Segmentally Fractured Femoral Küntscher Nail Extraction Using a Variety of Techniques

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Intramedullary nails are standard treatment for lower extremity long-bone fractures. Implant failure (nail fracture) is usually associated with nonunion but can occur with a healed fracture. Broken-nail extraction is usually required in the treatment of an associated nonunion but may also be indicated if symptomatic with a healed fracture. Extraction of a broken nail can be quite challenging. Many authors have described techniques for extracting the distal fragment of broken nails.

In this article, we report the case of a patient with a segmentally broken Küntscher nail (K-nail) with a healed femoral shaft fracture. The nail was removed 14 years after fracture healing.

Case Report

A man in his mid-30s was referred for right greater trochanteric and anterior thigh pain aggravated by activity. Fourteen years earlier, he had sustained a closed femoral shaft fracture and was treated with an open Küntscher nailing. The postoperative course was uncomplicated. The fracture healed in 7 months, during which he was kept non– or partially weight-bearing. The treating surgeon reviewed him 6 years after fracture healing for pain in the right trochanteric region and knee. An attempt was made to remove the K-nail, but it was fractured, and only its most proximal fragment was removed. Symptoms were temporarily relieved. Four years later, the patient had recurrent trochanteric pain, controlled with corticosteroid injection. Six months before being referred to our institution for definitive management, he developed anterior thigh pain, which was intermittently treated with nonsteroidal anti-inflammatory drugs.

Both lower extremities were of equal length and normal alignment. The right thigh had lateral midthigh and trochanteric scars, both of which were soundly healed and lacked inflammatory signs. The patient had full, pain-free range of motion of both right hip and knee. The right knee had some anteroposterior instability compared with the contralateral side. Magnetic resonance imaging was warranted but could not be done because of the hardware. The distal neurovascular supply was normal. Total leukocyte count was high-normal, and C-reactive protein was elevated. A plain radiograph of the right femur showed several K-nail fragments, minus the proximal segment, which had been previously removed (Figure 1). A scanogram confirmed equal length of the lower limbs. The pain was thought to be caused by a low-grade infection or by an aseptic inflammatory reaction to the metallic hardware. The plan was to proceed with implant removal, intramedullary culture, débridement, and irrigation.

In the operating room, the patient was placed in the lateral decubitus position on a radiolucent table. Under image intensifier, the medullary canal was approached through the previous trochanteric incision. After placement of a guide wire to the level of the first nail segment, reaming was carried out to approximately 2 mm wider than the nail diameter (Figure 2A). An attempt was made to extract the proximal 2 segments using an extraction hook after bending it at a 30° angle 15 mm from its distal end (Figure 2B). Efforts to extract more than a segment at a time did not work, as

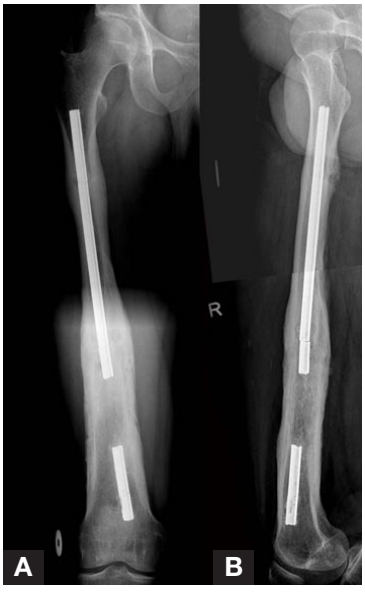

Figure 1. Preoperative plain anteroposterior (A) and lateral (B) radiographs of right femur show healed shaft fracture and segmentally broken Küntscher nail.

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Am J Orthop. 2009;38(3):E59-E60.

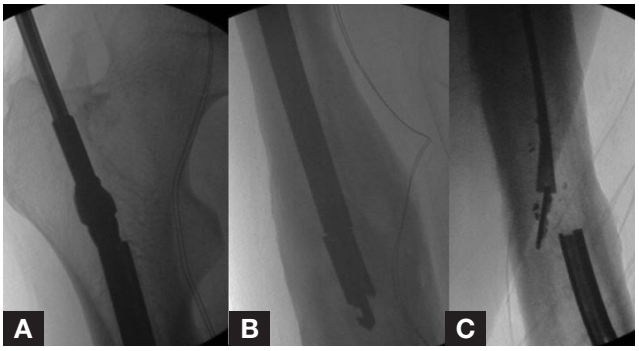

Figure 2. Intraoperative fluoroscopic images show reaming of medullary canal to 2 mm larger than nail diameter (A) to facilitate nail extraction using hook (B) and alligator forceps (C).

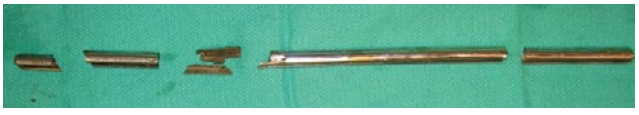

Figure 3. Broken-nail segments after extraction.

the segments tended to tilt in the medullary canal and get jammed. Cannulation of the nail was too small to allow stacking of guide rods to increase the rigidity of the broken segments. After repeated efforts, one of the segments was further comminuted with some barrel staving. We resorted to removing one segment at a time. After extraction of each segment, the canal was reamed down to the next segment. The segment that had been split was retrieved using a long alligator forceps under radiographic control (Figure 2C). A segment incarcerated in the isthmus was pushed distally into the wider metaphyseal area to allow the isthmus to be reamed up to facilitate its extraction. Figure 3 shows the nail pieces after extraction. Medullary reamings were sent for microbiological evaluation. After nail removal, the medullary canal was thoroughly irrigated with normal saline to remove metallic debris—an irrigation tube was passed down the medullary canal, and suction was applied proximally. Ultimately, the suction catheter was passed down the medullary canal. Osteoset T Pellets (Wright Medical Technology, Inc., Arlington, TN) were placed into the medullary canal before wound closure.

The patient was fully mobilized and went home the next day. The postoperative period was uneventful. The intramedullary cultures were negative. Two weeks after surgery, the patient was back to work. At 6-week follow-up, he reported no trochanteric or anterior thigh pain.

Discussion

Broken nails can be extracted using hooks,[1-3] a hook supported with wires,[4] a single guide wire with a beveled-angled distal end,[5] multiple guide wires (ball-tipped and smooth[6]; 2 ball-tipped[7]; 3 ball-tipped[8]), a ball-tipped guide wire with a 12-mm cortical screw passed in the distal locking holes,[9] a ball-tipped guide wire with a washer introduced retrograde through a femoral intercondylar channel,[10] cerclage wires,[11] a smaller nail impacted in the broken distal piece,[12-14] an Ender nail inversely introduced in a broken slotted K-nail and rotated to bring its wide end under the tip of the distal end of the K-nail,[15] a hand reamer,[16] a corkscrew extractor,[17] or a laparoscopic forceps.[18] In addition, the distal broken segment of a solid nail can be extracted through a femoral lateral condylar channel.[19]

All previously reported broken K-nail extractions were associated with nonunion. To our knowledge, none of these nails was as highly segmented as the one in the present case. Our patient's fracture had healed without any deformity, suggesting that the nail fractured after bone healing. The reason for the multiple fractures is unclear.

Extraction of broken slotted nails is unique in that impacting a smaller nail or any instrument in its cannulation widens its diameter and obstructs the extraction. Likewise, any protracted effort at removing an incarcerated segment with a hook or jammed ball-tipped wire can mushroom the end of the nail and further obstruct removal. Extraction with a hook can also prove to be difficult, as the hook often slips through the slot. A combination of multiple techniques might be required, as in our case, and this depends on intraoperative decision making.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article. The authors obtained informed consent from the patient for publication of his case report and the figures.

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