

Superficial Femoral Artery Pseudoaneurysm after Total Knee Arthroplasty: An Uncommon Vascular Complication

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Learning Point of the Article:

Tourniquet use and adductor canal blocks during total knee arthroplasty may contribute to proximal arterial injury, highlighting the need for careful perioperative vascular assessment and post-operative vigilance.

Abstract

Introduction: Total knee arthroplasty is widely recognized as a major advancement in orthopedic surgery, yet vascular complications, though rare, remain a clinically significant concern. While the popliteal artery is most frequently affected, isolated involvement of a more proximal vessel such as the superficial femoral artery (SFA) has been documented, although only in scattered case reports. Reported events range from hemorrhage to pseudoaneurysm formation and may occur months after surgery, making timely recognition of these injuries essential for preventing limb-threatening consequences.

Case Report: We report a 72-year-old male with swelling in his right thigh 4 weeks following a bilateral total knee replacement. After physical examination, radiographs, Doppler, and computed tomography angiography, a probable diagnosis of a pseudoaneurysm from the SFA was made. It was confirmed on peripheral angiography through the common femoral artery and was embolized successfully by coiling.

Conclusion: The author advocates the occurrence of pseudoaneurysm to the possibility of a tourniquet injury at the time of knee arthroplasty or an anesthetic procedure (post-operative block for analgesia) as the inciting event.

Keywords: Pseudoaneurysm, superficial femoral artery, total knee arthroplasty, vascular complications.

Introduction

Total knee arthroplasty (TKA) has been one of the most important orthopedic advances. However, vascular lesions and complications in TKA are well documented with sufficient data. The popliteal artery is more commonly involved [1], but some cases involving an isolated injury to the superficial femoral artery have been reported in a few isolated case reports. Hence, the incidence is unknown.

Calligaro et al. [2] studied an overall incidence of 0.03–0.17% arterial complications among a sample of 13618 (including 1665

revisions) during TKA. There were 24 cases of arterial complications, of which 5 were popliteal artery pseudoaneurysms.

Butt et al. in 2010 explained the mechanisms of arterial complications following TKA [1].

According to He and Yang [3] and Zhao et al. [4], vascular lesions can occur up to 5 months after surgery, ranging from an active hemorrhage to the development of pseudoaneurysms or false popliteal aneurysms. Early diagnosis of such lesions can be life and limb-saving and prove to be the most important factor in

Author's Photo Gallery



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Figure 1: Clinical picture showing right knee and thigh swelling – 4-week post-operative. Clinical picture of both knees showing right knee and thigh swelling at 4-week post-operative period. Swelling is more compared to the left side.

prognosis. The mechanism of vascular injury in this case, however, still seems to be unclear.

Case Report

A 72-year-old male with a past medical history of diabetes mellitus was operated on for bilateral total knee replacement. He was not on any anticoagulants preoperatively and he did not have any known preexisting vascular disease. Pre-operative arterial ultrasound Doppler was not done, as it is not routinely done in our institute, and ankle-brachial pressure index was recorded to be 1.0. The pneumatic tourniquet pressure was set at 300 mmHg for a duration of 35 min for each side. In the immediate post-operative period, he was administered with adductor canal blocks for both the limbs on the operating table after

completion of the surgery. He was started on 0.6 mL of Clexane (60 mg Enoxaparin) postoperatively, and bilateral deep vein thrombosis pumps were used during the hospital stay of 5 days. He was discharged after an uneventful stay in the hospital. Four weeks later, he presented to the emergency department with right thigh and knee pain and swelling, which, according to him, was increasing in size (Fig. 1). There was no history of fever. After thorough clinical examination, there was a compressible swelling extending into the mid-thigh. There was no redness or local rise in temperature, but there was mild tenderness. Distal neurovascular status was unaffected. On investigation, hemoglobin was found to be 5.7 g/dL with total leukocyte count within normal limits. Radiographic evaluation comprising X-rays, a venous and arterial Doppler, and a computed tomography (CT) angiogram was advised. Doppler showed a hematoma and bleeding from a principal vessel (Fig. 2). CT angiogram revealed a narrow-necked small pseudoaneurysm of size 5 mm × 4 mm arising from a muscular branch of the superficial femoral artery, described as the third branch arising distal to the common femoral artery bifurcation, with opacification of a small pseudoaneurysmal sac. The pseudoaneurysm corresponded to the focus of active extravasation identified on CT angiography and was associated with a large intramuscular hematoma within the vastus intermedius. This hematoma in turn caused a compression of the right superficial femoral vein (Fig. 3).

The patient was referred to the vascular intervention team and underwent diagnostic peripheral angiography through a right common femoral artery approach. Angiography confirmed active extravasation from a muscular branch of the superficial femoral artery, corresponding to the third branch distal to the common femoral artery bifurcation and the pseudoaneurysm identified on CT angiography. The lesion was a small, narrow-neck pseudoaneurysm measuring 5 × 4 mm and was associated

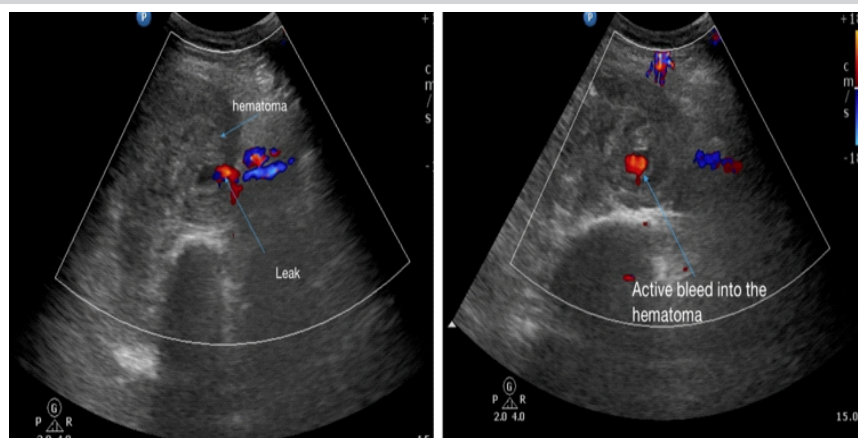


Figure 2: Doppler showing hematoma and active bleeding from a principal vessel. Venous and arterial Doppler showing hematoma in the thigh and active bleeding from the principal vessel.



Figure 3: Computed tomography angiography axial and coronal images showing active bleeding from the pseudoaneurysm. Axial and coronal images showing hematoma and bleeding into the hematoma in the right vastus intermedius in the upper thigh. Bleeding identified from the pseudoaneurysm of the third muscular branch of superficial femoral artery.

with a large intramuscular hematoma within the vastus intermedius.

Considering the small size and muscular branch origin of the pseudoaneurysm, selective endovascular embolization was chosen to achieve hemostasis while avoiding intervention on the main superficial femoral artery. Two 3-mm coils were deployed to occlude the culprit branch. Completion angiography demonstrated successful cessation of bleeding from the affected branch. Coil embolization was preferred over open surgical repair because it provided a minimally invasive method of achieving definitive hemostasis in a deep proximal thigh lesion. Ultrasound-guided compression or thrombin injection, although established options for selected femoral pseudoaneurysms, were considered less suitable given the small muscular branch origin and associated deep intramuscular hematoma. Covered stent placement was also not considered appropriate for a small muscular branch because of the need to preserve the parent superficial femoral artery and avoid unnecessary implantation in a branch vessel. 3 units of low-density packed red blood cell components were transfused, and the patient was discharged after a successful recovery.

Discussion

Post-operative pseudoaneurysm in the superficial femoral artery after knee arthroplasty is a very rare occurrence and is an anomaly in the rehabilitative phase of knee arthroplasty.

The SFA is unique in nature, as it runs along the length of the thigh without any important branches and collaterals. Hence, a range of forces is exerted on it that alters the flow in the vessel during flexion, extension, contraction, torsion, and compression [5]. This makes it more susceptible to tethering during manipulation under a tourniquet.

Butt et al. described four mechanisms of arterial complications following TKA [1]. Embolization of an atheromatous plaque,

especially with the use of a pneumatic tourniquet, commonly affected the superficial femoral artery [6,7,8]. However, large-scale studies are yet to be published on its incidence.

Excessive manipulation can cause intimal tears of major vessels. When combined with the low-flow state that results from applying a tourniquet, these favor thrombus development and consequent ischemia [6,7,8,9]. Release of severe flexion contractures can cause traction injury and intimal tears of the popliteal artery [6,7,8,9,10]. Extensive releases should be done cautiously. Rubash et al. described, in cadaveric specimens, the vessels at risk during excessive retraction and releases performed during TKA [11].

The last mechanism involves direct injury to major vessels by various instruments used during TKA [8].

Sanchez et al. [12] and Vorobeichik and Abdallah [13] described that not only surgical procedures but also adductor canal blocks given as a method of post-surgical pain management can be linked to inadvertent puncture of the superficial femoral artery during application. Post-operative adductor canal block is routinely practiced in our institute following TKA which can be kept in mind as a cause of the complication. Bomberg et al. [14] demonstrated a 1.1% risk of vascular puncture while performing a femoral block. Cappelleri et al. [15] suggested the possibility of vascular injury even if the adductor canal block was done under ultrasonic guidance.

A pre-operative assessment to identify the risk of arterial injury in patients undergoing TKA is essential to avoid such complications. History of tobacco intake, hypertension, diabetes mellitus, claudication symptoms, and previous history of stroke or cardiovascular surgery are important considerations in history taking before surgery [1,2,16,17]. Skin condition and pulses in comparison to the contralateral limb should be examined by the operating surgeon.

The routine use of ankle-brachial pressure index is an important tool in developing suspicion of an existing arterial disease, but values of >1.3 in cases of diabetes mellitus can be highly misleading. Values <0.5 are suggestive of severe ischemia [16,17]. The presence of vascular calcification on plain radiographs should raise concern for an existing arterial disease [18].

Pre-operative Doppler of arterial and venous systems is recommended in such cases. When intervention is needed or there is a high level of suspicion, CT angiography may be necessary [2,17].

Most complications are diagnosed within 48 h of surgery. Post-operative excessive pain, swelling in the knee, high drain output

with fresh blood, and other signs of ischemia are suggestive of intimal tear or laceration of an artery. It is mandatory that there are routine checks in the immediate and early post-operative period to recognize any sign of arterial injury following TKA. A delay in diagnosis can have devastating complications such as irreversible ischemia, compartment syndrome, and surgical amputation [2].

Once clinical suspicion is raised, the opinion of a vascular surgeon is mandatory. Management options include arterial embolization using coils or intraluminal thrombin, endovascular stenting, oversewing of the aneurysm neck, or excision and repair or bypass [19,20,21,22]. Ultrasound-guided compression repair is the gold standard treatment for a proximal femoral artery pseudoaneurysm [23]. Our case was treated with embolization of the affected vessel with 3 mm coils and post-operative blood transfusion.

Mortality and amputations are quite rare. Calligaro et al. [2] reported no deaths, and limbs could be salvaged in all 24 cases with arterial complications. However, other studies reported the need for amputation of the limb after events of an arterial injury, the occurrence being very few. He also reported that a delay in diagnosis and cases where surgery was delayed for more than 24 h from the time of occurrence needed surgical procedures like fasciotomies along with the principal surgery performed by the vascular surgeon.

Only case reports with generally positive results are available for studies on pseudoaneurysms following TKA. Even fewer case reports have mentioned an SFA aneurysm. In most of the case reports, no definite etiology has been mentioned as a reason for the vascular injury. While most cases talk about injury to the popliteal artery or anterior tibial artery, which is in the vicinity of the surgical field, in our case, the SFA pathology is much more

proximal to the surgical field. Therefore, the author feels the likely etiology could be due to the application of the tourniquet or due to the adductor canal block in the immediate post-operative period.

Conclusion

Pseudoaneurysm of the superficial femoral artery following TKA is an extremely rare but serious complication that may present in a delayed manner. Although vascular injuries after TKA typically involve the popliteal artery, surgeons should remain vigilant for proximal arterial lesions when patients present with unexplained thigh swelling and pain in the post-operative period.

Prompt recognition with appropriate imaging modalities and early endovascular intervention can lead to favorable outcomes and prevent limb-threatening sequelae. Awareness of various etiologies, including tourniquet-related injury in cases with the aforementioned risk factors and regional anesthesia techniques such as adductor canal block, is essential to ensure a timely diagnosis and management.

Clinical Message

This case emphasizes that superficial femoral artery pseudoaneurysm, although rare, is a potentially limb-threatening delayed complication after TKA that may present with vague symptoms such as thigh swelling and pain. Awareness of these risk factors encourages surgeons and anesthetists to maintain vigilant post-operative vascular monitoring and use early imaging in suspicious cases, especially when tourniquets or adductor canal blocks are employed.

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.

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