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Original Research

Expert Tibial Nails for Treating Distal Tibial Fractures With Soft Tissue Damage: A Patient Series

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ABSTRACT

Distal tibial fractures with soft tissue damage are relatively difficult to treat. We assessed the outcomes of patients with these fractures treated with Expert Tibial Nails® (DePuy Synthes, Raynham, MA) from March 2012 to December 2014. At 6 months postoperatively, the general health quality of patients was assessed using operative time, interval to return to work, American Orthopaedic Foot and Ankle Society ankle scale score, pain measured using a visual analog scale, and short-form health outcomes 36-item survey physical functioning and mental health dimension scores. Of 11 cases, 7 were open fractures (3 Gustilo-Anderson type II, 3 type IIIA, and 1 type IIIB) and 4 were closed fractures with Tscherne-Oestern type II tissue damage. Their mean age was 52.2 (range 28 to 66) years. The mean operative time was 83 (range 65 to 105) minutes. The mean follow-up period was 16.3 (range 14 to 18) months. The median short-form 36-item survey scores were 79.1 (range 68.9 to 89.0) for the physical function dimension and 77.0 (range 64.3 to 90.0) for the mental health dimension. The mean postoperative ankle score was 88.6 (range 84 to 94). The mean pain score was 1.6 (range 0 to 4) mm. The mean interval to return to work was 14 (range 11 to 17) months. No patient showed evidence of neurovascular damage, malunion, nonunion, or shortening of the tibia. Taken together, we have confirmed that Expert Tibial Nails can effectively treat distal tibial fractures with soft tissue damage.

Distal tibial fracture is a common traumatic injury often associated with various degrees of soft tissue damage. Distal tibial fractures usually have poor functional outcomes with a loss of quality of life and economic productivity. Conventional lateral and medial plates can be fixed firmly if the anterior soft tissue quality is good (1,2). Although external fixator fixation can avoid the need to repair soft tissue, the high prevalence of pin tract infection, nonunion, and malunion make this method less than ideal (3). Intramedullary nail fixation has been widely used because it minimizes surgical insult to the fracture and soft tissue. However, delayed bone healing, reoperation, and a high incidence of primary and secondary malalignment have been reported, especially in distal and proximal tibial fractures (4,5). Distal tibial fractures, especially those accompanied by soft tissue damage, have been relatively difficult to treat because fracture fixation can be compromised by the soft tissue damage (6). The Expert Tibial Nail® (ETN) (DePuy Synthes, Raynham, MA), a good method for the

Fig. 1. Patient positioning. The patient should be placed supine on the radiolucent table, ensuring that the knee of the injured leg can be flexed ≥90°.

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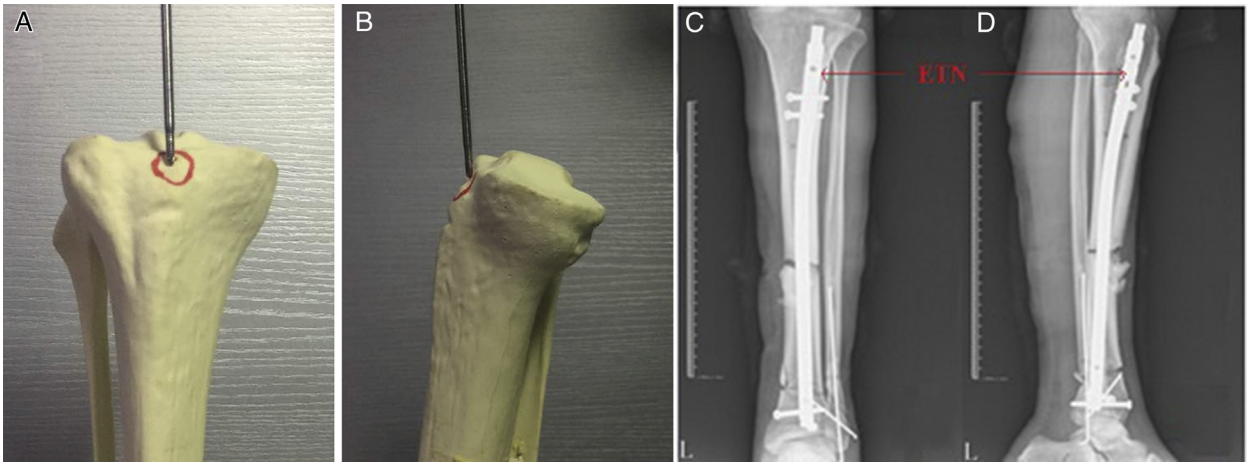

Fig. 2. The entry point defines the optimal position of the Expert Tibial Nail (ETN) in the intramedullary canal. (*A*) On the anteroposterior view, the entry point *(red circle)* should be in line with the axis of the intramedullary canal and the lateral tubercle of the intercondylar eminence. (*B*) On the lateral view, the entry point *(red circle)* should be at the ventral edge of the tibial plateau. (*C* and *D*) Immediate postoperative anteroposterior and lateral radiographic films showing placement of the ETN.

treatment of tibial fracture, is designed to improve the applicability of intramedullary nail fixation, especially for treating distal tibial fractures. This intramedullary nail has multiple locking options in different planes at both ends (7,8). However, only a few studies have assessed the value of ETNs for treating distal tibial fractures with soft tissue damage. In the present study, we used ETNs to fix distal tibial fractures with soft tissue damage. We assessed the functional and general health status of the patients, focusing on evidence of neurovascular damage, malunion, nonunion, and shortening of the tibia.

Patients and Methods

The ethics committee of Yantaishan Hospital (Yantai, China) approved the present study, and all the patients provided written informed consent. From March 2012 to December 2014, all adults with distal tibial fractures and soft tissue damage who presented to our clinic were treated with ETNs. Patients with autoimmune diseases, pathologic fractures, severe multiple trauma, blood disorders, or surgical contraindications were excluded.

Surgery was performed with the knee of the injured leg flexed ≥90° (Fig. 1). A median longitudinal incision was made on the patellar ligament for ETN insertion. The synovial membrane was retracted and the entry point exposed. On the anteroposterior view, the entry point will be in line with the axis of the intramedullary canal and with the lateral tubercle of the intercondylar eminence. On the lateral view, the entry point will be at the ventral edge of the tibial plateau (Fig. 2). The tibial crest was the landmark for inserting the guidewire, and the rotation of the nail was identical in all the patients. The ETN was then fixed internally. All open wounds were thoroughly debrided.

At 6 months after surgery, ankle function was assessed using the American Orthopaedic Foot and Ankle Surgery (AOFAS) ankle score, which ranges from 1 to 100, with a higher score indicating better function (9,10). Pain was measured using a visual analog scale that ranged from 0 (no pain) to 10 (worst pain imaginable). Quality of life and pain were evaluated using the Short-Form Health 36-item Survey (SF-36) physical and mental component scores. Both scores range from 1 to 100, with a high score indicating a better result. The operative time and mean interval to return to work were also recorded.

Results

The mean ± standard deviation age of the 11 patients (10 males) was 52.2 ± 13.5 (range 28 to 66) years. The mechanism of injury was a motor vehicle accident in 4, a fall from a height in 6, and a sports injury in 1. Of the 11 patients, 7 had open fractures (3 with Gustilo-Anderson fractures (11) type II, 3 with type III A, and 1 with III B), and 4 had Tscherne-Oestern (12) type II closed fractures.

The outcome variable data are listed in the Table. All the findings suggested a good health condition for all the patients after surgery. The mean operative time was 83 (range 65 to 105) minutes. All the patients were followed up long term for an average of 16.3 (range 14 to 18) months. The quality of life assessment revealed a median physical Short-Form Health 36-item Survey (SF-36) score of 79.1 (range 68.9 to 89.0) and median mental SF-36 score of 77.0 (range 64.3 to 90.0). The AOFAS ankle scale score was 88.6 (range 84 to 94), and all the scores indicated either excellent (score 90 to 100 for 4 patients) or good (score 80 to 89 for 7 patients) outcomes. Regarding the pain perception, good results were observed using the visual analog scale (VAS). The VAS score was 1.6 (range 0 to 4) mm. The patients returned to work after a median interval of 14 (range 11 to 17) months. In addition, no patient showed evidence of neurovascular injury, shortening of the tibia, early postoperative complications, implant failure, malunion, or deep-seated infection (Fig. 3). Of the 11 patients, 9 were treated with a single-stage operation and 2 with a 2-stage operation involving a local skin flap transfer.

Discussion

The tibia is the long bone most often fractured in motor vehicle accidents, falls from a height, and sport injuries. Distal tibial fractures

Table
Outcomes for 11 patients with distal fractures of the tibia and soft tissue damage after surgical fixation with Expert Tibial Nails*

Variable	Value
Operative time (min)	
Mean	83
Range	65–105
AOFAS ankle scale score	
Mean	88.6
Range	84–94
Physical function score†	
Median	79.1
Range	68.9–89.0
Mental function score†	
Median	77
Range	64.3–90.0
VAS pain score‡ (mm)	
Mean	1.6
Range	0–4
Interval to return to work (mo)	
Mean	14
Range	11–17

Abbreviations: AOFAS, American Orthopaedic Foot and Ankle Society (scale: 0, worst function; 100, best function); VAS, visual analog scale.

* Scores for ankle function and Short-Form 36-item Health Survey physical and mental health components were obtained 6 months after surgery.

† Score of 0 indicates worst function and score of 100, best function.

‡ VAS score: 0 to 4 mm, no pain; 5 to 44 mm, mild pain; 45 to 74 mm, moderate pain; and 75 to 100 mm, severe pain.