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Minimally Invasive Plate Osteosynthesis of Distal Tibia and Fibular Fractures Through a Single Distal Anterolateral Incision

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ABSTRACT

Treating distal tibia fractures is often challenging given the extent of soft tissue damage around the fracture and the risk of infection and other complications with internal fixation and the accompanying incisions. Minimally invasive plate osteosynthesis minimizes these complications and can be performed through a single incision. From April 2009 to January 2011, we treated 20 patients who had both tibial and fibular distal fractures through a distal anterolateral approach with this technique. The mean follow-up period was 15.5 (range 12 to 26) months. The mean interval to bony union was 21 (range 18 to 25) weeks. A 5° varus deformity was found in 1 patient. Another patient, who had a history of alcohol consumption and smoking, developed wound necrosis that was treated successfully with debridement and without skin grafting. The mean American Orthopaedic Foot and Ankle Society score for all patients was 91.8 (range 84 to 97). The anterolateral, minimally invasive plate osteosynthesis technique is a useful method for treating distal tibial and fibular fractures at the same level, with a low complication rate.

Distal tibial fractures are generally a result of high-energy trauma that also injures the soft tissues. The condition of the soft tissue in turn can affect the timing of surgery, the selection of the implant, and the surgical approach (1). For patients with severe soft tissue injury, some investigators have recommended a 2-stage operation until the soft tissue injury has thoroughly healed (2,3). Although the internal fixation principles of bony union introduced by Ruedi and Allgower (4) provide excellent guidance, the investigators reported a 12% complication rate and a 5% deep infection rate. Complications such as failure to unite, wound site problems, deep infection, and ankle joint stiffness have been common (5–8). Minimally invasive plate osteosynthesis (MIPO), because it does not disrupt the blood flow, has produced better results than those of open surgical repair (9–12).

For distal tibial fractures, Bohler's anterolateral approach allows better visualization of the distal tibial joint surface and fixation of the tibia and fibula with a single distal anterolateral incision (13,14). However, the incision requires wide dissection; thus, the surgeon must consider the possibility of soft tissue complications.

In the present study, we evaluated the outcomes of MIPO after fixing the tibia with a plate through a short anterolateral incision at the distal end and a stab incision at the proximal end without opening a fracture line on the tibia. This same, short incision allows access to the fibular fracture at the same or more distal level as the tibial fracture.

Patients and Methods

The patients treated in our clinic from April 2009 to January 2011 for distal fibular and tibial fractures at the same level were included in the present study. We excluded patients with grade III open fractures and multiple fragments at the medial distal tibia, those with a medial malleolus fracture, patients who had undergone fixation with a low-profile medial distal tibial plate, and those with accompanying injuries.

Surgical Technique

All patients underwent surgery within 24 hours after their referral to our clinic. Each received general or spinal anesthesia while supine on the operating table. A support was placed under the hip to keep the leg in a neutral position. A tourniquet was applied to the affected leg.

A 5-cm incision extending proximally from the joint level was placed between the distal tibia and fibula (Fig. 1). The superficial peroneal nerve was identified during subcutaneous dissection. After being released, the nerve was isolated (Fig. 2). After

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Fig. 1. The right leg of a 45-year-old female with distal tibial and fibular fractures at the same level prepared for minimally invasive plate osteosynthesis. The tibia was fixated with a plate inserted proximally through a 5-cm, distal Bohler anterolateral incision, which allowed access to the fibular fracture. The position of the plate was controlled through a 2- to 3-cm anterolateral incision on the proximal tibia.

opening the fascia of the distal tibia, the tibia was visualized between the extensor digitorum longus and the peroneus tertius, and a submuscular tunnel was created. The fibula was fixed first to maintain the length and alignment of the foreleg and to facilitate the reduction of the tibia. Fixation was accomplished with an anterior or lateral plate.

A second 2- to 3-cm anterolateral incision was placed at the proximal tibia at the end of the plate. The plate (3.5-mm LCP anterolateral distal tibia plate, DePuy Synthes, Zuchwil, Switzerland) was inserted submuscularly from the distal incision toward the proximal incision, and its placement was controlled through the proximal incision. Screws were inserted percutaneously through the proximal and distal incisions. The placement of the plate was controlled using C-arm fluoroscopic guidance (Fig. 3) after surgery to control reduction of the fracture and placement of the screws.

After surgery, the patients wore a mid-calf brace for 1 week, depending on the condition of the soft tissue. After 1 week, the patients began range of motion exercises. We scored all healed fractures using the American Orthopedic Foot and Ankle Surgeons foot and ankle function scale that evaluates pain after bone healing, function, and alignment (15).

Results

For the 20 patients meeting the eligibility criteria, the mean age was 38 (range 18 to 71) years, and 12 were males (Table). The most common fracture types were A2 (n = 9) and A3 (n = 8). The mean follow-up period was 15.5 (range 12 to 26) months.

At the final follow-up visit, all the fractures showed clinical and radiographic evidence of union. The mean interval to bony union was 21 (range 18 to 25) weeks (Fig. 4).

The deformities were evaluated radiographically using the picture archiving and communication system measurement tools. During the follow-up period, only 1 deformity was found: a 5° varus deformity. Neither tibial shortness nor restriction of range of motion was observed.

The 3 cases of open fracture (1 type I and 2 type II) showed no signs of infection when the medical dressings were changed. During 1 dressing change, wound site necrosis was discovered in a 57-year-old female patient with an A2 fracture. She had a history of alcohol consumption and smoking. The wound was debrided and healed completely without skin grafting.

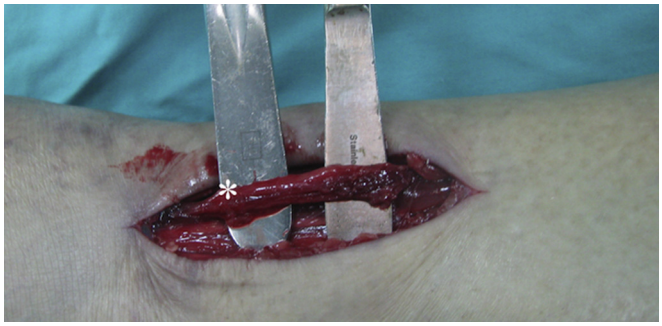

Fig. 2. The superficial peroneal nerve (*asterisk*) was isolated.

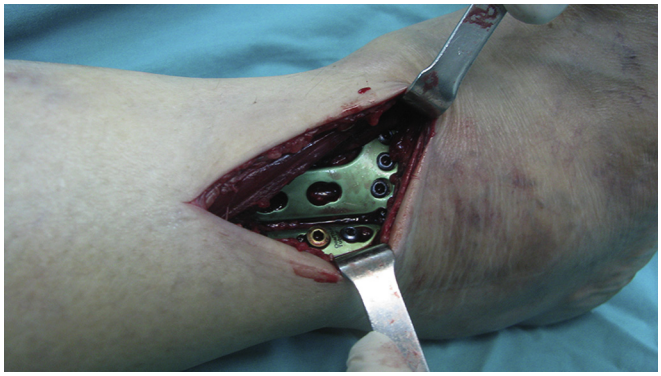

Fig. 3. The distal tibia and fibula plates.

The mean American Orthopedic Foot and Ankle Surgeons foot and ankle score was 91.8 (range 84 to 97). All the scores indicated either excellent (score 90 to 100 for 11 patients) or good (score 80 to 89 for 9 patients) outcomes. No patient showed evidence of neurovascular injury or shortening of the tibia.

Discussion

Treating distal tibial fractures is often challenging. Sarmiento and Latta (16) treated closed distal tibial fractures conservatively and reported a 13.1% malunion rate. Of 103 patients with distal tibial fractures treated with long leg plaster casts, 32 later required surgery (17). Intramedullary nailing is also technically difficult in the distal aspect of the tibia. Blocking screws (poller screws) are required to counteract varus and valgus malpositioning (18), and varying rates of malunion have been reported (19,20). Another alternative is internal fixation

Table
Patient characteristics

Characteristic	Value
All patients (N)	20
Male gender (n)	12 (60)
Age (y)	
Mean	38.2
Range	18 to 71
Left leg involved	12 (60)
Mean ± SD follow-up period (mo)	15.6 ± 3.4
Injury mechanism (n)	
Car accident	3 (15)
Fall	11 (55)
Pedestrian accident	6 (30)
Fracture type (AO/OTA) (n)	
A2	9 (45)
A3	8 (40)
C1	1 (5)
C3	2 (10)
Type 1 open fracture (n)	1 (5)
Type 2 open fracture (n)	2 (10)
Medical condition (n)	
Alcohol	1 (5)
Diabetes mellitus	2 (10)
Hypertension	1 (5)
Smoking	3 (15)

Abbreviations: AO/OTA, Arbeitsgemeinschaft fuer Osteosynthesisfragen (previously Müller) and Orthopaedic Trauma Association system of ankle fractures; SD, standard deviation.
Data in parentheses are percentages.