Using Intramedullary Nails with a Single Interlocking Screw: A Case Report Demonstrating Excellent Outcomes

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Abstract:

Background: Distal tibial fractures, particularly those involving the diaphyseal-metaphyseal junction, present a significant challenge in orthopedic trauma management. These injuries typically result from high-energy axial and rotational forces. Intramedullary nailing (IMN) has become a standard treatment modality due to its advantages, including lower rates of wound complications, reduced operative time, and accelerated postoperative rehabilitation. Although the use of two or more distal interlocking screws is the conventional standard for achieving adequate construct stability, this approach is often limited in distal fractures due to restricted bone stock. This report evaluates the clinical feasibility and efficacy of IMN fixation utilizing a single distal interlocking screw in a case where additional screw placement is anatomically limited.

The Case: We present the case of a 38-year-old male who sustained a spiral fracture of the distal tibia accompanied by an associated proximal fibular fracture. The patient underwent surgical stabilization using an IMN secured with a single distal interlocking screw. Clinical and radiographic outcomes were assessed over a six-month follow-up period to evaluate fracture healing and functional recovery. Clinical and radiographic assessments during the six-month follow-up revealed no signs of implant failure, fracture displacement, malunion, nonunion, or limb-length discrepancy. The patient demonstrated excellent functional outcomes, as indicated by an American Orthopaedic Foot & Ankle Society (AOFAS) score of 85 and a Visual Analog Scale (VAS) pain score of 1 to 2.

Conclusion: In simple, non-comminuted distal tibial fractures, the use of an IMN with a single distal interlocking screw constitutes a viable and safe therapeutic strategy when anatomical constraints preclude standard multi-screw fixation. While this approach benefits from the inherent advantages of IMN, these findings should be confirmed by further prospective, comparative studies to establish definitive clinical guidelines for such complex scenarios.

Keywords: Distal tibia fracture, Intramedullary nail, Interlocking screw, Internal fixation, Fracture fixation techniques

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Introduction

Distal tibia fractures involve the diaphyseal and metaphyseal regions of the bone.[1,2] These fractures are among the most challenging orthopedic injuries and account for approximately 10% of lower extremity fractures.[2] The primary causes of these fractures are rotational and axial forces exerted on the lower limbs.[3,4]

Appropriate fixation of distal tibia fractures can be achieved using intramedullary nails (IMN) or plates and screws.[2] Due to several advantages of IMN compared to alternative techniques—including promising treatment outcomes,[5-7] a reduction in wound complications by up to 2.5 fold, shorter operative times, preserving of soft tissue, and earlier rehabilitation[8]—the use of IMN devices for treating distal tibial fractures has become more common in recent years. The design of the nail determines the location, orientation, and number of distal interlocking bolts .Although it is generally recommended to place three interlocking bolts distally when possible, some studies report better outcomes using only two interlocking bolts.[9] Overall, most surgeons insert at least two interlocking bolts; however, the use of IMN requires sufficient distal bone stock to allow the placement of interlocking screws distal to the main fracture.[10] Given the advantages of the IMN technique over other fixation methods for distal tibial fractures, in cases where placing two interlocking bolts is not feasible, using a single screw can still enable the use of this technique. Herein, we present satisfactory results from a case treated with one interlocking bolt for a distal tibia fracture.

Case Presentation

A 38-year-old male smoker presented with a simple spiral fracture of the distal tibia, accompanied by a proximal fibular fracture, following a motor vehicle accident. The skin at the injury site was blistered, but the neurovascular status was normal. Surgery was performed one day later (Figure 1).

Figure 1- Preoperative radiograph

The patient was positioned supine with a bump placed under the ipsilateral hip. Fibular fixation was performed prior to tibial nailing. An infrapatellar tendon-splitting approach was used for the nailing procedure. The starting wire was placed at the appropriate entry point, followed by the use of opening reamers over the wire. The starting wire was then removed, and after fracture reduction, a ball-tipped guidewire was advanced to the center-center position at the ankle. Reaming was performed up to 1.5 mm larger than the nail diameter. The nail was then inserted, and the guidewire was removed. Interlocking screws were applied, with two screws placed proximally and one screw inserted distally. A short leg splint was used postoperatively for four weeks, and full weight-bearing was permitted after three months.

Discussion

In this case report, we assessed the patient's general health status, focusing on the occurrence of tibial shortening, malunion, nonunion, and neurovascular damage.

Due to the potential benefits and drawbacks of various methods for fixing very distal tibial fractures, their management remains a challenge for surgeons. Three

common methods for appropriate fixation of distal tibial fractures are IMN, plate fixation (PF), and external fixation (EF). PF is a viable option for treating distal tibial fractures; however, it is associated with delayed wound healing and a higher incidence of deep infections compared to the IMN method[11], as well as soft-tissue irritation and superficial infections.[12-15] Weight bearing is typically allowed earlier in patients treated with IMN fixation than in those treated with PF, as callus formation is observed earlier on radiographs in IMN patients.[16] Moreover, IMN can better tolerate axial loading than PF. Additionally, PF has been reported to involve longer operating times, increased soft-tissue disruption, and a higher rate of deep infections compared to IMN.[17-19] Although EF method may avoid the need for extensive soft tissue repair, it is associated with a high incidence of pin tract infections, malunion, and nonunion. This method is not ideal.[20]

In the most recent meta-analysis comparing IMN and PF, Ekman et al. suggest that IMN is a safer option for high-risk individuals, as complications are less likely with this method.[21]

However, because the strength of the nail is adjusted using proximal and distal additional screws placed around or through the nail, the use of IMN for treating distal tibial fractures is limited to cases with sufficient space to insert two or three interlocking screws.[22] Consequently, PF has been the preferred method for these patients. As mentioned, PF is associated with significantly more complications, especially in high-risk patients, compared to IMN.[19]

Expert nails are innovative nail designs that allow surgeons to place more screws in a confined space. Due to this characteristic, they are a good option for open distal tibial fractures, as they avoid the complications associated with other techniques.[23] However, as the name suggests, their use requires a high level of surgical expertise, and their availability in many parts of the world remains limited).

Figure 2- Radiograph immediately after surgery

Because the risk of infection was higher due to the open fracture described above, we used IMN method to fix his fracture despite the limited space for inserting multiple distal screws. We secured the nail distally with just one interlocking screw (Figure 2). Weight bearing was permitted three months after surgery. During the six months following the operation, the patient experienced no complications such as displacement, nonunion, malunion, tibial shortening, or infection, and he returned to work without any issues (Figures 2, 3, 4, and 5). Although the patient performed heavy labor as a worker during the follow-up period, no signs of varus or valgus deformity was observed. Some degree of posterior angulation was noted, but it remained within the normal range.

The American Orthopaedic Foot & Ankle Society (AOFAS) scale score is a measure used to document several foot-related parameters, including joint motion, footwear requirements, foot alignment, and pain.[24] This rating system consists of nine items divided into three subscales: alignment, function and pain. The maximum scores for these subscales are 100, 50, and 40, respectively.[25]

For this patient, the AOFAS score was 85, which is categorized as excellent. We also used the Visual Analogue Scale (VAS) to measure the patient's pain intensity. The VAS is 100 mm long, with the following ranges indicating pain levels: 0–4 mm for no pain, 5–44 mm for mild pain, 45–74 mm for moderate pain, and 75–100 mm for severe pain, respecrively.[26] In this study, the VAS score was 1-2, which was satisfactory. These results suggest that this method is a good alternative for patients with very distal tibial open fractures.

One important aspect to consider is the non-comminuted fracture in the patient described above. In the future, more extensive studies are needed to compare two separate groups: the PF method and the one-screw nail fixation method. Additionally, this method should be studied in comminuted fractures as well.

Figure 3(a,b)- Radiographs taken three months after surgery

Figure 3(a)

Figure 4(a)

Figure 4(a,b)- Radiographs six months after surgery

Figure 5(b)

Figure 5(a)

Figure 5(a,b,c)- Images of the patient's leg and foot six months after surgery

Conclusion

Using an IMN with just one interlocking screw is not a common method for fixing distal tibial fractures. However, since the IMN technique is generally considered superior to other methods, it may be reasonable to use a single screw when plating is not possible due to severe soft tissue damage and when the distal fragment does not have enough space for two screws. This approach is most appropriate in cases where the fracture is simple and not comminuted.

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