

Acute Limb Ischemia – Trials of Limb Salvage: A Case Report

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Abstract It is imperative that the frontier care providers from internists and hospitalists are aware of the red flags associated with acute limb ischemia (ALI). To strategize a methodical approach for better clinical outcomes in ALI, a multidisciplinary collaboration involving internist, interventional radiologist and vascular surgeons are crucial, ideally within the first 6 hours of symptom onset. This case report discusses the clinical evaluation of a 74-years-old female presenting with ALI post an angioplasty procedure. We highlighted the clinical evaluation of ALI in respect to the importance of clinical examination, diagnostic and therapeutic imaging modalities. Additionally, we emphasized that the presentation of peripheral artery stent thrombosis in the acute setting of endovascular intervention is a serious complication that may lead to limb amputation.

Keywords: acute limb ischemia, revascularization, limb salvage

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1. Introduction

Acute limb ischemia (ALI) is not uncommon, resulting from arterial perfusion to the affected extremity and presenting with profound symptoms, including disabling pain in the setting of acute vascular and neurologic deficits. ALI incidence is as high as 22 to 26 per 100,000 patients per year [1]. Selection of revascularization strategy is essential in determining successful clinical outcome in both limb salvage and reduction of patient morbidity and mortality. Advancements in thrombolytic therapy and catheter based interventional techniques have emerged in the treatment of ALI. Despite these therapeutics, ALI continues to be a challenge as the risks of mortality remains high (15% to 20% mortality within the 1st year post presentation with an ALI event) due to the inherent comorbidities in those patients and the wide range of amputation rates of 15% to 50% [2].

2. Case Report

We present a case of a 74-years-old female, with a past medical history of extensive smoking (quit 20 years ago), essential hypertension, type 2 diabetes mellitus, coronary artery bypass, long standing peripheral vascular disease with multiple stent implantation for chronic total

occlusion of the right superficial femoral artery (SFA) 1 week prior to the emergency department (ED) presentation. The patient presented to the ED with acute onset of numbness, and severe pain (10/10 intensity) in the right lower extremity. The patient denied having any fevers, chills, abdominal pain, flank pain, nausea or vomiting, or any prior similar symptoms. Family history was positive for extensive peripheral vascular disease in the mother. The patient home medications included Aspirin 81 mg once daily, Metformin 500 mg once daily, Atorvastatin 40 mg daily, Lisinopril 2.5 mg once daily, Gabapentin 100 mg twice daily, Amitriptyline 10 mg once daily, Insulin glargine 100 unit/ml, Eliquis 2.5 mg twice daily, and Ticagrelor 90 mg twice daily. Vital signs in ED included Blood Pressure 144/63 mmHg, Heart Rate 90/min, and Temperature 36.5° Celsius. Physical examination findings included cold to touch right lower extremity with mottled discoloration of the skin, distal toes cyanosis, and weak pulsation of right posterior tibial and dorsalis pedis artery (i.e., clinical signs of acute peripheral ischemia but no or partial sensory loss (grade IIa, Rutherford classification). There was also a chronic deep tissue injury (purple, maroon areas with diffused edges and peri wound erythema) noted on the right feet heels described as Wagner classification 1 (localized superficial ulcer not extending to bone or ligaments), as shown in [Figure 1](#). Heart and lung exams were normal except for visualized sternotomy scar. Chest Xray and ECG on admission shown in [Figure 2](#) were unremarkable.

Laboratory testing was significant for the following: Glucose levels of 192 (reference 74-106 mg/dL), White Blood Cells (WBC) (11.1, reference 4-11 $10^3/uL$), Platelets 367 (reference 130-360 $10^3/uL$), Creatinine of 0.73, reference 0.52-1.04 mg/dL; Blood Urea Nitrogen (BUN) 26, reference 7-17 mg/dL; Lipid profile included : Triglycerides 153 (reference 0-150 mg/dL); Cholesterol 142 (reference range 0-200 mg/dL), LDL 92 (reference 0-99 mg/dL); VLDL 36.6 (reference 0-30 mg/dL); and HDL 48 (reference 0-40 mg/dL). Comprehensive 2D, Doppler, and color-flow echocardiogram was performed to exclude any cardiac sources of emboli and it revealed mild to moderate concentric left ventricular (LV) hypertrophy, normal LV segmental wall motion, normal left ventricular ejection fraction (LVEF) of 45-50%, and normal right ventricular (RV) size and systolic function. There was no evidence of intracardiac masses or thrombi reported. The patient underwent emergency right lower extremity angiogram via left common femoral artery access which revealed complete occlusion of a previously stented superficial femoral artery (Figure 3, Movie File 1). Consequently, a multi-hole (side and end) infusion catheter was advanced from a contralateral common femoral artery puncture and was placed spanning distal common femoral artery terminating a few centimeters proximal to the distal superficial femoral artery (SFA) stent terminus to provide delivery of thrombolytic agent directly into the vicinity of the thrombus bound plasminogen. The patient was admitted to the intermediate care unit (ICU) for monitoring and distal thrombolysis was initiated for 24 hours. Thrombolysis included continuous infusion of Alteplase 4 mg at a rate of 12.5 mL/hour (0.5 mg/hour). Simultaneously, heparin sodium bolus (80 U/kg) followed by continuous infusion (18 U/kg/h) was given during lysis. Patient was prescribed pain killer medications (hydromorphone 1g/ mL) intravenously Q 4 hours per need. Follow up coagulation profile included PT 19.6, INR 1.98, and PTT 44 seconds. Patient symptoms did not improve post 24-36 hours thrombolysis. Figure 4 illustrates the right lower limb post thrombolysis infusion (day 2 of hospital admission) with persistent poor black discoloration over the right toes and extended mottling color all over the sole of the foot, low pulsation, and positive localized tenderness on clinical examination. On the next hospital admission, the patient returned to the Interventional radiography unit for repeated right lower extremity angiography. The arteriogram was performed through an indwelling sheath, and the popliteal artery was catheterized and suction-thrombectomy was performed throughout the popliteal and superficial femoral arteries demonstrating no removal of significant clot. This was followed by a gentle pullback angiogram which demonstrated a patent superficial femoral artery stent (Figure 5), but persistent occlusion of the distal popliteal artery as shown in Figure 6. It was noted that there is evident reconstitution of the anterior tibial artery just distal to its origin, but the posterior tibial artery, tibial peroneal trunk and peroneal arteries did not fill on angiography. A trial of anterior tibial artery catheterization was performed with an 18 inch-guidewire and alongside this wire, the Tibioperoneal trunk was crossed, and the peroneal artery was catheterized. The anterior tibial artery, peroneal artery and Tibioperoneal

trunk were all angioplastied using a 2.5 mm balloon. Unfortunately, the popliteal artery demonstrated a regular dissection and a visualized thrombus and hence was primarily stented using a 6 mm x 10 cm GORE® VIABAHN® stent, (W. L. Gore & Associates, Flagstaff, AZ, USA). A post stenting dilation using a 5 mm balloon was performed as shown in Figure 6. Furthermore, the entire superficial femoral artery stent was gently dilated with a 5 mm balloon. Post procedure repeat arteriogram was performed demonstrated a widely patent right common femoral artery, profunda femoris, superficial femoral artery, popliteal artery, anterior tibial artery, dorsalis pedis, Tibioperoneal trunk and peroneal artery. Wires, catheters, sheaths were removed, and hemostasis was obtained in the left groin using a Star Close device. The patient tolerated the procedure well without complications. Patient was prescribed indefinite dual antiplatelet along with continuation of novel oral anticoagulant Rivaroxaban. *The postoperative course* was uncomplicated within 24 hours despite the persistent pain with light touch and on physical examination, the right foot was slight cold to touch and maintained similar color of cyanosis but no signs of swelling excluding a compartmental syndrome. Figure 7 shows an ultrasound of the lower limb extremities, demonstrating both occlusion from the right proximal superficial femoral artery to the dorsalis pedis artery, and the left posterior tibial artery. Unfortunately, the patient refused to undergo any further procedures and decided to leave the hospital against medical advice (AMA). *At one month's phone call follow up post procedure*, the patient was reported to have been hospitalized in a different facility for uncontrolled blood glucose levels and worsening of right lower limb ischemia, which eventually led to into below knee amputation of the right lower limb.

3. Discussion

Minimally invasive endovascular procedures in patient with symptomatic peripheral artery disease (PAD) is highly prevalent. The durability and restenosis of peripheral intervention has been highlighted in the literatures, with the incidence of peripheral artery stent thrombosis reportedly to be 4.3% [3]. However, peripheral artery stent or vessel thrombosis in the *acute setting* of endovascular intervention is a serious complication that is not well recognized, and little is known about acute limb ischemia and major amputations following development of acute peripheral stent thrombosis.

Our patient had multiple comorbidities and prior PAD including prior superficial femoral artery (SFA) angioplasty and stenting within 1 week prior to the ED presentation and was found to have a definite stent thrombosis confirmed during peripheral angiography. Based on clinical event timing this was classified as an early stent thrombosis (defined as stent occlusion within ≤ 30 days of vascular intervention). Patient's presentation was relatively a *Rutherford categories IIa* for severity of limb ischemia and she had no contraindications to thrombolytic therapy. Hence, a catheter-directed thrombolysis was followed as the treatment of choice to help stop thrombus propagation along with the benefit of

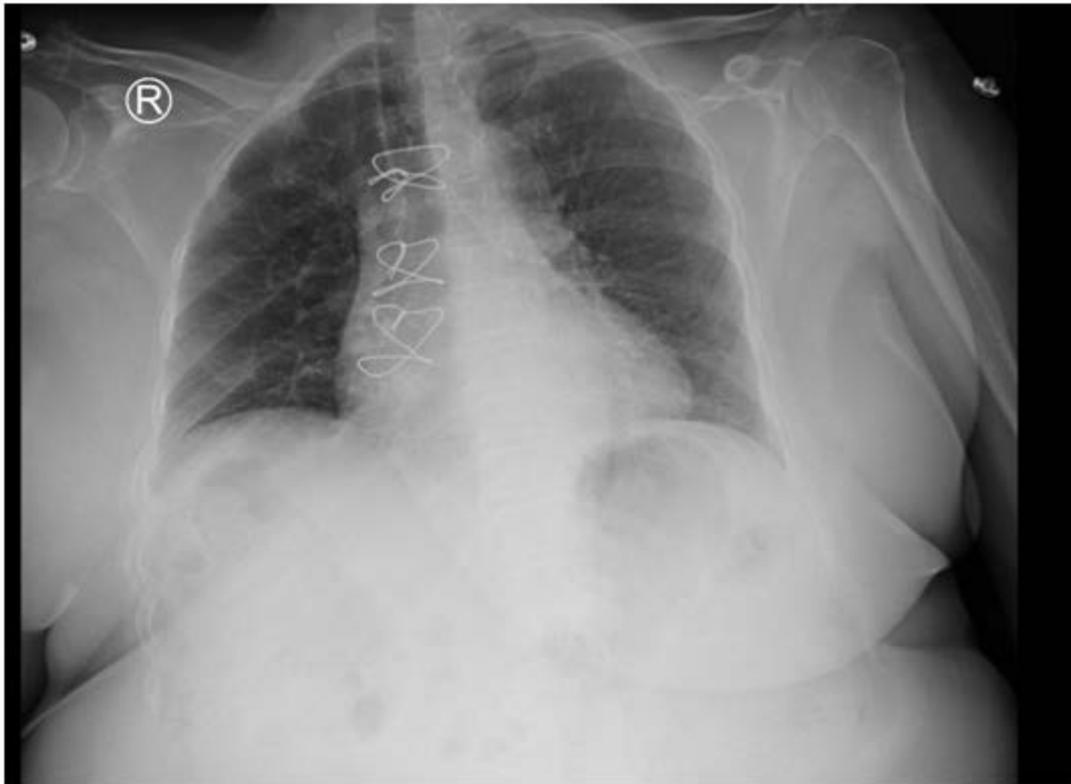
anti-inflammatory effect that lessens the ischemia [4]. In our case, the lysis was incomplete at around 36 hours of thrombolysis. Failed thrombolysis leads to an increased risk of distal embolization of the residual thrombus during any subsequent intervention, hence a second look angiogram was undertaken. Furthermore, the decision of a second look was taken because therapeutic endpoints (clinical improvement of the limb) to thrombolytic therapy was not attained. Studies have shown the benefits of using alteplase catheter directed infusion for clot lysis being achieved in 94% of cases with a mean infusion time 5.25 hours [4]. However, failure of thrombolysis has been also reported. Failure of thrombolysis has been characterized in patients with severe uncontrollable disease or lack of catheter proximity to the thrombus, which may have been the case in our patient.

Depending on the timing and the availability of collateral circulation, stent occlusion is likely to be thrombotic in the acute setting (immediately post stent placements) and present with limb threatening ALI which poses a high risk of amputation. Awareness of such clinical presentations and precipitating factors is crucial for practicing internists to perform the appropriate evaluation and management of these complications, as

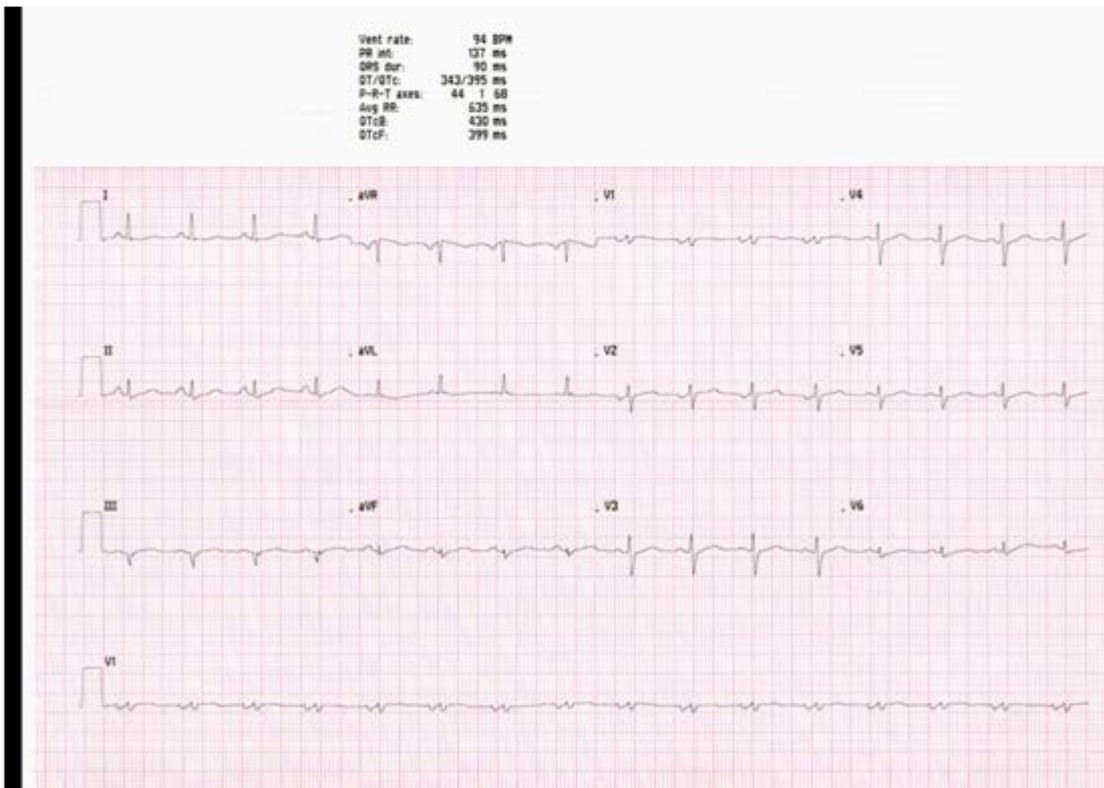
well as the timely referral for surgery amputation. Our patient received a GORE® VIABAHN® stent, (W. L. Gore & Associates, Flagstaff, AZ, USA) stent, which is known to have several advantages including a self-expanding nitinol stent, highly flexible, biocompatible with a smooth, blood contact surface, and good resistance to external compression. However, stent occlusions have been reported due to multiple factors including dislodgement, stent fractures, compression from Endo tension and infoldings from oversizing which almost leads to stent thrombosis [5]. Unfortunately, that was the case in our patient with multiple comorbidities and the lower limb doppler ultrasound revealed complete occlusions across the SFA to the dorsalis pedis artery. A repeat angiography was not performed due to patient signing AMA, but it would have helped us understand the exact mechanism of stent failure and clinical limb deteriorations. According to Banerjee and colleagues [3], treatment of chronic total occlusion and in-stent restenosis lesions are independently associated with an increased risk of future stent stenosis, specifically the femoropopliteal peripheral artery stent stenosis is associated with an increased risk for future adverse limb, but not for cardiovascular events. This has been illustrated in our case report.



Figure 1. Lower extremities showing (A) Right foot with black discoloration, open wound, low pulsation, positive localized tenderness on clinical examination, Wagner's classification 1 (localized superficial ulcer not extending to bone or ligaments). Schematic distribution of the arterial supply of the foot is also illustrated. Anterior tibial artery supplying whole dorsum of the foot. Plantar aspect of the foot supplied by the medial and lateral plantar artery and the calcaneal artery (B) Left foot is shown for comparison



A)



B)

Figure 2. A- Chest Xray shows no cardiopulmonary disease. Sternal sutures of Coronary Artery Bypass are shown and B- Electrocardiogram (ECG) on admission showing normal sinus rhythm

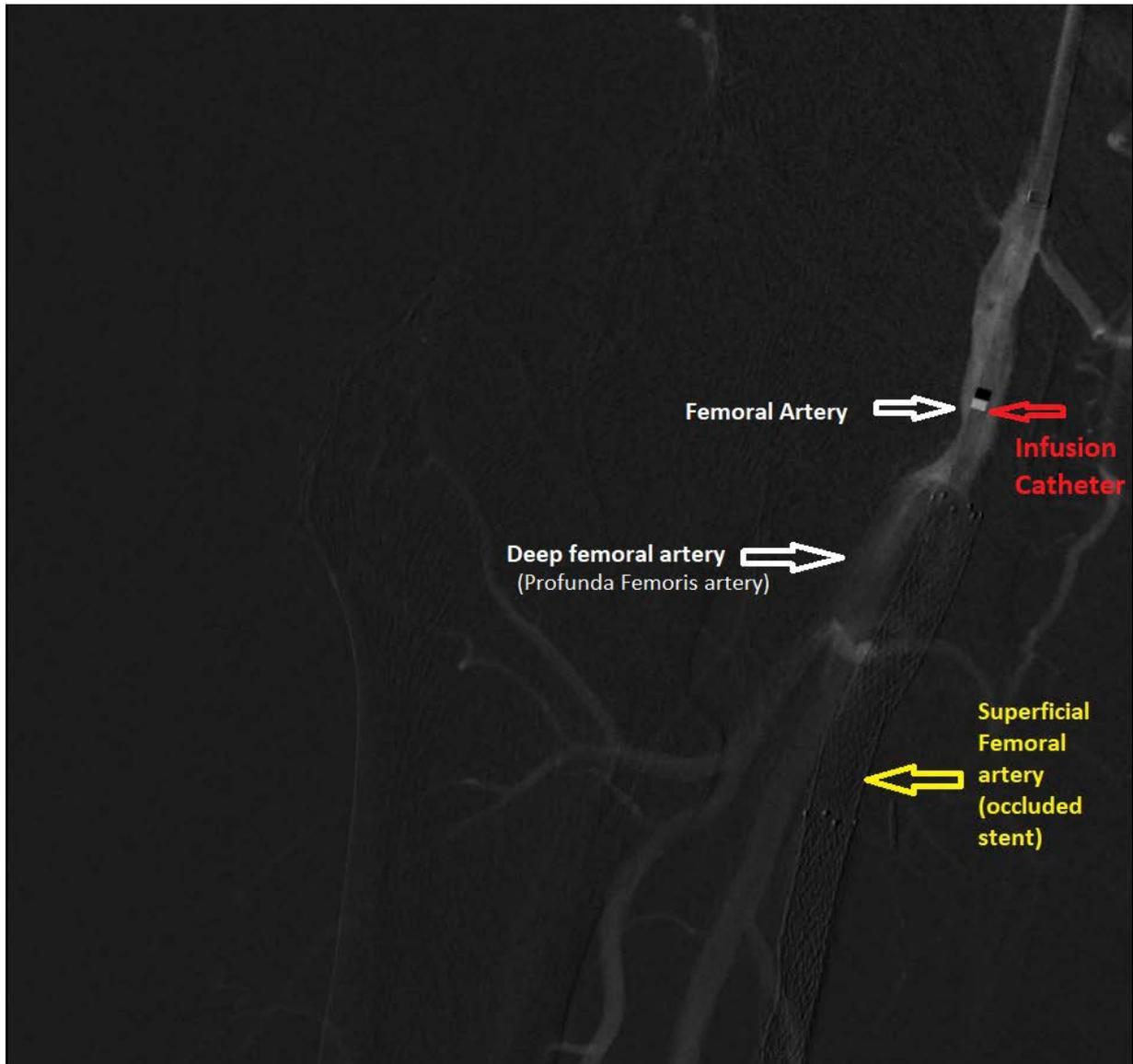


Figure 3. Admission baseline angiography showing Stent occlusion of the right superficial femoral artery (SFA). Multi hole Infusion catheter was left in place. **Movie file 1.** Admission baseline angiography showing Stent occlusion of the right superficial femoral artery (SFA). Multi hole Infusion catheter is shown in place.



Figure 4. In hospital course, Post thrombolysis. Lower extremities showing Right foot with persistent poor black discoloration over the right toes with extended mottling color all over the sole of the foot, low pulsation, positive localized tenderness on clinical examinations.

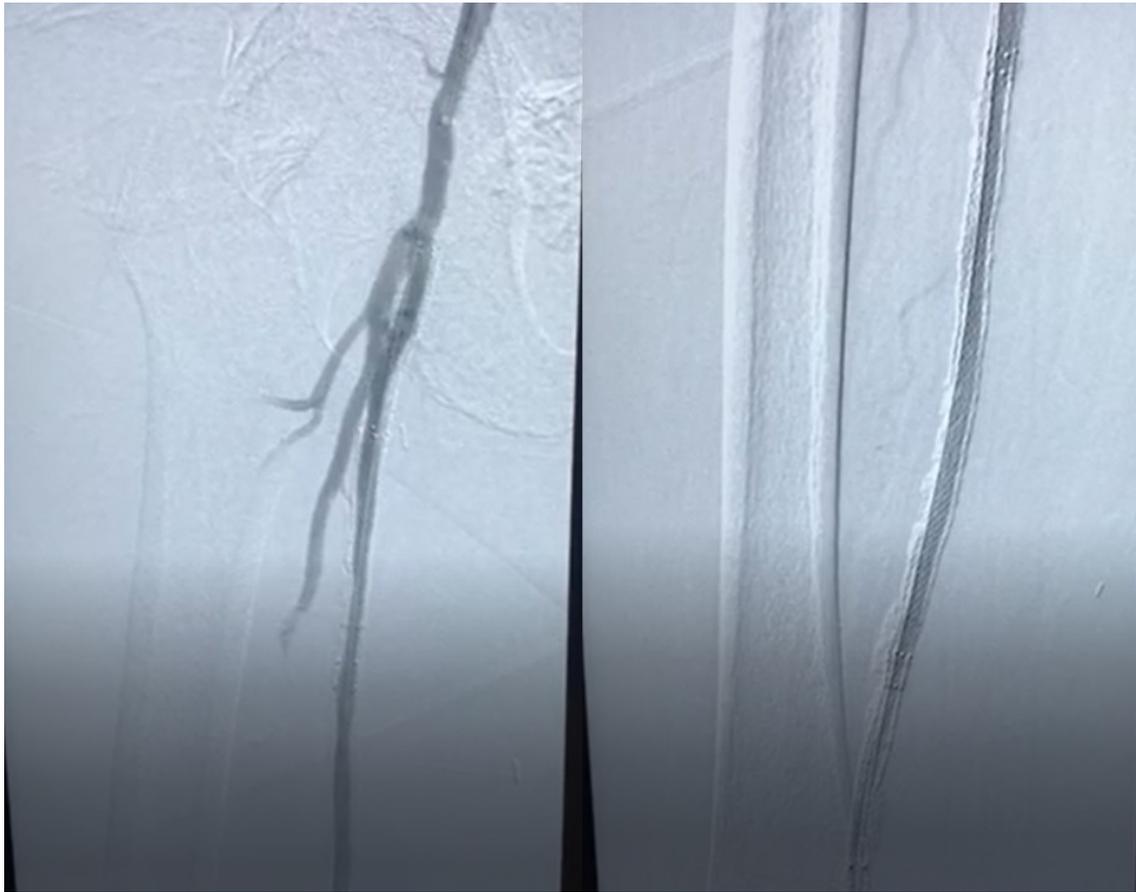


Figure 5. A gentle pullback angiogram demonstrates patent superficial femoral artery stents proximal (left image) and distal (right image). **Movie file 2 (a and b):** A gentle pullback angiogram demonstrates patent superficial femoral artery stents (a) proximal (left image) and (b) distal (right image)

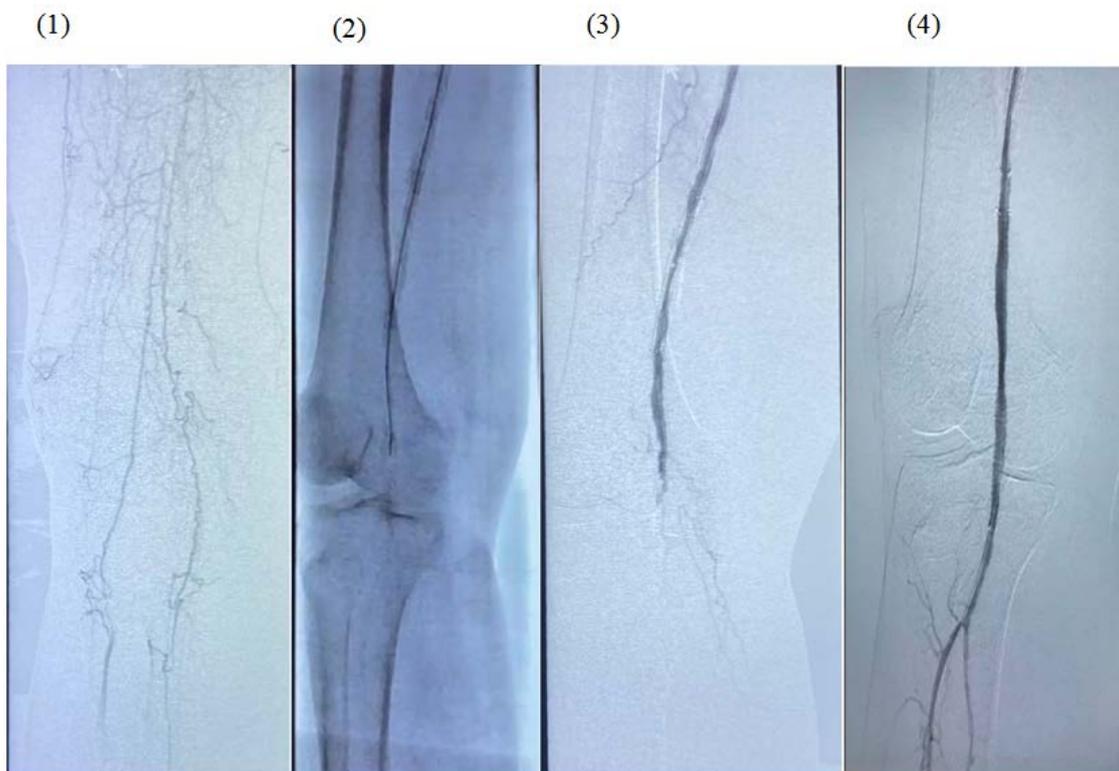


Figure 6. From left to right images showing (1) angiogram of popliteal artery occlusion, (2) crossing of the popliteal artery with guide wire, (3) a regular dissection and thrombus and (4) finally last image on the right showing the VIABAHN® stent placements and post dilation using a 5 mm balloon. **Movie File 3 (a and b):** (a) Angiogram of popliteal artery occlusion, (b) VIABAHN® stent placements and post dilation using a 5 mm balloon.



Figure 7. Duplex ultrasonography showing an occluded right superficial femoral artery (SFA) stent without any evidence of flow on color or pulsed wave Doppler

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