Original Research Article

Functional outcomes in the Distal Tibial Fracture fixation using the locking plates

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Received: 05-10-2021 / Revised: 08-12-2021 / Accepted: 22-12-2021

Abstract

Background: The best treatment for fractures of the distal tibia remains controversial. Most such fractures require surgical fixation but outcomes are unpredictable and complications are common. We aimed to evaluate the functional outcomes of fixation of distal tibial fractures using locking plates. **Material and Methods:** The present retrospective study included 10 cases aged more than 20 years, who were operated for distal tibial fractures over last 3 years with locking plates. **Results:** The mean age was 39.57±15.51 with a range of 20-68 years. Mean operating time was 85±11.15 minutes. Mean blood loss was 100±10.5 ml. Mean time for union was 18.15±2.35 weeks. The mean time to full weight bearing was 15.5±4 weeks. 1 patient had superficial infection which was managed with intravenous antibiotics. No deep infection was noted. **Conclusion:** Plating offers good functional outcome in distal tibial fractures management over other treatment methods.

Key Words: Distal tibia fracture, locking plates, MIPPO.

Introduction

Distal tibial fractures are among the most problematic fractures to manage due to the limited soft tissue cover available, poor blood supply of the distal tibia and proximity to the ankle joint. Infections, nonunion, and malunion are some of the complications encountered in the distal tibial fractures[1,2]. Intramedullary nailing and minimally invasive percutaneous plate osteosynthesis (MIPPO) are two commonly used methods for the treatment of these fractures. Using a Poller screw to guide the intramedullary nail in the canal is the surgical method used during nailing to prevent malalignment[3,4].Difficulty in reduction and insertion of poller screws make these fractures generally unsuitable for nailing, however certain studies in the literature do report good results in these fractures[5,6]. External fixation can be used as either another method of treatment, especially in fractures with soft tissue injury that have poor skin condition, but malunion and delayed union are the main problems associated with this method. Conventional plating methods using open reduction have the propensity of devascularising the fracture fragments, therefore, minimally invasive plating methods have the advantage of adequate fixation in a biological manner with minimal disturbance of the vascularity of the fracture and hence improving the functional outcomes in the patients[7,8].We aimed to evaluate the functional outcomes of fixation of distal tibial fractures using locking plates.

Material and Methods

The present retrospective study was conducted in the Department of Orthopaedics, PGIMS Rohtak and included 10 cases aged more than 20 years, who were operated for distal tibial fractures over last 3 years with locking plates. Patients were retrospectively followed up with all their previous surgical records and radiographs. Patients were clinically examined and functional outcomes were noted. Patients with age less than 20 years, having congenital or acquired deformity of injured limb before surgery, pathological fractures and open fractures were excluded from the study. According to the AO classification, 12 fractures were type A, five fractures were type B and three fractures were type C. Informed and written consent was taken from all the participants before enrolling into the study. On presentation full demographic profile of the patient, necessary investigations and radiographs were taken in two planes, anteroposterior view and lateral view before planning for surgical fixation.

Surgical Technique

Small longitudinal incision centered over the medial malleolus was made, taking care of the saphenous vein and nerve, the fracture was reduced and a locking plate was inserted extraperiosteally over the distal tibia. Precontouring of the plate was performed to match the contour of the distal tibia and was followed by fixation using locking screws. Closed reduction achieved anatomical alignment in 8 fractures and open reduction was required in the rest two fractures. In 6 fractures a distal medial tibial LCP (Fig 1 and 2) was used and in 3 fractures a 4.5-mm (Fig 3) limited-contact locking compression plate (LC-LCP) was used fractures. In one patient, fracture was fixed with 3.5 mm LCP *Anterolateral* Distal *Tibia Plate and Recon plate (Fig 4).* A 3.5-mm one third tubular plate was used to fix the fibular fracture before tibial fracture fixation to maintain the alignment of the leg, thus making the fixation of the tibia easier. We did fibular plating in 7 patients and in one patient fibula was fixed with K wire. It is not necessary to fix the fibular fractures when the tibial fracture is simple without much comminution and also the fibular fracture is proximal to the syndesmosis. However, if the fibular fracture is at the level of or distal to the syndesmosis, with comminuted fracture of the distal tibia, it requires surgical fixation to maintain the lateral column of the ankle.Postoperative radiographs were taken on first postoperative day to assess the position of prosthesis/implant. Intravenous antibiotics were continued for 4 days postoperatively and sutures were removed on 12th-14th postoperative day. Limb elevation and active toe and ankle movements were followed for the initial two weeks after the surgery. Patients were evaluated clinically and radiologically at 1

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month, 3 months, 6 months and 12 months follow up with varying parameters including range of motion, limb length discrepancy, mobility status of the patient and complications. Radiological evaluation was done at each follow up to ascertain implant position and to see bone implant assembly. Full weight-bearing was permitted only after radiological evidence of union. Union was defined as bridging of three of the four cortices and disappearance of the fracture line on the Xray. At the final follow up, functional outcomes were assessed using the Olerud and Molander scoring system. Statistical analysis was done with SPSS version 16 using descriptive statistical methods including the Pearson Chi squared test and student-t test. A p value of <0.05 was considered as statistically significant.

Results

The mean age was 39.57±15.51 with a range of 20-68 years. There were 7 males (70%) and 3 females (30%). Right side was involved in 6 patients (60%) while left side was involved in 4 patients (40%). All the patients had Road side accident (RSA) as mode of trauma for their fracture. The mean duration from admission to surgery was 5±1.34 days. Mean operating time was 85±11.15 minutes. Mean blood loss was 100±10.5 ml. Mean time for union was 18.15±2.35 weeks (Table 1). The mean time to full weight bearing was 15.5±4 weeks. 1 patient had decreased ROM due to stiffness at the ankle joint due to poor compliance of physiotherapy exercises. 1 patient had superficial infection which was managed with intravenous antibiotics. No deep infection was noted. One case of non union was noted in this study (Table 2). Secondary bone grafting was done in this patient to fill up the gap so that union could be achieved. There were one case of scar breakdown resulting in exposure of the plate. However, there was no infection noted, so implant removal was done. It was further managed by a patellar tendon-bearing (PTB) cast with weight-bearing to achieve union of the fracture.

Discussion

The management of distal tibia fractures is challenging because of the subcutaneous nature of the tibia, limited soft tissue cover and poor vascularity of the distal tibial region. The external fixator is used as a damage-control orthopaedics in open fractures, but are often bulky and but malunion and delayed union are the main problems associated with this method[9,10].These fractures are generally not suitable for intramedullary nailing and additional procedures are required to maintain the stability of these fractures with intramedullary nailing, such as blocking screws or poller screws, which will increase the duration of the surgery and medical cost to the patient.[11] Though early surgical intervention can be done, but we should delay the surgery in the presence of local swelling until swelling subsides and wrinkle sign appears to ensure good skin condition before the surgery and to achieve good functional outcomes.[6] In our study, we also delayed our surgery and the mean duration of surgery after admission was 5±1.34 days, so as to achieve better cosmesis and good functional results. If the surgery is done before the swelling subsides, then there are high chances of wound dehiscence, implant exposure and subsequent infection.The treatment of distal tibial fractures by intramedullary nailing or internal fixation using locking plates may be associated with complications such as malunion, nonunion, wound dehiscence, infection and stiffness of adjacent joints[12,13]. Minimally invasive percutaneous plate osteosynthesis (MIPPO) of these fractures is advantageous as it minimises soft tissue damage due to surgery and also decreases devascularisation of the fracture fragments.[14] In our study, we did MIPPO plating in 8 patients in whom we achieved closed reduction of the fracture. MIPPO in comparison to open reduction and plating had better healing, better cosmesis and faster fracture union time. The healing rate in our study was 90% which is comparable to the healing rate reported in the other studies in the literature done in the past[6,8,16] Collinge et al[8] in their study done on Minimally invasive plating of high-energy metaphyseal distal tibia fractures reported that MIPPO plating restored proper limb alignment after fixation and yielded successful functional outcomes for high-energy metaphyseal fractures of the distal tibia. However, they also reported significant reoperation rate of 35% and prolonged time to union in patients treated by the MIPO plating technique. They advised that extra procedures are to be done in high risk patients including those with comminution at the fracture site and open fractures.[8] In our study we also did additional procedures in comminuted fractures in the form of primary bone grafting in two cases and acute docking of the fracture even at the cost of some shortening in 3 cases so as to facilitate union in these complex fracture patterns. In our study, we also did MIPPO plating in 8 patients giving better healing and functional outcomes. There are biological advantages of MIPO techniques over open reduction methods while dealing with the distal tibial fractures. The non union rate in our study was 10% which is higher in comparison to the non union rate with distal tibial fractures reported in the literature in the other studies[6,13-14].This high non union rate could be attributed to the small sample size in our study. Nonunion of distal tibial fractures represent some of the most complex cases an orthopaedic surgeon can face. These can be associated with open fracture, infection, poor skin quality and limited soft tissue coverage and osteopenia. Additionally, patient factors such as diabetes, smoking and peripheral vascular disease also contribute significantly to the nonunion in distal tibia fractures. The MIPPO plating in the compression can decrease the nonunion rate. Bulkiness of the implant can lead to wound closure complications and increasing the soft tissue tension after closure. In our study, simple primary closure of the surgical wound was not possible in two cases, showing the bulky nature of these locking plates, so low profile implant use is desirable in the distal tibia fractures management. However, cost can be a limiting factor for the use of low profile plates in distal tibia fractures. This complication has been reported by other authors in their respective studies done in the past[6,16].In surgical management of distal tibial fractures, proper selection of approach plays a very important role in the surgery. The antero-lateral approach allows proper exposure of lateral malleolus and distal tibia. In case of extra-articular fractures, or fractures with the main medial fragment of distal tibia, the medial approach with use of medial metaphyseal plate with the MIPPO technique should be used to achieve good functional outcomes[17]. The limitation of this study is small number of cases and short follow up.

Table 1: Showing demographic profile and results

Parameter	Number
Mean Age	39.57±15.51
Sex	M=7 F=3
Side	R=6 L=4
Mode of Injury	RSA-10
Mean time of fracture healing (weeks)	18.15±2.35
Mean operating time (minutes)	85±11.15
Mean blood loss (ml)	100±10.5

Table 2: Complications

Complication	No of patients
Superficial infection	1
Deep infection	0
Non union	1
Wound dehiscence	1

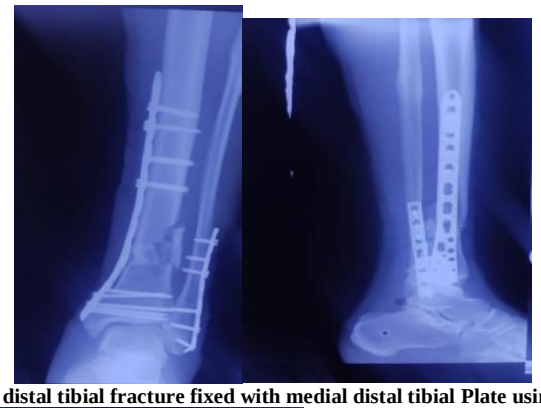

Fig 1: Xray showing distal tibial fracture fixed with medial distal tibial Plate using MIPPO technique

Fig 2: Fixation using MIPPO technique

Fig 3 Fixation by LCP using open reduction

Fig 4: Fixation using Anterolateral plate and Recon Plate

Conclusion

The treatment of distal tibial fractures with an LCP using the minimally invasive percutaneous plate osteosynthesis (MIPPO) technique is a good method of surgical management of the distal tibial fractures. MIPPO technique decreases the incidence of complications of soft tissue and enhances bone healing, gives better cosmesis when compared to the conventional plating methods. Plating also decreases the incidence of nonunion and malunion associated with external fixators when used in distal tibial fractures.

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Conflict of Interest: Nil Source of support: Nil