

A Study on Surgical Management of Distal Tibial Fractures by Using Minimally Invasive Technique of Percutaneous Plate Osteosynthesis with Locking Compression Plate

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ABSTRACT

Introduction: Tibia is the major weight bearing bone of the leg. It is the one of the commonest bone to be fractured. In an average population there are about 53 tibial fractures per 1 lakh population per year, out of which 70% are distal tibial fractures. For the past decade, plating using fracture reduction has been successful in treating complex fractures of the lower extremity especially distal tibia. Minimally invasive percutaneous plating will restore limb alignment and yield successful clinical outcomes for high-energy fractures of the distal tibia.

Aim & Objectives: 1. To study Distal Tibial Fractures including Pilon Fractures in adults. 2. To assess time required for fracture union. 3. To evaluate functional outcome of the surgery and compare with those in literature. 4. To study complications of surgery.

Methodology: The present study was conducted from 1st September 2016 to 1st September 2017 at the Department of Orthopaedics, Varun Arjun Medical College, Shahjahanpur, During this period 14 patients of distal one third tibia fractures were treated surgically.

Results: The age of the patients ranged from 18 to 65 years with the fracture being most common in the 3rd and 4th decade and an average age of 39 years. Out of 14 patients, 11 (78.57%) patients were males and 03 (21.43%) patients were females showing male preponderance. Out of the 14 cases, 09 (64.29%) cases were closed fractures and 05 (35.71%) cases were open fractures. At the end of 12 months of the 14 patients treated, 02(14.29%) patients had excellent outcome, 07 (50%) had good results, 03 (21.42%) had fair outcome and 02(14.29%) patient had a poor result. Only 2 (14.29%) cases were having ankle stiffness followed by superficial skin infection (7.14%) and deep infection (7.14%).

Key words: Tibial fractures, Pilon Fractures, closed fractures, Minimally invasive percutaneous plating.

INTRODUCTION

Tibia is the major weight bearing bone of the leg. It is the one of the commonest bone to be fractured. In an average population there are about 53 tibial fractures per 1 lakh population per year, out of which 70% are distal tibial fractures. Males are more commonly affected than females with male incidence being about 41 per lakh per year and female incidence

about 12 per 1 lakh per year. ^[1] Open fractures are more common, because of its surface is subcutaneous throughout most of its length. Distal third of tibia is particularly prone for delayed and non union because of its precarious blood supply. ^[2]

Before 1970, studies advised conservative treatment for distal tibial extra and intra articular closed fracture treated with slab, cast application for 4 to 6 week,

followed by functional bracing or patellar tendon bearing Conservative treatment of distal tibia fracture often results in a number of complications including malunion, non union and ankle stiffness. Operative treatment is indicated for most tibial fractures caused by high energy trauma. Operative treatment allows early motion, provides soft tissue access, and avoids complication associated with prolonged immobilization. The goals of treatment are to obtain a healed, well- aligned fracture; pain free weight bearing; and functional range of motion of ankle joint.

For the past decade, plating using fracture reduction has been successful in treating complex fractures of the lower extremity especially distal tibia. The goal of this technique is to apply stable plate fixation while maintaining the fracture biology and minimizing soft tissue problems. [3] Recently, there has been an increasing trend towards use of a locking plate for treatment of complex fractures of the distal part of the tibia. [4] The fundamental goal of treatment of distal tibial fractures is restoration of normal or near normal alignment and articular congruity with locking compression plate. Compared with a conventional plate, a locking plate imparts a higher degree of stability and provides better protection against primary and secondary losses of reduction and minimization of bone contact. [3]

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 fit. [4] The newer techniques include Minimally invasive percutaneous plate osteosynthesis which aims at minimal periosteal dissection and disruption of hematoma, stable anatomical fixation and early mobilization, decreased post operative complications and higher rates of union. Minimally invasive percutaneous plating will restore limb alignment and yield successful clinical

outcomes for high-energy fractures of the distal tibia.

In this study the fractures are classified according to AO classification and soft tissue damage according to Tsherne classification.

Aims and Objectives:

1. To study Distal Tibial Fractures including Pilon Fractures in adults.
2. To assess time required for fracture union.
3. To evaluate functional outcome of the surgery and compare with those in literature.
4. To study complications of surgery.

MATERIALS AND METHODS

The present study was conducted from 1st September 2016 to 1st September 2017 at the Department of Orthopaedics, Varun Arjun Medical College, Shahjahanpur, During this period 14 patients of distal one third tibia fractures were treated surgically.

Inclusion Criteria:

1. All adults.
2. Patients with fracture of Tibia with or without fracture of fibula of the leg involving region between mid 1/3rd-distal 1/3rd junction to the ankle joint.
3. Closed and Gustilo & Anderson type I,II & IIIA open lower one-third Fractures of the leg.
4. All closed extra and intra articular distal Tibial fractures as per AO Classification 43A, 43B, 43C with Tsherne and Ostern grade 0 and grade 1.

Exclusion Criteria:

1. Patients less than 18 years of age.
2. Patients medically unfit for surgery.
3. Patient not willing for surgery.

On admission of the patient general information like name, age, sex, occupation and address were noted. Then a detailed history was elicited regarding mode of injury, Road traffic accident, direct injury to leg and ankle. Enquiry was made to note site of pain and swelling over the affected leg. Past medical illness and family history

were also recorded. General condition of the patients was examined for pallor, pulse rate and blood pressure. Respiratory and cardio

vascular system were examined for any abnormalities.



Figure: 1 & 2: Clinical images and locking compression plates.

Post-operative treatment

Postoperative treatment with Locking Compression Plates does not differ from conventional internal fixation procedures. Regular follow up for every 4 weeks was done. Local examination of the affected tibia and fibula for tenderness, instability deformity and ankle movements were assessed. X-rays were taken at each follow up visits to know about progressive fracture union and implant position. Rehabilitation of the affected extremity

were done according to the stage of fracture union and time duration from day of surgery. Patients were followed up till radiological union.

The fracture was designated as united, when there was periosteal bridging callus at the fracture site at least in three cortices in the anteroposterior and lateral views. trabeculations extending across the fracture site was also taken into consideration.

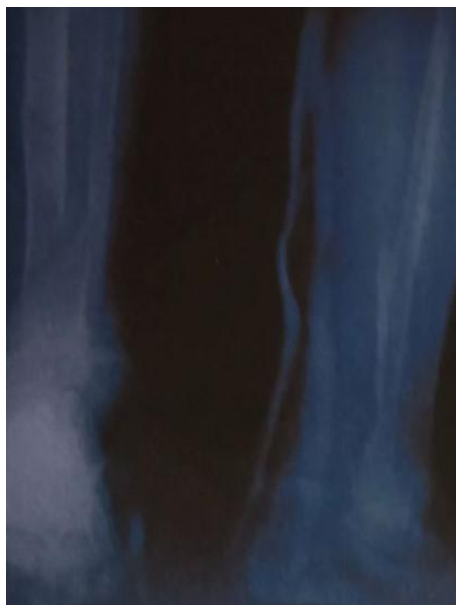


Figure 3: Pre-OP X Ray



Figure 4: Post-OP X Ray

Follow Up X Rays



Fig.5: 1 MONTH

Fig.6: 3 MONTH

Fig.7: 6 MONTH

RESULTS

The present study consists of 14 cases of fracture of the distal third of tibia. All the cases were fixed using locking compression plate by MIPPO method.

Table 1: Distribution of cases as per age

Age	Number Of Patients	Percentage
18-30	04	28.57
31-40	05	35.71
41-50	02	14.29
51-60	02	14.29
61-70	01	7.14
TOTAL	14	100

Table 1 shows age distribution of subjects. The age of the patients ranged from 18 to 65 years with the fracture being most common in the 3rd and 4th decade and an average age of 39 years.

Table 2: Distribution of cases as per sex

Sex	Number Of Patients	Percentage
Male	11	78.57
Female	03	21.43
Total	14	100

Table 2 shows sex distribution of cases. Out of 14 patients, 11 (78.57%) patients were males and 03 (21.43%) patients were females showing male preponderance.

Table 3: Distribution of cases as per type of fracture

Mode of Injury	Number Of Patients	Percentage
Open	05	35.71
Closed	09	64.29
Total	14	100

Table 3 shows type Distribution of cases as per type of fracture. Out of the 14 cases, 09 (64.29%) cases were closed fractures and 05 (35.71%) cases were open fractures.

Table 4: Distribution of cases as per results of surgery

Grade	No of patients	Percentage
Excellent	02	14.29
Good	07	50.00
Fair	03	21.42
Poor	02	14.29
Total	14	100

Table 4 shows distribution of cases as per results of surgery. At the end of 12 months of the 14 patients treated, 02(14.29%) patients had excellent outcome, 07 (50%) had good results, 03 (21.42%) had fair outcome and 02(14.29%) patient had a poor result.

Table 5: Distribution of cases as per complications of surgery

Complication	Number of Patient	Percentage (%)
Superficial Infection Skin	1	7.14
Ankle Stiffness	2	14.29
Deep Infection	1	7.14

Table 5 shows distribution of cases as per complications of surgery. Only 2 (14.29%) cases were having ankle stiffness followed by superficial skin infection (7.14%) and deep infection (7.14%).

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. The goal of operative treatment is to obtain anatomic realignment of the joint surface while providing enough stability to allow early motion. This should be accomplished using techniques that minimize osseous and soft tissue devascularization in the hopes of reducing the complications resulting from treatment.

The present study was undertaken to determine the efficacy of the locking compression plates in treatment of the fractures of the distal tibial metaphysis using minimal invasive technique.

In the present study the age of the patients ranged from 18 to 65 years with the fracture being most common in the 3rd and 4th decade and an average age of 39 years. It is comparable with other studies on similar fractures conducted by Heather A Vallier et al [13] and Collinger C et al [3] which shows average age of presentation is 43 years and 39.1 yrs respectively. In Bahari et al studies shows average age of presentation is 35 years.

In the present study, Out of 14 patients, 11 (78.57%) patients were males and 03 (21.43%) patients were females showing male preponderance. It is comparable to the study by Collinger C et al, [3] which was 66% possibly due to the fact of male dominance over the female in travelling, occupational injuries etc., in India. Also, the study by Heather A Vallier et al [13] was comparable in the fact that they had 67% male patients.

Ovadia and Beals [7] reviewed 34 fractures equivalent to Ruedi Type III treated with traditional open reduction and plate fixation. Good to excellent results were achieved in only 47%. Complications were numerous and, although not sub classified according to fracture type, superficial infections or skin loss developed in 9 patients (11%), osteomyelitis developed

in 5 patients (6%), 17 patients (12%) required either ankle arthrodesis or arthroplasty.

Gao et al, [10] studied 32 adult patients with very short metaphyseal fragments in fractures of distal tibia treated with a polyaxial locking system. The polyaxial locking system showed results of 87.3% excellent to good functional outcome using American Orthopaedic Foot and Ankle Society score. They concluded that the polyaxial system offers more fixation versatility and can be used as a reasonable treatment option for distal tibia fracture with very short metaphyseal segments.

In a study that established open reduction with plate and screw fixation as the standard, Ruedi and Allgower [5] achieved 74% acceptable results in 84 patients. These results did not deteriorate for 9 years. Mast et al [14] reported 78% satisfactory results in 37 patients with a minimum follow up interval of 6 months. Less dramatic results were reported by a variety of authors when the plafond fractures studied included larger numbers of high energy injuries. Bourne and colleagues [6] studied 42 patients with tibial plafond fractures, 62% of whom were victims of high-energy trauma. Of the 19 Ruedi type III fractures treated by open reduction and internal fixation, only 44% had a satisfactory result. The majority of these fractures were complicated by nonunion (25%), infection (13%), and Arthrodesis (32%).

Hazarika et al, [9] in their study of 20 patients of distal tibial fracture treated using locking compression plates through MIPPO technique got 87.5% of good to excellent results. Fractures were classified according to the AO system and performed as scored stage surgery after stabilization with external fixators primarily.

Mc Ferran et al [12] reported on 52 tibial plafond fractures of which 46 were treated with open reduction and internal fixation. 21 cases (40%) of these were Ruedi Type III injury. A total of 21 fractures developed major local

complications with Osteomyelitis and wound breakage being most commonly encountered complications seen in 6 cases. Other complications encountered being deep infection, mal-union, non-union, loss of fixation and inadequate soft tissue coverage.

Ozkaya U et al, [11] in a retrospective review of 22 patients with distal third tibial fractures who were treated with titanium locking compression plates using minimally invasive technique, reported good biological fixation of distal tibia. A total of 81% of good to excellent outcome was assessed using American Orthopaedic Foot and Ankle Society.

Im GI et al, [8] in a study of 30 patients using anatomic plates and screws, open reduction and internal fixation was done with 88.2% excellent to good results according to Olerud and Mollander functional ankle score and with a better alignment of fracture fragments.

CONCLUSION

According to this study, 14 patients with fractures of the distal tibia had undergone closed reduction with MIPPO technique and internal fixation with locking compression plates. This technique has resulted in the effective stabilization of these fractures. It does provide adequate stability and allows early motion. It not only helps in achieving reduction but also in rapid union, because it facilitates preservation of the blood supply to the fragment. The greatest advantage in internal fixation with MIPPO using locking compression plates is that anatomical reduction is achieved and fracture haematoma is not disturbed much. It is also effective in extra articular fractures occurring within 5cm of the joint where intramedullary nails do not provide enough stability and external fixators, usually applied for primary stabilization until soft tissue edema subsides, causes ankle stiffness and delays the return to work.

It is simple, has a rapid and straight forward application and has a reduced surgical time in both extra articular fractures

and intra articular fractures due to newer anatomically contoured locking compression plates for the distal end tibia fractures.

Although, a larger sample of patients and longer follow up are required to fully evaluate this method of treatment, we strongly encourage its consideration in the treatment of such complex fractures.

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