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Clinical and radiological outcome of percutaneous plating in extra-articular proximal tibia fractures: A prospective study

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ABSTRACT

Background: Despite various techniques of fixation, proximal tibia fractures are associated with poor outcome and increased rates of complications. Minimal access and rigid fixation are the keys for optimal outcome in such fractures. Therefore, this study was designed to look for the clinical and radiological outcomes of percutaneous locked plating (PLP) in extra-articular proximal tibia fracture.

Methods: Between April 2008 and September 2010, 47 consecutive patients with 49 proximal third extra-articular tibial fractures (29 closed and 20 open injuries) underwent PLP. The patients were followed up at 6 weeks, 3 months, 6 months and 1 year. The union rate and complications of this fixation were evaluated. The clinico-radiological outcomes were assessed at 1 year of surgery.

Results: Four patients had infection in the postoperative period which needed repeated debridement, gentamycin bead application and prolonged antibiotic therapy. Three of these infective cases ended up with nonunion and needed cancellous bone grafting. All the remaining fractures united. The average time for union was 20 weeks in closed and type I open fracture and 25 weeks in type II and III fractures. No neurovascular injury, hardware failure or loss of fixation was documented till the last follow-up. The mean range of knee joint movement was 119°. The average lower extremity functional score (LEFS) was 59 (74%). There were 10 cases of malunion (20.14%), with six varus/valgus and five procurvatum/recurvatum (one having both sagittal and coronal malunion) angulations. There were no statistical differences between patients with malunion and normal alignment with regard to knee range of motion and LEFS.

Conclusion: Minimally invasive osteosynthesis using PLP in extra-articular proximal tibia fractures showed a promising result with minimal complications.

Introduction

Extra-articular proximal tibia fracture accounts for 5–11% of all tibial fractures.[1–4] Complications of treatment and associated injuries with this fracture have led to several approaches and mode of fixation with little consensus on optimal management. Conventional Arbeitsgemeinschaft für Osteosynthesefragen (AO) plating needs fracture exposure and extensive soft-tissue dissection, thus carrying the risks of bleeding, infection and soft-tissue healing problem. Although the soft-tissue healing problem and deep infection can be largely avoided with a hybrid fixator, it carries the risks of nonunion, malunion and pin track infection; patient dissatisfaction is also a major limit of this procedure. The intramedullary nail (IMN) has its limitation as it cannot be used in high proximal tibial fracture and in fracture with intra-articular extension. It is inefficient in providing rigid stability in the proximal tibia because of the trumpet-shaped widening of the proximal tibia medullary cavity, resulting in increased incidence of malalignment.[5,6] With the improvements in nail design and adjunctive reduction techniques, however, many authors believed that IMN can rigidly fix the extra-articular proximal tibia fracture and can maintain the alignment of the limb.[7–16] With the introduction of the locking plate (LCP) and less invasive stabilisation system (LISS) in the fracture fixation, the fixation of proximal tibia fracture has undergone a revolutionary change. Percutaneous fixation of proximal tibia with the above plates has shown promising results.[9,17–19]

The concept of minimally invasive osteosynthesis using percutaneous plate was established when the surgeons realised that the length and alignment of proximal tibia can be restored with indirect manipulation and reduction techniques.[20–22] Biological fixation with percutaneous plating augments the healing process without additional risks of wound disruption and

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infection. The purpose of this article is to report the clinical and radiological outcome of percutaneous lateral locked plating (PLP) in proximal tibia fracture.

Materials and methods

Patient recruitment

A prospective cohort study was designed in which all patients with extra-articular proximal tibial fracture (Orthopaedic Trauma Association[23] 41 A1, A2 and A3) attending to our emergency services between April 2008 and September 2010 were treated with PLP (Synthes AO, Lateral tibial LCP 4.5/5 system) fixation. Patients with pathological fracture or who were unwilling to participate in this study were excluded. Ethical committee approval was obtained and patients were recruited once written informed consent was signed.

A total of 47 patients (43 male and 4 female) were recruited in this study. The mean age of the patients was 42 years, ranging from 20 to 71 years. The injury was bilateral in two patients and thus, a total of 49 proximal tibial fractures were treated with the lateral tibial LCP. The mode of injury in 41 patients was because of high-velocity road-traffic accident where as 6 were due to fall from a height. Twenty-one patients had associated systemic or musculoskeletal injury: five patients had associated ipsilateral femur shaft fracture, four had associated hip fractures and/or dislocations, five had ankle fractures, two had ipsilateral patella fractures and five patients had associated head injuries.

Twenty-nine proximal tibial fractures were closed and remaining 20 were open fractures. As per the Gustilo and Anderson classification, the open injury was graded as type I in 12 patients, type II in 5 patients and type III in 3 patients (two type IIIA and one type IIIB). The closed fractures without any complication underwent primary fixation at the earliest possible time, that is, at an average of 2.7 days (range 1–7 days). The open fractures underwent initial debridement within 12 h, followed by LCP fixation after a delay of an average of 5.7 days (range 2–15 days), when the wound appeared healthy. Three patients had an impending compartment syndrome that needed double incision fasciotomy and external fixator application. Within 2 weeks they underwent LCP fixation and split-skin grafting over the fasciotomy wound. The type IIIB open fracture underwent LCP fixation and local reconstruction flap once the general and local evidence of infection were ruled out.

Fig. 1. Curvilinear skin incision for percutaneous fixation of locking compression plate in extra-articular proximal tibia fracture.

Surgical technique

The patients were operated in supine position (under general or regional anaesthesia) on a radiolucent table, with a sand bag underneath the ipsilateral hip joint. A tourniquet was applied to the proximal thigh. The affected leg was prepared and draped in the standard sterile fashion.

A curvilinear incision (S-shaped) was made over the proximal tibia on the lateral side. Skin incision was approximately 6 cm in length and extended distally if required (Fig. 1). The fascia of the iliotibial band was divided longitudinally parallel to its fibres starting at the Gerdy's tubercle. Dissection was extended distally through the fascia of tibialis anterior muscle. Indirect reduction was achieved with axial traction and/or application of reduction clamps or distractor. To achieve reduction at the fracture site, we applied an AO-reduction clamp percutaneously in the medio-lateral direction (to correct varus–valgus malalignment). The antero-posterior (AP) malalignment was corrected using a cob elevator/periosteal elevator (by lifting the depressed fragment). Axial traction over the limb was maintained throughout the reduction manoeuvre. An image intensifier was used to verify reduction, alignment and rotation. Subsequently internal fixation with a proximal tibia lateral LCP was achieved. The general principles of LCP fixation were strictly followed during internal fixation with a plate. Fracture reduction was obtained prior to screw placement. Alignment was maintained even if the plate did not precisely fit the bone. Cortical screws were fixed first on either side of the fracture site for internal reduction. A minimum of three locking screws were fixed distally and proximally.

The plate (Titanium Synthes Locking Compression Plate 4.5/5 mm, 5-hole plates to 13-hole plates, Fig. 2) was guided through

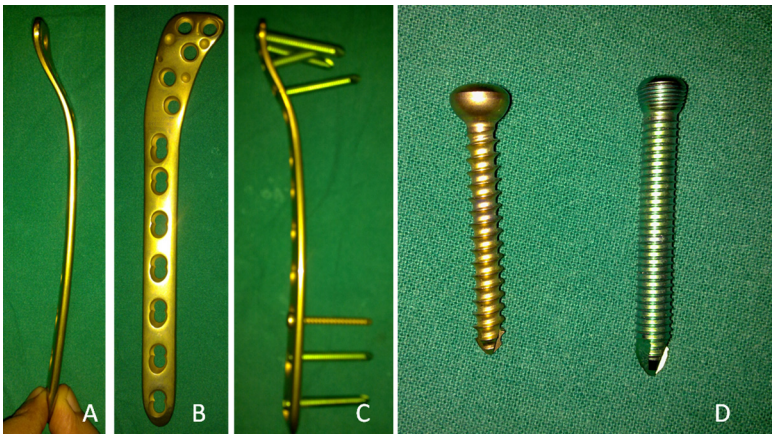

Fig. 2. Photographs showing plate design from the front (A) and side (B). (C) Angled fix construct of LCP along with polyaxial screws. (D) Colour coding of the screws; yellow-cortical screw and green-locking screw.