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Case Report

Perivascular radiolucent line during recanalization of superficial femoral artery ☆,☆☆,★

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ABSTRACT

During the recanalization of chronic total occlusions in the superficial femoral artery, severe calcification adds technical difficulty in guidewire crossing due to poor ultrasound visualization and uncontrollable guidewire manipulation. Herein, we present the case of a 70-year-old man with chronic total occlusion of the superficial femoral artery to report the *"perivascular radiolucent line"* indicating aspirated air in the subintimal space, which could be noted after a failed subintimal angioplasty. The *perivascular radiolucent line* helped a safe guidewire tail crossing by making the vascular wall visible. Physicians should be aware of the perivascular radiolucent line in case of failed subintimal angioplasty.

Introduction

Although multiple antegrade techniques and devices have been developed to cross chronic total occlusion (CTO) lesions of the superficial femoral artery (SFA), the failure rate has remained approximately 20% [1,2]. Especially, severe calcification adds the technical difficulty in crossing the CTO due to poor ultrasound visualization and uncontrollable guidewire manipulation.

Retrograde approaches such as distal SFA, transpopliteal, and pedal arteries are the most commonly used alternative method to recanalize CTOs of the SFA when antegrade methods have failed [3]. However, the use of a retrograde technique requires another arterial puncture and may increase the risk of access-site complications. Furthermore, the use of transcollateral approach requires adequate collateral size and increases the potential risk of perforation and bleeding [4].

As a last resort of an antegrade approach, an attempt using a 0.035-in. sharpened and angled guidewire tail (Fig. 1) can make it possible to cross even hard plaque lesion, owing to pushability and torquability. However, under poor visualization of duplex in severe calcified lesions, the technique is unsafe and may result in associated complications, such as vas-

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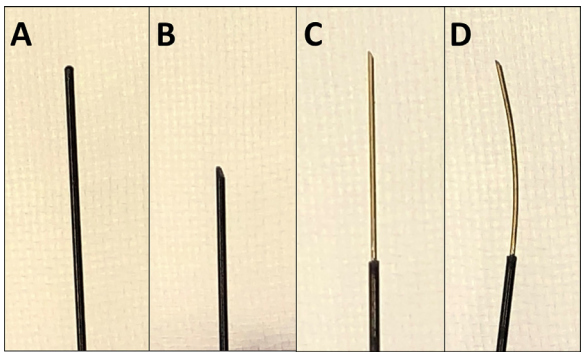

Fig. 1 – (A) The tail of the 0.035-in. guidewire. (B) The sharpened tail of the guidewire that was cut. (C) The sharpened tail of the guidewire that was cut and uncoated. (D) The sharpened tail of the guidewire that was cut, uncoated, and angled.

cular injury due to incident vascular wall penetration.

Herein, we present a sample case to illustrate the "perivascular lucent line," indicating aspirated air in the subintimal space of the SFA, a helpful sign for safe guidewire tail crossing by making vascular wall visible.

Case report

A 70-year-old man was referred to our hospital due to intermittent claudication of Rutherford category 3 in the right leg. He was a past smoker with additional risk factors for atherosclerosis, such as arterial hypertension and dyslipidemia. He had a pain-free walking distance of <500 m, with an ankle brachial index (ABI) of 0.69 on the right side. A duplex examination and angiography revealed an occluded right SFA with severe calcification from the origin of the artery to the distal end. The total length of the diseased segment was 280 mm (Fig. 2A).

The procedure was started with the antegrade approach from the right common femoral artery using a 6-Fr sheath. We intended to cross the lesion under biplane fluoroscopic guidance relying on the spotty calcification due to poor ultrasound visualization. A 100-g tip-load, 0.014-in. guidewire failed to penetrate the proximal hard cap of the lesion. An attempt to cross the lesion using a 0.035-in. sharpened and angled guidewire tail (Radifocus; Terumo, Tokyo, Japan) was also interrupted due to pain associated with vessel wall penetration. Then, a 0.035-in., 1.5-mm J-shaped stiff guidewire (Radifocus; Terumo) was repeatedly retracted and advanced with forward pressure to perform subintimal recanalization. However, the subintimal space was enlarged, and the guidewire and catheter in the subintimal space at the mid-SFA could not be advanced any further. In the process, "*perivascular radiolucent lines* (PRL)" along the SFA, was observed, indicating aspirated air drawn into the subintimal space (Fig. 2B). Therefore, we opted to perform guidewire tail crossing again based on the radiolucent lines indicating the vessel wall. PRL enabled advancement of the sharpened guidewire tail without vessel wall penetration (Fig. 2C). After crossing the lesion, recanalization was successfully performed using 2 interwoven stents without vascular injury or air embolism (Fig. 2D).

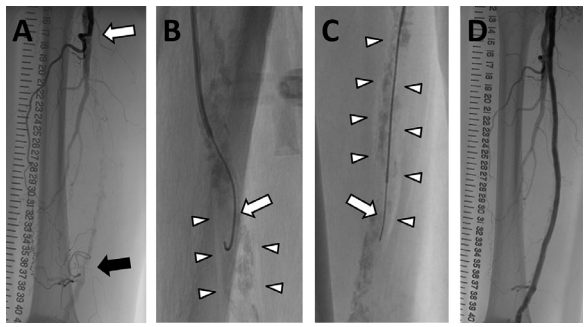

Fig. 2 – (A) Unsubtracted angiogram of the right common femoral artery demonstrating extensive heavily calcified chronic total obstruction of the superficial femoral artery beginning at the proximal segment (arrow) and reconstituting at the adductor canal (black arrow). (B) Fluoroscopic image of the perivascular radiolucent line (arrowhead) representing air drawn into the subintimal space (Arrow: 1.5-mm J-shaped guidewire). (C) Fluoroscopic image of the perivascular radiolucent line (arrowhead) during a crossing intramural space using the sharpened tail of the guidewire that was cut, uncoated, and angled (arrow: sharpened tail of the wire). (D) Unsubtracted angiogram of the right common femoral artery following the recanalization using interwoven stent.

The patient was free of any ischemic pain while walking with an ABI of 1.04 on the right side at the 3-month follow-up.

Discussion

In this report, we found 2 important clinical issues: PRL indicating vascular wall was noted after a failed subintimal angioplasty for SFA CTO lesion and helped in an attempt using a guidewire tail to cross the lesion without vessel penetration.

First, PRL can make a distinct visualization of the vessel wall possible. Since Cluley et al. [5] first introduced an echo-guided angioplasty, the echo-guided technique contributed to a successful recanalization in noncalcified CTO lesions. However, due to poor ultrasound visualization in severely calcified lesions, the guidewire and vessel wall position is invisible. Spotty calcification under fluoroscopy cannot be used to sufficiently understand the vessel wall borderline, which can lead to a potential risk of guidewire tail-induced penetration. The enlarged space during the subintimal approach using the knuckle wire technique acts as a vacuum causing PRL, indicating air drawn into the subintimal space. PRL allows the vessel wall itself to be delineated by air.

Second, PRL made the guidewire tail crossing safety without wall penetration. Although an application of a guidewire tail for the treatment of severely calcified CTO has been less described, except by Kawarada et al. [6], corresponding with techniques has been used in the real world to measure the last

resort of endovascular treatment. In our strategy, an attempt using a 0.035-in. guidewire tail can be considered in cases of failed guidewire passage with intraluminal approach or with subintimal approach due to the underlying severely calcified occlusion. The technique using a 0.035-in. guidewire tail provides sufficient wire handling with pushability and torquability. However, the technique is used off-label, unsafe, and can potentially increase vascular-penetrating complications, particularly in the patient who already underwent anticoagulated. Nonetheless, the concern remains even in the retrograde approach with added distal puncture or the transcollateral approach. With vascular wall visualization using PRL, guidewire tail crossing can be safely performed without wall penetration.

In the present case, any complication including air embolism did not occur. The air that made up PRL remained during the guidewire tail crossing and seemed to diffuse by balloon dilatation and vessel recanalization. Although the presence of air or contrast agent aspirated into the subintimal space can be detected during the subintimal angioplasty, the degree and extent of PRL will depend on the chance and uncontrollable. To perform PRL by the intentional injection of air or CO_2 into the subintimal space should not be allowed due to potential risk of embolism.

In conclusion, PRL indicating vascular wall can be noted after a failed subintimal angioplasty of SFA CTO lesion and was helpful for safe guidewire tail crossing. Physicians should be aware of the perivascular radiolucent line in case of failed subintimal angioplasty.

Patient consent statement

Written informed consent was obtained from the patient for publication.

Ethical approval

This article does not contain any studies with human participants or animals performed by any of the authors. IRB approval for this type of study is not required.

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