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Pseudoaneurysm of the deep femoral artery caused by a guide wire following femur intertrochanteric fracture with a hip nail: A case report



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ABSTRACT

An 85-year-old woman developed severe swelling and pain in the proximal thigh after internal fixation of an intertrochanteric fracture of the femur with a hip nail. In order to identify the causes and determine the effective treatment, angiography was performed. The results of the angiography revealed a pseudoaneurysm of a branch of deep femoral artery. Endovascular embolization was used to treat the pseudoaneurysm. After reviewing all possible causes, we found a mistake in insertion of a guide wire for hip nail. Using intraoperative fluoroscopic images, we found the mal-positioned guide wire located posterior to trochanter on lateral view of hip. This case study reminds us that pseudoaneurysm can occur in a guide wire during hip nailing. Surgeons can avoid this complication with confirmation of lateral and anteroposterior view of hip.

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Introduction

Hip fractures are one of the most common osteoporotic fractures, and the incidence of proximal femur fractures is expected to increase in the future.¹ Internal fixation using sliding hip screw or intramedullary nails is the standard procedure in the treatment of the proximal femur. A percutaneous insertion of intramedullary nails has become more common.^{2,3} There have been reports about pseudoaneurysm during hip fracture surgeries,^{4–9} and most of the reports noticed that the deep femoral artery (DFA) injury might occur in insertion of screws of dynamic hip screw (DHS).^{4,5,7,9} With an intramedullary nail, there is a similar risk of insertion of distal locking screw of hip nail.⁶ We present a case of a patient with pseudoaneurysm of the DFA caused by a guide wire, not drill bit or screws following internal fixation of trochanteric fracture using a hip nail. We also have reviewed the literature on the subject.

Case report

An 85-year-old female suffered pain in her left hip after a mechanical fall at home. She had a medical history of hypertension and angina pectoris, and she had a total knee arthroplasty revision performed one year ago. Plain radiographs revealed intertrochanteric fracture of the left femur (AO/OTA 31-A2, Fig. 1). Surgery was done on the 2nd day after injury. Routine preoperative evaluation was done prior to the surgery. Closed reduction was achieved under fluoroscopy, and internal fixation of her left proximal femur was performed with proximal femoral nail antirotation-II (PFNA2; Synthes, Oberdorf, Switzerland, Fig. 1B). Preoperative hemoglobin (Hg) was 11.6 g/mL with 33.2% of hematocrit (Hct) and immediate postoperative Hg was 8.9 g/mL (Hct 26.3%). Intraoperative blood loss was minimal due to percutaneous procedure and transfusion was not applied. However, she complained severe pain in the proximal thigh and severe swelling of left thigh was revealed. Postoperative Hg at 12 h after surgery was 6.3 g/mL (Hct 18.3%), but the vital sign was stable. Four units of packed red blood cells were transfused. In general, a small hematoma can be treated conservatively including rest, ice, compression and elevation. However, potential injury to the deep femoral artery should be considered and a percutaneous endovascular procedure should be

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Fig. 1. Preoperative and postoperative radiologic findings. (A) Left hip anteroposterior (AP) and lateral x-ray showing intertrochanteric fracture of the left femur (AO/OTA 31-A2). (B) Postoperative AP and lateral view demonstrating good reduction of fracture.

performed when unexpected large thigh swelling is encountered after hip fractures.⁸ Therefore computed tomography (CT) angiography was immediately performed with a suspicion of vessel injury because this procedure usually does not result in massive bleeding and unexplained anemia might be caused by vessel injury such as pseudoaneurysm. CT angiography demonstrated a large hematoma in the left thigh (Fig. 2) and a large pseudoaneurysm originated from the DFA (Fig. 3A). CT angiography also detected atherosclerotic aortoiliac calcifications without significant stenosis. Angiography result revealed a 3 cm-sized pseudoaneurysm arising from a muscular branch of the DFA corresponding to the abnormality seen on the CT angiography (Fig. 3B). The pseudoaneurysm was embolized with coils including afferent and efferent segment, and there was no further active hemorrhage (Fig. 3C). Without any other

complications, she was discharged 2 weeks after the operation (Fig. 3D). Informed consent was obtained from the patient for the publication of this study.

Discussion

Iatrogenic pseudoaneurysms of femoral artery after fracture of femur are rare. This report describes the cause of iatrogenic injury, anatomical consideration of the proximal femur, risk factors of pseudoaneurysm, and prevention tips against pseudoaneurysm.

There are several other causes of iatrogenic pseudoaneurysm following surgery of proximal femur fracture. Pseudoaneurysm of the DFA is caused primarily by overpenetration of the drill bit or screws.^{7–10} Pseudoaneurysm of the superficial femoral artery can

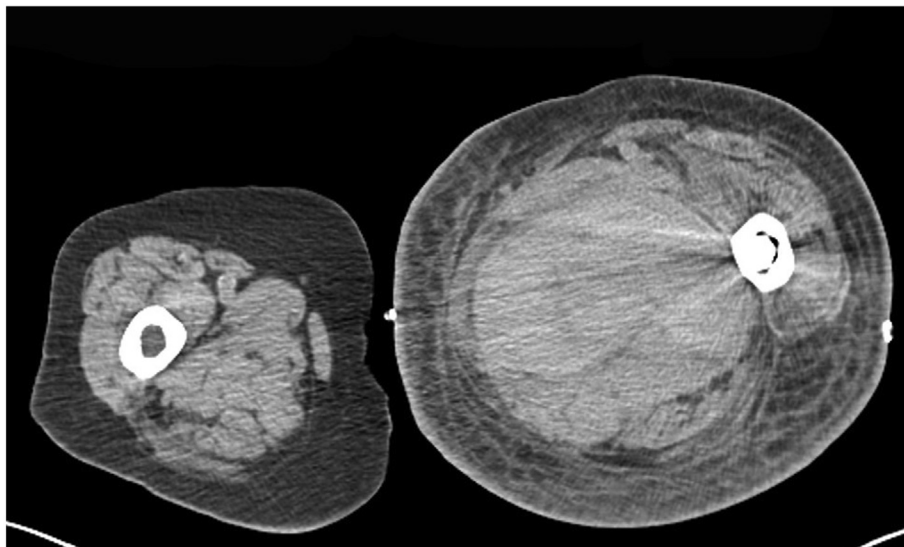


Fig. 2. Computed tomographic image of the upper thigh demonstrating the dramatic difference between the size of left (66 cm) and right thigh (51 cm).

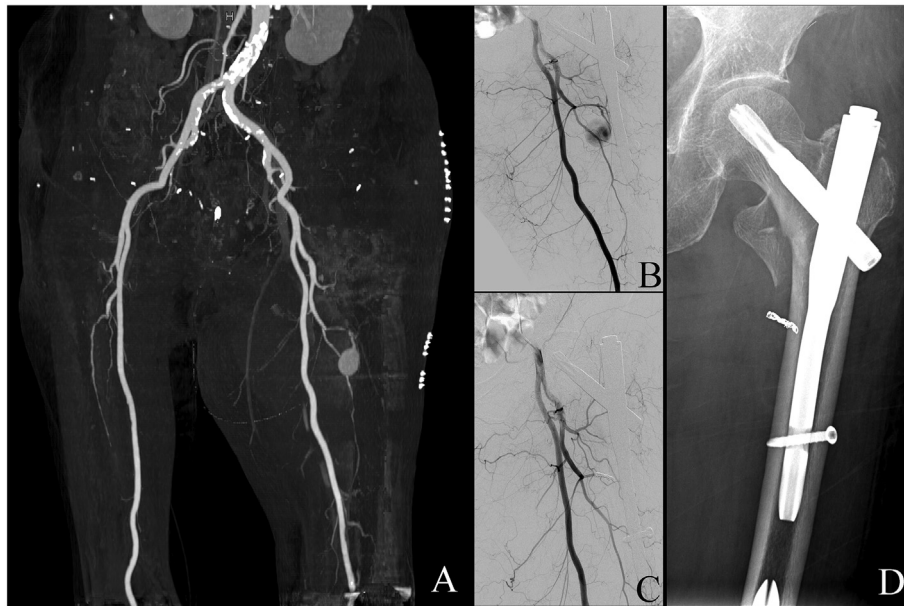


Fig. 3. (A) Computed tomographic angiography showing a large hematoma at left hip and a 3 cm sized pseudoaneurysm originated from the deep femoral artery (DFA). (B) Following angiography revealing a 3 cm-sized pseudoaneurysm arising from a muscular branch of the DFA. (C) Embolization with coils. (D) Left hip AP x-ray at postoperative 2 weeks.

also occur by drill bit or screws after closed hip nailing. Since the artery lies marginally on the medial aspect of the femur, adduction and internal rotation of the involved limb can be risky.⁶ In this case, we suspected the distal locking screw as a cause of pseudoaneurysm, but the area of pseudoaneurysm was not consistent with the site of distal locking screw. And then we reviewed all intraoperative fluoroscopic images to identify a cause of pseudoaneurysm. A lateral image showed mal-positioned guide wire, and the end of guide wire was exactly consistent with the area of pseudoaneurysm (Fig. 3). Therefore we concluded that mal-positioned guide wire caused a pseudoaneurysm of deep femoral artery.

DFA arises from the lateral side of femoral artery, about 4 cm (range, 0–8 cm) inferior to the inguinal ligament.¹¹ It descends posterior to the adductor longus and gives off perforating arteries and supplies anterior thigh muscles and hamstrings. The number of perforating artery branches varies from two to six, but is usually three branches. The first branch passes between the pectineus and adductor brevis, after which it pierces the adductor magnus near the femoral shaft. It produces several muscular branches for the adductors and hamstring muscles, which are located posterior to lesser trochanter. In cadaver study, the distance from 1st perforating arteries to the greater trochanter is 113 ± 10 mm (range, 100–140 mm), and the first perforating artery always crosses the femur at its second sixth with the femur divided into sixths (proximal to distal), which is consistent with the area below the lesser trochanter.¹² The muscular branch is at risk when guide wire is slipped posteriorly to lesser trochanter during nailing (Fig. 4).

In order to find risk factors associated with pseudoaneurysm, we reviewed the literature after interventional catheterization. The reasons for the high incidence of femoral pseudoaneurysm are the high rate of emergency procedures, large-diameter catheters used during procedure, diathesis of atherosclerosis, and long procedure time.¹³ Other risk factors associated with patients for the development of femoral pseudoaneurysm are age older than 60 years, female sex, diabetes, hypertension.^{14,15} Hip fractures occur commonly in the elderly. Many of these elderly patients often have



Fig. 4. Embolization site (A) is exactly consistent with the tip of a guide wire in intraoperative c-arm image (B).

comorbidities such as hypertension and diabetes. In this case, she had 4 risk factors; age older than 60 years, female, hypertension, and atherosclerosis. In proximal femur fractures, most of the patients with hip fractures have risk factors of pseudoaneurysm, and surgeons should be careful at every single step during hip nailing.

Detection of pseudoaneurysm is usually quite late as progressive swelling is painless in most cases. In addition, thigh compartment syndrome can occur after pseudoaneurysm formation.⁸ A superficial pseudoaneurysm may be shown as a pulsatile palpable mass whereas a deep pseudoaneurysm may not have any specific sign or symptom and it can only be detected on further imaging.³ In clinical practice, pseudoaneurysm of the DFA should be excluded when a patient complains pain and swelling at the proximal femur or there are unexplained fever and anemia.

Conclusion

We found that a mal-positioned guide wire can cause vascular injury during hip nailing. Entry point of a guide wire should be confirmed with both AP and lateral images as principles of the procedure. In learning curve of hip nailing, we recommend that lateral view should be checked along with anteroposterior view to ensure the correct entry position so that posterior slippage of a guide wire can be prevented.

References

1. Kanis JA, Black D, Cooper C, et al. A new approach to the development of assessment guidelines for osteoporosis. *Osteoporos Int*. 2002;13(7): 527–536.
2. Forte ML, Virnig BA, Eberly LE, et al. Provider factors associated with intramedullary nail use for intertrochanteric hip fractures. *J Bone Jt Surg Am Vol*. 2010;92(5):1105–1114.
3. Radcliff TA, Regan E, Cowper Ripley DC, Hutt E. Increased use of intramedullary nails for intertrochanteric proximal femoral fractures in veterans affairs hospitals: a comparative effectiveness study. *J Bone Jt Surg Am Vol*. 2012;94(9): 833–840.
4. Patelis N, Koutsoumpelis A, Papoutsis K, et al. Iatrogenic injury of profunda femoris artery branches after intertrochanteric hip screw fixation for intertrochanteric femoral fracture: a case report and literature review. *Case Rep Vas Med*. 2014;2014, 694235.
5. Tiwary SK, Kumar S, Khanna R, Khanna AK. Iatrogenic femoral artery aneurysms in orthopaedic practice. *ANZ J Surg*. 2007;77(10):899–901.
6. Yang KH, Park HW, Park SJ. Pseudoaneurysm of the superficial femoral artery after closed hip nailing with a Gamma nail: report of a case. *J Orthop Trauma*. 2002;16(2):124–127.
7. Fordyce A. False aneurysm of the profunda femoris artery following nail and plate fixation of an intertrochanteric fracture. Report of a case. *J Bone Jt Surg Br Vol*. 1968;50(1):141–143.
8. Karkos CD, Hughes R, Prasad V, D'Souza SP. Thigh compartment syndrome as a result of a false aneurysm of the profunda femoris artery complicating fixation of an intertrochanteric fracture. *J Trauma*. 1999;47(2):393–395.
9. Murphy PG, Geoghegan JG, Austin O, More-O'Ferrall R, Quinlan WR, Keaveny TV. Pseudoaneurysm of the profunda femoris artery due to intertrochanteric fracture of the hip. *Arch Orthop Trauma Surg*. 1999;119(1–2): 117–118.
10. Fernandez Gonzalez J, Terriza MD, Cabada T, Garcia-Araujo C. False aneurysm of the femoral artery as a late complication of an intertrochanteric fracture. A case report. *Int Orthop*. 1995;19(3):187–189.
11. Schünke von Michael, Schulte Erik, Schumacher Udo, Ross Lawrence M, Lamperti Edward D. *Thieme Atlas of Anatomy: Latin Nomenclature: General Anatomy and Musculoskeletal System*. New York: Thieme; 2006.
12. Farouk O, Krettek C, Miclau T, Schandelmaier P, Tscherner H. The topography of the perforating vessels of the deep femoral artery. *Clin Orthop Relat Res*. 1999;368:255–259.
13. Ates M, Sahin S, Konuralp C, et al. Evaluation of risk factors associated with femoral pseudoaneurysms after cardiac catheterization. *J Vasc Surg*. 2006;43(3): 520–524.
14. Ricci MA, Trevisani GT, Pilcher DB. Vascular complications of cardiac catheterization. *Am J Surg*. 1994;167(4):375–378.
15. Kussmaul 3rd WG, Buchbinder M, Whitlow PL, et al. Rapid arterial hemostasis and decreased access site complications after cardiac catheterization and angioplasty: results of a randomized trial of a novel hemostatic device. *J Am Coll Cardiol*. 1995;25(7):1685–1692.