Injury, Int. J. Care Injured 44 (2013) 1102–1106

Contents lists available at SciVerse ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Comparison of minimally invasive percutaneous plate osteosynthesis with open reduction and internal fixation for treatment of extra-articular distal tibia fractures

Jian Zou, Wei Zhang *, Chang-qing Zhang

Department of Orthopaedics, Shanghai Sixth People's Hospital, 600 Yishan Road, Shanghai 200233, China

ARTICLE INFO

Article history:
Accepted 2 February 2013

Keywords:
Distal tibia fracture
Fracture fixation
Prospective study
Plate osteosynthesis

ABSTRACT

Introduction: Minimally invasive percutaneous plate osteosynthesis (MIPPO) has become a widely accepted technique to treat distal tibia fractures. However, it remains unclear whether this strategy of biological osteosynthesis with a bridge plate is superior to that of absolute stability with traditional open reduction and internal fixation (ORIF).

Methods: In this pilot study, patients with distal tibia fractures, aged from 18 years to 60 years, were included from October 2005 to June 2007. Patients were randomly assigned to a closed group (the patients were treated by MIPPO) or an open group (the patients were treated by traditional ORIF) before they were categorised by AO fracture type. Wound healing was assessed at 2 weeks, 4 weeks, and 3 months postoperatively. Follow-up was performed once a month until the fractures achieved clinical union based on the standard criterion (pain-free full weight-bearing). Evaluation was performed for ankle range of motion, limb rotation, fracture healing, and radiographic alignment.

Results: Forty-two patients were randomised to the open group and 52 to the closed group. According to AO/OTA classification, fractures were classified as Types A (55.3%), B (25.5%), and C (9.1%). The median follow-up time was 14.0 months for the open group and 15.0 months for the closed group. There was no significant difference between the groups in healing time for Type A and Type B fractures; however, for Type C fractures, there was a trend towards shorter healing time in the closed group compared with the open group.

Conclusions: Our findings suggest that the strategy of biological osteosynthesis with a bridge plate might be superior to that of absolute stability for treating Type C tibia fractures. Further studies are needed to confirm our findings.

© 2013 Elsevier Ltd. All rights reserved.

Introduction

With the development of biological fixation and locking plates for treating fractures of the extremities, minimally invasive percutaneous plate osteosynthesis (MIPPO) has become a widely accepted technique. The main advantages of MIPPO are that it avoids direct exposure of the metaphyseal fracture lines, and because it involves indirect reduction it preserves vascular perfusion.[1–4] There are reports in the literature of MIPPO being used successfully to treat periarticular knee fractures, humeral shaft fractures, and distal tibia fractures.[5–10] Many published reports have shown that the use of MIPPO for treating fractures reduces periosteal damage, provides a favourable microenvironment for fracture healing, improves direct bone healing, and reduces fracture healing time.[11–16] Although MIPPO has been used successfully to treat distal tibia fractures, it remains unclear whether biological osteosynthesis with a bridge plate is superior to absolute stability with traditional open reduction and internal fixation (ORIF) for treating this type of injury.

The aim of this study was to compare directly the strategy of biological osteosynthesis with a bridge plate using MIPPO with that of absolute stability using ORIF for treating distal tibia fractures. In addition, the study was designed to answer the following two specific questions: (1) Are all the distal tibia fracture types appropriate for treatment using MIPPO? (2) Are there any indications for using ORIF? We hypothesised that the type of fracture may be an indication for using either ORIF or MIPPO.

Patients and methods

Patients

This study included patients with displaced extra-articular distal tibia fractures who presented to the Emergency Department

* Corresponding author. Tel.: +86 21 64369181.
E-mail addresses: davidzhang@hotmail.com, wzhang02@163.com (W. Zhang).

0020–1383/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.injury.2013.02.006

of Shanghai Sixth People's Hospital from October 2005 to June 2007. Eligible patients were aged from 18 years to 60 years and were diagnosed as having closed distal tibia AO/OTA classification type 42 fracture with or without fibular fracture. Patients were excluded if they had open distal tibia fracture; pathologic fracture; multiple fractures or injury; or brain trauma. In addition, patients were excluded if they had existing disorders having an effect on the healing process and function such as multiple sclerosis, paraplegia, or other relevant neurologic disorders, or polytrauma with an injury severity score > 16.

The study was a prospective, single-blind, randomised trial. Since no power calculation was performed at the beginning of the study we consider this to be a pilot study. Patients were randomly assigned by drawing lots to either a closed group or open group before they were categorised by AO fracture type. Patients were not informed to which group they had been assigned. The patients were treated by MIPPO in the closed group and treated by traditional ORIF in the open group. All patients received skeletal traction with a traction pin before surgery. Ice and mannitol (IV 250 mg daily) were used preoperatively to decrease swelling. Patients with hypercoagulability and those who needed to stay in bed for several days before surgery were treated with low molecular weight heparin (40 mg subcutaneously daily) to prevent venous thromboembolism. The operation was carried out when the skin appeared wrinkled. The operations were performed by three surgeons who were experienced in both MIPPO and ORIF and had been performing these procedures without supervision for at least 3 years. The study was approved by the institutional review board of the hospital. All patients signed an informed consent statement.

Operation procedure

In both groups the patients were placed in the supine position and were administered continuous epidural anaesthesia. A tourniquet was often used for patients in the open group.

In the open group, the leg to be operated on was prepared and draped in the usual sterile fashion, and was exsanguinated using a tension bandage. If the patient also had a fibular fracture, the posterolateral approach was selected to fix the fibular fracture first. The anteromedial approach was chosen to fix the distal tibia fracture. A classic AO incision was begun proximally 5–10 mm lateral of the anterior tibia crest, then crossed over the tibialis anterior muscle, and curved medially distal to the medial malleolus. When the soft tissue was separated, the fracture site was exposed without periosteum stripping. The fracture was reduced under direct vision. Bone forceps or Kirschner wire were used to reduce/hold the fracture temporarily. If the fracture line was spiral or oblique, one or two cortical screws could be used as a lag screw(s). Fifteen patients received lag screws. Finally, the locking plate was used to fix the fracture completely. In 12 patients locking screws were used for plating and in the other 30 patients non-locking plates were used. All plates were placed on the medial surface of the tibia. The alignment and screw length were checked by fluoroscopy.

In the closed group, preparation and treatment of any fibular fracture was done in the same manner as in the open group and then bridge plating was performed. Forty-one patients were plated using locking screws and the others were fixed with non-locking plates. The plate was placed parallel to the tibia axial line on the medial surface of the operated leg. With the aid of fluoroscopy, an appropriate locking plate was selected based on its length and curve. There had to be at least three holes on both sides of the fracture site. According to the plate location in vitro, two 3–4 cm longitudinal incisions were made in the skin beneath the two ends of the plate. One incision was at the midline of the medial malleolus, the other was made along the medial aspect of the tibia located at the proximal end of the plate. An extraperiosteal, subcutaneous tunnel could then be fashioned between these two incisions using blunt dissection. The great saphenous vein was protected and the plate was inserted percutaneously from distal to proximal. The assistant applied traction to the operated leg to restore length and coronal alignment under fluoroscopy. When the reduction was achieved, the plate position was adjusted and the bone and plate were fixed by locking screws.

In both groups, at least 6 cortical layers should be penetrated on both fracture sides, and 7–8 layers in patients with osteoporosis.

Postoperative care

Both groups received the same postoperative care. Antibiotic therapy was used for 2–3 days postoperatively according to the wound condition. The drainage tube was removed 2 days after the operation. Active ankle and knee joint motion was allowed as soon as possible. After the soft tissues healed and postoperative swelling was diminished, the patients were allowed nonweight-bearing ambulation with crutches. Progressive weight-bearing was encouraged once there was radiographic evidence of callus formation. Wound healing was assessed in the outpatient clinic at 2 weeks, 4 weeks, and 3 months postoperatively. Clinical evidence of infection, incision breakdown, and skin necrosis was recorded. Deep infections were defined as those below the deep investing muscular fascia. Superficial infections were clinically confined to the dermal and subcutaneous tissue. Follow-up, including clinical examination and radiographic examination, was performed once a month until the fractures achieved clinical union based on the standard criterion (pain-free full weight-bearing). Evaluation was performed for ankle range of motion, limb rotation, fracture healing, and radiographic alignment.

Healing was defined as bridging mature callus, the radiographic standard criterion for union, combined with pain-free full weight-bearing. A healing time of less than 6 months was considered as normal, whereas a healing time from 6 months to 9 months was considered to be a delayed union. Fractures not healed within 9 months were classified as nonunion. Malreduction (malalignment/malunion) was defined as angulation, or rotational deformity of 5° or more. To measure the rotational deformity the patients laid in the supine position in bed with the bilateral patella overturning. The angles were measured between the lateral edge of the feet and surface of the bed. The left and right sides were compared. In patients with malreduction, if both the tibia and fibula were fractured, the fibula was fixed first and then the tibia was fixed.

Statistical analysis

The data for continuous variables were presented as median and inter-quartile range (IQR) due the non-normal distribution of continuous variables; data were expressed as counts and percentages for categorical variables. The medians between the open and closed group were compared by Mann–Whitney *U* test. The association of AO/OTA classification and groups was analysed by χ^2 test. The difference in healing time between the two groups for the three types of fractures (AO/OTA classification Types A, B, and C) was compared by two-way ANOVA. The level of significance was set at 0.05. Statistical analyses were performed by using the statistics software SAS 9.1 (SAS Institute Inc., Cary, NC).

Results

Table 1 presents the demographic data for the 42 patients in the open group and 52 patients in the closed group. There was no significant difference in the distribution of AO/OTA classification

Download English Version:

https://daneshyari.com/en/article/6083663

Download Persian Version:

https://daneshyari.com/article/6083663

Daneshyari.com