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Extra-articular distal tibia facture (AO-43A): A retrospective study comparing modified MIPPO with IMN

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ABSTRACT

Purpose: We introduce a new MIPPO procedure which is simple and effective for the treatment of extra-articular distal tibia facture (AO-43A). The aim of this retrospective study was to compare our modified MIPPO with IMN.

Materials and methods: This retrospective study included 64 patients treated with our modified MIPPO and 61 patients with IMN. The data of sex, age, operation time, blood loss, wound complications, mal-reduction, shortening and fracture healing was analyzed.

Results: The operation time was significantly shorter in the MIPPO group than in the IMN group (56.0 min vs. 85.0 min, $P < 0.001$). There were 5 patients (8.2%) in the IMN group and 2 patients (3.1%) in the MIPPO group who had wound complications ($P = 0.399$). Mal-reduction occurred in 17 patients (27.9%) managed with IMN and in 3 patients (4.7%) who had MIPPO ($P < 0.001$). Furthermore, no patients had a left/right difference in the length of the tibia of >1 cm and nonunion in both groups.

Conclusions: Our results have shown that our modified MIPPO has enormous advantages over IMN for extra-articular distal tibia fracture (AO-43A).

Introduction

The extra-articular distal tibia facture (AO-43A) is the most common fracture type, especially with the uprising of traffic accidents [1]. The main etiologies of the extra-articular distal tibia fracture (AO-43A) involve simple falls, motor vehicle trauma, or sports-related injuries as a result of axial compression and/or rotational forces [2,3]. Trauma surgeons are proficient in dealing with this kind of fracture which can be treated with non-operative management or surgical management. Non-operative management of this kind of facture often leads to frustrating deformity and unavoidable ankle stiffness which is not recommended as the ideal treatment [4]. Surgical management options, which have been reported for the treatment of extra-articular distal tibia fracture (AO-43A), include intramedullary nailing, plate, as well as external fixator systems embracing the Ilizarov frame and hybrid fixators [1]. Among those surgical manangement options, Intramedullary Intramedullary: intramedullary nailing and plate are the common choices for dealing with extra-articular distal tibia fracture (AO-43A). External fixators may be beneficial only in selected cases—particularly those with severe soft tissue injuries.

With the development of internal fixation, minimally invasive percutaneous plate osteosynthesis (MIPPO) designed as the new approach of biological osteosynthesis (BO) and IMN have gained superiority over other surgical management in dealing with extra-articular distal tibia fracture (AO-43A) [5–9]. MIPPO and IMN have numerous advantages in the aspects of indirect exposure of the fracture lines, preservation of vascular perfusion, less possibilities of mal-union or nonunion, less complications of soft tissue and lower risk of joint stiffness [1,9–13]. Now there exists a lot of controversy about the question which is the better choice for dealing with extra-articular distal tibia fracture (AO-43A), MIPPO or IMN. Most trauma surgeons [5,10] prefer IMN for better biology, lower rate of nonunion and less wound complications for the surgical management of extra-articular distal tibia fracture (AO-43A). Moreover, IMN has been reported to take less operation and radiation time [5,8]. We shared the same opinion with most trauma surgeons and preferred IMN for patients with extra-articular distal tibia fracture (AO-43A) before 2010. However, after we modified the MIPPO procedure, we has converted to MIPPO for patients with extra-articular distal tibia fracture (AO-43A).

The purpose of this retrospective study was to compare the results of patients with extra-articular distal tibia fracture (AO-43A), treated with our modified MIPPO with those treated with IMN. We hypothesized that our modified MIPPO should lead to shorter operation time, less blood loss, no increase in wound

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Fig. 1. The anatomical locking plate must be adequate length so that 6–8 cortices are obtained on distal fragment and proximal fragment of the fracture. Two incisions are made at proper sites.

complications, less mal-reduction and no increase in nonunion versus IMN.

Our modified MIPPO technique

Antibiotics (cefuroxime sodium IV 1500 mg once) are used before starting anaesthesia. After general anaesthesia, all the patients are placed on a standard radiolucent table in the supine position. Then the calcaneal traction, which was performed under local anaesthesia in emergency operation room to reduce the subsequent bleeding of fracture area and decrease swelling of fracture area caused by abnormal movements before the patients were admitted to inpatient ward, is removed and tourniquets are used to reduce bleeding during operation. The tourniquets are deflated after 60 min and the time interval is 10 min. If the patient has a concomitant fibular fracture, the ORIF procedure is performed to fix the fibular fracture first. On the other hand, upper third of the fibular fractures accessed by X-ray measurement are often left unfixed. The mean length of tibia is 340.22 mm in Chinese people [14]. It is the fracture site about 200 mm away from the external malleolus that we leave unfixed. The standard is safe enough to prevent potential ankle instability caused by concomitnat fibular fractures [15]. The anatomical reduction of fibular fracture is crucial for the following indirect reduction of tibia fracture [16,17].

A distal tibia anatomical locking plate (Synthes; Smith & Nephew) is adhered to the anteromedial surface of tibia. The anatomical locking plate must be adequate length so that 6–8 cortices are obtained on both distal fragment and proximal fragment of the fracture. The fracture is reduced by indirect means without opening the fracture area. The surgical procedure is visualized and confirmed under C-arm.

(1) A 2–3 cm incision is given at the center of the medial malleolus and ensure the vena saphena magna not to be hurt. Another 2–3 cm incision, away from the fracture area, is made in the proximal fragment of the plate. (Fig. 1) Then a subcutaneous tunnel is opened and constructed with a periosteum detacher by careful blunt separation. Thereafter, the distal tibia anatomical locking plate is inserted smoothly and gently through prepared subcutaneous tunnel.
(2) A cortical screw (critical screw) (Fig. 2) is inserted in the plate in the distal fragment. The length of the cortical screw (critical screw) is 3–4 mm longer than the measured figure for the convenience to shape the fracture to the anatomic-designed aspect of the plate when the surgeon adjusts the tightness of the cortical screw to cortex. It is crucial that this cortical screw should not be tightened until the achievement of satisfactory reduction.
(3) The indirect reduction procedure mainly contained three steps which should be manipulated at the same time (Fig. 3): ① contract the proximal extremity continuously; ② percutaneously reduce the fracture by hands; ③ adjust the tightness of the cortex screw (critical screw) utilizing the anatomical designed locking plate to reshape the fracture and correct the lateral displacement. The key of indirect reduction is that the

Fig. 2. Black arrow: the hole used to insert critical screw; triangle: ankle pillow.