



FUNCTIONAL OUTCOME OF DISTAL TIBIA FRACTURES TREATED WITH LOCKING COMPRESSION PLATES USING MIPPO TECHNIQUE

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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. 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.

METHODS: 30 patients with distal tibia fracture with or without intra articular extension were treated with Closed Reduction and MIPPO with locking compression plate (LCP) Closed Reduction and. The patients were prospectively followed up for the duration of 12 months.

RESULTS: There were 30 patients in the study including 22males and 8 females in the age group of 23 to 62 years (average 42years). The mean follow up period of our patients varied ranging from 6 months to 12 months. All fractures united at an average of 16 weeks (range- 12 to 20 weeks). In our study rate of superficial infection was 16.7% (5 patients), and ankle stiffness 6.7% (2 patients). There were no cases of deep infection, delayed union, malunion or non union.

CONCLUSION: MIPPO with LCP is a reliable and effective method of treatment for the distal tibia 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.

KEYWORDS : Distal Tibia Fracture, Mippo, Functional Outcome, Lcp

INTRODUCTION:

Fractures of the distal tibia have been a challenging situation. Stable fractures with minimal shortening can be treated conservatively, but requires prolonged immobilisation. It has also been associated with malunion, shortening of affected limb, restriction of range of motion and early osteoarthritis.^{1,2} External fixation can be a useful option in open fractures with soft tissue injury, but can lead to pin-track infections, septic arthritis, mal-alignment and delayed union.³ Soft-tissue management has been seen to play a vital role in the management alongside the bony reconstruction.⁴ Internal fixation usually failed due to infection, inadequate skin coverage and avascular necrosis of the skin leading to sloughing. In a study of 84 patients by Ruedi and Allgower⁵, that established the open reduction and internal fixation with screws and plate as the standard, the authors with a nine year follow up reported 74% good functional results.

The principles of treatment included

1. Re-establishment of the fibular length
2. Re-construction of the lower articular surface of tibia

3. Placement of metaphyseal bone graft; and
4. Stabilization of the medial aspect of tibia using a plate

In a series of 26 patients, Kellam and Waddell⁶ divided them into 2 groups based on fracture pattern. Type A fractures with twisting injuries with little comminution, whereas Type B fractures were more severe injuries, with a crush component. Better results were obtained in Type A fractures (84%) than B (53%). Crucial factors besides fracture type were the length of immobilization and quality of reduction. Bourne et al⁷, in a retrospective clinical review of 42 patients treated with open reduction and internal fixation demonstrated the importance of using a logical classification system in describing the outcome of fractures of the distal tibia. The results of this study have clearly demonstrated that Types I and II (Ruedi and Allgower) are amenable to open reduction and stable internal fixation with an 80% success rate. The Type III fractures present a much more difficult problem; a satisfactory outcome was present only in 6 of the 19 patients (32%) in this study. Dillin and Slabaugh⁸, in a series reported disastrous results when inadequate and unstable fixation was used to treat the

distal tibia fractures. They had 36% rate of skin sloughing and a 55% infection rate¹⁶. Follow up evaluations of 34 distal tibia fractures by Helfet et al¹⁰, showed that results of operative treatment are dependent on the severity of the initial injury, the quality and stability of the reduction. Hazarika et al¹², in a series of 20 patient of distal tibia fracture treated using locking compression plates through MIPPO technique. This provided 87.5% of good to excellent results. Ozakaya et al¹³, in a retrospective review of 22 patients with distal third tibia fractures were treated with titanium locking compression plates using minimally invasive technique good biological fixation of distal tibia. A total of 81% of good to excellent outcome was assessed using American Orthopaedic Foot and Ankle Society Score¹³. Locking plates (LPs) have the biomechanical properties of internal and external fixators, with superior holding power because of fixed angular stability through the head of locking screws, independent of friction fit¹⁴. With the increasing prevalence of high energy injuries and the accompanying soft tissue damage, more recent treatment protocols have focused on maintaining a healthy soft tissue envelope while reducing the articular surface by indirect means using minimally invasive techniques. Minimally Invasive Percutaneous Osteosynthesis aims at minimal periosteal dissections and disruption of hematoma, stable fixation and early mobilization, decreased post-operative complications and higher rates of union. More importantly it helps preserve the fragile soft tissue envelop and avoids stripping of the precious periosteum.^{19,20}

METHODS:

The present study was conducted in the inpatient and outpatient department of orthopaedic surgery, H.B.T. Medical College & Dr. R. N. Cooper Municipal General Hospital, Mumbai during the period of September 2017 to September 2019. We involved 30 patients of distal tibia fractures, after satisfying the inclusion and exclusion criteria. Ethical committee clearance was obtained prior to the study Patients were given information sheet and details of the study were explained. After obtaining written informed consent, patients were enrolled into study.

Inclusion Criteria were Age more than 18 years, both males and females with Distal tibia fractures both intra-articular and extra-articular. Exclusion criteria included patients less than 18 years of age, patients unfit for surgery, Gustilo Anderson Type-III open fractures. Plain Radiographs were taken, antero-posterior view and lateral view of full length tibia and fibula along with ankle mortise view of the affected side was obtained. The fractures were classified using AO/OTA classification system. The patient was posted for surgery, once anaesthesia fitness was obtained. The surgical procedure of fixation with LCP using MIPPO technique was carried out on a fracture table with Image Intensifier. Tourniquet was applied routinely. In patients with distal fibula fracture, it was fixed first by open reduction using 3.5mm reconstruction plate/distal fibula pre-contoured locking plate.

Patients were followed up and evaluated in detail post operatively both clinically and radiologically at 1 week, 4 week, 2 months, 4 months, 6 months,9 months and 1 year. At every follow up clinical examination was done to assess status of the surgical wound, pain, swelling, tenderness, range of motion, stability of the fracture and clinical union

RESULTS:

There were 30 patients in the study including 22males and 8 females in the age group of 23 to 62 years with mean age of 42 years(Table 1).

Table 1: Age group distribution.

Age group	Frequency	Percent
23 to 30 years	5	16.7

31 to 40 years	12	40.0
41 to 50 years	6	20.0
51 to 60 years	5	16.7
more than 60 years	2	6.7
Total	30	100.0

The fractures were classified according to AO–OTA classification in to various types. Out of 30 cases, 6(20%) were Type A1, 12(40%) Type A2, 11(36.6%) Type A3 and 1(3.3%)Type B1. 23(76.7%) of patients sustained injury following road traffic accidents and 7(23.3%) patients sustained injury due to fall. 26 (86.6%) cases were closed fractures and 4 (13.3%) cases were open fractures. Classification of the 4 cases of open fractures was done based on Gustillo Anderson classification of open fractures, 3(75%) were type 1 compound, 1(25%) were type 2 compound. 23(76.7%) of patients sustained injury following road traffic accidents and 7(23.3%) patients sustained injury due to fall. Follow-up period of our patients varied ranging from 6 months to 24 months. The mean time to union was 16 weeks, (range– 12 weeks to 20 weeks). Out of 30 cases, 23(76.7%) had no complications, 2(6.7%) developed ankle stiffness, 5(16.7%) developed superficial skin infection(Table 2).

Table 2: Post op complications.

POST OP COMPLICATIONS	Frequency	Percent
Absent	23	76.7
Ankle Stiffness	2	6.7
Superficial Skin Infection	5	16.7
Total	30	100.0

Five superficial wound infections were treated with oral antibiotics and regular dressing. All patients were kept nil weight bearing till radiological signs of union was seen. Functional outcome was evaluated as per clinical scoring by Teeny and Wiss criteria. 8(26.7%) had excellent outcome, 17(56.7%) good Outcome, 3(10%) fair outcome and 2(6.7%) had poor outcome(Table 3).

Table 3: Functional outcome.

Functional Outcome	Frequency	Percent
Excellent	8	26.7
Fair	3	10.0
Good	17	56.7
Poor	2	6.7
Total	30	100.0

In our study there was a statistical significance between age and functional outcome with cases in age group 23 to 30 years having more excellent outcome compared to patients more than 50 years.(Table 4)

Table 4 : Association between Age and Functional Outcome

			Functional Outcome				Total
			Excellent	Fair	Good	Poor	
Age group	23 to 30 years	Count	4	0	1	0	5
		%	50.0%	0.0%	5.9%	0.0%	16.7%
	31 to 40 years	Count	1	0	10	1	12
		%	12.5%	0.0%	58.8%	50.0%	40.0%
	41 to 50 years	Count	2	2	2	0	6
		%	25.0%	66.7%	11.8%	0.0%	20.0%
	51 to 60 years	Count	1	0	3	1	5
		%	12.5%	0.0%	17.6%	50.0%	16.7%
	more than 60 years	Count	0	1	1	0	2
		%	0.0%	33.3%	5.9%	0.0%	6.7%
Total		Count	8	3	17	2	30
		%	100.0%	100.0%	100.0%	100.0%	100.0%

In our study there was a statistical significance between post operative complication and time of union, with longer duration of union in cases with complication like infection as shown in the graph. The study showed statistical significance between gender and time of union with early union rates in male

patients compared to female patients. Also functional outcome was better in male patients. No statistical significance was found between mode of injury and time of union.

DISCUSSION:

Fractures of distal tibia are among the most difficult fractures to treat effectively. The status of the soft tissues, the degree of comminution sustained at the time of injury affect the long term clinical results. Treatment of these fractures with conventional plates by open reduction techniques, intra medullary nailing resulted in high rates of complication. With the development of technique of MIPPO with LCP which preserve extraosseous blood supply, respect osteogenic fracture haematoma, biologically friendly and stable fixation method is available for distal tibial fracture.

Cory Collinge et al¹⁵ observed 100% high energy fractures in his study. However, our present study correlates with the study conducted by Neeraj Mahajan¹⁸ who attributed 65% of such injuries to be high energy injuries. In our study, 20% were Type 43A1 fractures, 40% Type A2, 36.6% Type A3 and 3.3% Type B1 which was comparable to study by Supe AC²². The average surgical time was 53 minutes. It is comparable with the average of 97.9minutes taken by J.J. Guo et al¹⁷ in their study. The average time for fracture union in various studies conducted using various methods was 16-28 weeks. In study by GI et al¹⁹ showed in their study that average time for union was 20 weeks. Our study had an average time of fracture union of 16 weeks which is comparable to study by Muzaffar N et al.²¹ in which it was 16.8 weeks.

CONCLUSION:

MIPPO with LCP is a reliable and effective method of treatment for the distal tibia 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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