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Bridging-minimally invasive locking plate osteosynthesis (Bridging-MILPO): Technique description with prospective series of 20 tibial fractures

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Summary Bridging-MILPO provides an alternative to other internal and external devices in the management of tibial fractures.

A pre-contoured, stainless steel locking compression plate (Synthes©) is fed subcutaneously through a small incision from a site distant to the zone of injury across the fracture site, respecting the fracture haematoma. Two or three locking screws are placed specifically at the ends of the plate. This 'spring leaf' like construct allows micro-motion at the fracture site. This induces callus formation, initially on the opposite cortex from the plate, accelerated by the allowance of immediate full weight bearing post-operatively. Twenty cases were performed over a 3-year period. Excellent final results were obtained in 19 out of the 20 cases. Complications included two superficial wound infections, one delayed union and one case needed revision plating. No loss of reduction was seen in any of the cases.

Introduction

Ilizarov considered respect for the soft tissues, vascularity, stability and micro-motion through immediate weight bearing as crucial to reliable bone healing.[3] The cumbersome frame however is often poorly tolerated by patients and can hinder the weight bearing required.

Traditional plate osteosynthesis (ORIF) of long bone fractures is very much focused on anatomical reduction of the fracture and absolute stability, but this method is plagued by infection and sequestrum formation, as respect for soft tissues is often left by the wayside.

Intramedullary nailing is still considered a gold standard treatment for diaphyseal fractures of long

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Table 1 Patient demographics

Variable	No.
Total no. of fractures	20
Lost to clinical follow up	1
Average age (range) years	34 years (12—85)
Male	14
Female	6
Smokers	8/20

Table 2 Fracture characteristics

Variable	No.
Closed injury	16
Open injury	4
Proximal metaphysis	2
Diaphysis-transverse	5
Oblique	3
Spiral	7
Segmental	1
Distal metaphysis	2

bones. Distal fractures however, have a tendency to angular malunion and anterior knee pain is also a common problem in the treatment of tibial fractures. Narrow medullary canals can prove to be an obstacle to nailing and repeated reaming through this bone can cause significant thermal injury to the shaft.[4]

Minimally invasive locking plate osteosynthesis (MILPO) is a burgeoning technique providing an alternative to intra-medullary devices, external fixation and standard plate osteosynthesis in long bone fracture management.

Mechanical testing has shown that the configuration of a long plate and two screws at either end produces predictable micro-motion[8], reproducing best the axial elasticity of an Ilizarov frame. This is in contrast to a plate with screws near and far relative to the fracture or a shorter plate with all holes filled. These result in a very rigid construct.

We describe a reproducible technique of bridging-minimally invasive locking plate osteosynthesis (Bridging-MILPO) in both metaphyseal and diaphyseal fractures of the tibia using a stainless steel locking compression plate (LCP) and locking screws (Synthes©). Qualification of our technique is provided by the results of 20 cases, which we followed up until union.

Patients and methods

20 consecutive patients with a unilateral tibial fracture were treated using Bridging-MILPO over a 31/2-year period between November 2003 and June 2007. All cases were performed or closely supervised by the senior author. One patient was lost to clinical follow up. Her injury and surgery occurred whilst on holiday in our region. She was discharged home and followed up by a local orthopaedic surgeon. Telephone interview at 1 year and clinical letter review confirmed union. The 19 remaining patients were followed prospectively with final examination at clinical and radiological union or after removal of the metalwork. Patient and fracture characteristics are summarised in Tables 1 and 2. Table 3 provides the detailed data for the 20 individual cases.

By the time of the study completion (September 2007) each case was reviewed to assess fracture healing and rehabilitation. This was performed clinically, questioning the presence of pain at the fracture site along with using the Oxford knee score (OKS) and American Orthopaedic Foot and Ankle Society (AOFAS) Ankle Score. Independent analysis of radiographic fracture healing was made by the corresponding author. All fractures involved the tibia. An associated fibula fracture was managed in 13 instances.

Surgical technique

Initial management of all fractures, particularly open was as recommended by the ATLS© guidelines. At operation the patient was placed supine on a radiolucent, split leg table. The affected limb was flexed approximately 30° at both hip and knee. Intravenous antibiotics were given on anaesthetic induction and three further doses were given postoperatively. No tourniquet was used in any of the cases, so as not to impair tissue perfusion. Indirect reduction of the fracture was achieved and maintained with traction through the ankle via a barrel sling.[7] Where necessary the fracture was manipulated with a percutaneous Kirschner-wire to achieve a good reduction or to unlock a malpositioning. These were always removed at the end of the operation. A narrow large fragment LCP or a small fragment LCP, depending on availability and size of the bone, was pre-contoured. The plate was then laid over the skin of the antero-medial facet of the tibia and checked for conformity with an image intensifier in antero-posterior, lateral and two oblique views.

A 3 cm incision was made either distal or proximal, depending on the fracture location, and the pre-contoured locking compression plate was fed subcutaneously across the reduced fracture site. In our cohort all patients received the Synthes© stainless steel LCP, typically of 10—12 hole length. Following insertion, correct position was confirmed