Journal of Rare Cardiovascular Diseases
ISSN: 2299-3711 (Print) | e-ISSN: 2300-5505 (Online)
www.jrcd.eu

Case report

Management of a Large Femoral Artery Pseudoaneurysm as a Complication of Endovascular Carotid Intervention: a case report

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Article History
Received: 22.09.2025
Revised: 30.09.2025
Accepted: 27.10.2025
Published: 01.12.2025

Abstract: ***Background***: Femoral artery pseudoaneurysm is a serious, but rare, complication of endovascular treatment. This case illustrates the rapid evolution of a large, symptomatic pseudoaneurysm in a high-risk patient and emphasizes the importance of urgent surgical treatment. ***Case Presentation :*** A 45-year-old south Asian man with a history of type 2 diabetes, hypertension, dyslipidemia, and prior ischemic stroke came to the emergency department with right groin pain and rapidly increasing swelling four days post left internal carotid artery stenting through right femoral access. Physical examination identified a pulsatile mass with overlying bruit. CT angiography indicated a large hematoma with extravasation of active contrast from the right femoral artery. Because of the hematoma size and active bleeding, the patient was taken for emergent surgical exploration, evacuation of a 1 kg clot, removal of the pseudoaneurysm sac, and primary repair of the arterial defect. His postoperative course was uneventful with preserved limb perfusion and successful discharge. ***Conclusion:*** This case highlights the fact that significant, growing pseudoaneurysms with ongoing extravasation usually need to be treated with definitive open surgical intervention. It underlines the need for close post-procedure monitoring, particularly in high-risk patients on antithrombotic therapy, and the necessity of having a low threshold for imaging and surgical referral.

Keywords: Femoral artery pseudoaneurysm; Ischemic stroke; femoral artery; Carotid artery stenting; Surgical repair.

INTRODUCTION

Endovascular procedures have greatly improved the diagnosis and treatment of vascular diseases. The femoral artery is still one of the most common access points for angiography and other procedures, even though radial artery access is becoming more popular in cardiology and neurology 1,2. The femoral artery remains essential for complex cases that need larger devices 2,3. However, its use can lead to several complications at the access site, with femoral artery pseudoaneurysm being one of the most common and important.

A pseudoaneurysm, or 'false aneurysm,' happens when the layers of the artery wall are disrupted after a procedure. Blood leaks through the puncture site and collects in the nearby soft tissue, instead of staying within all three layers of the artery wall. The resulting hematoma stays connected to the artery through a narrow channel, which causes turbulent blood flow 3,5. Unlike a true aneurysm, which involves all layers of the artery, a pseudoaneurysm is only held by the surrounding tissue or outer layer. This makes it more likely to grow, rupture, or cause other problems if not treated quickly.

The pathognomonic diagnostic hallmark is the “to-and-fro” waveform on duplex Doppler ultrasonography, representing systolic inflow into the pseudoaneurysm sac and diastolic outflow back into the artery 4,7. Duplex ultrasound is considered the gold-standard imaging modality because it is rapid, non-invasive, bedside-available, and highly accurate 7,8. CT angiography provides complementary information in complicated or large lesions, particularly for surgical planning.

With the rising global burden of cardiovascular and neurovascular disease, percutaneous procedures are increasingly performed. Recent data suggest that more than one million femoral artery catheterizations are performed annually worldwide. The incidence of pseudoaneurysm varies widely, ranging between 0.2% and 8% depending on sheath size, patient comorbidities, puncture technique, and the use of antithrombotic medications 6,9. For example, smaller diagnostic

catheters are associated with lower complication rates compared to larger interventional sheaths used for stenting or thrombectomy.

Patient-specific factors are important. Advanced age, poorly controlled diabetes, hypertension, dyslipidemia, and peripheral arterial disease can weaken blood vessels and slow healing 6,10,12. Antithrombotic therapy, though essential for stroke and heart protection, complicates bleeding control at puncture sites 9,12. Our patient, a middle-aged man, had diabetes, hypertension, dyslipidemia, and was on dual antiplatelet therapy after carotid artery stenting.

Pseudoaneurysms can vary widely. Some are small and cause no symptoms, while others appear as painful, throbbing groin masses or rapidly growing hematomas. Complications can include limb ischemia or unstable vital signs 5,13,14. Large pseudoaneurysms are more likely to rupture, become infected, or press on nerves and vessels 14,15. Early diagnosis and proper treatment are essential to prevent serious problems 7,15.

Treatment methods have changed a lot in the past 30 years. At first, ultrasound-guided compression was common, using long periods of manual pressure to form a clot. This approach was less invasive but often painful, slow, and likely to recur, especially in patients on blood thinners 9,16. Ultrasound-guided thrombin injection was then introduced, quickly causing clotting in most cases 16,18. However, it can still cause complications like embolization or allergic reactions 17,19.

Nevertheless, open surgical repair remains indispensable in select patients, especially those with large, expanding pseudoaneurysms, active bleeding, or infection 19,20. Surgical techniques include sac excision with primary arterial repair, patch angioplasty, or interposition grafting depending on the defect size 20. Although more invasive, surgery provides definitive management and excellent long-term outcomes when performed promptly.

In this report, we describe the case of a 45-year-old man who developed a large right femoral artery pseudoaneurysm after carotid artery stenting. Due to active contrast extravasation and large hematoma, he required urgent open surgical repair. His case illustrates the importance of early recognition, the interplay of comorbidities and procedural factors, and the ongoing relevance of surgery in the modern management of femoral pseudoaneurysms.

Case presentation

2.1 Patient Demographics and History

A 45-year-old male with type 2 diabetes mellitus, hypertension, dyslipidemia, and a previous ischemic stroke in the left Anterior Cerebral Artery-Middle Cerebral Artery (ACA–MCA) region underwent digital subtraction angiography (DSA) with stenting of the left internal carotid artery on 02/04/2024. The procedure was performed via right femoral artery access. He was discharged the following day in stable condition, on dual antiplatelet therapy and anticoagulation.

On 06/04/2024, four days after discharge, the patient returned to the emergency department with sudden swelling and severe pain in the right groin at the site of femoral puncture. The swelling had rapidly enlarged over several hours, and he described the pain as throbbing, radiating to the upper thigh, and severe enough to impair walking.

2.2 Clinical Examination

2.2.1 General Examination

The patient was alert and oriented (GCS 15/15). Vital signs were stable: pulse 82/min, blood pressure 150/80 mmHg, respiratory rate 18/min, SpO_2 98% on room air. He was afebrile. No pallor, cyanosis, clubbing, icterus, lymphadenopathy were observed.

2.2.2 Local Examination

Inspection revealed a large, tense, tender swelling in the right groin with overlying skin fullness. Palpation confirmed a pulsatile mass with audible bruit on auscultation. Distal pulses in the right lower limb were initially palpable but became progressively difficult to assess due to increasing edema and compression from the hematoma.

2.2.3 Systemic Examination

Cardiovascular: Heart sounds normal, no murmurs. Peripheral pulses well felt in the contralateral lower limb and both upper limbs.
Respiratory: Chest expansion symmetrical, vesicular breath sounds bilaterally, no adventitious sounds.
Abdominal: Soft, non-tender, no organomegaly or bruit.
Neurological: Conscious, oriented, no new deficits compared to baseline post-stroke status. Motor strength 5/5 in all limbs, cranial nerves intact, sensory function preserved.

3. Investigations

When the patient arrived with severe groin pain and swelling, a series of blood tests and imaging studies were carried out to understand the extent of the complication.

3.1 Laboratory Investigations

Table .1 Hematological and Biochemical Tests

Category	Parameter	At Admission (06/04/2024)	Post-op Day 1 (08/04/2024)	At Discharge (13/04/2024)
Hematology	Hemoglobin (Hb)	13.2 g/dl	12.8 g/dl	12.5 g/dl
	RBC Count	4.6 million/µL	4.4 million/µL	4.3 million/µL
	Hematocrit (PCV)	39%	38%	37%
	Total Leukocyte Count (TLC)	8,600 /mm³	9,200 /mm³	7,800 /mm³
	Platelet Count	2.4 lakh /mm³	2.3 lakh /mm³	2.5 lakh /mm³
Renal & Metabolic	Serum Creatinine	0.9 mg/dl	1.0 mg/dl	0.9 mg/dl
	Blood Urea Nitrogen (BUN)	18 mg/dl	20 mg/dl	19 mg/dl
	Sodium (Na^+)	138 mmol/L	139 mmol/L	140 mmol/L
	Potassium (K^+)	4.2 mmol/L	4.0 mmol/L	4.3 mmol/L
	Chloride (Cl^-)	102 mmol/L	103 mmol/L	104 mmol/L
	Bicarbonate (HCO_3^-)	23 mmol/L	22 mmol/L	24 mmol/L
Blood Sugar Profile	Fasting Blood Sugar (FBS)	180 mg/dl	150 mg/dl	130 mg/dl
	Postprandial Blood Sugar	320 mg/dl	210 mg/dl	170 mg/dl
	HbA1c	10.3%	–	–
	Random Blood Sugar	255 mg/dl	190 mg/dl	165 mg/dl
	Capillary Blood Glucose (CBG)	280 mg/dl	170 mg/dl	150 mg/dl
Lipid Profile	Total Cholesterol	220 mg/dl	–	200 mg/dl
	LDL	140 mg/dl	–	120 mg/dl
	HDL	35 mg/dl	–	38 mg/dl
	Triglycerides	240 mg/dl	–	200 mg/dl
Coagulation	Prothrombin Time (PT)	12 sec	13 sec	12 sec
	INR	1.0	1.1	1.0
	aPTT	31 sec	33 sec	30 sec
Inflammatory Parameters	ESR	40 mm/hr	35 mm/hr	25 mm/hr
	CRP	15 mg/L	10 mg/L	6 mg/L

Table .1 Hematological and Biochemical Tests

This table demonstrate the blood workup showed that hemoglobin and red cell counts were only slightly reduced, suggesting that the bleeding had been largely contained within the hematoma and had not caused major systemic blood loss. White cell counts and inflammatory markers (ESR and CRP) were mildly elevated, pointing to ongoing tissue inflammation around the swelling. His blood sugar levels were poorly controlled, which is important because diabetes delays healing and increases the risk of complications. Coagulation parameters such as PT, INR, and aPTT were within normal range, which meant there was no clotting disorder contributing to the bleeding.

3.2 Imaging Studies

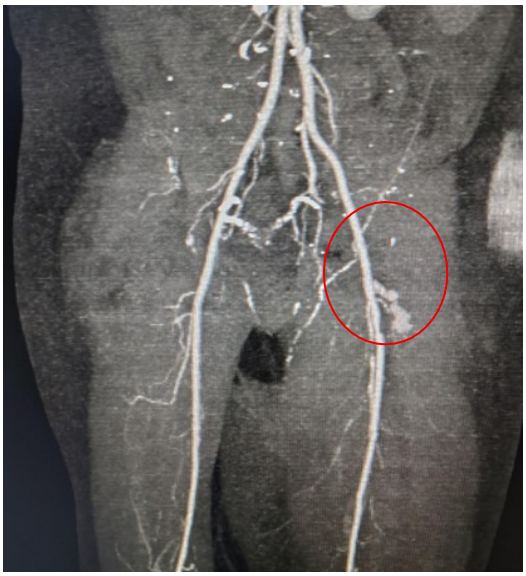

Figure .1 CT Peripheral Angiogram

Figure .2 CT Peripheral Angiogram

Figure .1 & .2 – CT Peripheral Angiogram
These images demonstrate the pseudoaneurysm arising from the anterior wall of the right femoral artery. The contrast leak can be visualized as a bright jet spilling into the surrounding hematoma measuring 18 × 13 × 8 cm, which occupies a large area in the groin. This vividly illustrates the active bleeding site.

4. Diagnosis
Right Femoral Artery Pseudoaneurysm Following Femoral Access for Carotid Artery Stenting

5. Management and Hospital Course
5.1 Initial Treatment
On presentation (06/04/2024), conservative measures were initiated. These included analgesics (IV paracetamol 1g, oral ketorolac 10mg), local ice packs, antihypertensive therapy (telmisartan 40mg), antidiabetic therapy, dual antiplatelet therapy, and anticoagulation therapy and neuroprotectants for stroke. Despite these measures, the enlarging swelling, severe pain, and imaging evidence of active bleeding necessitated urgent surgical intervention**.**

5.2 Surgical management

On 07/04/2024, the patient was shifted to the operating theatre. Under aseptic precautions, an oblique groin incision was made. Approximately 1 kg of organized clot was evacuated. The pseudoaneurysm sac was excised. Proximal and distal vascular control of the femoral artery was secured, and systemic heparinization administered.
A 6-mm arterial wall defect was identified at the anterior wall of the femoral artery. This was repaired primarily with 6-0 prolene sutures. Hemostasis was achieved, the wound irrigated with saline, and a vacuum drain placed before layered closure. The procedure was uneventful, with preservation of distal perfusion confirmed intraoperatively.

Figure .3 Post-Surgery

Figure .3 – Post-Surgery image
This picture shows the surgical site after clot evacuation and repair of the arterial defect. The image highlights the restoration of vascular integrity and the clean surgical field following removal of nearly 1 kg of clotted blood.

5.3 Postoperative Care

The patient was transferred to the surgical intensive care unit (SICU) for close monitoring. He received antibiotics, anticoagulation, dual antiplatelet therapy, analgesics, and supportive care. Postoperative Doppler ultrasonography confirmed preserved arterial and venous flow in the right lower limb, with only residual edema and hematoma.
Gradual mobilization was initiated on the third postoperative day. By April 13th, he was ambulating independently with stable vital signs and intact distal pulses. He was discharged home with the drain in situ, scheduled for removal during follow-up three days later. His discharge medications included antiplatelets, anticoagulants, antihypertensives, antidiabetic agents, analgesics, and wound care instructions.

6. Outcome and discharge plan

The patient tolerated the procedure well and remained hemodynamically stable. Mobilization was initiated on the third postoperative day. By 13/04/2024, he was ambulating independently, with intact distal pulses and stable vital signs. He was discharged with the vacuum drain in situ, to be removed during follow-up.
Discharge medications included:

- Analgesics: paracetamol, chymoral forte
- Antiplatelets: aspirin/atorvastatin combination
- Anticoagulant: rivaroxaban
- Antidiabetics: metformin, vildagliptin, glimepiride, insulin
- Antihypertensives: telmisartan
- Neuroprotectants: Piracetam and Citicoline
- Antibiotics: linezolid
- Supportive: proton pump inhibitor, stool softener, topical wound care

7. Follow up outcome

At follow-up three days post-discharge, the vacuum drain was removed after confirming minimal output. Subsequent reviews demonstrated healthy wound healing, with no signs of recurrence, infection, or limb ischemia. Doppler ultrasonography confirmed patent femoral and distal vessels with gradual resolution of the hematoma.
The patient resumed normal daily activities over the following weeks, while continuing strict diabetic and hypertensive management, along with dual antiplatelet and anticoagulant therapy.

DISCUSSION

Femoral artery pseudoaneurysm remains one of the most clinically important vascular complications associated with femoral access for diagnostic and therapeutic endovascular procedures. Despite the increasing adoption of alternative access sites, such as the radial artery in cardiology and brachial access in neurointervention, the femoral artery remains the default route in many institutions, particularly for procedures requiring larger sheath sizes or complex device delivery.

The trade-off is an inherent exposure to complications such as hematoma, arterial dissection, arteriovenous fistula, and pseudoaneurysm.

Pathophysiology and Risk Factors

A pseudoaneurysm forms when the arterial puncture site fails to seal after the sheath is removed. Blood escapes through the breach in the intima and medial layers but is contained by the adventitia or surrounding soft tissues, creating a false sac. This sac remains in connection with the arterial lumen via a narrow neck, allowing blood to flow in during systole and out during diastole, producing the characteristic "to-and-fro" Doppler signal. The persistence of this abnormal circulation prevents spontaneous healing in many cases and exposes the patient to complications.

Risk factors are both procedural and patient-related. Procedural contributors include large sheath size, repeated puncture attempts, low puncture site below the femoral bifurcation, inadequate compression post-procedure, and emergency interventions where optimal technique may be compromised. Patient-related risk factors, as seen in our case, include diabetes mellitus, hypertension, dyslipidemia, advanced age, and prior vascular disease. Moreover, the widespread use of dual antiplatelet therapy combined with anticoagulants in stented patients makes achieving hemostasis particularly challenging. Our patient exhibited many of these vulnerabilities, explaining the development and rapid expansion of his pseudoaneurysm.

Clinical Presentation

The presentation of pseudoaneurysm is variable. Some patients remain asymptomatic, with pseudoaneurysms discovered incidentally during follow-up imaging. Others present with groin swelling, pain, and a palpable pulsatile mass, as in our patient. Audible bruits on auscultation and diminishing distal pulses due to compression add to the clinical suspicion. Severe presentations include rupture, hemodynamic instability, neuropathy due to nerve compression, venous thrombosis, or distal ischemia from embolization. In our patient, the rapid enlargement of swelling, severe pain, and progressive compression of distal pulses signaled the need for urgent intervention.

Diagnostic Modalities

Duplex ultrasound remains the gold standard for diagnosing pseudoaneurysms due to its high sensitivity, non-invasive nature, and ability to characterize both the size of the sac and the presence of the "to-and-fro" flow. In complex cases, or when surgical planning is required, CT angiography provides detailed anatomical information, as in our case, where active contrast extravasation and the relation of the sac to the profunda femoris were clearly delineated. Angiography itself is rarely needed solely for diagnosis, given the accuracy of non-invasive imaging.

Evolution of Management Strategies

The management of femoral pseudoaneurysm has evolved significantly over the last few decades.

Conservative Observation – Small pseudoaneurysms (<2 cm) in asymptomatic patients may thrombose spontaneously, particularly if antithrombotic therapy can be modified. However, this strategy requires close surveillance with repeat imaging, as delayed rupture remains a possibility.

Ultrasound-Guided Compression – Once the mainstay, this involves applying direct pressure over the pseudoaneurysm neck under ultrasound guidance until thrombosis occurs. While non-invasive, it is uncomfortable for patients, time-consuming (often requiring over an hour of compression), and less effective in anticoagulated individuals. Recurrence rates are also high.

Ultrasound-Guided Thrombin Injection – This minimally invasive method has become widely adopted. Direct injection of thrombin into the pseudoaneurysm sac induces rapid clot formation, with success rates exceeding 90% in many series. Rare but serious risks include distal arterial embolization if thrombin enters the parent vessel. Allergic reactions, though uncommon, have also been reported.

Endovascular Approaches – Covered stent placement or coil embolization has been described in select cases, particularly when pseudoaneurysms occur at non-compressible sites or in high-surgical-risk patients. However, such approaches require careful consideration, as stent placement in the femoral artery can limit future access options.

Surgical Repair – Despite advances in percutaneous therapy, open surgery remains indispensable for large, expanding, or complicated pseudoaneurysms, especially those associated with rupture, rapid hematoma formation, infection, or failure of less invasive techniques. Surgical options include primary repair, patch angioplasty, or interposition grafting, depending on the defect size. In our patient, the sac size, active extravasation, and compressive hematoma mandated surgery, which successfully restored arterial integrity.

Comparative Outcomes

Several studies have compared percutaneous and surgical management. Thrombin injection offers high success with shorter hospital stays and less morbidity, but is best suited for small-to-medium-sized pseudoaneurysms. Surgical repair, while more invasive, provides definitive treatment in complex cases. Recurrence rates after surgical repair are very low, and long-term limb salvage rates are excellent when timely intervention is performed. In our patient, surgery not only prevented rupture but also salvaged the limb, with preserved distal circulation confirmed on follow-up Doppler studies.

Preventive Strategies

Given the morbidity associated with pseudoaneurysm, prevention is paramount. Strategies include:

Optimal puncture technique - using ultrasound guidance to identify the common femoral artery above the bifurcation reduces low punctures and arterial wall injury.

Appropriate sheath selection - minimizing sheath size to the lowest feasible diameter decreases arterial trauma.

Adequate hemostasis - prolonged manual compression or vascular closure devices, when properly deployed, can reduce pseudoaneurysm formation.

Risk stratification - recognizing high-risk patients (elderly, obese, on multiple antithrombotics) and monitoring them more closely post-procedure.

Early imaging – prompt use of duplex ultrasound in patients with groin pain or swelling allows early detection before catastrophic complications occur.

Patient-Centered Perspective

Beyond technical considerations, this case also reflects the human dimension of vascular complications. For the patient, the sudden development of pain and swelling after an apparently successful neurovascular intervention was alarming. Having only recently recovered from a stroke, he feared disability and loss of independence. The rapid recognition of his complication, clear communication with him and his family, and timely surgical repair provided not just physical recovery but psychological reassurance. Such cases remind clinicians that complications are not only medical events but also deeply personal crises for patients.

Broader Implications

On a systems level, pseudoaneurysm management carries implications for healthcare resources. Minimally invasive approaches are cost-effective and reduce length of stay, but surgical repair, though resource-intensive, is unavoidable in complicated cases. Preventive strategies, such as the adoption of ultrasound-guided puncture as standard practice, may reduce incidence rates and overall healthcare burden. Furthermore, structured follow-up protocols for high-risk patients could detect complications earlier, preventing morbidity and lowering costs associated with delayed intervention.

CONCLUSION

Femoral artery pseudoaneurysm is an uncommon but significant complication of femoral arterial access. Its occurrence is closely linked to both procedural factors, such as sheath size and puncture technique, and patient factors, including diabetes, hypertension, dyslipidemia, and the use of multiple antithrombotic agents. Our patient, embodying many of these risk factors, developed a large pseudoaneurysm complicated by active extravasation and compressive hematoma.

This case illustrates several important lessons. First, vigilance is essential. Any patient presenting with post-procedural groin pain and swelling must be evaluated promptly with duplex ultrasound. Second, management must be individualized. While thrombin injection is highly effective for many pseudoaneurysms, large or complicated cases require surgical repair. In our patient, timely open repair was lifesaving and limb-saving.

Third, prevention is better than a cure. Adoption of ultrasound-guided puncture, careful sheath management, and meticulous post-procedure compression can significantly reduce the incidence of pseudoaneurysms.

From a patient-centered perspective, complications such as this are frightening events. Clear communication, empathy, and reassurance are as vital as surgical skill in restoring the patient's trust and confidence. The favorable outcome in this case was the product of not only technical success but also coordinated multidisciplinary care.

Finally, this case underscores the importance of ongoing vigilance in the era of expanding endovascular therapies. As procedures become more frequent and more complex, the potential for vascular access complications will remain. Systematic approaches to prevention, early diagnosis, and appropriate treatment are crucial to safeguarding patient outcomes. For clinicians, the case serves as a reminder that even routine access can harbor hidden risks, and readiness to act swiftly can make the difference between disaster and recovery.

Acknowledgements

The authors gratefully acknowledge the cooperation of the patient and his family, whose willingness to share their medical experience made this report possible. We also thank the surgical and intensive care team for their skilled management and the Department of Pharmacy Practice, School of Pharmaceutical Sciences, Vels Institute of Science, Technology and Advanced Studies, for their valuable guidance and academic support.

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