

Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) using Locking Compression Plate (LCP) in Distal Tibial Fractures: A Prospective Study of 50 Cases.

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Abstract

Background: The limited soft tissue, subcutaneous location of large portion of tibia and precarious blood supply renders the treatment of distal tibial fracture very challenging. The main treatment of this type of fracture is reinstatement of the normal alignment and articular congruity. Conventional osteosynthesis is not suitable because distal tibia is subcutaneous bone with poor vascularity. Closed Reduction and MIPPO with locking compression plate (LCP) has emerged as an alternative treatment option because it respects biology of distal tibia, maintains fracture haematoma and provides biomechanically stable construct, early mobilization, less complications and relatively higher rates of union. The aim of this study was to evaluate the functional and clinical outcomes of distal tibia fracture of patients, treated by internal fixation by minimally invasive plating osteosynthesis (MIPPO) technique with locking compression plate (LCP).

Methods: 50 patients with distal tibia fracture with or without intra articular extension were treated in our department, with MIPO with LCP and were prospectively followed for average duration of 6 months. The outcome was evaluated using American Orthopedic Foot and Ankle Society (AOFAS) score (Ankle – Hindfoot Scale)

Results: There were 50 patients (36 males and 14 female) with mean age of 38.4 years. The mean follow up period of our patients was 6 months. All fractures united at an average of 19.13 weeks (range- 16-24 to weeks) except two cases of non-union. There were 8 superficial wound infections which were treated with oral antibiotics and progressed to union and there were no failures of implants. According to AOFAS score at 6 months, 6 cases had score of 31 to 70 and 44 cases had score of 71 to 100.

Conclusions: Minimally invasive plating osteosynthesis (MIPPO) is an effective method of treatment for distal tibial fractures. The use of indirect reduction techniques and small incision is technically demanding and it is effective, minimally invasive, optimises the operation time, promotes early healing and reduces the incidence of infections and complications associated with conventional method of open reduction and internal fixation.

Keywords: Distal tibia, LCP, MIPPO, Osteosynthesis, Plating.

Introduction

Distal tibial fractures are a big challenge to an orthopaedic surgeon as far as management of these injuries are concerned. Various problems associated with these fractures are because of subcutaneous location of the bone with associated soft tissue trauma, high incidence of compound fractures combined with poor vascularity which many a times lead to delayed union or non-union. Achieving and maintaining anatomical axial and rotational alignment of limb and getting a good functional outcome with minimal soft tissue damage are the main factors that make the

management of these fractures all the more difficult [1].

For classification of distal tibial fractures, two classifications system are mainly in use

- Reudi and Allgower's classification [1]

- AO/OTA classification [2] – more comprehensive and complete classification

Different management methods for these fractures are - close reduction and POP cast application, use of external fixator or distractors, nailing and open reduction and internal fixation (ORIF) with plating [3].

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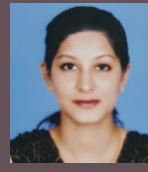
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Sr. No	Parameters	Number	Percentage
1	Age (years)		
	18-20	8	16%
	20-40	28	56%
	40-60	12	24%
	>60	2	4%
2	Sex		
	Male	36	72%
	Female	14	28%
3	Mode of injury		
	RTA	30	60%
	Fall from height	14	28%
	Direct assault	6	12%
4	AO Classification		
	Type A	34	68%
	Type B	10	20%
	Type C	6	12%
5	Type of fracture		
	Open	14	28%
	Closed	36	72%

Table 1: Demographic variations of Patients and fracture patterns

Sr. No	Parameters	Number	Percentage
1	Complications		
	Fever	6	12%
	Dermal Skin necrosis	2	4%
	Superficial Infection	8	16%
	Malunion	4	8%
	Non-union	2	4%
	Deep infection	1	2%
2	Time of Union		
	16 Weeks	10	20%
	20 Weeks	29	58%
	24 Weeks	9	14%
	Non-union	2	4%
3	AOFA Pain score		
	No pain – mild	46	92%
	Moderate - severe	4	8%
4	AOFA Function score		
	10-30	8	16%
	30-50	42	84%
5	AOFA Alignment score		
	Poor	6	12%
	Fair to good	44	88%
6	AOFA Total score		
	0-30	0	0%
	30-70	7	14%
	70-100	43	86%

Table 2: Clinical and functional results with Complications

Each method has its own advantages and disadvantages. However there is a general consensus that operative treatment is the treatment of choice for such fractures to achieve almost a perfect bony union and excellent functional outcome.

Osteosynthesis using locking plates provides angular and axial stability thereby decreasing the chances of loosening and the whole construct acts as an internal splint. This technique is very useful especially for distal tibial comminuted fractures where-in an indirect reduction is done and the locking plates are mainly used by minimal invasive percutaneous plate osteosynthesis (MIPPO), technique bridging the comminuted segment, minimising soft tissue dissection and devascularisation of bony fragments without much compromise on stability³. The present study was also carried out mainly to assess the clinical outcome of minimal invasive percutaneous plate osteosynthesis in management of distal tibial fractures.

Material And Methods

This was a prospective study of 50 cases of either sex of distal tibial fractures treated in a tertiary care centre. Ethic committee approval was taken for the study and informed consent was taken from all patients. All closed/open type 1 and 2 as per Gustillo and Anderson classification without or with (non-comminuted) joint involvement were included in the study [4]. However type 3 compound fracture and fractures (AO B3 and C3) with grossly

comminuted articular involvement and those with evidence of infection were excluded from the study. After initial resuscitation in the emergency department and thorough examination to rule out associated injuries, patient was then subjected to surgery after thorough investigation and pre-anesthetic clearance. Informed consent was taken of every patient. Under spinal/ epidural anaesthesia patient operated in supine position on radiolucent table under all aseptic conditions. (Fig. 1) Indirect reduction was done with the help of manual traction-counter traction or femoral distractor). In case of intra-articular fracture minimal open reduction of fracture was done. Reduction was verified under C-ARM and when found accepted, stabilised using minimally invasive technique. (Fig. 2 and 3). In this technique an oblique incision was made at the tip of medial malleolus and extended proximally to create easy passage. The proximal position of the plate was checked to ensure central placement on the tibial shaft using the C-ARM. Minimum of 3-4 screws were used in each main fragment. Immediate post-operative and then regular radiograph was taken at monthly interval to assess the union and functional outcome according to AOFAS (American Orthopaedics foot and ankle society). (Fig 4 and 5). AOFAS score (Ankle-Hindfoot Scale) based on 3 categories of pain (40 points) , function (50 points) and alignment (10 points) [5].



Figure 1: Late complications



Figure 2: Minimally invasive approach



Figure 3: Post operative Radiograph

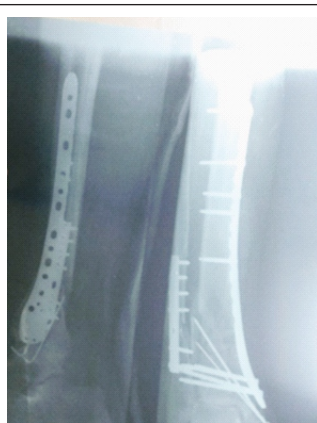


Figure 4: Radiograph at 6 months showing union



Figure 5: Clinical photograph showing final functional outcome

Observations And Results

In our study we had following observations in preoperative assessment (Table 1) and post operative assessment (Table 2). Details of complications and functional outcomes are also included in table 2.

Discussion

Treatment of distal tibial fracture have always posed a challenge because of associated soft tissue injury and comminution. The main aim of managing these fracture is to achieve bony union in proper alignment and good functional outcome. Present study enrolled 50 patients with fracture of distal end tibia using locking plate by MIPPO technique.

In our study it was found that distal tibial fractures were common in middle age group (20-40) with mean age 38.4 years. As this is the age group which indulge in more outdoor activities, so they were prone to accident with vehicular accident. Male predominance (72%) was seen. Similar results were reported by Hazarika et al [6] and Mushtaq et al [7] in their studies. Most common mode of injury was road traffic accident (60%), fall from height(28%) and assault (12%). Hence distal tibia fracture most commonly occur after high energy trauma especially RSA so soft tissue insult is also quite high, and here lies the importance of appropriate management of such fracture. Similar observations were made in studies conducted by Gupta et al [8] and Leung et al [9].

We used AO/ATO classification system. Most common fracture

type was Type-A (68%) Type-B (20%) and Type-C (12%).

Studies conducted by Leung et al [9] and Ronga et al [10] has similar pattern of fractures.

Out of 50 distal tibial fracture 47 fracture (94%) united primarily after fixation; of these 16 (32%) united by 16 week, 24 (48%) by 20 weeks and 7(14%) fractures healed by 24 weeks. Average time of union was 19.13 weeks.

Fracture non-union was observed in two patient (4%) at 6 months. In one patient implant

removal was done before union, due to development of deep infection and is considered as a failure. Similar union rate and time was also reported by Mushtaq et al [7], Ronga et al [10], Bahari et al [11], Zha et al [12].

We have 8(16%) superficial infections in our study using MIPPO, all of them heal with oral medications. Two (4%) cases had early scar breakdown which was managed by debridement and dressings till the granulation tissue was formed and later wound closure was done. Gupta et al [8], Hazarika et al [6] and Mushtaq et al [7] also have similar share of complications in there series.

Malunion was observed in 4 (08%) patients. Valgus malalignment was observed on immediate post-operative radiographs of one patient which healed with no change in alignment. The other patient had varus malunion at 6 month follow up. Such observations are comparable to the study conducted by Protzman et al [13]. In present study, AOFAS (Ankle Hind-foot scale) score was used to analyse the functional outcome of the cases. It was observed that final average AOFAS score at 6 month was 84.2. Similar results were reported by Bahari et al [11], Jha et al [12] and Collinge et al [14].

Conclusion

MIPPO with LCP is a reliable and effective method of treatment for the distal tibial fractures with or without intra articular extension, preserving most of the osseous vascularity and fracture haematoma and thus providing for a more biological repair. The

use of indirect reduction technique and small incision is technically demanding as it is effective, minimally invasive, safe, optimises the operation time, reduces the incidence of infection, allows restoration of limb alignment and provides good clinical

and radiological results with low complications and high union rates.

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