


Pedunculated Thrombus in a Left Popliteal Artery Aneurysm Which Resolved On Anticoagulation Therapy

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Abstract

Popliteal artery aneurysms (PAAs) account for approximately 70% of all peripheral artery aneurysms. Despite the exact prevalence of PAAs being unknown, it is thought to be present in about 1% of the elderly male population. Acute thrombus in a PAA can increase the risk of lower limb ischemia and amputation. We present a case documenting an incidental finding of an asymptomatic “floating” or pedunculated thrombus within a left PAA on duplex ultrasound. This thrombus resolved following a period of anticoagulation with intravenous Heparin followed by oral administration of apixaban.

Keywords

duplex ultrasound, popliteal artery aneurysm, floating pedunculated thrombus

Introduction

Duplex ultrasound is the gold standard for assessing popliteal artery aneurysms (PAAs).¹ This report documents an unusual finding of an asymptomatic “floating” or pedunculated thrombus extending for approximately 4.5 cm within a left PAA. This thrombus completely resolved within 10 days on anticoagulation (intravenous and oral).

Patient Description

A 69-year-old man with known multiple arterial aneurysms and associated vascular interventions presented to the Non-Invasive Vascular Unit, Beaumont Hospital, for routine surveillance of his PAAs by duplex ultrasound. The maximum diameter of the right PAA was 2.4 cm and the maximum diameter of the left PAA was 2.6 cm. From the level of the left popliteal crease, a pedunculated “floating” asymptomatic thrombus was documented which extended for approximately 4.5 cm into the left tibioperoneal trunk artery.

This patient had previous major vascular interventions which included an open repair of his abdominal aortic aneurysm in 2004. In 2008, he experienced a subarachnoid hemorrhage and intraventricular hemorrhage which required an external ventricular drain for hydrocephalus. He was subsequently diagnosed with an anterior communicating artery aneurysm and a right posterior communicating artery aneurysm which was coiled. In 2011, bilateral common iliac artery

aneurysms were documented and his right popliteal artery was noted to be ectatic in 2012. The patient was diagnosed with a metastatic adenocarcinoma of unknown origin which was successfully treated by chemotherapy in 2015. One year later, in 2016, he went on to develop a para-renal aneurysm which was treated with a 4-vessel fenestrated endovascular aneurysm repair (FEVAR) in Birmingham. He is an ex-smoker with family history of stroke, abdominal aortic aneurysm, and ischemic heart disease.

Ultrasound Technique

Duplex ultrasound was performed using a Philips EPIQ Ultrasound machine and the 12L-3 linear array probe (Philips Ultrasound Inc, Pennsylvania). The popliteal arteries were examined in transverse and longitudinal B-Mode to document any vessel wall abnormality. Outer wall anterior-posterior (AP) and transverse diameters were measured with the calipers’ function. The presence of stenosis, occlusion, or thrombus was documented.

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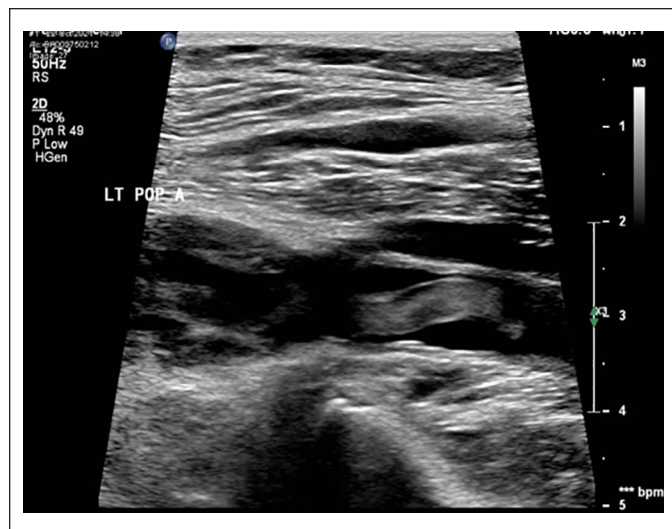


Figure 1. Longitudinal B-Mode image of the left PAA from the initial duplex examination showing the “floating” or pedunculated thrombus prior to anticoagulation.

Note. PAA = popliteal artery aneurysms.

Using both color Doppler and spectral Doppler, peak systolic velocities (PSVs) were measured within the popliteal arteries at and below the popliteal crease. Color scale and gain were adjusted dynamically to optimize visualization of flow within the vessels, and the Doppler angle was maintained at 60° during the examination. The 12L-3 linear array probe was employed to assess the left anterior tibial artery (ATA), the left posterior tibial artery (PTA), and the left peroneal artery. With B-Mode, all three infra-popliteal arteries were examined in transverse and longitudinal views to assess for aneurysmal dilation and the presence of plaque or thrombus. Color Doppler was used to assess for the presence or absence of flow. Spectral Doppler was employed to record the PSVs within the vessels. Anatomical locations such as origin, upper calf, mid-calf, and lower calf were referenced.

As the patient was asymptomatic and pulses were palpable, an ankle brachial index (ABI) was performed using the Viasonix Falcon Pro Machine (Viasonix Vascular Inc, Hixson, TN). This is a noninvasive physiological test which compares the systolic pressure within the brachial artery with that of the dorsalis pedis artery and the PTA of both feet. Digit pressures were also evaluated using photoplethysmography and a toe brachial index (TBI) calculated for each foot.

Test Results and Clinical Course

The left PAA was patent with a maximum AP diameter of 2.6 cm. Pedunculated or apparently “floating” mural thrombus, extending for at least 4.5 cm into the left tibioperoneal trunk artery (Figures 1 and 2), was visualized. The right PAA was patent with a maximum AP diameter of 2.4 cm. Lower limb physiological assessment demonstrated no severe arterial occlusive lesions: the ABI on the right was 0.98, and on the left



Figure 2. Color duplex image from the initial duplex examination showing arterial flow surrounding the thrombus in the left PAA.

Note. PAA = popliteal artery aneurysms.

the ABI was 0.91. The TBIs were 0.71 on the right and 0.68 on the left.

Following these initial tests, the patient was admitted for further management. Heparin therapy was commenced with a bolus of 5000 IU of unfractionated heparin followed by an infusion, as per protocol, for a therapeutic target of the APTT ratio of 1.5 to 2.5. Subsequent computed tomographic angiography (CTA) with contrast confirmed the duplex findings with nonocclusive mural and pedunculated luminal thrombus in a 2.6 cm left PAA with no distal occlusion demonstrated (Figures 3 and 4). The CTA findings also included significant stenosis in the left limb of the FEVAR, with mural thrombus in a left common iliac artery aneurysm. Multilevel disease of less than 50% stenosis in the left superficial femoral artery was documented. At this point, a left femoral-popliteal arterial bypass was considered to be the correct course of treatment.

On hospital day six, the patient’s left PAA was rescanned, and the diameter of the “floating” portion of the thrombus had decreased; however, the length of the thrombus remained the same (Figures 5 and 6). A duplex scan of the left great saphenous vein was also performed, and it was determined to be suitable for use as a bypass graft conduit. By hospital day 11, the patient had received six days of heparin infusion followed by oral administration of apixaban, and a duplex ultrasound of the left PAA was repeated in preparation for the planned bypass surgery. That scan showed the pedunculated thrombus had completely resolved (Figure 7), and all three infra-popliteal arteries were patent to the foot. The left PTA demonstrated triphasic waveforms and velocities of approximately 0.47 m/s. The left ATA demonstrated biphasic waveforms with velocities ranging from 0.15 to 0.29 m/s. The left peroneal artery was patent throughout but demonstrated monophasic low-velocity flow. As all three calf arteries were patent

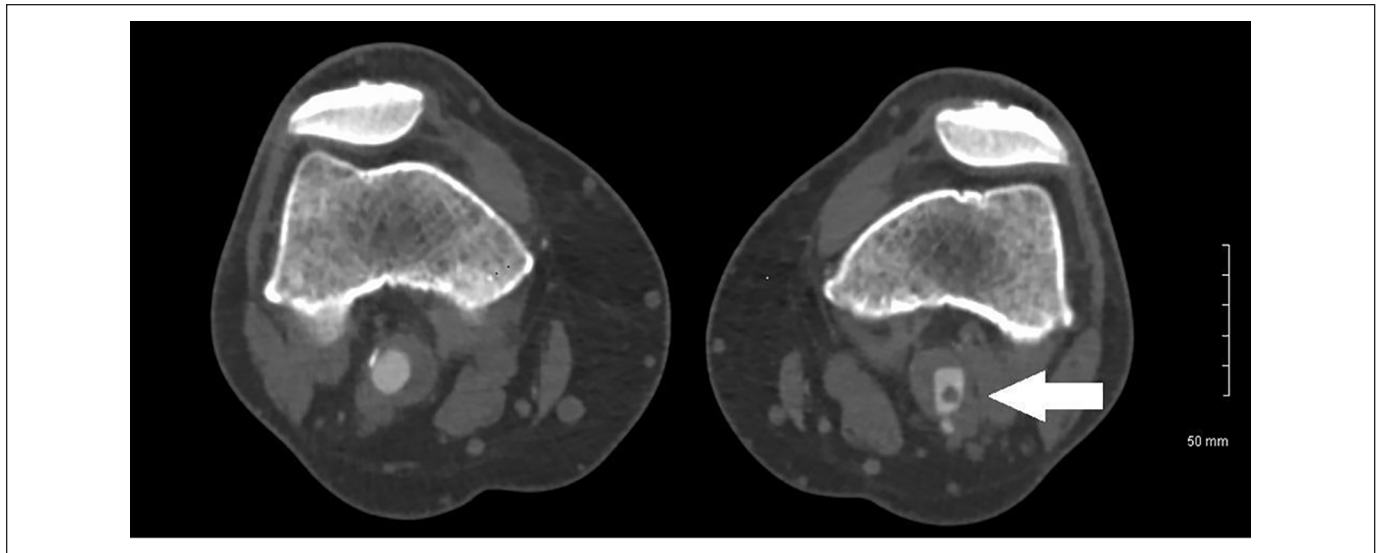


Figure 3. Computed tomographic angiography (CTA) showing an axial view of the bilateral popliteal arteries. Thrombus (arrow) is visualized on the left PAA.

Note. PAA = popliteal artery aneurysms.



Figure 4. Computed tomographic angiography (CTA) showing a sagittal view of the left PAA with the extent of the pedunculated thrombus indicated by the arrows.

Note. PAA = popliteal artery aneurysms.

to the foot, there was no evidence of major embolization of the thrombus. The planned left lower limb revascularization was canceled, as the pedunculated PAA thrombus had resolved after ten days of anticoagulation therapy.

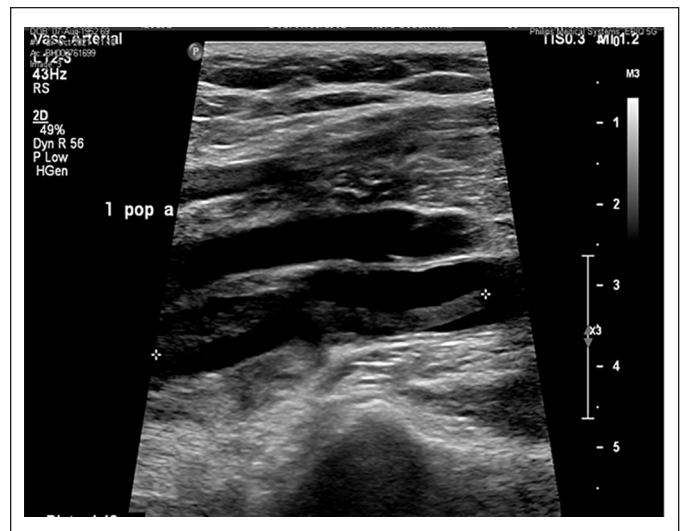


Figure 5. Longitudinal B-Mode image of the left PAA from the repeat duplex examination on day 6 of IV heparin therapy.

Note. The diameter of the thrombus is decreased compared with the initial scan (Figure 1), but the length of the thrombus is unchanged. PAA = popliteal artery aneurysms.

Discussion

The popliteal artery is a direct continuation of the superficial femoral artery as it emerges from the adductor hiatus.² It passes obliquely downward and outward behind the knee joint within the popliteal space to the lower border of the popliteus muscle.³ The ATA arises from the popliteal artery, usually before the tibio-peroneal trunk bifurcates into the PTA and the peroneal artery.² The popliteal artery differs from other lower limb

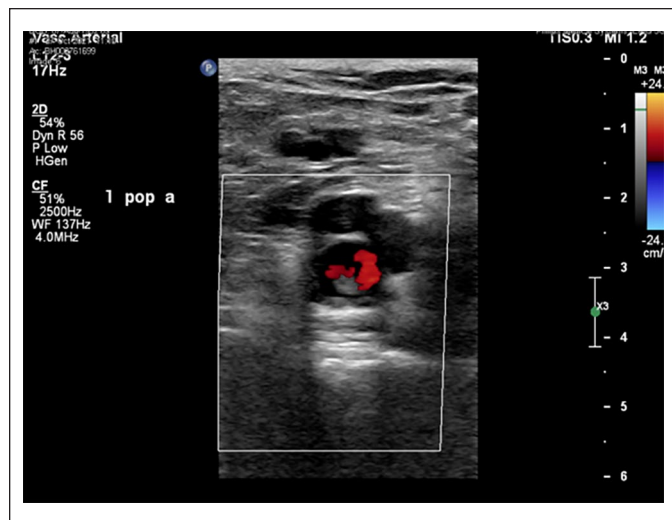


Figure 6. Transverse color duplex image of the left PAA from the repeat duplex examination on day 6 of IV heparin therapy showing the distal portion of the residual thrombus in the left tibioperoneal trunk artery.

Note. PAA = popliteal artery aneurysms.

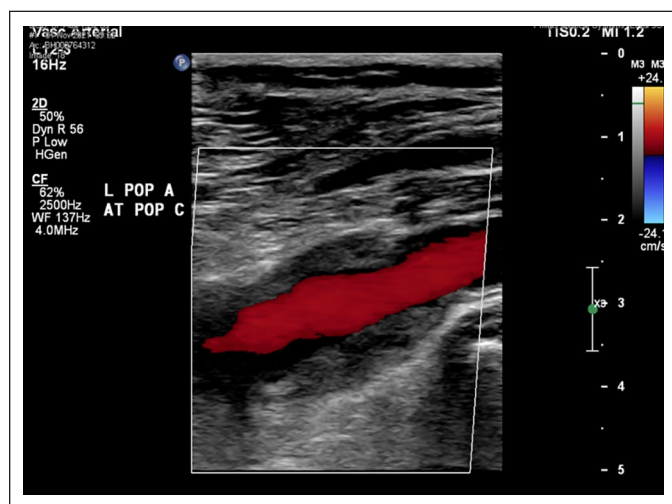


Figure 7. Longitudinal color duplex image of the left PAA from the follow-up duplex examination on hospital day 11 (after 10 days of anticoagulation therapy).

Note. The pedunculated portion of the thrombus has completely resolved. PAA = popliteal artery aneurysms.

arteries in that it is exposed to biomechanical forces as a result of repetitive flexion of the knee.⁴

The normal popliteal artery diameter ranges between 0.5 and 0.9 cm. A vessel is considered aneurysmal when all 3 layers of the vessel wall are abnormally dilated.⁵ Specifically for the popliteal artery, this refers to a focal dilation that is 1.5 times larger than the normal diameter, or if the diameter exceeds 1.5 cm.² A PAA may be saccular or fusiform in shape, and the presence of thrombus in the lumen increases the risks of symptoms and possibly the rate of expansion of the aneurysm.^{6,7} The PAAs are the most common type of peripheral

artery aneurysms,^{7,8} and they account for approximately 70% of all peripheral artery aneurysms.⁹ They are more frequently found in men and are bilateral in 50% of cases.^{10,11} While the exact prevalence of PAAs is unknown, it is estimated to be present in 1% of the elderly male population¹² and is usually diagnosed in the sixth or seventh decade.²

Duplex ultrasound is the gold standard method of choice for routine surveillance of PAAs.¹ This noninvasive method can accurately determine the outer wall AP and transverse diameters of the aneurysm. Duplex ultrasound can also display any calcific plaques or mural thrombus within the aneurysm and assess the patency of the tibioperoneal trunk and its associated run-off vessels.¹⁰

Many PAAs may be asymptomatic; however, common signs and symptoms include claudication, distal ischemia, and the presence of a mass within the popliteal fossa.^{1,11} Chronic thromboembolism associated with a PAA can result in intermittent claudication, rest pain, blue toe syndrome, or acral necrosis.¹¹ Symptoms resulting from acute thrombosis of a PAA are not only limb-threatening but also life-threatening. An embolic event to the distal run-off arteries can increase the risk of lower limb amputation.¹³ Farber et al highlighted that aneurysm size and the risk of embolization and thrombosis are not directly related.² Patients with PAAs may have multiple “silent” thromboembolic events prior to admission for an acute event.^{6,14} Patients with PAAs may also present with an acute deep vein thrombosis (DVT) due to compression of the vein by the adjacent aneurysm.^{15,16} Rupture of a PAA, although rare, is thought to occur in 2% of patients and can be limb-threatening.¹¹ One study reported 45 cases of ruptured PAAs over a 25-year period between the years 1987 and 2012.⁸ Only 8 of those 45 patients were correctly diagnosed with a ruptured PAA, and 27 were initially diagnosed as having a DVT or a Baker’s cyst.⁸ Ravn et al made the point that as women have smaller blood vessels than men, this may explain why their PAAs become symptomatic much earlier as they develop mural thrombus, emboli, and eventually arterial occlusion.¹² Furthermore, the authors of a Swedish study suggest that the presence of thrombus in a PAA increases not only the risk for symptoms but also the rate of expansion.⁷

Repair of a PAA should be considered when the aneurysm is greater than 2 cm in diameter or if it is symptomatic.² An open surgical bypass graft using the great saphenous vein as a conduit is considered to be the gold standard for treatment.^{9,17} It is a safe procedure with low risk and high patency rates.¹⁸ As our patient initially met these criteria, he was evaluated and scheduled for a left femoral-popliteal arterial bypass graft. In recent years, an endovascular approach using a synthetic stent graft has become more popular for repair of a PAA.⁹ Advantages of this approach include its minimally invasive nature with reduced operative and hospital recovery time when compared with open surgical bypass.¹⁹ However, there is concern about deploying a stent graft across the knee joint. Most surgeons favor the durability of a bypass over an endovascular approach if the patient is fit for surgery and a suitable vein conduit is available.

We believe that this is one of the first documented cases of “floating” or pedunculated thrombus in a PAA diagnosed by ultrasound. Left atrium mobile thrombi and thoracic aortic mural thrombus (TAMT) have been documented by both CTA and transesophageal echocardiography. Oishi et al reported complete resolution of a thrombus attached to the left atrial appendage after 48 hours of heparin anticoagulation.²⁰ That thrombus measured 1.6 cm × 1.4 cm in diameter. Abissegue and colleagues²¹ state that this type of thrombus is responsible for 0.9% of all peripheral arterial emboli. Another study reported 14 patients with 17 symptomatic TAMT diagnosed between 1996 and 2010.²² Thirteen of the 17 thrombi were described as highly mobile (pedunculated). “Floating” thrombus in the infrarenal abdominal aorta is rare.²³

In conclusion, we report a rare case of asymptomatic “floating” or pedunculated thrombus within a PAA documented by duplex ultrasound. The initially planned open bypass procedure was canceled when the thrombus resolved after a period of heparin therapy followed by oral administration of apixaban. Absence of significant embolization of thrombus to the infrapopliteal arteries was excluded by duplex ultrasound.

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The patient presented in this report has agreed to publication of the pertinent details and images of his case.

Declaration of Conflicting Interests


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