

Superior Gluteal Artery Injury After Cephalomedullary Nailing of a Hip Fracture in a Patient on Anticoagulation: A Case Report and Literature Review

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Learning Point of the Article:

Superior gluteal artery injury following cephalomedullary nailing should be suspected when unexplained hemodynamic instability or acute internal bleeding occurs despite a dry wound; prompt CT angiography and interventional radiology consultation are essential, and anticoagulation should not delay timely fixation.

Abstract

Introduction: Superior gluteal artery (SGA) injury following cephalomedullary nailing (CMN) is exceedingly rare. To our knowledge, this is the first reported case of acute SGA hemorrhage in a patient on therapeutic direct oral anticoagulant therapy, representing a clinically distinct presentation from previously described delayed pseudoaneurysm formation.

Case Report: A 75-year-old anticoagulated female (apixaban, Factor V Leiden) sustained an intertrochanteric femur fracture treated with CMN. Three hours postoperatively, she developed hypotension, tachycardia, and a hemoglobin drop to 6.9 g/dL despite a dry wound. Gluteal swelling prompted computed tomography (CT) angiography, which identified active extravasation from an SGA branch. Selective coil embolization achieved hemostasis, and the patient was discharged on post-operative day 11.

Conclusion: SGA injury is a rare but life-threatening complication of CMN. Unexplained hemodynamic instability with gluteal swelling should prompt urgent CT angiography and interventional radiology consultation. Anticoagulation should not delay timely hip fracture fixation.

Keywords: Superior gluteal artery, cephalomedullary nailing, intertrochanteric fracture, anticoagulation, embolization.

Introduction

Hip fractures in older people carry high morbidity, and surgical fixation is the standard of care to facilitate early mobilization. Vascular complications, while uncommon, have been reported following intramedullary fixation [1]. Arterial injuries most often involve branches of the profunda femoris artery; injury to the superior gluteal artery (SGA) is exceedingly rare [2]. The SGA exits the pelvis above the piriformis to supply the gluteal musculature, and a handful of cases have documented SGA

injury or pseudoaneurysm formation following intertrochanteric or subtrochanteric fracture fixation [1,3,4]. These injuries can cause massive hemorrhage, gluteal compartment syndrome, and hemodynamic shock if not promptly recognized [2,3,4,5].

Anticoagulation adds further complexity to hip fracture management. Our patient was on apixaban for Factor V Leiden thrombophilia. Recent evidence demonstrates that hip fracture surgery without delay for DOAC clearance is safe and not

Author's Photo Gallery



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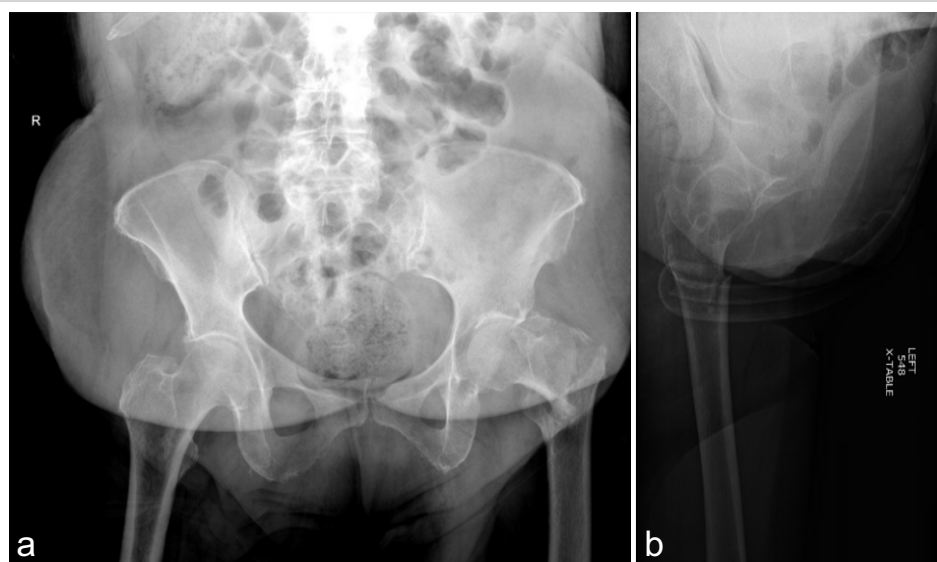


Figure 1: (a) Pre-operative anteroposterior radiograph of the left hip demonstrating a displaced intertrochanteric femur fracture. (b) Pre-operative lateral radiograph of the left hip demonstrating a displaced intertrochanteric femur fracture.

associated with increased blood loss or complications [6]. We present this rare vascular complication of cephalomedullary nailing (CMN) in an anticoagulated patient and review the relevant literature.

The patient was informed that data concerning this case would be submitted for publication and provided consent to do so.

Case Report

A 75-year-old female with a medical history of hypertension, type 2 diabetes, stage 3 chronic kidney disease, Factor V Leiden thrombophilia (on apixaban for prior deep vein thrombosis), stroke, and giant cell arteritis sustained a low-energy fall. She was found at home approximately 8 h after the fall and was brought to the emergency department. On evaluation, she was alert and oriented with a primary complaint of left hip pain and inability to bear weight. Physical examination revealed left hip tenderness with a positive log-roll and axial load pain. The limb was neurovascularly intact. Initial hemoglobin was 10.4 g/dL. Radiographs of the hip and femur demonstrated a displaced intertrochanteric femur fracture (Fig. 1a and 1b). Given her anticoagulation status and fracture pattern, a decision was made to proceed with surgical fixation once medically optimized.

The patient was taken to the operating room the same day for open reduction and internal fixation of the left hip fracture. A 12-mm intermediate-length Trochanteric Fixation Nail Advanced (DePuy Synthes) CMN was placed in antegrade fashion via a proximal femoral trochanteric entry point. The surgery was uncomplicated with approximately 400 mL of blood loss recorded. A vacuum dressing was applied over the

incision. There were no arterial injuries noted intraoperatively, and hemostasis appeared adequate upon wound closure (Fig. 2).

In the PACU, 3 h after surgery, the patient was noted to be hypotensive (blood pressure 80/50 mmHg) and tachycardic. The post-operative hemoglobin returned to 6.9 g/dL. She was resuscitated with two units of packed red blood cells (PRBCs), intravenous fluids, started on vasopressor support (phenylephrine), and transferred to the surgical intensive care unit. Immediate focus was placed on determining the source of bleeding. Her surgical dressing remained dry with no external signs of bleeding, but on examination, her left thigh and buttock appeared increasingly firm and

swollen. By the next morning (post-operative day 1), despite transfusions, her hemoglobin again fell from 8.1 to 6.8 g/dL, accompanied by rising serum lactate to 5.6 mmol/L, increasing the concern for ongoing internal hemorrhage.

A CT angiogram (CTA) of the abdomen and pelvis with runoff was obtained on post-operative day 1 to localize the bleeding source. The CTA revealed a large hematoma in the left gluteal region, measuring approximately 7.5 × 6 × 9 cm, with active contrast “blush” indicative of active arterial extravasation in the vicinity of the SGA distribution. Given the location of the hematoma lateral to the gluteal musculature, an injury to a



Figure 2: Post-operative anteroposterior radiograph of the left hip following open reduction and internal fixation with a cephalomedullary nail.

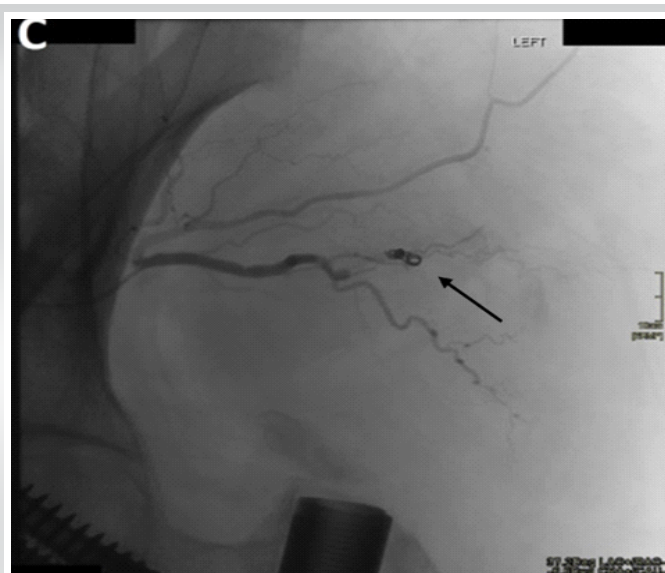


Figure 3: Intraoperative angiogram demonstrating successful hemostasis achieved following selective coil embolization.

branch of the left SGA was suspected. Interventional radiology was consulted urgently.

The patient was brought to the angiography suite on post-operative day 1 for urgent pelvic angiography and possible embolization. Angiography of the left internal iliac artery confirmed active arterial bleeding from a branch of the SGA. A selective catheterization of the SGA branch and coil embolization were then performed, achieving hemostasis of the SGA branch. The patient's hemodynamics stabilized following the procedure (Fig. 3). Post-embolization hemoglobin was 6.9 g/dL, and one additional unit of PRBC was transfused.

The patient remained in the intensive care unit for continued close monitoring. Over the following 24–48 h, her hemoglobin stabilized at approximately 7.9–8.2 g/dL without further transfusion requirements. Vasopressor support was weaned off, and the patient had no signs of compartment syndrome or neurological deficit in the left lower extremity. Given the history of thrombophilia, a low-dose heparin infusion was restarted on post-operative day 4 once bleeding was controlled, with a later transition back to therapeutic apixaban prior to discharge as coordinated with hematology. On post-operative day 11, the patient was discharged to a subacute rehabilitation facility in good condition, having received a

total of five units of blood postoperatively. Subsequent follow-up demonstrated appropriate fracture healing progress and no further hemorrhagic complications (Fig. 4a and b).

Discussion

Mechanism of injury to the SGA

Vascular injury during intramedullary nailing of proximal femur fractures is uncommon, and SGA injury is particularly rare [2, 4]. The exact mechanism in our case is uncertain, but several possibilities exist. The guidewire or reamer may have strayed from the ideal trajectory, perforating an SGA branch near the greater sciatic notch; Carroll et al. similarly implicated guidewire trajectory in a deep-branch SGA pseudoaneurysm after CMN [5]. Alternatively, a sharp rather than blunt trochanteric incision may lacerate the vessel, as Ward et al. speculated in their case of SGA injury during subtrochanteric fracture nailing [4]. Even a slightly anterior or medial entry point can endanger the SGA's deep branch as it runs between the gluteus medius and minimus, a risk highlighted by both anatomical studies and clinical series [7,8,9]. Comminuted fracture fragments may also contribute – sharp edges or displaced lesser trochanteric fragments can injure adjacent vessels, and Fernandes et al. attributed their case of SGA hemorrhage after pertrochanteric nailing to reaming or nail insertion [3].

SGA injuries also occur with pelvic ring fractures and iliosacral screw fixation, sometimes causing gluteal compartment syndrome or delayed hemorrhagic shock [2]. Regardless of mechanism, angiographic embolization is the definitive treatment given the vessel's deep pelvic location, and published

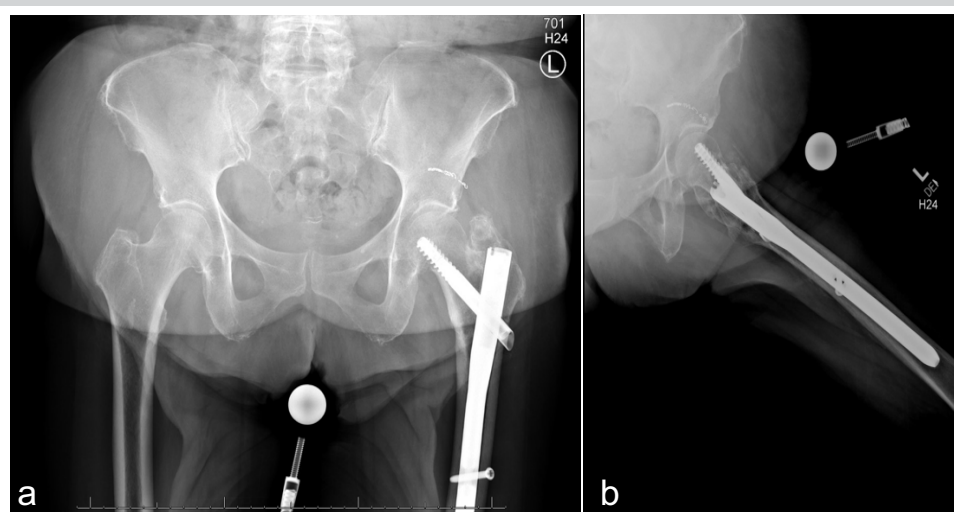


Figure 4: (a) Follow-up AP radiograph of the left hip demonstrating appropriate fracture healing and stable hardware positioning following cephalomedullary nail fixation and superior gluteal artery embolization. (b) Follow-up lateral radiograph of the left hip demonstrating appropriate fracture healing and stable hardware positioning following cephalomedullary nail fixation and superior gluteal artery embolization.

Table 1. Published cases of superior gluteal artery (SGA) injury after cephalomedullary nailing or femoral intramedullary fixation for hip fractures

Source (Year)	Patient & Fracture	Presentation Timing	Management	Outcome and Cause if Given
Ward et al. [4] (2013)	81-year-old female, incomplete subtrochanteric stress (atypical) fracture – prophylactic IM nail	Post-op Day 1: acute anemia, buttock hematoma.	Angiography → Coil embolization of SGA branch.	Recovered; attributed to sharp dissection injury.
Ailaney et al. [1] (2019)	79-year-old female, atypical femoral fracture – IM nail fixation.	Immediate post-op: acute blood loss anemia, extensive thigh ecchymosis.	CTA → SGA extravasation; Angiography → Coil embolization of SGA pseudoaneurysm.	Recovered.
Carroll et al. [5] (2020)	72-year-old female, intertrochanteric hip fracture – CMN fixation.	Post-op Day 0–1: thigh/gluteal swelling, anemia.	Angiography → Coil embolization of deep branch of SGA.	Recovered; guidewire malposition.
Fernandes et al. [3] (2020)	66-year-old female, pathological pertrochanteric fracture – long IM nail.	Post-op Day 5: hemoglobin drop, large gluteal hematoma.	Angiography → Selective SGA branch embolization.	Recovered
Nambiar et al. [10] (2022)	84-year-old female, periprosthetic hip fracture – revision long CMN fixation.	Post-op Day 4: expanding gluteal hematoma, pseudoaneurysm.	Angiography → Coil embolization.	Recovered; first reported during revision fixation.
Forin Valvecchi et al. [14] (2022)	35-year-old male, femoral shaft fracture – IM nail.	Post-op day 14 in rehab: acute hip pain and Hgb drop.	Angiography → Selective embolization of bleeding SGA branch.	Recovered.
Başak et al. [9] (2024)	72-year-old female, intertrochanteric fracture – short CMN fixation.	3 weeks post-op: gluteal hematoma, anemia.	Ultrasound/CT → Angio → Coil embolization.	Recovered
Hgb = hemoglobin; IM = intramedullary; CMN = cephalomedullary nail; ex-fix = external fixator; CTA = CT angiography.				

reports consistently demonstrate successful hemostasis with this approach [1,3,4,5,9,10].

Literature review of reported cases

Including the present patient, we identified several reported cases of SGA injury or pseudoaneurysm following intramedullary fixation of proximal femur fractures. Table 1 summarizes the key details of these cases from the literature. Notably, the majority of patients were elderly females with intertrochanteric or subtrochanteric fractures, reflecting the typical osteoporotic hip fracture demographic, though one case involved a young adult with a high-energy femoral shaft fracture. The timing of presentation ranged from acute post-operative hemorrhage (within 24–48 h, as in our case) to delayed presentations several weeks later due to pseudoaneurysm formation. Common clinical signs were an unexplained drop in hemoglobin, large thigh or gluteal hematoma, and hemodynamic instability or anemia not proportional to the surgical loss. In all cases, CT angiography or conventional angiography was used to localize the bleeding, with IR-guided coil embolization of the SGA (or its branch) successfully achieving hemostasis [1,3,4,10].

Role of anticoagulation and timing of surgery

Our patient's anticoagulated status (apixaban for Factor V Leiden) likely contributed to the severity of her hemorrhage. It

is well known that anticoagulation can increase bleeding risk from any source. In this case, the decision was made not to significantly delay surgery, given the urgent nature of hip fracture fixation in an elderly patient. Current evidence supports this approach: recent studies have found that performing hip fracture surgery within 24 h in patients on DOACs does not significantly increase intraoperative or post-operative bleeding compared to delaying surgery for drug clearance [11,12]. Wang et al. showed that expedited surgery (≤ 24 h) in DOAC-treated hip fracture patients resulted in lower pre-operative blood loss and no difference in total blood loss or transfusion rate, as well as shorter hospital stays with fewer complications, compared to delayed surgery [11]. Similarly, Brameier et al. and Kolodychuk et al. reported that the use of DOACs is not an automatic reason to postpone hip fracture operations, as timely surgery can be accomplished safely with appropriate precautions [6,13].

Conclusion

SGA injury is a rare but serious complication of intramedullary hip fracture fixation. This case underscores the importance of recognizing disproportionate hemoglobin decline, unexpected hypotension, or gluteal swelling as harbingers of internal arterial injury. Early CTA and prompt embolization are the cornerstones of management and were critical in this patient's

survival. Anticoagulation and advanced age should inform perioperative planning but not delay timely fixation, as outcomes remain favorable with a multidisciplinary approach.

Surgeons should maintain awareness of SGA injury risk, use meticulous technique, and engage interventional radiology early when post-operative hemorrhage is suspected.

Clinical Message

Acute superior gluteal artery hemorrhage is a distinct and previously unreported presentation in patients on therapeutic direct oral anticoagulant therapy following CMN. Unlike delayed pseudoaneurysm formation (the more commonly described SGA complication), acute hemorrhage presents within hours of surgery with rapid hemodynamic deterioration and expanding gluteal hematoma, demanding immediate recognition and action. CT angiography is the diagnostic modality of choice, and selective coil embolization by interventional radiology is both limb- and life-saving. Surgeons should employ meticulous technique at the trochanteric entry point, maintain a low threshold for vascular imaging when post-operative bleeding is disproportionate to surgical blood loss, and engage interventional radiology early. This case further demonstrates that DOAC use need not delay timely surgical fixation of fragility hip fractures, but mandates heightened post-operative vigilance for hemorrhagic complications.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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