

Evaluation of Anterolateral Plating of Distal Third Tibial Fractures

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ABSTRACT

Background

Distal one-third tibial fractures with or without articular involvement can be difficult to manage. Variety of treatment methods have been suggested for these injuries, including conservative treatment, external fixation with or without limited internal fixation, intramedullary nailing, plate fixation (medial or anterolateral) and more recently minimally invasive plate osteosynthesis (MIPO). All of these techniques have advantages and disadvantages. None of these techniques can be considered the “gold standard” for these injuries.

Objective

The objective of this prospective study was to evaluate the results of anterolateral plating of these fractures.

Method

Forty-five fractures of distal third of tibia were treated with open reduction and internal fixation with anterolateral tibial plate from December 2011 to December 2016. All the patients were followed up at least for nine months for the study. Radiological union was finally assessed in nine months.

Result

All the fractures united within nine months of plating without angulation in sagittal or coronal plane. One patient (2%) had limb length shortening of more than one cm. Full range of motion of ankle and knee joint was achieved compared to the normal side by nine months follow up. 17 (38%) patients developed marginal skin necrosis. Three (7%) patients developed superficial wound infection. These complications were seen more in patients in whom posterior below knee slab was used for pre-operative splintage (as compared to calcaneal traction).

Conclusion

Hence distal one-third tibial fractures with or without articular involvement can be treated with anterolateral tibial plate.

KEY WORDS

Anterolateral, Distal, Fracture, Plating, Tibia

INTRODUCTION

Distal one-third tibial fractures with or without articular involvement can be difficult to manage.¹⁻³ Metaphyseal reduction and restoration of articular alignment without soft tissue complication is always challenging.^{2,4} Variety of treatment methods have been suggested for these injuries, including conservative treatment, external fixation with or without internal fixation, intramedullary nailing, plate fixation (medial or anterolateral) and more recently minimally invasive plate osteosynthesis (MIPO).^{3,5-10} But none of these techniques are without complications. Conservative treatment may result in malunion if the fracture extends to the articular surfaces. External fixation and intramedullary nailing have less soft tissue complications but have higher rates of malunion.^{1,3,11-14} Intramedullary nailing has got limitations with far distal fractures and with fractures extending to the joint line.¹⁵ Plate osteosynthesis has local soft tissue complications including wound dehiscence and infection.¹⁶ The purpose of this study was to evaluate the results of anterolateral plating of these fractures.

METHODS

This is a prospective study carried out at Kathmandu Medical College Teaching Hospital from December 2011 to December 2016. Ethical clearance was achieved from the hospital ethical board. Forty-five closed fracture distal 1/3 (up to the junction of middle and lower one third) of tibia or tibia and fibula AO (Arbeitsgemeinschaft für Osteosynthesefragen) type 43 A, B C1 and C2 were included in the study. Open fractures, AO type 43 C3, pathological fractures and polytrauma were excluded from the study. Those patients arriving in the hospital immediately after trauma were kept either in below knee posterior slab or in calcaneal skeletal traction till soft tissue healing. All the operations were carried out in spinal anaesthesia. Tourniquet was applied in all the cases. Anterolateral approach was used to reach the fracture site. Fracture was identified and reduced. Anatomical pre-bent plate was placed on the lateral surface of tibia and fixed with 6 mm cancellous screws at epiphysio-metaphyseal region and with 4.5 mm cortical screws at diaphyseal region. Inter-fragmentary screws were inserted if required (Figure 1-6). Associated fibula fracture was also fixed with 3.5 mm one third tubular plate with the same incision. Below knee posterior slab was continued for two to three weeks in postoperative period depending upon soft tissue healing. After slab removal ankle mobilization exercise was started. Plain X-rays were taken in anteroposterior and lateral views in six weeks follow up and partial weight bearing ambulation was started. Gradual full weight bearing ambulation was started in 12 to 14 weeks after achieving check X-rays. All the patients were followed up at least for nine months for the study. Radiological union was finally assessed in nine months X-ray. Reduction was graded satisfactory if fracture

angulation was less than 5° in sagittal and coronal plane and limb length shortening of up to 1 cm. These parameters were measured in postoperative period and at nine months follow up. Wound complications were recorded and correlated with size of the wound and method of preoperative immobilization (posterior slab versus skeletal traction). Statistical analysis was performed with Statistical Package for the Social Sciences (SPSS) (Chicago, Illinois, USA) version 15 software for window. Unpaired t-test and Chi Square tests were used for statistical analysis to determine significance. A p value of 0.05 or less was considered significant.



Figure 1. Plate fixation over lateral surface of tibia



Figure 2. X-ray of ankle AP/Lat view showing fracture



Figure 3. X-ray of ankle AP view after fixation



Figure 4. X-ray of ankle lateral view after fixation



Figure 5. X-ray of ankle AP view after bony union



Figure 6. X-ray of ankle Lat view after bony union

RESULTS

There were twenty-eight (62%) male and seventeen (38%) female patients. Average age of the patient was 31.7 years ranging from 20 to 56 years. Twenty-seven (60%) patients had fracture in right lower limb and eighteen (40%) in left. Twenty-seven (60%) patients had AO type A fracture, thirteen (29%) had type B and five (11%) had type C. All the fractures united within nine months. Average immediate post-operative angulation in coronal plane was 2.62° and it was 2.64° in final follow up. Deformity in sagittal plane was 2.36° in immediate post-operative X-ray and 2.42° in final follow up. None of the patients had angular deformity of more than 5°; neither in sagittal nor in coronal plane in immediate postoperative period and in final follow up. One patient (2%) had limb length shortening of more than one cm. Full ankle and knee range of motion was achieved by nine months. Marginal wound necrosis was found in 17 (38%) patients. Out of 22 patients who were kept in skeletal traction before operation 4 (18%) patients developed marginal epithelial wound necrosis whereas 13 (59%) out of 23 patients who were immobilized in posterior slab had this problem. Superficial wound infection was found in three (7%) patients. Infection was controlled by appropriate antibiotics and by regular wound dressing. Wound complication was found significantly lesser with those patients who were immobilized in skeletal traction (calcaneal traction) than with those who were immobilized in posterior slab in preoperative period. There was no significant difference between wound complication and fracture types (AO type A, B and C) (Table 1).

Table 1. Wound complication

	Wound complication		Total	P value
	NO	Yes		
AO fracture type	A	16	11	27
	B	9	4	13
	C	3	2	5
Total	28	17	45	0.82

DISCUSSION

The treatment of distal tibial fractures often become difficult for orthopaedic surgeons because of the limited soft tissue around the bone, its subcutaneous location, and poor vascularity.^{2,5} The main objectives of the treatment of these fractures are maintenance of articular surface, restoration of limb alignment, avoidance of soft tissue complications and achieving fracture union.^{2,4} Conservative treatment has higher rate of malunion and limb shortening.¹⁷

Intramedullary interlocking nail is well accepted for the treatment of fractures of middle third of tibia. Many surgeons have recommended its use in distal tibial fracture. Medullary cavity in distal third of tibia widens distally. Hence nail is not snugly fitted into the cavity and there is a chance of malunion of the fracture.¹¹ Its use is difficult in the fractures extending to the articular surface.¹⁵

Janssen et al. found that in distal tibial fractures control of alignment was difficult with an intramedullary nail.¹² Guo et al. had no patient with more than 10° of angular deformity in both nailing and plating group.¹⁶ Ehlinger et al. used intramedullary interlocking nail in fractures extending to distal articular surface.¹⁴ Axial deviation greater than 5° was observed in 27.5% of patients.

Plate osteosynthesis of distal tibial fracture is one of the good methods of treatment with less malalignment.^{18,19} Vallier et al. reported angular malalignment of 5° in 23% of patients treated with nails and 8.3% of patients treated with plate.¹¹ In immediate postoperative radiograph and in final follow up none of the patient in our patients had more than 5° in sagittal and coronal plane.

There are options of medial and lateral plates. Medial conventional plating gives good fracture reduction, but results in soft tissue complications.^{16,20,21,22} Lateral plating has minimal soft tissue complication, as tibia is not subcutaneous laterally. Lee et al. conducted comparative study of medial and lateral plating for surgical treatment of distal tibia fractures.²¹ In their study they achieved good functional outcomes with low malunion rate in both medial and lateral plating, however lateral plating had more advantages and fewer complications than medial plating.²¹ In their study they had superficial wound infection in 5% of patients with lateral plating. Manninen et al. had a study of 20 cases using lateral approach for fixation of distal tibia.²³ Ten percent of patients developed malunion after good primary reduction. Twenty percent of patients had superficial wound infection.²³ In our study 7% of the patients had superficial wound infection and they were treated conservatively. By using anterolateral incision fibular fracture can also be fixed eliminating the need for two separate incisions.²⁰

Minimally invasive percutaneous plate osteosynthesis has less soft tissue complications.⁶⁻¹⁰ This method is technically demanding.¹⁰ Very often it is difficult to achieve anatomical reduction of the fracture especially if it is intra-articular. Hardware being subcutaneously placed, its prominence may require an early removal.^{9,10,16,22} Lau et al. and Shrestha et al. reported removal of implant due to skin impingement

in 52% and 30% of the patients treated with minimal invasive plate osteosynthesis in distal tibia fractures respectively.^{9,10} In the study of Maffulli et al. seven patients out of twenty had angulation of more than 7°. This method of fixation is not recommended in the fractures with soft tissue injury medially.¹⁸ Lau et al. reported late infection in 15% of his patients treated with this method.⁹ Because of the stripping of the hexagonal recess and threads of the locking screws there was difficulties in removing locking plates, which was less in conventional plate and screws.¹⁶ But this problem was not encountered in the study of Shrestha et al.¹⁰

Definitive treatment with external fixators in those fractures result in malunion, stiffness and pain than open reduction and internal fixation (ORIF).¹ However, application of external fixator spanning the ankle joint as a first stage surgery followed by definitive ORIF as a second procedure reduces soft tissue complication and malunion.^{1,24} In our study also wound complication was found significantly lesser with those patients who were immobilized in skeletal traction than with those who were immobilized in posterior slab in preoperative period. This result might be due to the fact that skeletal traction helps in maintaining the length of the limb, which is not achieved with slab immobilization. Wound complication was irrespective of AO type (Table 1). Definitive surgical procedure after soft tissue healing might have been the reason of insignificant wound complication even in type C fractures. It has been reported that staged surgical protocol; external fixator application till soft tissue healing followed by definitive surgical procedure; for complex fractures of distal tibia lessens postoperative wound complication.²⁴⁻²⁶

This is not a randomized case control study. Comparison between different techniques would have been better in terms of accessing the results.

CONCLUSION

We conclude that distal third tibial fractures with or without articular involvement can be treated with anterolateral tibial plate.

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