sciences spectrum antibiotic cover as prevention of infection is the main aim. If there is significant soft tissue loss after debridement, adequate soft tissue cover is difficult in this area hence skin graft and free flap are viable treatment options [5]. Reports in the literature on ORIF of distal tibia or pilon fractures are plagued by wound infection [6-9]. During high velocity trauma the initial injury causes massive soft tissue damage which devitalizes the tissue around the fracture site, in distal tibia the anterio medial aspect is most risk for wound infection and wound dehiscense [10]. Open reduction and internal fixation has shown increased rates of deep infection and wound dehiscence are the major soft tissue complications. Wound debridement, antibiotics, skin grafting, myocutaneous flap and even arthrodesis have a role to play in management. Studies using external fixation techniques reported significant reduction in infection rates [11, 12]. The rate of infection is drastically decreased with the use of minimmaly invasive percutaneous plate osteosynthesis (MIPPO) in comparison with external fixator and ORIF [13]. This is reflected in our results, with only two cases of superficial wound infection, which completely resolved with appropriate antibiotics. Reports suggest that

intramedullary nailing has the lowest infection rates compared with other techniques [14] but the technique is associated with other complications such as malunion, fat embolus syndrome, compartment syndrome and anterior knee pain. Angular malalignment and malunion have been reported with intramedullary nailing of these fractures. The studies on external fixator showed complications such as imperfect reduction loosening, malunion and pin tract infections. Open reduction with fixation of plates have reduced rates angular malunion when compared to external fixation or intramedullary nailing but disadvantages of high incidences of infection. AO distal tibial locking plate using MIPPO technique provides a stable and rigid fixation of the fractures minimizes the angulation and malunion without wound complications as in ORIF. The distal tibia plate is precontoured to the anatomy of the distal tibia and thus allows placement of the plate without distruption of fracture fragments. The distal end of the plate allows placement of locking screws that provide stability where satisfactory bone purchase is difficult. The threaded holes lock to the locking screw head and minimise plate-bone interface and maintain the vascularity of the fracture site. The proximal combination holes allow insertion of locking or cortical screws where relative or absolute stability can be achieved. Acceptable tibial aligment was 5° of varus or valgus and 10° of recurvatum or procurvatum. All of our patients were found to have acceptable reduction and alignment post operatively and at union. Fracture healing is defined as mature callus formation seen on plain radiograph with pain free full weight bearing. Average fracture healing time was 18.8 weeks post operatively. Associated fibula fractures are fixed with one third semitubular plate As it is a rigid fixation, postoperative plaster immobilization was not necessary as ankle stiffness was not a problem, ankle stiffness was only seen in only 3 patients reason due to comminuted fracture, prolong immobilization and delayed weight bearing. Weight bearing was delayed till radiological callous was visible on post-operative check X ray on average weight bearing was started on 12th week post operatively and partial weight bearing was started on an average of 6th weeks. Our results are comparable to other studies using the MIPPO technique [15]. Comparing the results with other methods of fixation, our results are better in comparison with ORIF and external fixation. Other complication we found was delayed union which of due to primary bone grafting was not done and due to infection. Primary bone grafting was done in 3 patients where there was comminute fracture, fragments and bone loss. All patients were returned to work in 6 months. 80% patients felt pre injury status in 6 months.

Conclusion

It is concluded that locking plate fixation by minimally invasive percutaneous plate osteosynthesis technique (MIPPO), is the most effective procedure for closed extra-atricular distal tibial Dia-metaphyseal fractures.

References

1. Shrestha D, Acharya BM, Shrestha FPM. Minimally invasive plate Osteosynthesis with locking compression plate for distal diametaphyseal tibia fracture. Kathmandu Univ Med J (KUMJ) 2011;9(34):62-8.
2. Pierre Joveniaux, Xavier Ohl, Alain Harisboure, Aboubekr Berrichi, Ludovic Labatut, Patrick Simon *et al*. Distal tibia fractures: management and complications of 101 cases. International Orthopaedics SICOT 2010.
3. Topliss CJ, Jackson M, Atkins RM. Anatomy of pilon fractures of the distal tibia. J Bone Joint Surg Br 2005;87:692-697.
4. Mockford BJ, Ogonda L, Warnock D, Barr RJ, Andrews C. The early management of severe tibial pilon fractures using a temporary ring fixator. Surgeon 2003;1:104-107.
5. Sands A, Grujic L, Byck DC, Agel J, Benirschke S, Swiontkowski MF *et al.* Clinical and functional outcomes of internal fixation of displaced pilon fractures. Clin Orthop 1998, 131-137.
6. Bonar SK, Marsh JL. Tibial plafond fractures: Changing principles of treatment. J Am Acad Orthop Surg 1994;2:297-305.
7. Bone LB. Fractures of the tibial plafond. Orthop Clin North Am 1987;18:95-104.
8. Teeny SM, Wiss DA. Open reduction and internal fixation of tibial plafond fractures. Clin Orthop 1993;292:108-117.
9. Wyrsch B, McFerran MA, McAndrew M *et al.* Operative treatment of fractures of the tibial plafond. Randomised, prospective study. J Bone Joint Surg Acta Orthopædica 1996;78-A:1646-1657.
10. Konrath G, Moed BR, Watson JT, Kaneshiro S, Karges DE, Cramer KE. Intramedullary nailing of unstable diaphyseal fractures of the tibia with distal intraarticular involvement. J Orthop Trauma 1997;11:200-205.
11. Piper Kj, Won HY, Ellis AM. Hybrid external fixation in complex tibial plateau and plafond fractures: An Autralian audit of outcomes. Injury 2005;36:178-184.
12. Rammelt S, Endres T, Grass R, Zwipp H. The role of external fixation in acute ankle trauma. Foot Ankle Clin 2004;9:455-474.
13. Perren SM. Minimally invasive internal fixation. History, essence and potential of a new approach. Injury 2001;32:SA1-3.
14. Im GI, Tae SK. Distal metaphyseal fractures of tibia: a prospective randomised trial of closed reduction and intramedullary nail versus open reduction and plate and screw fixation. J Trauma 2005;59:1219-1223.
15. Redfern DJ, Syed SU, Davies SJM. Fractures of the distal tibia. Minimally invasive plate osteosynthesis. Injury 2004;35:615-620.