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Fractures of the tibia shaft treated with locked intramedullary nail

Retrospective clinical and radiographic assesment

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ABSTRACT
Background: The gold standard treatment for complex fractures of tibial shaft is the reamed interlocking intramedullary nail. There has been some controversies about dynamization of statically locked nail, and some authors recommend routine dynamization for promotion of healing. This study evaluates the treatment of complex fractures of tibia shaft with static and dynamic interlocking intramedullary nail method.
Methods: In this retrospective study, we studied 100 patients treated in Clinical Emergency Hospital Constanta between April 2012 – July 2013 diagnosed with tibia and fibula shaft fractures. They were treated by external fixation, and intramedullary nail. The intramedullary nail was blocked distally static or dynamic.
Results: All patients achieved union during 12-18 weeks. The need of dynamization was required at 23 patients after 10 weeks from osteosynthesis.
No significant complication was observed in our patients. Alignment of tibial fracture was perfect in all patients without any shortening and rotation.
Conclusion: Locked intramedullary nailing is the treatment of choice for fractures of the tibial shaft.

Keywords: tibial and fibula shaft fracture, interlocking intramedullary nail, dynamization, image intensifier, external fixation

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Introduction

Because of its location, the tibia is exposed to frequent injury; it is the most commonly fractured long bone. Because one third of the tibial surface is subcutaneous throughout most of its length, open fractures are more common in the tibia than in any other major long bone [1].

Locked intramedullary nailing currently is considered the treatment of choice for most type I, type II, and type IIIA open and closed tibial shaft fractures and is especially useful for segmental and bilateral tibial fractures. Intramedullary nailing preserves the soft-tissue sleeve around the fracture site and allow early motion of the adjacent joints. The ability to lock the nails proximally and distally provides control of length, alignment, and rotation in unstable fractures and permits stabilization of fractures located below the tibial tubercle or 3 to 4 cm proximal to the ankle joint. Nailing is not recommended in patients with open physes, anatomical deformity, burns or wounds over the entry portal, and most type IIIC open fractures [2].

This retrospective study evaluates the union rate of tibia shaft fractures treated with static interlocking nailing.

Material and methods

Operative treatment includes: external fixation, and intramedullary nailing of displaced and comminuted shaft fractures with locking screws above and below the fracture site.

Intramedullary nailing allows relatively early function and healing while the patient temporarily depends on the intramedullary rod for stability [3].

The blood supply to the tibia is more precarious than that of bones enclosed by heavy muscles. High-energy tibial fractures may be associated with compartment syndrome or neural or vascular injury. The presence of hinge joints at the knee and the ankle allows no adjustment for rotary deformity after fracture, and special care is necessary during reduction to correct such deformity. Delayed union, nonunion, and infection are relatively common complications of tibial shaft fractures [1].

Fractures which are unstable because of their pattern may be manipulated to the best position that can be obtained and any residual angulation treated by wedging. Nevertheless this method of treatment requires much experienced supervision: union may be delayed, and stiffness in the knee and ankle may become a problem. For the majority of fractures under normal circumstances closed intramedullary nailing (with interlocking nails) is the treatment of choice.

The leg must be positioned so that traction can be applied while at the same time there is good surgical and image intensifier access. The knee should be flexed, and care must be taken to avoid undue pressure on the popliteal structures. This may be achieved in a number of ways on an orthopedic table. A pneumatic tourniquet should be available, but it need not be used routinely. The patellar ligament is retracted after making a medial or lateral incision; or alternatively, and often preferred, a patellar tendon splitting incision may be used. The knee joint is not entered. The safe area for insertion of the nail lies anterior to the menisci and proximal to the tibial tuberosity, and lies on a line 2 mm lateral to the most prominent part of the tubercle [4].

A proximal interlocking was performed with specific interlocking guides and a distal locking under an image intensifier. Post-operatively, the patients started partial weight bearing ambulation as early as possible (usually after 48 hours post-operation). An isometric quadriceps exercise and a range of motion in the knee, hip and ankle were encouraged. The patients were followed by the same surgeon at 3-6 week intervals until complete union was achieved. The clinical and radiologic signs of healing process were recorded.

All patients were followed for at least for 30 weeks. Fracture union was defined as follows: Clinically there was no tenderness or pain and fracture had no motion and patients were walking without any walking aids. Radiographically, solid bridging callus with cortical density connected fracture fragments in at least 3 from 4 cortices.

Results

From April of 2012 to July 2013, 100 patients (67 males and 33 females - Figure 1) with complex fracture of tibial and fibula shaft were treated with static proximal and distal interlocking intramedullary nails.

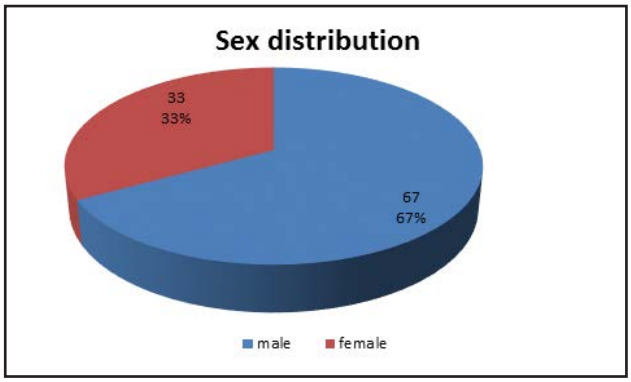

Figure 1

All patients developed fractures due to high energy trauma (a motor vehicle accident, falling from the height, sport accident, work accident - Figure 2)

and all underwent surgery for treatment of fracture soon after a systemic condition that was stabilized.

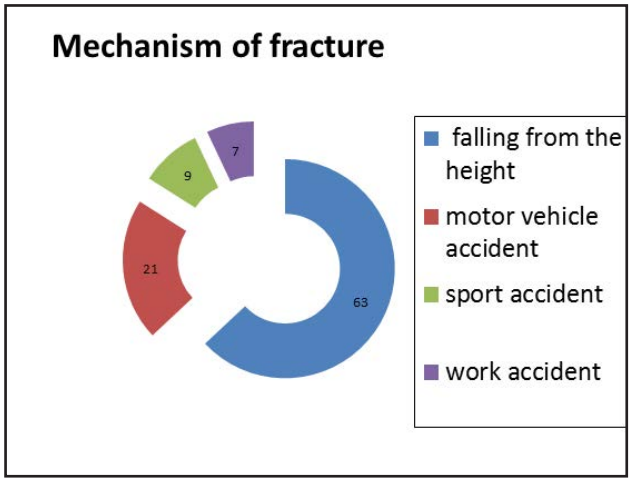

Figure 2

Our patients were 16 to 94 years old (mean: 47.48 - Figure 3). 58 patients had right sided fracture and 42 had a left sided one.

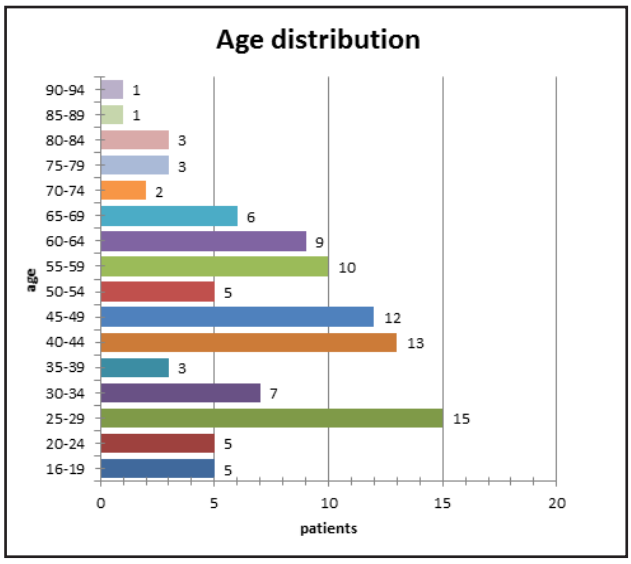

Figure 3

All patients underwent static interlocking intramedulary nailing as soon as general condition of patients was stabilized. The operation is performed as soon as the patient`s condition will allow, and prophylactic antibiotic cover is frequently advocated.

In all patients, open reduction was performed under spinal anesthesia and the canals were reamed as large as possible (usually 11-12 mm in diameter) and an adequate size static interlocking nail was inserted (usually 10 or 11 mm in diameter - Figure 4).

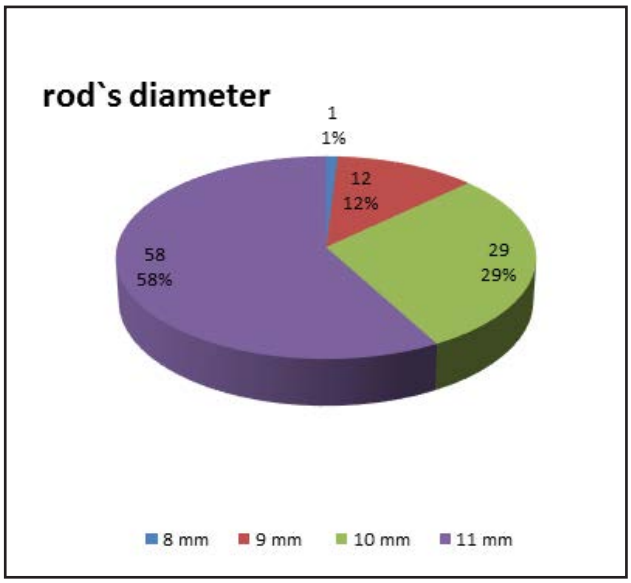

Figure 4

According to the AO classification; 31 patients were 42A1, 18 patients 42A2, 15 patients 42A3, 17 patients 42B1, 11 patients 42B2, 5 patients 42B3, 2 patients 42C1, and a patient 42C2 (Figure 5).

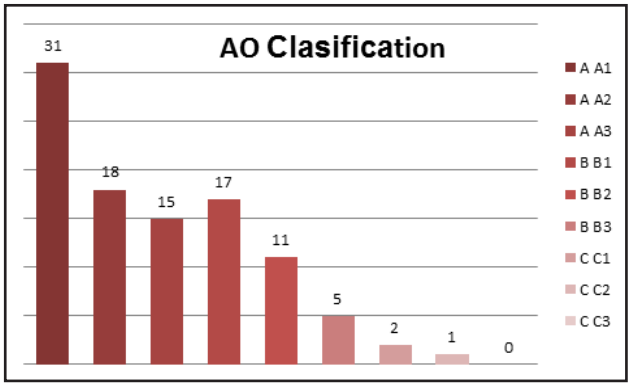

Figure 5

According to the Gustilo-Anderson classification, 22 fractures were opened: 11 patients type I, 7 patients type II, 3 patients type IIIA, and a patient type IIIB (Figure 6).

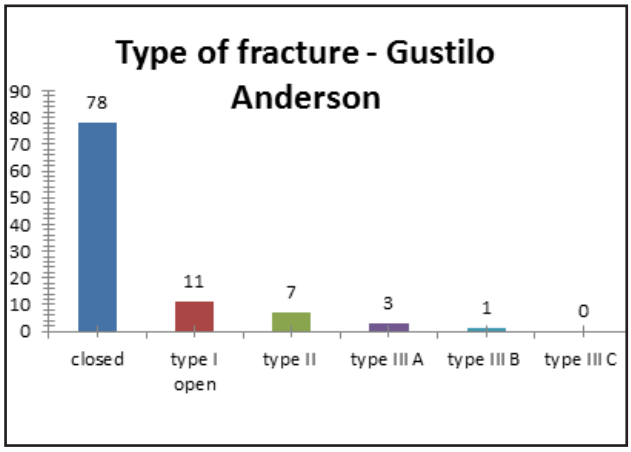

Figure 6

All patients with tibial shaft fracture achieved union during 12-28 weeks (mean: 13.4 weeks); we performed dynamization in 23 patients with transverse fracture, after 15 weeks, and they achieved union completely up to 28 weeks. Alignment of tibial fracture was perfect in all patients without any shortening and rotation.

Discussion

Intramedullary nailing has become the treatment of choice for fractures of the tibial shaft [5].

For many fractures of the tibial shaft, closed intramedullary nailing will not control rotation or telescoping of the fragments.

Locked intramedullary nailing combines closed nailing with the percutaneous insertion of screws that interlock the bone and nail. This method permits static locking that controls rotation and telescoping and subsequently conversion to dynamic locking when weight-bearing is started after approximately twelve weeks. By providing greater stability, this method extends the indications for intramedullary nailing to severely comminuted, oblique, and spiral fractures as well as to fractures complicated by loss of bone and fractures of the tibial shaft [6].

Intramedullary rodding allows excellent control of bending forces on long bone fractures when adequate sized rods are used. This is made possible by reaming when necessary. Torsional stability is poor if adequate bone nail contact is not obtained and there is little bone fragment interdigitation. This can be optimized with the interlocking system, especially with proximal and distal fractures. Intramedullary rods allow transmission of compressive load so there must be adequate bone to bone contact without comminution to prevent shortening. If a great deal of comminution is present, an interlocking system must be used to resist compressive loads. The interlocked devices have not been proven to be a detriment to union and indeed are a semi-rigid fixation system when used in comminuted shaft fractures. The strength of an osteosynthesis with an intramedullary rod depends on the geometry of the rod and the geometry of the fracture complex. Both locked and non-locked intramedullary rods perform extremely well when one understands the mechanical principles involved in intramedullary rodding and pays close attention to detail [7].

Anteroposterior and lateral radiographs of tibia shaft fracture. Follow-up radiographs: ±external fixator (open fractures), locked intramedullary nail.

42A1 ♀ 42 years, falling from height

42C2 ♂ 31 years, motor vehicle accident

42A1 ♀ 44 years, work accident

42B1 ♀ 61 years, falling from height

42C1 ♂ 59 years, falling from height

Conclusions

Locked intramedullary nailing is the treatment of choice for fractures of the tibial shaft.

In complex and comminuted fractures of tibial shaft, it is not possible to dynamize the intramedullary nailing because of concern about shortening and rotational instability. So it is mandatory to use interlocking intramedullary nails in such fractures. During recent years, many authors recommended dynamization for promotion of healing in statically locked intramedullary nails of tibial diaphyseal fractures [7]. In our study, dynamization was performed only in transverse fractures, to avoid the complications that may occur, such as loss of length and rotational mal-alignments.

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