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TECHNICAL NOTE

Indirect reduction using a simple quadrilateral frame in the application of distal tibial LCP—technical tips

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Tibial pylon fractures

Summary Minimally invasive percutaneous plate osteosynthesis (MIPPO) has become widely practiced in the operative management of articular, metaphyseal and transitional zone fractures. Early indirect reduction of such fractures of the distal tibia can be achieved easily using a simple quadrilateral frame. This enables CT scanning where required and allows the soft tissues to be assessed with ease.

Distal tibial anatomical locking compression plates (LCP Synthes UK) have recently become available. Retrograde insertion of the AO distal tibial anatomical LCP via a distal transverse wound enables the MIPPO to be completed rapidly, with minimal surgical trauma to the zone of injury, with the frame in place until the procedure is completed—a particular advantage in these often highly unstable injuries.

Introduction

The operative management of distal tibial articular, metaphyseal and transitional zone fractures is challenging. Spanning external fixation has been advocated for their initial management.[1,3,7,9,11] Early indirect reduction of such distal tibial fractures can be achieved easily using a simple quadrilateral frame. With the frame in place, the soft tissues can be assessed with ease and CT scanning can be performed without interference (Fig. 1). Minimally invasive percutaneous plate osteosynthesis (MIPPO) avoids the need for extensive soft tissue dissection which risks wound complications and delayed/non-union associated with traditional open reduction and internal fixation (ORIF).[3–5] Similarly, MIPPO avoids the problems of pin site sepsis and soft tissue transfixion associated with circular frame or hybrid external fixation methods.[8]

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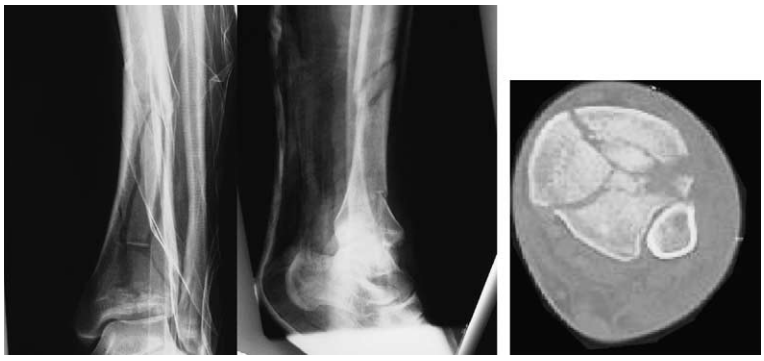

Figure 1 Admission radiographs of tibial plafond fracture sustain in a fall from a height. Compartment syndrome was present, hence a simple quadrilateral frame was applied and fasciotomies performed. CT scanning was then performed with the frame in place.

The technique described is a staged approach, with the application of the quadrilateral frame as soon as practical after admission. The second stage, (including articular reconstruction when required and retrograde insertion of the distal tibial LCP) can be achieved with the fixator in place. This intra-operative stability can be a major advantage in these highly unstable fractures.

Technique

Stage 1: application of the quadrilateral frame external fixator

The patient is positioned supine on a radio lucent table, with a tourniquet applied to the thigh of the injured leg, but not inflated. A bolster is secured to the table under the thigh at the level of the tourniquet, and a large sand bag is placed under the ipsilateral hip. The limb is then prepared and draped using a large U-sheet secured above the knee. A number of towels are then rolled together into a bolster to support the fracture site and ankle. The leg is, thus, elevated clear of the un-injured limb for ease of radiographic evaluation. In the case of open fractures, debridement is carried out in this position and a fresh U-drape is applied prior to the frame application.

The quadrilateral frame is then applied (Fig. 2). Denham type centrally threaded pins are inserted through the proximal tibia and calcaneum. The tibial pin is passed from lateral to medial, ensuring no risk of injury to the common peroneal nerve. An oblique skin incision is made over the lateral tibial condyle, 2.5 cm anterior to the fibular head, and the pin is advanced to transfix the proximal tibia, parallel to the articular surface. To avoid injury to the plantar nerves, the calcaneal pin is inserted parallel to the sole of the heel, from medial to lateral in a similar manner, with an entry point 2.5 cm from the plantar and posterior heel surface. These are then connected to each other using appropriate length rods and rod-to-pin connectors to make the basic quadrilateral frame construct. Care should be taken to assure that all of the rod-to-pin connectors are positioned so that the transfixion pins will not pull out of the jaws of the clamp as traction is applied. Also, in tall patients extra length is sometimes required, and additional clamps should be positioned near the knee to facilitate radiographs (particularly CT) and definitive fixation.

This simple frame invariably achieves excellent reduction with relatively little traction. After dressing the pin sites, a plaster of Paris back slab may be applied at this stage. If greater stability is desired, a further medial threaded half pin can be inserted into the proximal tibia and secured to the medial longitudinal bar (Fig. 3). This resists pro-and recurvatum. An additional threaded half pin can be inserted into the first metatarsal base medially and

Figure 2 Lateral view of the simple quadrilateral frame applied and fasciotomies performed.