

External fixator followed by a plate for distraction, reduction, and fixation in neglected femoral diaphyseal fractures



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ABSTRACT

Introduction: This study aims to investigate the outcome of a two-stage surgery in the treatment of neglected femoral diaphyseal fractures which are not uncommon in developing nations.

Patients and methods: Ten patients with neglected or late-presenting femoral diaphyseal fractures were considered in this study. All patients underwent a two-stage surgery, which consisted of distraction by an external fixator and open reduction by internal plate fixation. All patients received a supervised regimen of physiotherapy. Patients were followed up clinically and with radiographs at 2 months to assess union and at monthly intervals thereafter.

Results: All patients achieved bony union in an average of 3.7 months (2–6 months) with no one lost follow-up. Seven patients regained full range of motion, and the mean knee range of motion was 139.5°. No wound related or neurovascular complications were detected. One patient with stiff knee was re-admitted 1 year after surgery for metal removal, arthrolysis and quadricepsplasty for improving knee range of motion to 90° flexion.

Conclusions: We conclude that the treating of neglected femoral diaphyseal fractures with a two-stage surgery is a satisfactory therapy showing reliable bony union, however continuing medical education is necessary for physicians in primary medical facilities as well as for patients with traditional views.

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Introduction

Although the treatment of femoral diaphyseal fractures in an acute setting is well established with remarkably good outcomes, neglected femoral shaft fractures still present challenging problems to orthopaedic surgeons in developing countries.^{1–3} In patients with polytrauma, femoral fracture is neglected in some peripheral hospitals because of accompanied mortal wounds, which are considered as first priority in life-rescue strategy. Some patients seek treatment from traditional bonesetters who use local herbs and inadequate splinting, and sometimes inappropriate immobilisation. Malalignment of neglected femoral diaphyseal fractures causes considerable morbidity, pain, pseudarthrosis and limb-length discrepancy with restricted knee range of motion. These factors lead to difficulties in restoration of length and reduction of fracture and knee stiffness. Moreover one-stage lengthening is associated with neurovascular complications, and preoperative traction limits knee range of motion further.⁴

Since there are no guidelines for safe one-stage reduction and fixation of this kind of fracture, most surgeons prefer staged treatment strategy. The Ilizarov technique allows the use of distraction, compression, bone lengthening and deformity correction, but its use is not widespread because it is labour intensive and there is low patient tolerance. However, the external ring fixation is performed for the treatment of many orthopaedic disorders, including leg length discrepancies, congenital or acquired limb deformities, bone defects, nonunion of different bones and osteomyelitis.^{5,6} In this report, we present 10 patients with the use of a modified Ilizarov external fixator for traction and reduction of the neglected femoral diaphyseal fractures at the first step, which is followed by final fixation with plates and screws at the second step. This can make correction of deformities gradually in order to avoid neurovascular complications and allow knee exercises during reduction. Furthermore, the internal fixation is easy to handle by both patients and physicians. The effectiveness and complications are also evaluated during the whole process.

Patients and methods

From July 2006 to November 2010, 10 adult patients with neglected femoral shaft aseptic nonunion, who sustained a closed fracture in the first place and had no prior surgery, were identified from our database (Table 1). There were seven men and three

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Table 1
Preoperative demographic data.

Patient No.	Age (years)	Sex	Mechanism	Delay	Site	Knee ROM	LLD (cm)
1	22	F	MVA	5 weeks	Midshaft	10–110	5.5
2	27	M	Fall from height	7 weeks	Midshaft	Full	4
3	30	M	Fall from height	1 month	Midshaft	Full	4.5
4	35	F	Direct injury	6 weeks	Midshaft	5–115	5
5	43	M	MVA	1 month	Midshaft	0–100	4
6	29	M	MVA	9 weeks	Midshaft	5–125	5.5
7	41	F	Fall from height	3 months	Midshaft	5–110	5
8	25	M	MVA	3 weeks	Isthmic	Full	4
9	51	M	Direct injury	6 months	Midshaft	10–35	6.8
10	22	M	MVA	3 weeks	Midshaft	5–125	5.7

MVA: motor vehicle accident; ROM: range of motion; LLD: leg length discrepancy.

women with a mean age of 32.5 years (19–51 years). The mean delay was 7.7 weeks (3–24 weeks). The mechanism of injury was various, including fall from a height, motor vehicle accident and direct injury. A retrospective review and analysis of all these cases were carried out. All preoperative radiographs showed obvious shortening deformity and angulation deformity in all patients (Fig. 1). After traction and reduction were performed with a ring external fixator gradually (Fig. 2), the fracture was fixed firmly by a dynamic compression plate (DCP) (Fig. 3). All patients were followed up until union of the neglected fracture. No one was lost to follow-up. Two types of neglected femoral shaft fracture were encountered in our hospital: fractures accompanied with poly-trauma of other organs after non-operative management in other health-care facilities and fractures treated by local traditional bonesetters with persistent malalignment.

Every treatment procedure was divided into two steps—distraction with external fixator and fixation with a plate. Each fracture was fixed by a modified Ilizarov external fixator with half rings, composed of one proximal half ring, one distal half ring and three rods (two with an extension hinge) at the very beginning (Beijing Institute of External Skeletal Fixation Technology, China) (Fig. 2). First, two 4.0-mm Kirschner wires (K-wire) applied in the distal part were parallel to the joint line and placed at 60°. Then, the same two pins fixed in the proximal part were orthogonal to the femur and also maintain a 60° angle to obtain adequate stability. Second, two half rings and three rods were placed over the cross wires in each femoral part after intra-operative traction had been applied to all affected limbs, which made the limb approach its maximum tension in order to shorten the reduction time. Both the proximal ring and distal ring were placed approximately 5 cm away from the fracture line. Seven patients received an excision surgery of callus around the fracture site at the same time.

Deformity correction commenced on the second postoperative day at a rate of 2–3 mm per day (4 times × 0.5 mm or 4 times × 0.75 mm a day) of extension. The static rod was locked to provide extra stability for the whole system after every extension. Neurovascular safety was guaranteed by careful observation in order to determine the extension rate. Active and passive knee mobilisation and quadriceps exercises were started under guidance during the whole distraction period. The angular deformities and discrepancy of limbs were gradually corrected with the use of hinges. When the overlap was <1.5 cm, an operation of open reduction and internal fixation under general or spinal anaesthesia with a posterolateral approach was performed with the patient in a supine position in all cases. The nonunion site was exposed down to the bone and the bone ends excised, if sclerotic. The external fixator was removed; the fracture was realigned accurately under direct vision and fixed with a DCP plate (Synthes Inc., Zuchwil, Switzerland) firmly (Fig. 3). Bone grafting was not applied to any patient. Non-weight-bearing quadriceps-strengthening exercise was allowed 2 days after surgery, and

physical therapy for restoring knee range of motion was started at the same time. Half weight-bearing stand and walk with a pair of crutches were allowed when the fracture line becomes obscure with much callus. Full weight-bearing was gradually achieved after

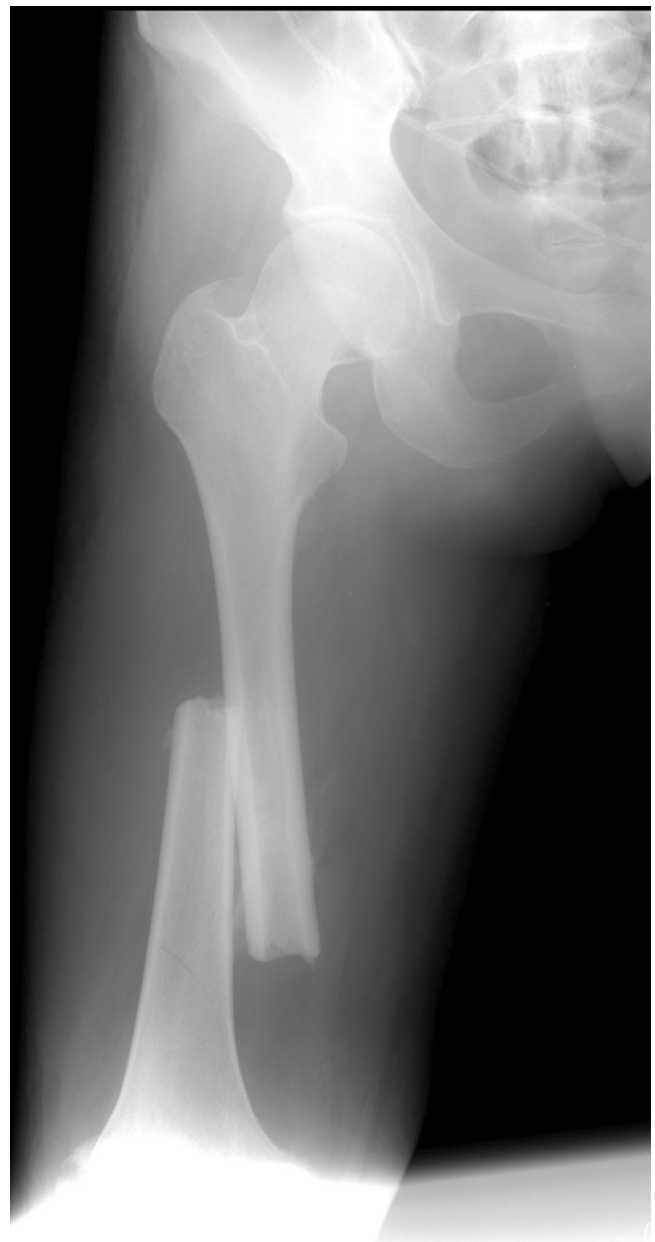


Fig. 1. 22-years old, female, motor vehicle accident, neglected non-union shaft of femur for 5 weeks, discrepancy between limbs is 5.5 cm.

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