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Minimal invasive percutaneous plate osteosynthesis (MIPPO) in treatment of 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 MIPO 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 at Guru Gobind Singh Medical College and Hospital, Faridkot by MIPPO 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.

Results: There were 50 patients in the study including 36 males and 14 female of mean age 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 12 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 as it is effective, minimally invasive, optimises the operation time, promotes early healing and reduces the incidence of infections.

Keywords: Distal tibia fracture, LCP, MIPPO

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:- 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.

As far as classification of distal tibial fractures are concerned two classifications system are mainly in use

- Reudi and Allgower's classification ^[1].
- AO/OTA classification ^[2] – more comprehensive and complete classification

Main aim of management of these fractures are to achieve and maintain proper axial and rotational alignment of limb till union, minimal soft tissue damage, accurate restoration of articular surface whenever required and a sound functional outcome.

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.

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.

External fixators are quite useful in compound injuries especially with severe soft tissue trauma. However pin related problems, joint contractures and stiffness, delayed union and poor patient compliance are the main issue associated with it. Intramedullary nailing is quite effective as it preserve the fracture biology and allow early joint motion. However, as the fracture tends to be more distal including intra-articular, it is difficult to get a mechanically stable construct with nail. ORIF with traditional plating system requires extensive soft tissue stripping with associated soft tissue and bony problems leading to more devascularisation lead to higher incidences of delayed union and non-union with poor functional outcome.

All these factors have led to development of concept of biological osteosynthesis using locking plates. These locking screws provide angular and axial stability thereby decreasing the chances of loosening and the whole construct act 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 stability. 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.³

Material and Methods

This was prospective study of 50 cases of either sex of distal tibial fractures treated in a tertiary care centre (Guru Gobind singh Medical College and Hospital, Faridkot). 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. However type 3 compound fracture and fracture's (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. 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. In this technique an oblique incision was made at the tip of medial malleolous 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). AOFAS score based on 3 categories, pain (40 points), function (50 points) and alignment (10 points).

Observations and Results

Table 1: Pre-operative parameters

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

Table 2: Post-operative parameter

Sr. No	Parameters	Number	Percentage
1	Complications		
	Fever	6	12%
	Skin necrosis	2	4%
	Superficial Infection	12	24%
	Malunion	4	8%
	Non-union	2	4%
2	Deep infection	2	4%
	Time of Union		
	16 Weeks	16	32%
	20 Weeks	24	48%
2	24 Weeks	7	14%
	Non-union	3	6%
3	AOFAS Pain score		
	No pain – mild	46	92%
3	Moderate - severe	4	8%
	AOFAS Function score		
4	10-30	8	16%
	30-50	42	84%
5	AOFAS Alignment score		
	Poor	6	12%
5	Fair to good	44	88%
	AOFAS Total score		
6	0-30	0	0%
	30-70	7	14%
	70-100	43	86%

Legends



Fig 1: Pre operative Radiograph



Fig 2: Minimally invasive approach



Fig 3: Post-operative Radiograph



A B
Fig 5: Clinical photograph showing final functional outcome

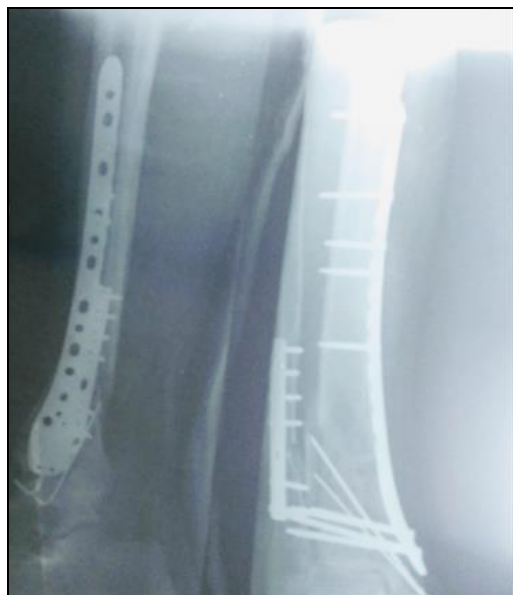


Fig 4: Radiograph at 6 months showing union

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 MIPO 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.* [4] and Mushtaq *et al.* [5] 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, here lies importance of appropriate management of such fracture. Similar observations were made in studies conducted by Gupta *et al.* [6] and Leung *et al.* [7].

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.* [7] and Ronga *et al.* [8] 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 three patient (6%) at 6 months. In two patient implant removal was done before union, due to development of deep infection. Similar union rate and time was also reported by Mushtaq *et al.* [5], Ronga *et al.* [8], Bahari *et al.* [9], Zha *et al.* [10].

We have 12 (24%) superficial infections in our study using MIPO, all of them heal with oral medications. 2 (4%) case 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.* [6], Hazarika *et al.* [4] and Mushtaq [5] *et al.* also have similar share of complications in there series.

Malunion was observed in 4 (08%) patients. Valgus mal alignment was observed on immediate post-operative radiographs of this 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.* [11].

In present study, AOFAS 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.* [9], Jha *et al.* [10] and Collinge *et al.* [12].

Conflict of interest: Nil

Conclusion

MIPO 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 hematoma 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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