Outcome of distal tibia fractures: A prospective study of 25 patients

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Abstract

Aims and Objectives: To Study the outcome of distal tibia fracture fixation with locking plate and compare it with other methods of fixation and assess time taken for radiological union and functional outcome.

Methods: 25 patients admitted between June 2016 to August 2018, aged between 27 to 66 years with distal tibia fractures including both extraarticular and intraarticular type were studied prospectively.

Results: Of the total 25 patients, 21(84%) patients had excellent to good recovery of plantar flexion and dorsiflexion movements, 3(12%) patients had fair recovery of movements and 1(4%) patient had poor recovery of movements.

Conclusions: With good articular reduction along with correction of length and rotation with Stable fixation and good postoperative rehabilitation, Good to Excellent results can be achieved.

Keywords: Distal tibia, prospective study, plating

Introduction

The distal tibia region is also known as tibia pilon. It includes the diaphyseal, metaphyseal region as well as tibiotalar and tibiofibular articulation and distal part of fibula. The medial malleolus is a distal and slight anterior projection from the medial aspect of the weight bearing portion. The lateral malleolus is the terminal distal portion of fibula that articulates with lateral aspect of the talus bone [1]. Distal tibia fracture is one of the most complex injury involving the ankle joint, accounting for approximately 7% of all tibia fractures also known as “PILON” or “Plafond” fractures [1, 2]. Distal tibia fracture involves fracture in distal diaphyseal, metaphyseal, intraarticular region of tibia fracture, distal fibula with or without syndesmosis joint injuries and with or without medial malleolus [3]. Modern lifestyle and increase in high speed road traffic accidents especially two wheelers, has lead to an increased incidence of complex fractures of the distal tibia which has made their treatment all the more difficult. It may present in isolation but also seen frequently in poly traumatized patients associated with marked metaphyseal and articular comminution, wide displacement, chondral impaction, associated fibula fracture and articular debris [1]. Treatment of the fracture of distal tibia is a challenging task because of many reasons. With less soft tissue coverage over the bone, comminution of weight bearing articular surface of distal tibia has high chances of nonunion. (5% to 6.6 %). Open injuries are often difficult to manage with primary internal fixation [5]. Considerable advances in the method of internal fixation and new innovations in implants and operative techniques helped to meet such difficulties. The surgical management of distal tibia fracture has evolved over the past years in a large part due to an improved understanding of the importance of the soft tissue envelope. The ultimate goals of distal tibia fractures are restoring anatomic articular surface, maintaining joint stability, restoring mechanical alignment, achieving fracture union and to regain functional and pain free weight bearing and motion while avoiding complications [3]. At present era innovations of newer pre contoured anatomical locking plates with specifications like low profile, locking combinations hole with undercut, optimal distal application of head screw and also availability of guiding blocks with advances in operative technique like MIPPO has improved the bony fixation, preserved the vascularity and surrounding soft tissue so that overall outcome can be improved [3]. In this study an attempt has been made to evaluate the results of fractures of distal tibia fixed with distal tibia...
locking plate in terms of fracture type, modality of treatment used, duration of fracture union time and extent of functional outcome to the patient and compare those results with other study results.

**Aims and Objectives**

To Study the outcome of distal tibia fracture fixation with locking plate and compare it with other methods of fixation and assess time taken for radiological union and functional outcome.

**Methods and Material**

This study includes Twenty Five patients with distal tibia fractures treated with distal tibia locking plate at our institute, NHL Municipal Medical College, Ahmedabad after obtaining approval from ethical committee of the institute. It is a prospective observational study. This study is carried for patients admitted between June 2016 to August 2018. This study includes patients between 27 to 66 years of age with distal tibia fractures including both extraarticular and intraarticular type. This study include all patients with closed or open grade 1 and 2 distal tibia fracture. This study excluded all open grade 3 distal tibia fracture, distal tibia fracture with associated vascular injury, also exclude pathological distal tibia fracture.

Fixation for distal tibia fracture done with distal tibia locking plate either with MIPPO or ORIF. Fixation for fibula fracture done either with closed Nailing or ORIF with plate. If distal tibia fractures were associated with severe swelling and open wound where primary plating not possible then those patient were treated with Primary external fixator for tibia and CRIF with nailing for fibula which later on converted into distal tibia locking plate fixation. Patient discharged after 3 to 4 day of surgery. Regular post operative follow up done on outdoor orthopaedic department.

In this study all twenty five patients of distal tibia fractures fixed with distal tibia locking plate. For fixation of distal tibia locking plate different operative techniques were used. First if fractures of distal tibia associated with severe soft tissue edema plus ecchymosis and on clinical assessment we found that it was not possible to do definitive internal fixation with distal tibia locking plate, then we primarily fixed those fractures with closed reduction and external fixator plus associated distal fibular fracture managed with CR and nailing, later on those patients treated with removal of external fixator and definitive internal fixation with distal tibia locking plate. If on clinical assessment we found that after 2 to 3 days of pin traction and elevation, soft tissue was favorable for internal fixation as primary definitive management then we went for direct closed reduction plus MIPPO distal tibia locking plate fixation or primary definitive ORIF with distal tibia locking plate. With patient positioned supine on radiolucent table, antibiotic prophylaxis given and intra operative fluorooscopy is used throughout the procedure. The operative limb is prepared and draped above the knee. Tourniquet inflated whenever feasible. In first stage if there is distal fibula fracture present then first Closed Reduction and fixation of fibula done with intra medullary nail was done. Under IIITV a tibial reduction assessed. The intraarticular fragments anatomically reduced preferably without opening the fracture site. K wires may be used to joystick the fracture fragments into proper position. Once the intraarticular reduction, length, alignment and rotation achieved and compared with the opposite limb, fracture is then provisionally fixed with K wires. Plate length was selected according to zone of injury and number of screws selected. There are two limbs of the incision. One distally, for application of screws in the metaphyseal region and one proximally for application of screws in the shaft. In some cases, we have to put stab incision in the proximal part to apply screws into the proximal holes of the plate. The length of the distal incision varies from 3-10 cm, centering it on the tip of the medial malleolus. We try to keep the incision as small as possible. A subcutaneous tunnel created between the distal and proximal incisions. A proper sized plate passed along the tunnel, bridging the fracture site. The plate has to be long enough to bridge the metaphyseal zone and to allow at least three bicortical screws insertions proximal to the fracture. Plate can be held temporary in place with plate holding forceps or K wires. Distally 4 mm locking cancellous screws applied, and proximally simple or locking cortical screws applied. At least three bicortical screws are applied proximally. Reduction checked and confirmed under IIITV. Closure done layerwise and finally done with skin sutures. All patients having intraarticular fractures, highly comminuted, open grade 2 fractures with bone loss, those fractures that can not reduced with closed reduction and internal fixation techniques were fixed with open reduction and plate fixation. Check x-ray done to see reduction and joint congruity, implant placement. Below knee slab given for 2 weeks till suture removal. Analgesics and supportive drugs given. On regular follow up examination, Ankle toe mobilization started after removal of slab at around 2 weeks, Toe touch weight bearing around 6 weeks, Partial weight bearing walker walking around 9 to 10 weeks and full weight bearing walker walking after 12 weeks. The course of healing was documented radiologically (AP and lateral) and clinically. The moment of complete healing was defined as follows: Radiologically complete bone regeneration at the fracture site and a patient capable of pain-free, 100% loading of the injured limb. Delayed healing was defined as inadequate consolidation at six months after the operation. Evaluation of any possible loss of reduction that might have occurred by comparing the postoperative radiographs. Assessment and analysis of any complications observed and the necessary revision operations with regard to cause, the role of the implant and operative technique. Assessment done with functional and anatomical score (AOFAS SCORE)

**Fig 1: Fibula Fixation**

**Fig 2: Provisional K Wire Fixation**
Observation and Results

This study included twenty five patients of distal tibia fracture with or without intra articular involvement and with or without fibula fracture treated with distal tibia locking plate with minimum follow up of three months and maximum follow up of two years. CT SCAN is better for preoperative planning and management of distal tibia fracture with intra articular involvement. In this study we observed patients with minimum age of 27 years and maximum age of 66 years. In this study we included twenty five patients and observed that out of 25 patients, 23 patients were male and 2 were female in whom 13 were left side, 11 were right side, 1 patient had bilateral fracture which consisted of 4 intra articular and rest extra articular fractures. Most common mode of trauma for distal tibia fracture is Road traffic accident as shown in Table 1. In this study we observed out of 25 patients, 15 patients had closed fracture, 10 had open fracture, out of 10 open fractures 6 patients had grade one open fractures and remaining 4 patients having grade two open fracture. We observed five patients had other bony injuries having intertrochanteric fractures, medial malleoli fractures, distal shaft femur and lower end tibia fractures while two patients had head injury. Of all the patients, two patients were treated with external fixator and secondary plating due to compromised soft tissue envelope, eighteen patients treated with MIPPO technique of plating, four patients treated with open reduction and internal fixation and one patient required multiple interventions. In this study functional outcome measured with AOFAS SCORE, out of 25 patients we found 14(56%) patients had excellent AOFAS score, 5(20%) patients had good AOFAS score, 5(20%) patients had fair AOFAS score and 1(4%) patient had poor AOFAS score shown in Table No.2. In this study we found more wound related complications when we had done open reduction and internal fixation, 3 had superficial infection which were treated with antibiotics, 1 patient had deep infection which was treated with debridement and long term antibiotic (6 weeks) and implant removal at 6 months. In this study shows that radiological union appear between 3 to 4 months out of which maximum patients had radiological union by 16weeks as shown in Table No.3. In this study as we allowed early mobilization so we found 21(84%) patients had excellent to good recovery of plantar flexion and dorsi flexion movements, 3(12%) patients had fair recovery of movents and 1(4%)patient had poor recovery of movements.

Table 1

<table>
<thead>
<tr>
<th>Mode of Injury</th>
<th>No. of Patients</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Road Traffic accidents</td>
<td>19</td>
<td>76</td>
</tr>
<tr>
<td>Domestic Fall</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Assault</td>
<td>1</td>
<td>4</td>
</tr>
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</table>

Discussion

In this study, we found 25 patients with mean age group of 45 years with majority of patients in between 46-60 years, Paluvadi et al. [6] noted 50 patients with mean age group of 36 years and sitnik et al. [7] observed 80 patients with mean age group of 43 years. We observed male predominance (92%), similar to Somashkehr et al. [8] also observed male predominance (75%) and Corry collinge et al. [9] observed 77% male dominance. In this study, We found road traffic accidents (76%) as a most common cause for Distal tibia fractures. Hegazy et al. [10] also observed 80% of distal tibia fractures associated with Road traffic accidents. Kosalraman et al. [11] observed 60% distal tibia fractures associated with Road traffic accidents. Heather valleur et al. [12] observed 51% fractures associated with it. 15(60%) patients associated with closed injury, rest of the patients had open grade 1 and 2 fractures, while Bhairi et al. [13] observed 70% patients with Closed injury, Prakash et al. [14] observed 90% patients with closed injuries.

In this study, 21(84%) patients had extraarticular and 4 patients had intraarticular fractures, while Gulabi et al. observed [16] 16 extraarticular and 4 intraarticular fractures, Kundu et al. [15] observed 17 extraarticular and 3 intraarticular fractures. In this study, 4 patients treated with primary ORIF out of which 2 had intraarticular extension, 18 patients were treated with primary CRIF with MIPPO technique, 2 patients treated with primary external fixator and later on converted into distal tibia locking plate fixation. In this study, two patients had associated Head injury out of which one patient had mandibular fracture and another patient had extradural hematoma in temporoparietal region. In this study all patients were treated within five days of admission as MIPPO technique was used which has an advantage of minimal soft tissue injury during procedure. In this study we found 7 patients (28%) with postoperative complications, 4(16%) patient had postoperative infections, 1 patient had Superficial infection which was treated by antibiotics postoperatively, 3 patient had Deep infection, Paluvadi et al. [6] observed 12% postoperative complications, JJ GUO et al. [17] observed 14,6% postoperative complication rate. Plate impingement (4%) was observed in one patient hampering day to day activities, 1(4%) patient had done weight bearing early and ultimately implant failure and fibrous nonunion. 1(4%) patient had Nonunion with Chronic osteomyelitis. Hasenboehler et al. [14] observed 17% patients with Nonunion, Hazarika et al. [17] observed 10% patients with nonunion, Collinge et al. [9] observed 8% Nonunion rates. In this study average time for radiological union was 15 weeks, Bahari et al. [10] observed mean radiological union time of 23.4 weeks, Paluvadi et al. [6] observed 21.4 weeks, Ahmed et al. [18] observed 15 weeks.
this study of 25 patients, 21 (84%) patients had excellent to good ankle movement recovery. SK Ali et al. also observed (83.2%) patients had excellent to good results, rest of the patients had fair to poor recovery of ankle movements. In this study, outcome measured by AOFAS score, mean AOFAS score in this study is 88, with 14 patients had excellent results (56%), 5 (20%) had good results, 5(20%) patients had fair results, 1 (4%) had poor results. We compared our score with similar study design by Ahmed et al and P.Joveniaux et al.

### Summary and Conclusion
This study comprise 25 patients of distal tibia fracture treated with distal tibia locking plate by various methods like primary external fixator with definitive locking plate later, primary CR and MIPO locking plate fixation and ORIF with locking plate. With good articular reduction along with correction of length and rotation with Stable fixation and good postoperative rehabilitation, Good to Excellent results achieved. AO classification had been widely used for classification of Distal Tibia extra as well as intra articular fractures. Age of patient, general medical status, systemic disorder as well local skin condition will alter the outcome of distal tibia plating results. Fixation with distal tibia plate provide stabilization and allowed early mobilization. The fixation with these plates not only helps in achieving reduction in difficult situations, but also helps in union, because it facilitates preservation of the blood supply to the fragment and anatomical reduction of the fracture. Its greatest advantage is anatomical reduction and undisturbed fracture hematoma. It is also effective in extra articular fractures of the distal tibia because intramedullary nails often do not provide enough stability in distal end and external fixators usually applied for primary stabilization until soft tissue get subsided, delays the return to work with fixators. There are fewer incidences of delayed union and non-union, plate exposed and other complications. But in spite of all these, there is a decreased need for bone grafting and incidence of infection is less due to limited exposure and low profile anatomical contoured plate. MIPO with smaller incisions, lesser soft tissue dissection, lesser bleeding and strong implant construct, which allows us to do internal fixation even in compound fracture type 1 and 2. Removal of implant after minimal invasive procedure is also easy n require minimal soft tissue dissection. MIPO using locking plates is particularly effective in managing fractures of osteoporotic bones. So at last in this study we concluded that with application of proper operative method specially MIPO distal tibia locking plate fixation provide good outcome.

### AOFAS Scores

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<tr>
<th></th>
<th>Excellent (90-100)</th>
<th>Good (75-89)</th>
<th>Fair (50-74)</th>
<th>Poor (&lt;50)</th>
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<tbody>
<tr>
<td>Ahmed et. Al</td>
<td>64%</td>
<td>20%</td>
<td>8%</td>
<td>8%</td>
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<tr>
<td>P.Joveniaux et al</td>
<td>30.6%</td>
<td>24.75%</td>
<td>36.6%</td>
<td>7.9%</td>
</tr>
<tr>
<td>This Study</td>
<td>56%</td>
<td>20%</td>
<td>20%</td>
<td>4%</td>
</tr>
</tbody>
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References
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3. Gray’s anatomy for students, anatomy of leg, 3.