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A clinical study: management of distal tibial fractures with minimally invasive plating osteosynthesis

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ABSTRACT

Background: Distal tibial fractures of bone poses major challenge to the trauma orthopaedic surgeons as this bone is subcutaneous associated with soft tissue injuries and precarious blood supply. Distal tibial fractures require accurate reduction, perfect articular restoration with stable fixation with minimal stripping of soft tissues, thereby preserving the blood supply. Minimally invasive osteosynthesis using locking plates has emerged as viable option of fixing such fractures due to poor results associated with open plating which leads to extensive soft tissues stripping and subsequently poor blood supply.
Methods: 27 patients with closed distal tibial fractures with or without articular involvement without vascular compromise were treated with LCP fixation using MIPO technique studied from June 2017 to December 2018.
Results: All fractures in our series united well at the end of 5 months with mean time to clinical and radiological union was 17 weeks. There was no case of implant failure while 2 patients had varus angulation. Very few soft tissue complications with excellent functional outcome were seen.
Conclusions: We concluded that distal tibial fractures can be effectively managed with LCP using MIPPO technique with excellent functional outcome and avoiding the complications associated with other treatment methods.

Keywords: Distal tibia, MIPPO

INTRODUCTION

Distal tibial fractures are complex injuries and challenging because of its subcutaneous location, precarious blood supply and proximity to the ankle joint. These results mainly from road side accidents leading to high energy trauma which damages overlying soft tissues that leads to severe oedema of involved limb. Variety of treatment methods have been described for management of these fractures with associated rates of complications. Non-Operative treatment leads to non-union because of tendency of fragments to displace, shortening, rotational malunion deformities and joint stiffness because of prolonged immobilisation.[1] Operative treatments allows perfect reduction, early mobilization and avoids complications like joint stiffness. Operative options available are IM nailing and plating. IM nailing reported with higher rates of mal-union because nail many times cannot provide tight fit at distal fracture site which has wide medullary canal and also difficult to achieve two distal locking screws.[2-4] Management of these fractures over last few years has changed dramatically. In earlier days, open reduction and internal fixation with plate used to be treatment modality.[5] But open plate osteo-synthesis lead to extensive soft tissue dissection, periosteal stripping and may be associated with higher incidence of infection, non-union and delayed union.[6-11] External fixators are very useful in treatment of compound distal tibial fractures but these are associated with complications like non-union, malunion, pin tract infections and also having poor patient compliance.[12,13] Nowadays these fractures are managed with minimally

invasive osteo-synthesis MIPO which is based on indirect reduction, stable fixation and thus preserving the blood supply and fracture hematoma and allows better fracture healing with fewer comlications.[14-20] Locking plates function as internal fixators. The bridging principle is represented by the concept of minimally invasive percutaneous plate osteo-synthesis (MIPPO technique) whereby the angular stable plate is used as an internal splint that bridges the comminuted fracture.

Goals of treatment of distal tibial fractures are anatomical reduction with articular restoration and stabilization and delicate soft tissue handling.

METHODS

27 patients with distal tibia fractures without vascular compromise treated with locking compression plate using MIPO technique were included in the study. This was a prospective study done from June 2017 to December 2018.

Inclusion criteria

All patients with closed distal tibial fractures and grade 1, 2 Gustilo and Anderson compound fractures aged more than 18 years with or without intra-articular extension and without vascular compromise were included in our study.

Exclusion criteria

Skeletally immature patients, grade 2 and 3 Gustilo and Anderson compound fractures and pathological fractures were excluded from the study. On admission, affected limb was immobilised in above knee plaster slab and laboratory and radiological investigations done. The surgery was done as earliest as possible unless there was gross oedema present over the affected limb. All patients were given splint and elevation until definite fixation could be undertaken. A 3 cm long curved longitudinal incision was over the medial malleolus taking care to protect the saphenous nerve and vein. A pre-measured and pre-contoured locking plate was inserted in the extra-periosteal subcutaneous tunnel through the distal incision over the medial malleolus and fracture reduced and fixed using cortical and locking screws.

In patients associated with lateral malleolar fractures, fixation done using 3.5mm 1/3rd tubular plate. After ensuing hemostasis and thorough wash, wound closure done with negative suction drain. Active ankle and knee movements were encouraged from first postoperative day itself as per the pain tolerance and compliance of the patient. Patients were mobilized strict non-wt. bearing with walker. Non-wt. bearing was advocated for a minimum of 12 weeks or until the clinical and radiological union of the fracture. Following discharge clinical and radiological evaluations were done at 6, 8, 10, 12, 14, 18, 22, 30 weeks. All patients were evaluated using American Orthopaedic Foot and Ankle Society Score (AOFAS).

RESULTS

In this study, 27 patients with distal tibial fractures were treated by LCP fixation using MIPO technique.

Table 1: Age of the patients.

S.no	Age in years	No. of patients	Percentage (%)
1.	19-40	17	62.96
2.	41-60	10	37.04

Table 2: Sex incidence.

S.no	Sex	No. of patients	Percentage (%)
1.	Male	21	77.78
2.	Female	06	22.22

Table 3: Mode of injury.

S.no	Mode of injury	No. of patients	Percentage (%)
1.	RTA	22	85.19
2.	Fall	05	14.81

Table 4: Associated fractures.

S.no	Associated fractures	No. of patients	Percentage (%)
1.	Fibula	18	66.67

Table 5: Type of fracture.

S.no	Type of fracture	No. of patients	Percentage (%)
1.	Closed	21	77.78
2.	Open	06	22.22

Table 6: Type of fracture according to AO/OTA classification.

S.no	OTA type	No. of patients	Percentage (%)
1.	43-A1	19	70.38
2.	43-A2	04	14.81
3.	43-A3	03	11.11
4.	43-B1	01	3.7

Table 7: Injury treatment interval (days).

S.no	Interval (Days)	No. of Patients	Percentage (%)
1.	<3 days	17	62.96
2.	3-5 days	7	25.93
3.	>5 days	3	11.11

Table 1 show two age groups were taken in this study. Majority of the patients were in 19-40 years age group as compared to 41-60 years age group. Table 2 show that 21 males and 6 females were included in the study. Table 3 show 22 road side accident was the mode of injury in 22 patients as compared to fall from height in 5 patients. Table 4 show 18 patients were having associated fibula fracture. Table 5 show 21 patients had closed fractures and 6 patients had open grade 1 Gustilo and Anderson fractures. Table 6 show most of the the patients were having type fracture type 43-A1 according to the AO/OTA classification. Table 7 show most of the patients were operated within 3 days while 7 patients were operated within 3-5 days and 3 after 5 days.

Table 8: Time to callus (weeks).

S.no	Time to callus (weeks)	No. of patients	Percentage (%)
1.	8-12	24	88.89
	>12	3	11.11

Table 9: Time to Bony union.

S.no	Time to Bony union (weeks)	No. of patients	Percentage (%)
1	14-18	24	88.89
2	18-21	3	11.11

Table 10: Time to full wt. bearing (weeks).

S.no	Time to full wt. bearing (weeks)	No. of patients	Percentage (%)
1.	12-16	24	88.89
2.	>16	3	11.11

Table 11: Showing complications.

S.no	Complications	No. of patients	Percentage (%)
1.	Superficial skin infection	3	11.11
2.	Deep infection	0	0
3.	Skin necrosis	0	0
4.	Non-union	0	0
5.	Varus angulation 5-7 deg.	2	7.41
6.	Implant failure	0	0
7.	Ankle movements restriction		
	>75%	0	0
	50-75%	0	0
	25-50%	2	
	<25%	1	3.73

Table 8 show time callus formation time was 8-12 weeks in 24 patients and more than 12 weeks in 3 patients with mean time to callus formation was 10 weeks. Table 9 show 24 patients got clinical and radiological bony union in 14-18 weeks' time with mean clinical and radiological union time was 17 weeks.

Table 12: AOFAS score.

S.no	AOFAS score	No. of patients	Percentage (%)
1.	Excellent	23	85.19
2.	Good	04	14.81
3.	Fair	0	0

Table 10 show 24 patients started full wt. bearing within 12-16 weeks with mean time was 15 weeks. Table 11 show there were no non-union, deep infection and implant failure in our series. 3 patients developed superficial infection which settled down with dressings and antibiotics. 2 Patients had varus angulation while 3 patients got partial restriction of movements. Table 12 show results based on AOFAS score, 23 patients were having excellent results and 4 had good results.

DISCUSSION

Distal tibial fractures are one of the difficult fractures to manage. Various modalities for fixation of these fractures are available like open reduction and internal fixation, IM nailing, external fixators. External fixation for distal metaphyseal fractures reported with higher rate of non-union, malunion and pin tract infections and hence recommended only for temporary stabilization of open fractures with severe soft tissue injury.[12,13] Interlocked Intramedullary nailing have the advantage of close fixation of fracture without disturbing the hematoma and also maintain the underlying soft tissues.[18] Distal tibia has got circular cross sectional area with thinner cortex as compared to triangular diaphysis with thicker cortex, so as the medullary canal widens widens at dia-metaphyseal junction, the IM nail which is designed for tight interference fit at diaphysis cannot provide same stability at distal fracture result in complications like loss of reduction and malunion.[2,3] Open reduction and internal fixation with compression plates lead to disruption of extraosseous blood supply as compared to minimally invasive technique. These fractures are also associated with oedema post injury which results in poor wound healing. So, in cases with severe limb oedema, limb elevation was done waiting for the swelling to subside, and due to this reason surgery was performed post 3 days following injury in 10 patients. We observed that there were no difference in union rate and other complications in all patients whether operated early or late. With the invention of MIPPO technique which preserves extra-osseous blood supply, fracture hematoma allows better fracture healing with fewer complications.

In our study, it was found distal tibial fractures were common in 19-40 age group and males were predominantly affected as compared to females. Similar results were reported by Hazarika et al, Leung et al, Mushtaq et al.[16,21,23] We used OTA classification to

classify the type of fracture and the most common was type 43-A1 with 19 patients followed by 43-A2 having 4 patients and 43-A3 with 3 patients. Similar results were found in the studies of Leung et al, Ronga et al and Faschingbauer et al.[21,22,24] All 27 patients united primarily after fixation; of these 24 patients united within 18 weeks time while 3 united by 21 weeks time. Mean time of union was 17 weeks. No non-union and deep infection was reported in our study. Only 3 Mushtaq et al, Ronga et al, Bahari et al, Zha et al and Collinge et al had almost similar union rate in their studies.[19,23-26]

2 patients had varus angulation in our study. Such observations are comparable to the study conducted by Protzman et al.[27]

In our study, AOFAS ankle and hind foot score was applied to analyse the functional outcome of the cases. After evaluation excellent score (85.19%) was observed in 23 patients. Similar results were reported by Bahari et al, Zha et al and Collinge et al.[19,23,24]

CONCLUSION

The results of our study corroborate with the contemporary literature relevant to distal tibial fractures fixation with plates. Meticulous handling of soft tissues with minimally invasive plating osteosynthesis (MIPPO) allows early rehabilitation result in excellent functional outcomes.

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