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Endovascular Management of Superficial Femoral Artery Occlusion Secondary to Embolization of Celt ACD® Vascular Closure Device

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Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
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Conflict of interest: None declared

Patient: Male, 70-year-old
Final Diagnosis: Embolization of vascular closure device
Symptoms: Claudication
Medication: —
Clinical Procedure: Angioplasty
Specialty: Radiology

Objective: Unusual clinical course

Background: This report describes the endovascular management of a Celt ACD® vascular closure device (VCD) lodged in the superficial femoral artery (SFA), 1 year after its deployment. There is a paucity of evidence in the existing literature regarding the management of complications related to embolized VCD discovered months or years after its deployment.

Case Report: A 70-year-old male patient, who was a heavy smoker, presented with right lower-limb intermittent claudication of 2 months' duration. He underwent a successful left retrograde iliac artery and left SFA angioplasty 1 year ago. The right femoral pulse was normal, whereas the right popliteal pulse was absent. The right ankle-brachial index was 0.64. Doppler ultrasound showed evidence of mid-right SFA occlusion. Angiogram showed an embolized Celt ACD VCD in the right SFA causing segmental occlusion. An endovascular attempt to retrieve the embolized VCD via a snare failed, as the VCD got deeply embedded in the vessel wall. After successful balloon angioplasty, a stent was placed into the SFA with excellent angiographic and clinical outcomes.

Conclusions: This case demonstrates the risk of dislodgement of the VCD and its distal embolization with a risk of late ischemia. Endovascular retrieval may be unsuccessful for chronically embolized VCD. Therefore, stent angioplasty is an acceptable option.

MeSH Keywords: Angioplasty • Catheterization, Peripheral • Device Removal • Embolization, Therapeutic • Foreign Bodies • Stents

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Background

Currently, vascular closure devices (VCDs) are widely used in endovascular surgery [1]. VCD achieves faster hemostasis at the access site, and allows prompt recovery and early mobilization after intervention [2]. However, it may cause infection, vascular dissection, and acute or chronic vascular occlusion secondary to distal embolization [2]. Celt ACD® (Vasorum Ltd., Dublin, Ireland) is a special VCD that accomplishes hemostasis through the delivery of a stainless-steel plug with extendable wings to secure the plug on both sides of the arterial wall. This is a case of endovascular management of chronic superficial femoral artery occlusion due to distal embolization of a VCD 1 year after deployment.

Case Report

A 70-year-old male patient who was a heavy smoker with a history of peripheral vascular disease presented with right lower-limb pain and intermittent claudication for 2 months, without signs of critical limb ischemia. Despite being overweight, with a body mass index of 27 kg/m^2, he had no history of diabetes or hypertension. The basic blood workup, metabolic panel, and coagulation values were normal. The patient had left lower-limb claudication and chronic left lower-limb ischemia since 1 year ago, for which he had undergone a lower-limb angiogram. The angiogram revealed left common iliac artery stenosis and total occlusion of the left superficial femoral artery (SFA). Through a retrograde approach, the left iliac artery and left SFA were stented with successful recanalization. The right SFA was mildly diseased. The procedure concluded with a satisfactory confirmatory angiogram followed by a vascular closure Celt ACD device in the right femoral artery, without notable postoperative complications. At 3- and 6-month follow-up, the patient demonstrated an excellent clinical outcome. At the 12-month follow-up, the patient was still asymptomatic in the left limb; however, he complained of calf claudication on his right side for the last 2 months. The right femoral pulse was normal, whereas the right popliteal pulse was absent. The ankle-brachial index was 0.64 and 1.45 on the right and left sides, respectively. Doppler ultrasound showed evidence of mid-right SFA occlusion, whereas the popliteal and runoff were patent.

In this study, the patient underwent an angiogram, which showed a metallic foreign body in the right SFA, consistent with VCD embolization associated with focal SFA occlusion (Figure 1).

An attempt was made to retrieve the VCD through an antegrade right common femoral artery access using an endovascular snare (BARD snare retrieval kit, 9 Fr, 20 mm, USA) (Figure 2). The attempt was unsuccessful because the VCD was deeply embedded and incorporated into the arterial wall, and an application of excessive force on the snare could pull the VCD along with a part of the arterial wall. Therefore, a guidewire was inserted and passed across and beyond the occluded part of the SFA where the VCD was lodged. Balloon angioplasty was performed, followed by successful deployment of a self-expanding 6×60 mm Nitinol stent (Luminexx, Medtronic, Santa

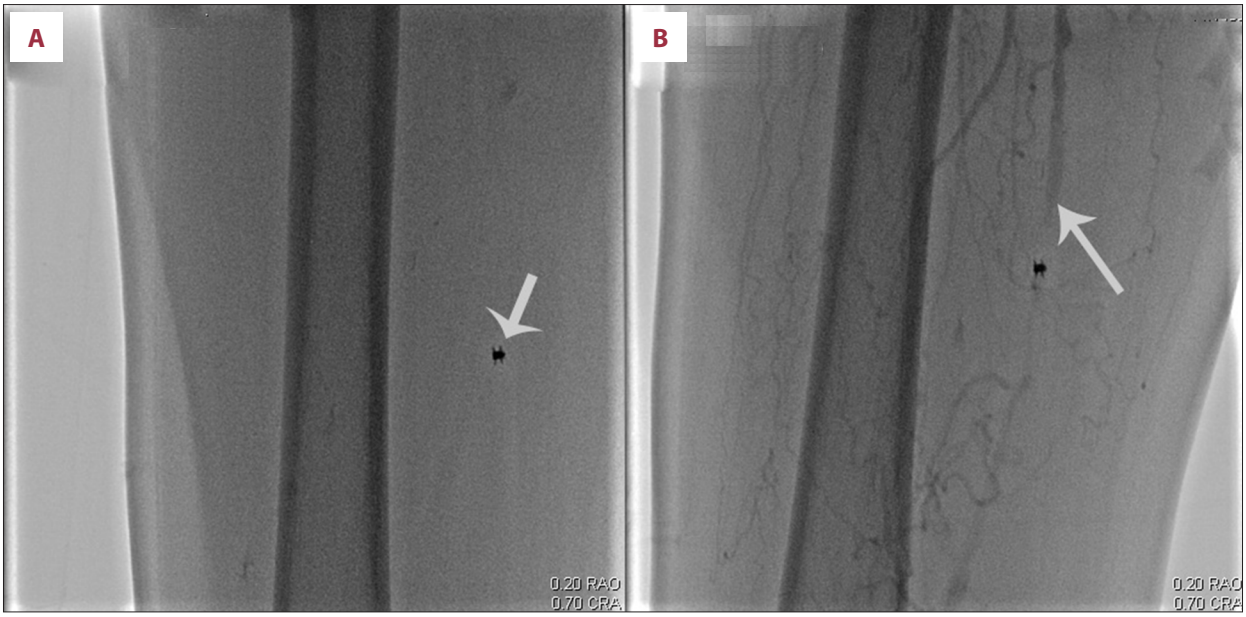

Figure 1. (**A**) Control film showing a typical appearance of vascular closure device (VCD) with two wings on either side of the plug. (**B**) Angiogram of the right lower limb illustrating VCD occluding the right superficial femoral artery with collateral development.

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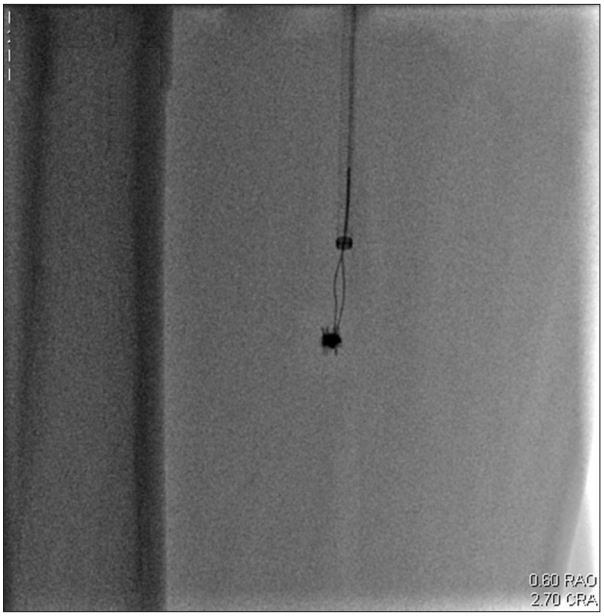

Figure 2. Attempt to retrieve the vascular closure device with an endovascular snare.

Rosa, CA, USA), with excellent angiographic results (Figure 3) and good runoff vessels. The patient was discharged on his regular medication and dual antiplatelet therapy: aspirin (permanently) and clopidogrel 75 mg once daily for 6 months. In the course of reviewing the patient in the clinic, he reported the resolution of the previous symptoms and palpable distal pulses. Follow-up Doppler ultrasound at 3 months revealed a patent stent and good runoff.

Discussion

Manual compression or the use of sandbags were the standard practices for controlling vascular access sites until the 1990s, when VCDs were introduced. There are three main subtypes of VCD: plug based, suture mediated, and clip based [3]. The main advantage of VCDs is the reduced time for hemostasis and resultant early patient mobility. However, it could cause vascular complications, such as infection, bleeding, and limb ischemia, the incidences of which are higher in case of device failure [4]. Suture-mediated VCDs, in particular, are associated with a high risk of failure compared with other device subtypes [4]. On the contrary, plug-based and clip-based devices are associated with a higher risk of ischemic complications due to the distal embolization of the intraluminal component [5].

Celt ACD device is a novel stainless-steel VCD with both intraluminal and extraluminal components. Its main advantages over other VCDs are a faster deployment by utilizing the existing procedural sheath, precise localization of the device by fluoroscopic detection in cases of maldeployment, an ability to be utilized in narrower vessels because of its small size compared with other VCDs, and a reduced time for hemostasis [6]. On the contrary, Celt ACD could dislodge and embolize distally, and it could equally injure the intima via its sharp edges, causing thrombus formation.

A standard conventional surgical embolectomy has been traditionally performed to manage distal device embolization [7,8]. However, more recent endovascular approaches have challenged

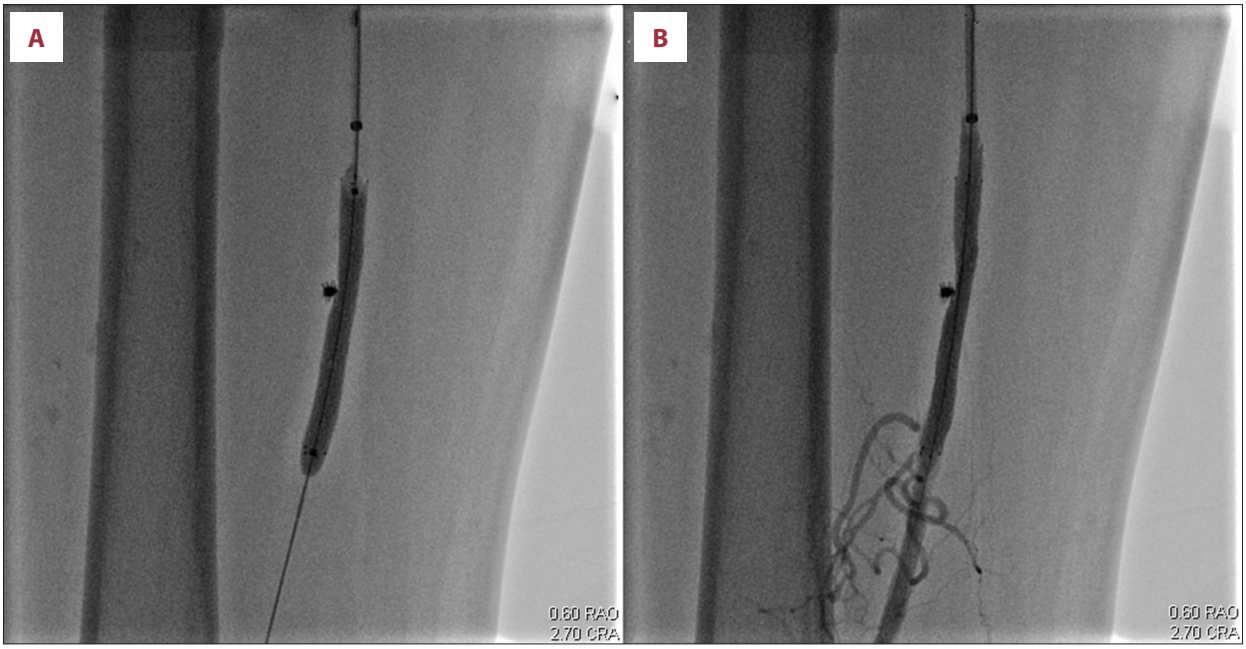

Figure 3. (**A**) Balloon angioplasty after successful stent deployment. (**B**) Satisfactory confirmatory angiographic result with mild residual stenosis.

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the traditional surgical approach, with promising results being reported [5,9,10].

Complications related to the failure of deployment or embolization of VCD usually occurred and were observed periprocedurally or within days postdeployment [1,7]. To the best of our knowledge, late presentation, months after deployment, has not been reported in the literature.

Upon discovery of the embolization of a VCD during deployment, it should be immediately managed either by endovascular snaring or open surgical retrieval [1,5,9]. However, symptomatic chronic embolization should be managed either by angioplasty or open surgical repair, as there is no chance for endovascular retrieval since the device will be embedded in the wall, possibly due to endothelialization and intimal hyperplasia.

One explanation for chronic presentation in this case could be the late embolization of the device, although this has not been previously reported. Although not described in the literature for Celt ACD, a possible mechanism underlying such late embolization could be the clutch of the wings of the device by an atheroma or ulcerating plaque that subsequently got ruptured and migrated.

An alternative explanation could be that acute embolization only caused partial nonsignificant stenosis that propagated into symptomatic complete occlusions over months. Supposedly, embolization of the wings in this case likely occurred shortly after hemostasis and was caught by an atheroma in the mid-SFA. The patient was fully heparinized during the initial procedure and was on dual antiplatelet therapy for 6 months, which might prevent acute thrombosis or clinically significant stenosis on follow-up. The vascular interventionist should be aware of possible late complications related to VCD.

Conclusions

In this case, the Celt ACD embolized to the SFA, where it was deeply embedded in the artery wall, impeding an endovascular retrieval attempt using a snare. A forceful pull on the snare would have extensively damaged the artery. Therefore, an endovascular stent was deployed, which led to the successful revascularization and exclusion of the device from the lumen.

The existing literature recommends an endovascular approach when attempting to retrieve an embolized VCD immediately after its deployment. However, there is a paucity of evidence on the management of chronically embolized VCDs when they are discovered months or years after their deployment, as they become incorporated into a vessel wall. This case demonstrates the risk of dislodgement of the VCD and its distal embolization with the risk of ischemia. Endovascular retrieval may be unsuccessful for chronically embolized VCD. Therefore, stent angioplasty is an acceptable option.

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