

Treatment of distal tibial fractures with minimally invasive plate osteosynthesis

Treatment of distal tibial fractures

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Abstract

Aim: Treatment of distal tibia fractures (DTF) is still controversial in the literature. In the current study, we aimed to report results of DTF treated with minimally invasive plate osteosynthesis (MIPO).

Material and Methods: Clinical results, union time and complications of patients with DTF treated using MIPO technique between June 2014 and January 2018 were evaluated.

Results: There were 17 male, 13 female patients with a mean age of 35 (range, 16-64) years. Mean follow-up time was 40,1±11,86 (range 24-60) months. The union was achieved on average in 5,3±1,66 (range, 3-8) months. One patient had superficial wound infection which was treated with antibiotherapy. One patient's implant was removed due to skin irritation symptoms 1 year after the complete union.

Discussion: MIPO technique is safe and effective with a very low complication rate in the treatment of DTF. Intraoperative care should be taken to prevent malunion and malalignment.

Keywords

Distal tibia; Fracture; Trauma; Minimal invasive

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Introduction

Distal tibia fractures (DTF) account for about 10% of all lower extremity fractures [1]. The fractures are caused by bending forces, rotational forces or high energy trauma [2]. Treatment of DTF is difficult due to poor blood supply, subcutaneous location (lack of overlying muscle) and closeness to ankle joint [3]. There are several options for treatment of DTF including open reduction and internal fixation (ORIF), minimally invasive plate osteosynthesis (MIPO), intramedullary nailing (IMN), and external fixator [3]. Each of these techniques has its own advantages and disadvantages so the ideal treatment of DTF is still controversial [4].

MIPO technique has the advantage of preserving periosteum and the fracture hematoma when compared to ORIF and preserving intramedullary blood circulation compared to IMN [5]. In this study we aimed to report our clinical results of MIPO technique in the treatment of DTF.

Material and Methods

The data of the patients treated for DTF between June 2014 and January 2018 were retrospectively reviewed. Inclusion criteria were patients treated with MIPO technique for DTF without articular extension, did not have a history of previous surgical intervention for DTF, closed or type 1 open fractures, patients with at least 1 year follow-up period. Exclusion criteria were patients treated with another technique than MIPO, articular extension, previous history of surgical intervention for DTF, follow-up period shorter than 1 year, type 2 or 3 open fractures. Fracture union was assessed with plain anterior-posterior and lateral radiographs and was defined as dense callus formation on at least 3 cortices on radiographs. Malunion was defined as angular deformity more than 5° and malrotation was defined as rotational malalignment of more than 10°. Clinical results were assessed with Johner-Wrush criteria [6]. Radiological and clinical records were assessed by an independent orthopedic surgeon who had no relation with the patient's treatment.

Local ethical approval was obtained. Informed consent form was obtained from all patients for inclusion in the study. All procedures in the study were in accordance with ethical standards of the the Helsinki Declaration.

Surgical Technique

Patients were operated under general or spinal anesthesia in the supine position. If the patient had a concomitant fibular fracture with syndesmotic instability, the fibula was fixed first via lateral approach (Figure 1). Reduction of fracture was achieved with closed reduction maneuvers or using clamps percutaneously under image intensifier. Once the fracture has been reduced a 4-5 cm curved or straight incision was made over medial malleolus. The saphenous vein was explored and protected. Then a tunnel between subcutaneous tissue and periosteum through proximal was created. An anatomical distal tibial plate with appropriate length passed through the tunnel. The plate temporarily was fixed with K-wires from proximal and distal to check its position with image intensifier both in anterior-posterior and lateral views. After appropriate positioning of the plate was achieved, it was fixed with locking screws (Figure 2). The wound was closed in standard fashion. Patients were mobilized with 2 crutches without weight-

bearing and ankle range of motions exercises were started the day after surgery. When the callus formation was seen on plain radiographs, progressive weight bearing was allowed. Patients were evaluated clinically and radiologically at 2 weeks, 6 weeks, 3 months and then monthly intervals till union was achieved (Figure 3). After the union was achieved, patients were followed at intervals of 3 months till post-operative 1st year, afterward at intervals of 6 months.

Statistical analysis

IBM SPSS version 22.0 (SPSS Inc., Chicago, IL, USA) was used to analyze data (mean, standard deviation).

Results

Thirty patients with complete data were included in the study. There were 17 male, 13 female patients with a mean age of 35 (range, 16-64) years. The right side was affected in 18, the left in 12 patients. Five patients had type 1 open fracture. Patients with open fractures have been started immediate intravenous antibioprohylaxis (cefazoline) soon after admission to the emergency department. All patients were operated in 48 hours after admission to hospital with a mean time of 18,13±11,09 (range, 4-48) hours. Mechanism of injury was a simple fall in 8 patients, fall from a height in 9, a motor vehicle crash in 7, a motorcycle accident in 3, and sports injury in 3 patients. There were 7 concomitant fibular fractures.

The mean follow-up time was 40,1±11,86 (range 24-60) months. The union was achieved in all patients after an average of 5,3±1,66 (range, 3-8) months. According to Johner-Wrush criteria, 15(%50) patients were excellent, 9(%30) were good, 5(%16,6) were fair, 1(%3,3) was poor.

One patient had superficial wound infection which was treated with antibiotherapy. One patient's implant was removed due to skin irritation symptoms 1 year after the complete union. No other complications (e.g. malunion, malrotation) were detected in our series at the final follow-up.

Discussion

Distal tibia fractures are one of the common fractures in daily trauma practice. There is no consensus about optimal treatment in the literature. The current study showed very good clinical and radiological results in the treatment of DTF with MIPO technique. There was a very low complication rate of the technique in our hands. All fractures healed in an average of 5,3 months.

Locking plaques have become a part of osteosynthesis techniques of orthopedics and traumatology surgeons in recent years. Similar or better results are reported with locked nails in applications in different parts of the body [7]. MIPO technique is worthwhile method to avoid some of the complications of conventional open plating [8]. Weak subcutaneous layer over distal medial tibia is one of the major concerns during treatment of DTF. Up to 50% infection rate has been reported in the literature following ORIF of DTF [8]. Gülabi et al. reported statistically significantly shorter hospital stay in patients treated with MIPO technique when compared to open plating technique [9]. Also there was no wound problem in MIPO group [9]. Vidovic et al. reported very good results with very low complications for DTF treated with MIPO [10]. In their series,



Figure 1. AP radiograph of a patient with distal tibia fracture concomitant with a fibula fracture



Figure 2. Intraoperative incisions after plate and screws were replaced



Figure 3. Postoperative AP X-ray showing bony union without malalignment and malunion

there was one wound breakdown and 2 skin irritations. In our series, we had one superficial wound infection treated with local debridement and antibiotic and one skin irritation treated with plate removal after the union.

One of the other concerns about MIPO technique is malrotation just like other indirect reduction of fracture [11,12]. In a recent study, it has been shown that malrotation could be prevented with experience and accurate usage of intraoperative fluoroscopy [13]. Cable test and compression with the uninjured site could be used to check rotation [13]. In our series, there was no malrotation or malunion in any of the patients. All surgeries in our study have been performed by experienced and national board certified orthopedic trauma surgeons.

Other treatment options have also been discussed in the literature [14-16]. External fixators could be used for treatment but pin tract infection was reported in about 15% of patients [14]. The usage of IMN for the treatment of DTF has been increasing [17]. In a prospective study comparing IMN with MIPO; radiation time, malalignment and intraoperative blood loss were statistically significantly higher in the IMN group [18]. Other studies reported that wound problems had been reported higher in the MIPO group while anterior knee pain and malrotation were higher in the IMN group [15,16].

Our study has several limitations. The retrospective design is major limitation. Retrospective design could cause bias in patient selection and assessment. To prevent bias, assessment of patients was done by an independent orthopedic surgeon. The relatively small sample size is also another limitation. There is also no control group in our study.

In conclusion, MIPO technique is safe and effective with a very low complication rate in the treatment of DTF. Using intraoperative fluoroscopy accurately and being careful during surgery would also prevent malalignment problems. Good clinical results and high patient satisfaction can be anticipated after MIPO of DTF.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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