

Exchange Femoral Nailing: A New Technique for Removal of a Broken Nail

Rodney K. Alan, MD, Rafath Baig, MD, and Frank R. Voss, MD

ABSTRACT

Exchange femoral nailing is the preferred method for treating femoral nonunions. When the index femoral nail is broken, the difficulty of exchange nailing increases dramatically. In this article, we describe a new technique for removing a broken retrograde nail—advancing it out of the proximal end of the femur.

Reamed intramedullary (IM) nailing of femoral shaft fractures results in union rates of 97% to 100%.¹ In the rare event of delayed union or nonunion, exchange IM nailing is recommended. The advantages of exchange nailing include relatively low morbidity, no bone graft harvesting, and immediate weight-bearing. Exchange IM nailing was reviewed and reported to have success rates of 53% to 100%.²

Dr. Alan is in private practice, Palmetto Orthopaedics and Sports Medicine, Sumter, South Carolina. He was Senior Resident, Department of Orthopaedic Surgery, University of South Carolina, Columbia, South Carolina, at the time that the article was written.

Dr. Baig is Resident, Division of Orthopaedic Surgery, Department of Surgery, Kingsbrook Jewish Medical Center, Brooklyn, New York.

Dr. Voss is Associate Professor, Department of Orthopaedic Surgery, University of South Carolina, Columbia, South Carolina.

Requests for reprints: Rodney K. Alan, MD, 595 W. Wesmark Blvd, Sumter, SC 29153 (tel, 803-469-4028; fax, 803-469-2663; e-mail, rka0822@yahoo.com)

Am J Orthop. 2007;36(9):XX-XX. Copyright Quadrant HealthCom Inc. 2007. All rights reserved.

Removal of broken IM nails can be difficult when exchange nailing is required. Even when an IM nail appears not to be broken, the surgeon should be prepared to remove a broken nail because fatigued implants may break at time of removal.³ Broken nails were encountered in 3 of 19 femoral nonunions treated with exchange nailing in one study.⁴ In another study, 5 of 60 femoral rods were found broken at time of removal.⁵

Specialized hooks, pliers, arthroscopic clamps, impacted guide

longer time to union and a slightly lower rate of union and require more secondary procedures for union.¹³

To our knowledge, this technique has not been described before.

TECHNIQUE

The patient is prepared and draped from the superior aspect of the iliac crest to the calf and then placed in the semilateral position on a radiolucent fracture table. The proximal and distal interlocking screws are removed. The broken nail is approached through the knee using the previous incision.

“[This is a] technique that can be used when exchanging a retrograde femoral nail for an antegrade femoral nail.”

wires, small impacted nails, basket forceps, alligator forceps, and biopsy forceps have all been reported being used for removal of broken femoral nails.⁵⁻¹¹ In some situations, residual nail pieces were left behind.⁵ Leaving a portion of a broken nail behind and plating was reported in the treatment of a nonunion,¹⁰ and leaving a portion of a broken nail and applying external fixation has been reported.¹²

In this article, we present a simple and effective technique for removing a broken retrograde femoral nail—a technique that can be used when exchanging a retrograde femoral nail for an antegrade femoral nail. We believe that this technique is particularly useful because, compared with antegrade nailing, retrograde nailing has been found to have a slightly

The distal end of the nail is removed through the knee. A straight-tipped or spade-tipped guide wire is advanced through the residual nail. The guide wire is then advanced through the proximal end of the nail up to the metaphyseal cortical bone of the piriformis fossa. A T-handle is attached to the guide wire, and a mallet is used to tap the guide wire through the piriformis fossa. With the leg adducted, the guide wire is advanced through the dermis. An incision is made around the guide wire, and blunt dissection is used to follow the guide wire to the piriformis fossa. A soft-tissue protector is placed, and a sharp cannulated end-cutting reamer is used to widen an entry hole in the piriformis fossa. The proximal portion of the nail is advanced out of the

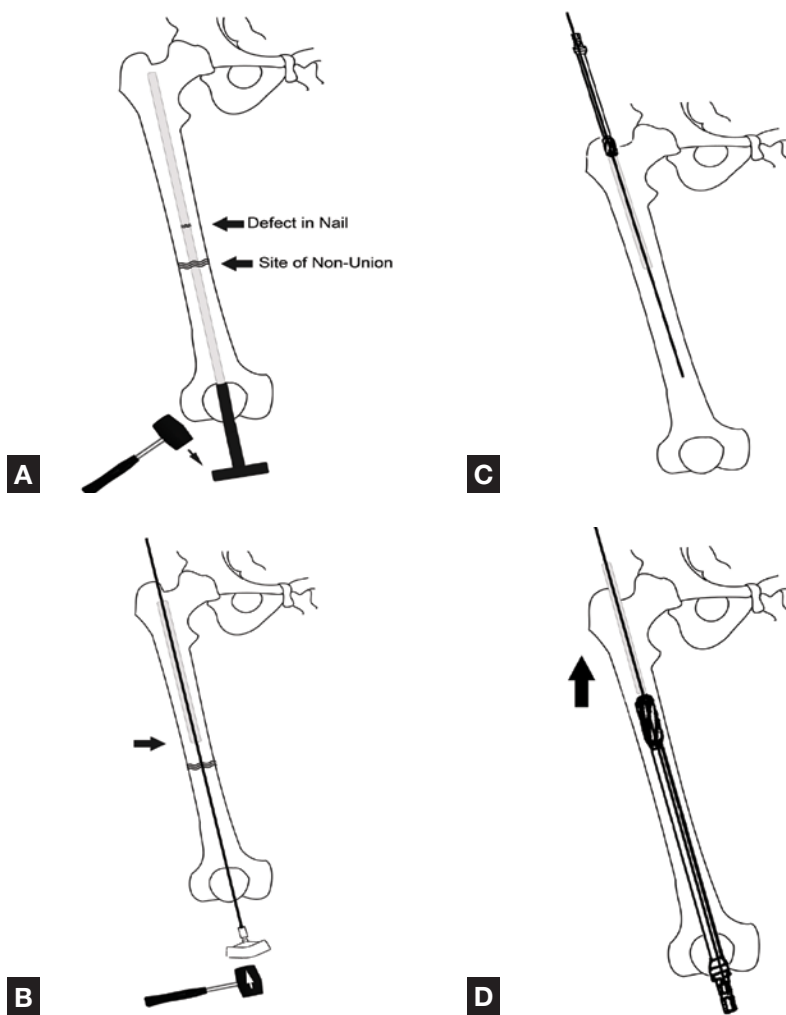


Figure. (A) The distal end of the broken nail is removed in standard fashion. (B) A guide wire is passed through the residual broken nail out of the proximal femur. (C) The proximal end of the femur is reamed over the guide wire so that the nail can be “pushed out.” (D) A reamer is used to push the proximal part of the broken nail out of the femur in retrograde fashion.

femur in retrograde fashion through the piriformis fossa using long flexible reamers as a “tamp” (Figure). After the broken nail is removed, reaming is carried out so that a nail 1 to 3 mm larger than the previous nail (2 mm) can be accepted, and a new nail is placed in antegrade fashion.

We recommend using an antegrade nail for exchange nailing. One advantage of converting a retrograde nail to antegrade is to allow for interlocking screws as far away as possible from the previous screw sites. In addition, the potential risk for knee pain after a hole larger than 13 mm is reamed in the intercondylar notch is ill-defined. Morgan and colleagues¹⁴ found that reaming up to 13 mm for a

retrograde nail does not increase patellofemoral contact pressures when the nail is seated appropriately, but we are unaware of any studies demonstrating the effect of reaming a hole larger than 13 mm in the intercondylar notch of the knee.

DISCUSSION

We have presented a new technique for removing a broken femoral nail. Milia and colleagues¹⁵ described a similar retrograde push-out technique for solid femoral nails. The difference between these techniques is that we use a guide wire to pass out of the proximal femur and through the dermis, avoiding a formal dissection through the gluteal muscles.

We derived our technique from one that we have used for insertion of knee fusion nails. We have used the new technique for exchange nailing in approximately 10 cases, and it has been successful in each. It is not difficult.

Important Caveats

- One concern we have about this technique is advancing a straight-tipped guide wire out of the piriformis fossa and potentially damaging the proximal femur. We agree that such a complication would be disastrous, but it seems avoidable if the guide wire is advanced carefully, under fluoroscopic imaging.

- A second concern is the additional morbidity of damaging the gluteal muscles by using an antegrade approach after previously using a retrograde nail. We believe that there is less soft-tissue injury to the hip using this technique than for primary antegrade nailing for 2 reasons. First, advancing the guide wire retrograde through the center of the broken femoral nail ensures that the guide wire will always come out of

“The guide wire [must be] advanced carefully, under fluoroscopic imaging.”

the proximal femur in the perfect starting point. This obviates the need for multiple passes with an awl or a drill. Second, a smaller incision and less dissection of the gluteal muscles are required when a guide wire has already been passed into the appropriate starting point for antegrade nailing. The benefits of removing the entire nail through a closed technique are substantial compared with the alternatives, which include abandoning the broken nail and treating the nonunion by open plating; abandoning the broken nail and treating the

nonunion with external fixation; and osteotomizing the femur to retrieve the nail.

In this article, we have presented a new technique for removing a broken femoral nail. Surgeons should be familiar with this technique when exchange-nailing a femoral nonunion previously treated with a retrograde nail. We believe that this technique is the simplest one for managing a broken retrograde nail.

AUTHORS' DISCLOSURE STATEMENT

The authors report no actual or potential conflict of interest in relation to this article.

REFERENCES

1. Brumback RJ, Virkus WW. Intramedullary nailing of the femur: reamed versus nonreamed. *J Am Acad Orthop Surg.* 2000;8:83-90.
2. Hak DJ, Lee SS, Goulet JA. Success of exchange reamed intramedullary nailing for femoral shaft nonunion or delayed union. *J Orthop Trauma.* 2000;14:178-182.
3. Star AM, Whittaker RP, Shuster HM, Duda J, Menkowitz E. Difficulties during removal of fluted femoral intramedullary rods. *J Bone Joint Surg Am.* 1989;71:341-344.
4. Banaszkiwicz PA, Sabboubeh A, McLeod I, Maffulli N. Femoral exchange nailing for aseptic non-union: not the end to all problems. *Injury.* 2003;34:349-356.
5. Miller R, Renwick SE, DeCoster TA, Shonnard P, Jabcozenski F. Removal of intramedullary rods after femoral shaft fracture. *J Orthop Trauma.* 1992;6:460-463.
6. Incavo SJ, Kristiansen TK. Retrieval of a broken intramedullary nail. *Clin Orthop.* 1986;210:201-202.
7. Bear JV, Troop R. Tips of the trade #10. Timesaving instruments for removing the distal interlock of a Brooker-Wills femoral intramedullary rod. *Orthop Rev.* 1989;18:360, 362.
8. Mooney J, Chabon SJ, Poehling GG. Tips of the trade #40. Removal of a fractured intramedullary nail. *Orthop Rev.* 1991;20:923-924.
9. Brewster NT, Ashcroft GP, Scotland TR. Extraction of broken intramedullary nails—an improvement in technique. *Injury.* 1995;26:286.
10. Franklin JL, Winquist RA, Benirschke SK, Hansen ST Jr. Broken intramedullary nails. *J Bone Joint Surg Am.* 1988;70:1463-1471.
11. Steinberg EL, Luger E, Menahem A, Helfet DL. Removal of a broken distal closed section intramedullary nail: report of a case using a simple method. *J Orthop Trauma.* 2004;18:233-235.
12. Lerner A, Herer D, Chezar A, Freiman S, Stein H. Treatment of nonunions with irretrievable broken nail pieces in the distal fragment. *Arch Orthop Trauma Surg.* 2004;124:151-153.
13. Ostrum RF, Agarwal A, Lakatos R, Poka A. Prospective comparison of retrograde and antegrade femoral intramedullary nailing. *J Orthop Trauma.* 2000;14:496-501.
14. Morgan E, Ostrum RF, DiCicco J, McElroy J, Poka A. Effects of retrograde femoral intramedullary nailing on the patellofemoral articulation. *J Orthop Trauma.* 1999;13:13-16.
15. Milia MJ, Vincent AB, Bosse MJ. Retrograde removal of an incarcerated solid titanium femoral nail after subtrochanteric fracture. *J Orthop Trauma.* 2003;17:521-524.

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

By Working Together We Can Achieve Anything

Thanks in part to your contributions, OREF has invested more than \$70 million to fund research grants and educational projects.

OREF is proud to acknowledge these companies for their generous support. A strong and productive alliance with industry enables OREF to fund quality programs that advance the orthopaedic profession, ultimately leading to improved patient outcomes.

To learn more about the Corporate Associates Program, please contact: **Judy Sherr**, VP, Corporate Relations at (847) 384-4356 or sherr@oref.org; or **Ivy Gard**, Corporate Relations, at (847) 384-4355, or gard@oref.org.



OREF Recognizes its Platinum Level (200,000 & above) Corporate Associates:



Orthopaedic Research and Education Foundation

www.oref.org

