Are Cephalomedullary Nail Guides Accurate? A Case Report of an Unexpected Complication After Nailing an Intertrochanteric Femoral Fracture

Rayan Fairag, MBBS\textsuperscript{1,2}, Fahad H. Abduljabbar, MBBS, FRCSC\textsuperscript{1,2,3}, Alex Page, MD, FRCSC\textsuperscript{3}, and Ron Dimentberg, MD, FRCSC\textsuperscript{3}

Abstract

Intramedullary nailing is the mainstay of treatment for unstable intertrochanteric hip fractures. Various complications have been described with the use of these nails. We report an unusual complication whereby the lag screw completely missed the nail. We hypothesize that this previously unreported complication may be related to a specific flexible carbon fiber aiming device. Surgeon awareness and thorough intraoperative imaging are crucial to avoiding this complication.

Keywords

hip fracture, intertrochanteric fractures, cephalomedullary nails, complication

Submitted August 12, 2017. Revised December 7, 2017. Accepted December 16, 2017.

Figure 1. Anteroposterior and lateral views of the right hip showing reverse obliquity intertrochanteric femoral fracture (OTA-A3.3).
Introduction

Hip fractures in the elderly patients are a common problem encountered in orthopedic practice. Intertrochanteric hip fractures account for approximately half of all hip fractures in the elderly patients.\(^1\) Unstable intertrochanteric femur fractures account for 50\% to 60\% of hip fractures.\(^2\) Hip cephalomedullary nailing is the mainstay of treatment as sliding hip screw failure is up to 50\% when used to treat such unstable fractures.\(^5\) Cephalomedullary nailing has gained popularity since its introduction in the 1980s.\(^6\) Biomechanically, these nails act as an intramedullary buttress to prevent excessive shaft medialization. Clinically, studies suggest that cephalomedullary nailing may have shorter operative times, decreased blood loss, greater fixation stability, and shorter hospitalization.\(^7,8\) On the other hand, using these nails has potential complications including cutout of the implant, nonunion, medial migration, nail breakage, intraoperative fracture, fracture site collapse, and fracture distal to the tip of short nails.\(^9,10\) We describe an unusual complication of cephalomedullary nailing not previously reported.

Case Report

A 60-year-old female patient presented to the emergency department with trauma to the right hip after she slipped on ice. Her past medical history includes hypertension, hypothyroidism, and mood disorder. Physical examination revealed tenderness over the right hip with shortening and external rotation of the right lower extremity. Plain radiographs showed a reverse obliquity intertrochanteric femoral fracture (OTA-31-A3.3)\(^11\) (Figure 1). Under spinal anesthesia on a fracture table, a closed reduction was performed, followed by internal fixation using a short (215 mm) 130° cephalomedullary nail system which was inserted using the carbon fiber targeting guide. Intraoperative fluoroscopy suggested a satisfactory reduction and implant placement (Figure 2); however, her X-ray on postoperative day 2 showed the lag screw to be outside the nail (Figure 3). The patient was kept non-weight bearing while awaiting further surgery. Under spinal anesthesia, the previous incision was used and the lag screw was removed. The targeting guide reconnected to the nail and the distal locking screw removed to rotationally realign the fracture, followed by lag screw reinsertion and distal locking. The position of the lag screw inside the nail was confirmed by anteroposterior (AP) view. Stable fixation was obtained and weight bearing as tolerated allowed. Her postoperative course was uneventful. Final X-rays at 2-year postsurgery show complete healing of the fracture (Figure 5). Our patient remains pain free and had good functional outcome.

Discussion

This case report describes a previously unreported intraoperative complication with the use of short cephalomedullary nail. Those nails are biomechanically advantageous over sliding hip screws for the fixation of unstable intertrochanteric hip fractures.\(^12\) The evolution of these nails over time has resolved many technique-
related complications. However, the use of these implants can still be associated with common complications including malalignment of the implant, positioning of lag screw within the femoral head, screw cutout, infection, drill bit breakage during the interlocking procedure, femur perforation with usage of long nails, malrotation, lower limb discrepancy secondary to femur overlengthening, nonunion, periprosthetic fracture distal to the tip of the nail, loss of reduction, implant failure, lag screw intrapelvic migration, neurovascular injury, secondary varus deviation, and refracture after implant removal. Fixation failure due to lag screw cutout is among the most common complications. Insertion of the lag screw central to the femoral head with a tip-to-apex difference of less than 25 mm has been shown to be an accurate predictor of screw cutout.

In the case described here, we hypothesize 3 events occurring which might have allowed the lag screw to miss the nail. First, improper tightening of the outer handle of the targeting guide would cause increased flexibility at the nail–jig junction which possible made the guidewire miss the nail completely because of failure to verify that the targeting guide was securely attached to the nail before insertion. Secondly, in addition to the flexibility of the nail–jig interface, aiming the guide pin anteriorly to match the femoral neck anteversion by rotating the aiming arm could also contribute to this complication. Thirdly, suboptimal intraoperative images might also have led to such a complication. To ensure a proper guidewire placement, surgeons must be sure that the targeting guide is securely attached to the nail, which was done twice in our case by the nurse and the surgeon. Our second hypothetical assumption needs a biomechanical study comparing different cephalomedullary nail systems “carbon fiber vs titanium targeting guide” to support our hypothesis. Most importantly to avoid such a complication, numerous and adequate intraoperative biplanar fluoroscopic imaging including true views of the lateral proximal femur is essential and should be obtained with each step of the procedure to make sure there is no technical compromise. This particular complication has not been described in the literature before. We believe that this kind of technical error could be related to the flexibility of the carbon fiber guide of the Zimmer Natural Nail System combined with the suboptimal intraoperative imaging. We hypothesize that this problem is less likely to happen when using a rigid aiming guide such as the Titanium Fixation nailing system. Also, we emphasize on the importance of tightening targeting guides to the nail and getting proper intraoperative views to insure the correct alignment of guidewires and lag screw for adequate fixation of the implant and avoid unwanted complications.

**Conclusion**

Cephalomedullary nails are considered a relatively safe option for hip fracture internal fixation. However, surgeons should be aware of potential complications when using intramedullary hip
screws with a flexible targeting device in a patient with a relatively narrow femoral canal. The consequences of discarding this issue are serious and would likely lead to complication and reoperation. Awareness and good quality intraoperative fluoroscopic lateral X-ray should prevent this complication when adjusting guidewide anteversion using a carbon fiber aiming guide.

**Authors’ Note**

Level of Evidence: V “Case report”.

**Declaration of Conflicting Interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Funding**

The author(s) received no financial support for the research, authorship, and/or publication of this article.

**References**

1. Lindskog DM, Baumgaertner MR. Unstable intertrochanteric hip fractures in the elderly. *J Am Acad Orthop Surg.* 2004;12(3):179-190.

2. Baumgaertner MR, Curtin SL, Lindskog DM, et al. The value of the tip-apex distance in predicting failure of fixation of peritrochanteric fractures of the hip. *J Bone Joint Surg Am.* 1995;77(7):1058-1064.

3. Koval KJ, Aharonoff GB, Rokito AS, et al. Patients with femoral neck and intertrochanteric fractures. Are they the same? *Clin Orthop and Relat Res.* 1996 Sep 1;330(1):166-172.

4. Zain Elabdien BS, Olerud S, Karlstrom G. The influence of age on the morphology of trochanteric fracture. *Arch Orthop Trauma Surg.* 1984;103(3):156-161.

5. Haidukewych GJ, Israel TA, Berry DJ. Reverse obliquity fractures of the intertrochanteric region of the femur. *J Bone Joint Surg Am.* 2001;83-A(5):643-650.

6. Vaughn J, Cohen E, Vopat BG, et al. Complications of short versus long cephalomedullary nail for intertrochanteric femur fractures, minimum 1 year follow-up. *Eur J Orthop Surg Traumatol.* 2015;25(4):665-670.

7. Davis J, Harris MB, Duval M, et al. Pertrochanteric fractures treated with the Gamma nail: technique and report of early results. *Orthopedics.* 1991;14(9):939-942.

8. Lindsey RW, Teal P, Probe RA, et al. Early experience with the gamma interlocking nail for pertrochanteric fractures of the proximal femur. *J Trauma.* 1991;31(12):1649-1658.

9. Erez O, Dougherty PJ. Early complications associated with cephalomedullary nail for intertrochanteric hip fractures. *J Trauma and Acute Care Surgery.* 2012 Feb 1;72(2):E101-5.

10. Lozano-Alvarez C, Alier A, Pelfort X, et al. Cervicocephalic medial screw migration after intertrochanteric fracture fixation, OTA/AO 31-A2, using intramedullary nail Gamma3: report of 2 cases and literature review. *J Orthop Trauma.* 2013;27(11):e264-267.

11. Marsh JL, Slongo TF, Agel J, et al. Fracture and dislocation classification compendium—2007: Orthopaedic Trauma Association classification, database and outcomes committee. *J Orthop Trauma.* 2007;21(10 suppl):S1-S133.

12. Boopalan PR, Oh JK, Kim TY, et al. Incidence and radiologic outcome of intraoperative lateral wall fractures in OTA 31A1 and A2 fractures treated with cephalomedullary nailing. *J Orthop Trauma.* 2012;26(11):638-642.

13. Bhandari M, Schemitsch E, Jonsson A, et al. Gamma nails revisited: gamma nails versus compression hip screws in the management of intertrochanteric fractures of the hip: a meta-analysis. *J Orthop Trauma.* 2009;23(6):460-464.

14. Mavrogenis AF, Panagopoulos GN, Megaloikonomos PD, et al. Complications after hip nailing for fractures. *Orthopedics.* 2016;39(1):e108-e116.

15. Geller JA, Saifi C, Morrison TA, et al. Tip-apex distance of intramedullary devices as a predictor of cut-out failure in the treatment of peritrochanteric elderly hip fractures. *Int Orthop.* 2010;34(5):719-722.

16. Steen B, Tornetta III P. Cephalomedullary nailing of fractures of the proximal femur: technical tip for precise lag screw placement. *Tech Orthop.* 2014;29(4):197-199.