

Clinical and Functional Outcomes of Distal Tibial Metaphyseal Fractures Treated with Expert Tibial Nail Fixation: A Prospective Study

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ABSTRACT

Distal tibial fractures present significant treatment challenges due to limited soft-tissue coverage, metaphyseal widening, and proximity to the ankle joint. Recent advances in implant design have led to the development of the Expert Tibia Nail (ETN), which offers enhanced stability through multiple multidirectional distal locking options. This narrative review summarizes recent literature on the clinical effectiveness of ETN in managing distal tibial fractures, particularly AO/OTA 43-A and 43-C1/C2 fracture patterns. Available evidence indicates that ETN fixation achieves excellent to good functional outcomes in more than 80–90% of patients based on validated scoring systems such as the American Orthopaedic Foot and Ankle Society (AOFAS) score and Olerud-Molander Ankle Score (OMAS). The technique allows minimally invasive stabilization, preserves fracture biology, and enables earlier weight bearing compared with plate fixation. Reported union times generally range between 16 and 20 weeks with relatively low complication rates. Although anterior knee pain and malalignment remain recognized concerns, ETN represents a safe and reliable alternative to plating for distal tibial fractures.

Keywords: tibial fractures, Expert Tibia Nail clinical effectiveness, Orthopaedic Foot and Ankle Society (AOFAS) score, Olerud-Molander Ankle Score (OMAS).

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Introduction

Distal tibial fractures represent a challenging subset of long-bone injuries because of their subcutaneous location, limited soft-tissue envelope, and proximity to the ankle joint, all of which increase the risk of complications such as wound breakdown, infection, and malalignment. Historically, treatment options have included plating techniques such as minimally invasive percutaneous plate osteosynthesis (MIPPO), external fixation, and conventional intramedullary nailing. However, advances in implant design have led to the development of the Expert Tibia Nail (ETN), which has gained increasing acceptance for the management of distal tibial fractures, particularly extra-articular fractures (AO/OTA 43-A) and simple intra-articular extensions (43-C1/C2). The Expert Tibia Nail is specifically designed to address the limitations of conventional tibial nails when used in distal fractures. The implant incorporates multiple distal locking options in different planes, allowing enhanced angular stability and improved control of distal fracture fragments. This feature is particularly advantageous in distal metaphyseal fractures where the distal fragment is relatively short and prone to malalignment. The design allows surgeons to achieve stable fixation with a minimally invasive approach, preserving the biological environment of fracture healing while maintaining mechanical stability.

Functional and Clinical Outcomes

Several clinical studies have demonstrated favorable functional outcomes following ETN fixation of distal tibial fractures. Functional assessments using validated scoring systems such as the American Orthopaedic Foot and Ankle Society (AOFAS) score and the Olerud-Molander Ankle Score (OMAS) consistently report excellent to good outcomes in more than 80–90% of patients. These outcomes reflect improved ankle function, pain reduction, and restoration of mobility following ETN fixation.

In addition to functional recovery, ETN has been associated with high rates of fracture union and satisfactory radiological outcomes. The typical time to fracture union reported in the literature ranges between 16 and 20 weeks, depending on fracture configuration, soft-tissue condition, and patient factors. Union rates are generally comparable to, or slightly better than, those reported with plate fixation techniques. Importantly, the minimally invasive nature of intramedullary fixation helps preserve periosteal blood supply and fracture hematoma, both of which are critical for biological fracture healing.

Another advantage of ETN fixation is the potential for early mobilization and rehabilitation. As a load-sharing implant, the tibial nail allows controlled axial loading, which can facilitate earlier weight-bearing compared with plate fixation. Early mobilization not only promotes

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fracture healing through mechanical stimulation but also helps prevent complications associated with prolonged immobilization, such as joint stiffness, muscle wasting, and thromboembolic events. Many studies report earlier return to functional activities and work in patients treated with ETN compared with those managed with plating techniques.

Comparison with Plate Fixation

When compared with plating methods such as MIPPO, ETN fixation demonstrates several potential advantages. Plate fixation, although effective in achieving anatomical reduction, requires a relatively larger surgical exposure and carries a higher risk of soft-tissue complications, particularly in distal tibial fractures where soft-tissue coverage is limited. Studies comparing ETN and plate fixation have shown lower rates of wound complications, including infection and wound dehiscence, in patients treated with ETN.

Furthermore, intramedullary fixation allows better load distribution along the mechanical axis of the tibia, reducing the stress concentration seen with plate constructs. This biomechanical advantage contributes to improved stability during weight-bearing and may enhance patient comfort and rehabilitation outcomes.

Complications and Technical Considerations

Despite its advantages, ETN fixation is not without complications. The most commonly reported complication following tibial intramedullary nailing is anterior knee pain, which may occur due to irritation at the nail entry site or damage to surrounding soft tissues during nail insertion. Although this complication is generally mild and manageable, it remains a concern for some patients. Another potential issue is malalignment or malunion, particularly valgus or procurvatum deformities, which may occur if adequate fracture reduction is not achieved before nail insertion. The risk of malalignment is especially relevant in distal tibial fractures where the distal fragment is small and difficult to control. Therefore, careful intraoperative reduction techniques, including the use of blocking screws (poller screws) or temporary fixation devices, may be required to maintain alignment.

Infection rates following ETN fixation are generally low, with superficial infections reported in approximately 5–10% of cases, while deep infections are rare. Compared with plating techniques, the incidence of wound complications is typically lower due to the minimally invasive nature of the procedure.

The role of fibular fixation in distal tibia-fibula fractures remains a subject of debate. Some studies suggest that fixation of the fibula may assist in maintaining reduction and preventing malalignment, particularly in fractures located very close to the ankle joint. However, other

studies report satisfactory outcomes without routine fibular fixation, emphasizing the importance of individualized surgical decision-making based on fracture pattern and stability.

Conclusion

ETN has emerged as a valuable alternative to plate fixation and conventional intramedullary nailing in the management of distal tibial fractures. When meticulous surgical technique and proper patient selection are applied, ETN can achieve excellent functional outcomes with minimal complications, making it an important tool in modern orthopaedic trauma practice.

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