Using the intramedullary nails with just one interlocking screw with wonderful outcomes

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Abstract:

Background and Objective: Distal tibial fractures, particularly those involving the diaphysis-metaphysis junction, represent a significant challenge in orthopedic trauma management, typically resulting from high-energy axial and rotational forces. Intramedullary nailing (IMN) has gained prominence as a standard treatment modality due to its associated benefits, including lower rates of wound complications, reduced operative duration, and accelerated postoperative rehabilitation. While the utilization of two or more distal interlocking screws is the conventional standard for achieving adequate construct stability, this is frequently precluded in distal fractures by restricted bone stock. This report evaluates the clinical feasibility and efficacy of IMN fixation utilizing a solitary distal interlocking screw in cases where additional screw placement is anatomically limited.

Materials & Methods: 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 via an intramedullary nail secured by a single distal interlocking screw. Clinical and radiographic outcomes were assessed throughout a 6-month follow-up period to evaluate fracture healing and functional recovery.

Results: Clinical and radiographic assessments during the 6-month follow-up revealed no evidence of implant failure, fracture displacement, malunion, nonunion, or limb-length discrepancy. The patient achieved excellent functional outcomes, evidenced by an American Orthopaedic Foot & Ankle Society (AOFAS) score of 85 and a Visual Analog Scale (VAS) pain score of 1–2.

Conclusion: In simple, non-comminuted distal tibial fractures, the use of an intramedullary nail 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 intramedullary nailing, these findings should be corroborated 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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Received: 22/12/2025
Accepted: 10/04/2026

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Background and Objective

Distal tibia fractures involve the diaphyseometaphyseal region of the bone.[1,2] Among orthopedic injuries, it is very challenging and accounts for approximately 10% of the lower extremity fractures.[2] The principal cause for these fractures is rotational and axial forces which exert on the lower limbs.[3,4]

Appropriate fixation of distal tibia fractures can be achieved with intramedullary nails (IMN) or plates and screws.[2] Due to various advantages of IMN in comparison with the alternative technique including promising treatment results,[5-7] less wound complications up to 2.5 fold, shorter operative time, preserving the soft tissue and earlier rehabilitation,[8] in recent years, the use of IMN devices to treat distal tibial fractures has been more common. The nail design dictates the location, orientation and number of distal interlocking bolts .Although, it is recommended that when it is possible, three interlocking bolts should be placed distally, some studies report methods using two interlocking bolts which cause better outcomes.[9] Overall, most surgeons insert at least two interlocking bolts, however, the use of IMN requires enough distal bone stock for permitting the application of interlocking screws in a place distal to the main fracture.[10] Because of different advantages of IMN technique comparing to other techniques for fixing distal tibial fractures, in cases which it is not possible to place two interlocking bolts, placing one screw will give us this chance to use this technique. Herein, we present the satisfactory results of a case using one interlocking bolts for treatment of the distal tibia fracture.

Case presentation

A 38-year-old smoker man presented with distal tibial simple and spiral fracture together with a proximal fibular fracture followed by a motor vehicle accident. The skin at the site of injury was blistered and neurovascular system was normal. The surgery was performed after one day (Figure 1).

Figure 1- Pre-operative radiography

The patient was placed in supine and a bump was placed under the ipsilateral hip. Fibular fixation was done before nailing the tibia. Infrapatellar tendon split approach was used for nailing. Starting wire was placed in its appropriate point. opening reamers was then used over that. Starting wire was removed and after reducing the fracture, ball-tipped guidewire was passed to center-center position in ankle. After reaming up to 1.5 mm greater than nail, we placed the nail and removed the guidewire. Interlocking screws were then applied. Two interlocking screws were placed for proximal, and it was possible to insert only one distal screw. Short leg splint was used post operatively for four weeks and full weight bearing was allowed just after three months.

Findings and Discussion

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

Due to the possibility, advantages, and disadvantages of various methods for fixing very distal fracture of tibia, the management of it remains a challenge for surgeons. Three common methods for Appropriate fixation of distal tibia fractures are intramedullary nails (IMN), plate fixation (PF) and external fixator

(EF). PF is an option for treating distal tibial fracture. However, it can cause delayed wound healing, more deep infections compared to IMN method(11), soft-tissue irritation and superficial infection.[12-15] Weight bearing is allowed earlier for individuals treated with IMN fixation than for individuals treated with PF, showing that calluses are seen earlier in radiography in the IMN patients.[16] Moreover, IMN can tolerate axial loading much better than PF. In addition, more deep infection, longer operating time[17] and more soft-tissue disruption[18] in comparison to IMN method is reported.[19] Although EF fixation may avoid the need for repairing soft tissue, because the pin tract infection, malunion and nonunion are highly occurred,
this method is not ideal.[20]

In the last meta-analysis about comparing IMN and PF, Ekman et al suggest that IMN is a safer choice in high-risk individuals, as complications are less probable in this method.[21]

However, as the strength of the nail is modulated using proximal and distal additional screws around or through the nail, the use of IMN for the treatment of distal tibial fracture is restricted to the ones which have enough space for inserting 2 or 3 interlocking screws.[22] Thus, up to now, PF has been used for these patients and as mentioned, it leads to much more complications specifically in high-risk patients in comparison to IMN.[19]

Expert nails are new nail designs which let the surgeon place more screws in a small place and due to this characteristic is a good option in open distal tibial fractures which do not cause other mentioned techniques complications.[23] However, as the name suggests, it needs the high expertise of the surgeon to use it and the availability of it in many areas of the world is another debate (Figure 2).

Figure 2- Radiography immediately after surgery

Thus, as risk of infection was higher in the case mentioned above because of open fracture, we used IMN method for the fixation of his fracture in spite of low space for inserting multiple distal screws and we fixed the nail in distal with just one interlocking screw. Weight bearing was allowed 3 months after surgery. During 6 months after operation, the mentioned case did not have complications such as displacement, nonunion, malunion, tibia shortening, infection and he returned to work without any problems (Figure2, 3, 4,5). Although, the patient did heavy works as he was a worker during follow-up, no signs of varus valgus was observed. Posterior angulation to some degree was seen, but it was at normal range.

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

For this patient the AOFAS score was 85 which is categorized as excellent.We also used the Visual Analogue Scale (VAS) for measuring the pain intensity in the patient. This score is 100 mm long. 0-4 mm, 5- 44mm, 45- 74mm and 75 -100mm indicate no pain, mild pain, moderate pain and severe pain respecrively.[26] In this study the VAS score was 1-2 which was satisfactory. These results show that this method is a good alternative one for patients with very distal tibial open fracture.

One of the things that we should pay attention to, is the non-comminuted fracture in the above patient. In future, more widespread studies are needed to compare two separate groups of PF and one-screw method of nail fixing and we also need to study this method in comminuted fractures, too.

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

Figure 3(a)

Figure 4(a)

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

Figure 5(b)

Figure 5(a)

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

Conclusion

Using the intramedullary nails with just one interlocking screw is not a common method of fixing a distal tibial fracture. However, as IMN method is the best way among other techniques, If we couldn't place a plate due to severe soft tissue damage, and on the other hand, the distal part did not have enough space for two screws, it seems reasonable to insert one screw in cases where the fracture is simple and not comminuted.

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