

Removal of the Distal Aspect of a Broken Tibial Nail

Joseph A. Gil, MD, Philip McClure, MD, and Christopher T. Born, MD, FAAOS, FACS



Figure 1. (A) Anteroposterior and (B) lateral radiographs show fracture of the left tibia and fibula with associated broken intramedullary nail.

Intramedullary nail (IMN) fixation is reliably used to manage tibial fractures and has become very popular for managing fractures of varying complexity.¹⁻⁴ An occasional complication of intramedullary nailing is nail breakage,⁵⁻⁷ which can result from a fatigue fracture (from excessive fracture site instability caused by inadequate nail diameter, delayed fracture healing, or fracture non-union) and direct traumatic impact.⁵⁻⁷ Several case reports have described unique methods used to

facilitate removal of broken hollow and solid IMNs from tibias and femurs.^{4,8-16} In this article, we describe an efficient technique for extracting broken tibial IMNs—a technique that can be used before attempting more invasive extraction methods. The patient provided written informed consent for print and electronic publication of this case report.

Take-Home Points

- Nail breakage is a known complication of intramedullary nail (IMN) fixation of tibial fractures.
- Several techniques have been described for broken IMN extraction.

Abstract

Nail breakage is a known complication of intramedullary nail (IMN) fixation of tibial fractures. Several case reports have described unique methods used to facilitate removal of broken IMNs. In this article, we describe an efficient technique for extracting broken tibial IMNs—a technique that can be used before attempting more invasive extraction methods.

Case Report and Surgical Technique

A 34-year-old male logger presented to our facility (Department of Orthopaedics, Warren Alpert School of Medicine, Brown University) with a new fracture of the left tibia and fibula with an associated broken IMN after a tree fell on his leg at work (**Figures 1A, 1B**). The same leg had been injured under the same circumstances 1 year earlier; another facility placed the nail at that time. The earlier fracture had healed with an internal rotation deformity, but the patient had been able to return to work without pain or functional deficit. Operative management was recommended for the new fracture. The 2 sets of instruments required for the broken tibial nail removal technique described in this article are the standard T2 Tibial Nailing System (Stryker) and the Implant Extraction System (Stryker).

The original IMN had been placed through a paramedian incision, with lateral to medial distal locking screws. The tibial shaft fracture and broken nail were displaced in the coronal plane (**Figures 1A, 1B**). For restoration of the central canal of the nail, closed reduction was performed in the operating room (**Figure 2A**). Once the fracture

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was reduced, the more proximal of the 2 distal interlocking screws was partially backed out so the extraction hook could be passed antegrade into the distal segment of the nail (Figure 2A). The distal interlocking screw was then partially backed out so the extraction hook could be advanced through the distal segment and engage the distal aspect of the nail (Figure 2B). Several unsuccessful attempts were made to hook the distal aspect of the nail, but neither the locking holes nor the distal end of the nail could be captured (Figure 2B). Bone ingrowth prevented capture of the distal nail segment. The hook was then rotated to point 180° away from the more distal of the 2 distal interlocking screws, and this screw was advanced against the extraction hook (Figure 2C), deflecting the hook enough to engage the distal aspect of the nail (Figure 2D). The broken nail tip became lodged after partial extraction (Figure 2E). The extraction hook was removed, and a conical extraction device was used to remove the proximal segment of the nail. A ball-tipped guide wire was then passed down the intramedullary canal and through the broken distal segment of the nail to allow a reamer to widen the canal above the incarcerated nail fragment (Figure 2F). Reaming was carried out to 12.5 mm (Figure 2F). The extraction hook was then passed down again, and it engaged the distal segment of the nail and extracted it (Figure 2G).

A ball-tipped guide wire was then passed down again, and reaming was carried out distally to 11.5 mm. A new tibial nail (10 mm × 315 mm) was placed down the intramedullary canal over the guide wire. The tibia was derotated to obtain better anatomical alignment using the fracture as an osteotomy, and 2 new distal interlocking screws were placed. The nail was then back-slapped to obtain impaction, and a single proximal dynamic interlocking screw was placed.

After surgery, the patient was allowed a gradual weight-bearing protocol. At the last 3-month follow-up appointment, the patient reported no pain, was fully weight-bearing, and had improved rotational alignment. Radiographs showed evidence of interval healing (Figures 3A, 3B).

Discussion

IMN fixation of tibial fractures is reliable.¹⁻⁴ An occasional complication of intramedullary nailing is nail breakage. Several case reports have described unique methods used to facilitate removal of broken hollow and solid IMNs from knees and femurs.^{4,8-16}

Our patient's case involved a cannulated tibial

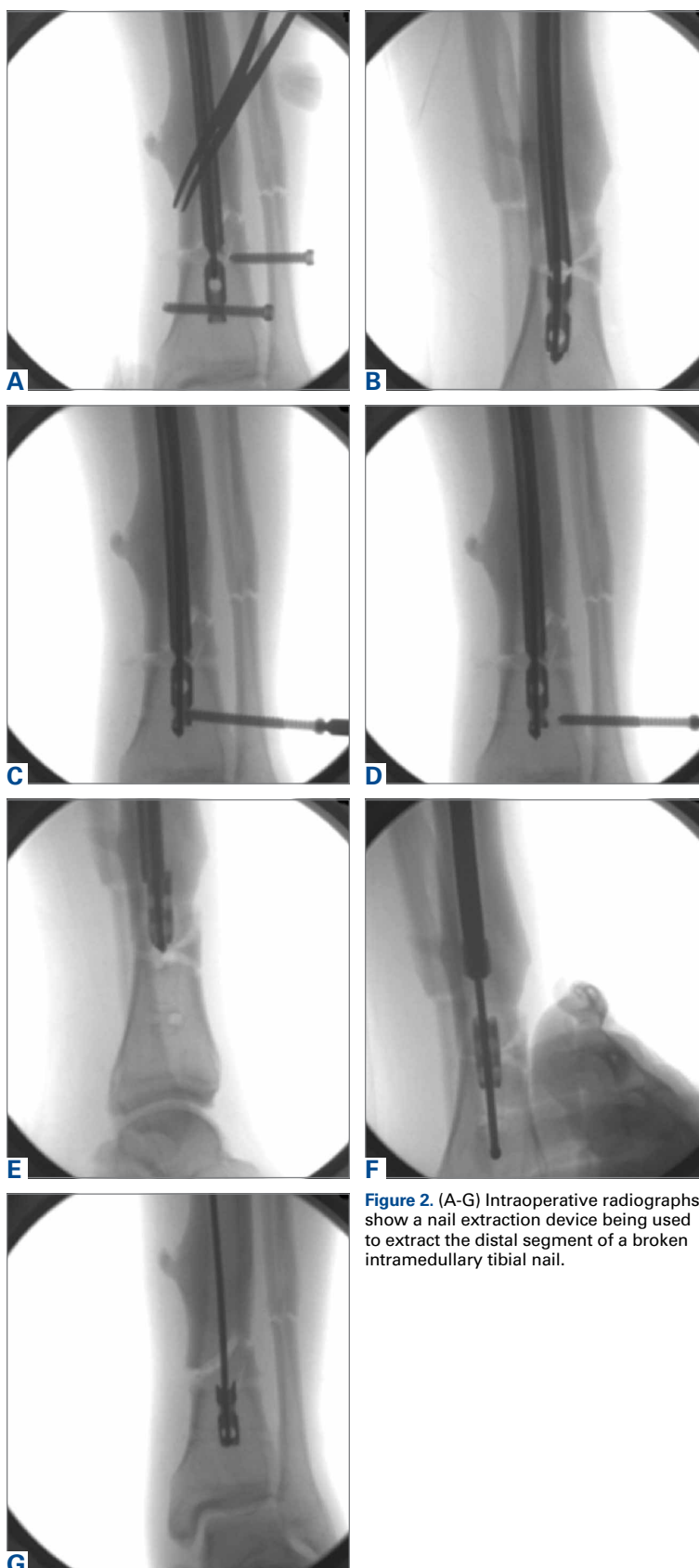


Figure 2. (A-G) Intraoperative radiographs show a nail extraction device being used to extract the distal segment of a broken intramedullary tibial nail.

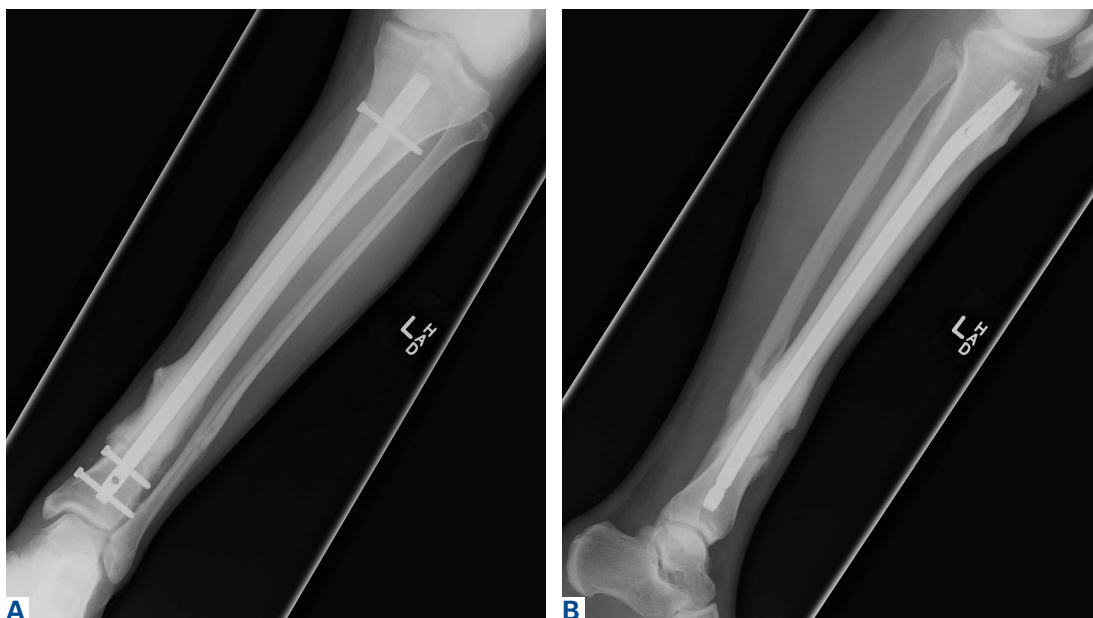


Figure 3. Postoperative (A) anteroposterior and (B) lateral radiographs show evidence of fracture healing in the left tibia.

IMN that broke secondary to an acute traumatic event. Several techniques have been used to remove the distal segment of broken cannulated tibial IMNs.^{8,9,14,17} Abdelgawad and Kanlic⁸ described a technique in which a small distractor hook was introduced past the distal end of the broken distal piece, and a small (~2 in) piece of flexible nail was introduced into the slot of the distal interlocking screw hole. The hook was pulled back and became incarcerated in the nail by the flexible nail piece, allowing the hook to extract the distal segment of the nail.

Charnley and Farrington⁹ used Petelin laparoscopic grasping forceps to extract the distal segment of a broken cannulated tibial IMN under fluoroscopic guidance. This tibial canal was initially reamed before inserting the instrument and removing the distal segment of the nail.

Levine and Georgiadis¹⁴ used a 4.5-mm bit to drill a hole in the distal aspect of the medial malleolus. A smooth Steinmann pin was used to engage the tip of the IMN. The nail was hammered several centimeters up the medullary canal of the tibia. A 3.0-mm ball-tipped guide wire was inserted in the hole in the medial malleolus and advanced through the distal aspect of the nail under fluoroscopic guidance. The guide wire was advanced through the extent of the nail proximally until it emerged through the knee incision. The distal segment of the broken nail was extracted with the guide wire; the end of the guide wire with the ball engaged the distal aspect of the nail.

Our technique allowed us to use a nail extraction

device to extract the distal segment of a broken tibial IMN. This device is usually on hand for routine nail extraction. We used the more distal of the 2 distal interlocking screws to push the extraction hook over the distal lip of the nail, allowing for extraction without additional incisions or additional drill holes in bone. Our technique was efficient in this particular situation and avoided more time-consuming extraction methods. In cases in which the extraction hook does not engage the distal aspect of the nail secondary to bone ingrowth, our technique should be used before attempting other extraction methods.

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This paper will be judged for the Resident Writer's Award.