

A Clinical Study to Evaluate the Functional Result of Distal Tibial Fractures Fixed with Distal Tibial Locking Plates

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Abstract

Aim: Evaluation of functional outcome of distal tibial fractures stabilized with distal tibial locking plate. **Methods:** A community based cross-sectional study was conducted in the Department of Orthopaedics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India for 1 year. We undertook a review of 30 patients treated by MIPO (Minimal Invasive Plate Osteosynthesis) for unstable fractures of the distal tibia our hospital. Adults (aged more than 18 years) males and females and Complex extra articular meta-diaphyseal fractures of the lower third of tibia were included in this study. **Results:** All the fractures united with an average of 16 weeks. Fractures of 12 (40%) patients united in 14 weeks, 8 (26.67%) patients united in 16 weeks, 8 (26.7%) patients united in 18 weeks and 2 (6.67%) patients united in 20 weeks. All cases fibula fracture healed without complications. At the end of our study of 30 patients treated 17(56.67%) patients had excellent outcome, 6(20%) had good results, 5(16.67%) had fair outcome and 2(6.67%) had a poor result based on subjective result and 19(63.33) patients had excellent, 5(16.67%), 3 had fair (10%) and 3(10%) had poor result based on objective result according to scoring system designed by Ovadia and Beals. **Conclusion:** It does provide excellent stability and allows early range of motion at ankle. The closed reduction not only helps in achieving reduction in difficult situations, but also in rapid union, because it facilitates preservation of the blood supply to the fragment and helps to achieve near normal anatomical reduction of the fracture.

Keywords: MIPO, Tibial Fractures, Locking Plate.

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Introduction

Distal tibial fractures are one of the most complex injuries around the ankle joint, accounting for approximately 7% of all tibial fractures[1]. Fractures of the distal tibial metaphysis with or without intra-

articular extension can present a management challenge because of their inherent instability, scarcity of soft tissues, subcutaneous nature and poor vascularity of bone. Treatment modality is dictated by the fracture displacement, comminution, intra-

articular extension and injury to the soft-tissue envelope[2]. Soft-tissue management has been seen to play a vital role in the management alongside the bony reconstruction[3].

Several methods of treatment are implemented including non-operative treatment, external fixation, intramedullary nailing, and internal fixation with traditional implants (standard screws and plates)[4]. However, each of these treatment options is associated with certain challenges.⁵ For the recent decade, nailing and plating for fracture stabilization have been successfully used in treating fractures of lower extremity, especially distal tibia. The goal of the techniques is to achieve stable fixation while maintaining the fracture biology and minimizing the soft tissue problems. The use of Locking Compression Plate has revolutionized the management of fractures by reducing immobilization in bed and ensuring early return to work. Compared to conventional plates, locking plates impart a higher degree of stability and provides better protection against primary and secondary loss of reduction[6-8].

Locking plates 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 fit.⁹ Locking plates are particularly useful in severely comminuted and fragility fractures due to their biomechanical properties of fixation[10]. Stress is laid on maintaining a precarious balance between devascularisation and mechanical perfection. This system stimulates callus formation due to flexible elastic fixation[11].

A mechanically stable fracture-bridging osteosynthesis can be obtained without significant dissection and surgical trauma to the bone and surrounding soft tissues by minimally invasive percutaneous plate osteosynthesis (MIPPO)[12].

Materials and methods

A community based cross-sectional study was conducted in the Department of Orthopaedics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India for 1 year, after taking the approval of the protocol review committee and institutional ethics committee.

We undertook a review of 30 patients treated by MIPO (Minimal Invasive Plate Osteosynthesis) for unstable fractures of the distal tibia our hospital. Adults (aged more than 18 years) males and females and Complex extra articular meta-diaphyseal fractures of the lower third of tibia were included in this study. Patients with open fractures and Intra articular fractures were excluded from this study.

The fracture pattern was classified based on Rudie and allgower classification for fractures of distal tibia. Of the 30 cases studied, 7 are A1, 10 are A2, 13 are A3. 22 out of 30 cases studied had an associated fracture of the lower third of fibula and 3 had upper third fibula fracture.

Local examination of the injured extremity revealed swelling, deformity and loss of function. Palpation revealed abnormal mobility and crepitus at the fracture site. Distal neurovascular status was assessed by the posterior tibial artery and dorsalispedis artery pulsations, capillary filling, local temperature, pallor and paraesthesia.

Antero-posterior and lateral radiographs of the affected leg along with ankle were taken and the fracture patterns were classified. The limb was then immobilized in an above knee Plaster of Paris slab till definitive fixation with locking compression plate done.

All the cases were taken for early primary fixation with locking compression plate. 5 cases were delayed for 10 days due to swelling and those cases were operated after appearance of wrinkle sign.

Surgical Technique

Medial approach is most commonly used for the Mipo technique. Plate inserted from distal to proximal through epiperiosteal

tunnel between periosteum and intact soft tissue. Fracture is reduced by indirect maneuvers using ligamento taxis and directly by percutaneous reduction forceps. 3-5 cm of slightly curved skin incision on medial aspect of distal tibia from the tip of medial malleolus. Incision carried out straight through subcutaneous fat without raising flaps. Great saphenous vein and nerve are held anteriorly. ORIF of fibula was part of first stage of fixation, which aids reduction of tibia. Epiperoistal tunneling made towards the diaphysis by blunt tip of plate or tunneling instrument. Plate is inserted from distal to proximal on anteromedial surface using drill sleeve as plate manipulator. Fracture is by passed and plate is first adjusted to periarticular area and locking screws inserted in one the distal holes just above ankle joint approximating the plate to bone which prevents overlying soft tissue irritation. Fracture reduced by closed reduction maneuvers. Using another drill sleeve as manipulator at proximal end the plate is fixed using locking cortical locking screw. Rest of the screws are inserted under c arm guidance using stab incisions at least three on either side. Tourniquet was removed, hemostasis was secured and incisions closed with 2'0 nylon.

Post-operative regimen

Non-weight bearing of the patient using standard walking frame and ankle range of movement exercises was done from the first post-operative day under the supervision of a physiotherapist. Intravenous antibiotic regimen was continued for 3 days after the surgery. Suture or staple removal was done at 10th-12th post operative day.

Follow up

The patients were followed up at intervals of two weeks, 4 weeks, 6 weeks, 3 months, 6 months, 10 months and 12 months to

assess the radiological union. After the 1st follow up of 4 weeks patient is allowed to partially bear weight. The fracture was designated as united, when there was periosteal bridging callus at the fracture site at least in three cortices in the antero-posterior and lateral views. Trabeculations extending across the fracture site was also taken into consideration. Partial and full weight bearing were allowed based on the radiological union and consolidation of the fractures.

Results

The mean age of the study group was 41.5 years (Range 20- 58.5). Out of 30 patients 25 (83.33%) are male patients and 5 (16.67%) were female patients showing increased male preponderance in view of travelling, working in fields and factories. In our study 21 patients (70%) sustained injury following RTA and 9 patients (30%) sustained injury following fall from height.

All the fractures united with an average of 16 weeks. There were 2 delayed union with 20 weeks signs of radiological callus formation. Fractures of 12 (40%) patients united in 14 weeks, 8 (26.67%) patients united in 16 weeks, 8 (26.7%) patients united in 18 weeks and 2 (6.67%) patients united in 20 weeks. All cases fibula fracture healed without complications. At the end of the our study of 30 patients treated 17(56.67%) patients had excellent outcome, 6(20%) had good results, 5(16.67%) had fair outcome and 2(6.67%) had a poor result based on subjective result and 19(63.33) patients had excellent, 5(16.67%), 3 had fair(10%) and 3(10%) had poor result based on objective result according to scoring system designed by Ovadia and Beals.

Table 1: Objective criteria

Rating	Ankle/ subtalar motion	Tibiotalar alignment	Tibial shortening	Chronic swelling	Equines Deformity
Excellent	>75% normal	Normal	None	None	None
Good	50-75%	Normal	None	Minimal	None
Fair	25-50%	<50 angulation	<1cm	Moderate	None
Poor	<25%	>50 angulation	>1cm	Severe	Present

Table 2: Subjective criteria

Rating	Pain	Return to work	Recreational activity	Limited walking	Pain medication	Limp
Excellent	None	Same work	Normal	No	None	None
Good	Mild	Same work	Mild modification	No	None	None
Fair	Moderate	Modified	Significant modification	Yes	Non narcotic	Occasional
Poor	Severe	Unable	None	Yes	narcotic	Yes

Table 3: Objective Results

Results	No of Cases	Percentage
Excellent	19	63.33
Good	5	16.67
Fair	3	10
Poor	3	10

Table 4: Subjective Results

Results	No. of cases	Percentage
Excellent	17	56.67
Good	6	20
Fair	5	16.67
Poor	2	6.67

Post-operative complications

5 of the patients developed superficial skin infections, which were treated with daily dressings and appropriate antibiotics according to the culture and sensitivity reports. All the infections subsided on the above said treatment.

We had 2 patient with ankle stiffness, probably due to the lack of compliance to the advised physiotherapy at home after discharge of the patient. Ankle stiffness ranged from restriction of ankle movement from 20-50%.

Discussion

Fractures of the distal tibia were among the most difficult fractures to treat effectively. The status of the soft tissues, the amount of comminution sustained at the time of injury affect the treatment modality and the long

term clinical results. The primary goal of operative treatment is to anatomically align the fractures fragments while providing enough stability to allow early motion. This is achieved with minimal bony and soft tissue devascularisation in order to decrease the complications resulting from the treatment. Gao *et al.* studied 32 adult patients with very short metaphyseal fragments in fractures of distal treated with a polyaxial locking system. The polyaxial locking system shown results of 87.3% excellent to good functional out come with American Orthopedic Foot and Ankle Society score which offer more fixation versatility, may be a reasonable treatment option for distal tibia fracture with very short metaphyseal segments[13]. Hazarika *et al.* studied a series of 20 patient of distal

tibial fracture treated using locking compression plates through MIPPO technique. This provided 87.5% of good to excellent results. Fractures were classified according to the AO system and performed as scored stage surgery after sterilization with external fixators primarily[14]. At the end of the our study of 30 patients treated 17(56.67%) patients had excellent outcome, 6(20%) had good results, 5(16.67%) had fair outcome and 2(6.67%) had a poor result based on subjective result and 19(63.33) patients had excellent, 5(16.67%), 3 had fair(10%) and 3(10%) had poor result based on objective result according to scoring system designed by Ovadia and Beals.

Cory collinge *et al.* had an average union of 21 weeks[15] and Abid mushtaq *et al* had an average of 22 weeks.¹⁶ Our study had an average fracture union of 16 weeks which were comparable with studies conducted using the locking compression plates[17].

Conclusion

30 patients with fractures of the distal tibia which have undergone closed reduction through MIPPO techniques and application of the locking compression plates states that this technique has resulted in strong and effective stabilization of these fractures. It does provide excellent stability and allows early range of motion at ankle. The closed reduction not only helps in achieving reduction in difficult situations, but also in rapid union, because it facilitates preservation of the blood supply to the fragment and helps to achieve near normal anatomical reduction of the fracture. Its greatest advantage is closed reduction and internal fixation with locking compression plates in near normal anatomical reduction where the fracture hematoma is not disturbed much. It is effective in extra articular fractures where it is a simple, has a rapid and straight forward application and has a reduced surgical time in extra articular fractures due to newer anatomically contoured locking compression plates for the distal end tibia fractures.

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