

# Penetration of Calcified Lesions in Chronic Total Occlusion Using a Brockenbrough Needle

Yusuke MIYASHITA

*Department of Cardiovascular Medicine and Advanced Cardiovascular Center,  
Shinshu University Graduate School of Medicine*

Endovascular treatment of calcified and occluded lesions remains a challenge. Dense calcifications in occlusive lesions hinder the advancement of guidewires, angioplasty balloon catheters, and stenting. We present a technique of piercing calcifications in a patient with chronic total occlusion (CTO) of the superficial femoral artery (SFA) using a Brockenbrough needle. The case was a 79-year-old man with resting pain in the left leg for a month. The ankle-brachial index in his left lower limb was 0.45. Duplex scanning and angiography revealed complete occlusion of the proximal left SFA. Endovascular treatment for the recanalization of the SFA-CTO was carried out using the bidirectional approach. Only the coronary CTO wire was able to cross the lesion, with the balloon catheters failing to cross. To widen the crossing site, a Brockenbrough needle was applied to penetrate the lesion. The needle successfully passed the lesion, and balloon passage was possible. Following predilatation, we deployed two Nitinol self-expandable stents. We confirmed the patency of this lesion with duplex sonography and angiogram 18 months later. *Shinshu Med J 59 : 97–102, 2011*

(Received for publication November 19, 2010 ; accepted in revised form January 17, 2011)

---

**Key words :** angioplasty, chronic total occlusion, claudication, peripheral arterial disease

---

## I Introduction

Patients with peripheral arterial disease suffer substantial functional disability through claudication, rest pain, or tissue loss. Exercise, rehabilitation, drug therapy, and percutaneous or surgical revascularization are the current therapeutic options for these symptomatic peripheral arterial disease patients.

With continuing advances in imaging techniques, angioplasty equipment, and endovascular expertise, the management of patients with superficial femoral artery (SFA) occlusive disease has dramatically changed. In recent years angioplasty has come to be considered the primary treatment strategy for SFA

occlusive disease. However, heavily calcified and occluded SFA disease remains a challenge for the endovascular approach. Advancement of the guidewire, balloon catheters, or stent delivery system are extremely difficult in densely calcified SFA chronic total occlusion (CTO). Even after successful wire passage, the balloon catheter or stent may not cross the lesions. We applied a technique of piercing calcifications in a patient with CTO of the SFA using a Brockenbrough needle after wire passage.

## II Case

A 79-year-old man with hypertension, hyperlipidemia, and coronary artery disease presented with complaints of resting pain in the left leg for one month. The ankle-brachial index of his left lower limb was 0.45. Even after 200 mg/day of Cilostazol was given, the pain in the limb was not alleviated. Duplex scanning and angiography of the lower extremity showed the complete occlusion

---

Corresponding author : Yusuke Miyashita  
Department of Cardiovascular Medicine and Advanced Cardiovascular Center, Shinshu University Graduate School of Medicine, 3-1-1, Asahi, Matsumoto-city, Nagano-prefecture, 390-8621, Japan

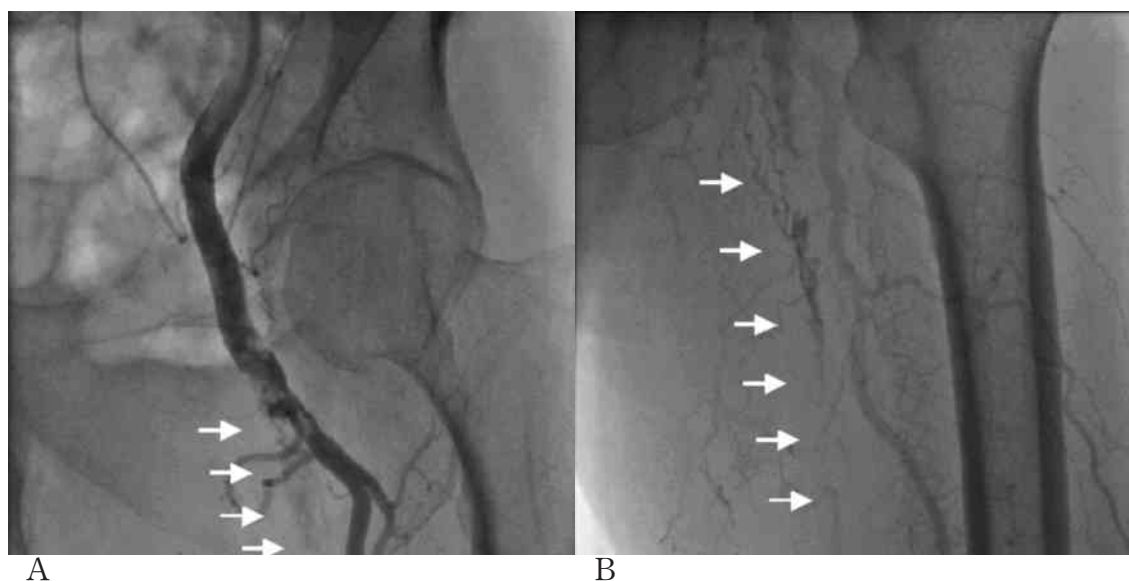


Fig.1 Control angiogram

A : Severe calcification of the superficial femoral artery is seen.

White arrows indicate the occluded SFA which was not visualized with contrast. The ostium of the SFA was completely occluded with dense calcium.

B : The white arrows indicate the occluded superficial femoral artery.

The occlusion continued to the middle SFA. Only the deposition of calcium indicated the existence of the SFA.

of the proximal left SFA (Fig. 1). Considering the heavily calcified CTO in the SFA, endovascular treatment was carried out by using the bidirectional approach. The retrograde approach was performed via the left popliteal artery. The patient was placed in the prone position, and a 4-Fr sheath was inserted into the left popliteal artery under duplex ultrasonographic guidance. The patient was then turned over and placed in the supine position. The antegrade approach was performed with a 6-Fr 45-cm Ansel-1 sheath (Cook Medical, Indiana, USA) placed in the left external iliac artery via the right femoral artery.

A 4-Fr JR 4.0 diagnostic multipurpose catheter (Medikit, Tokyo, Japan) was inserted in order to achieve stronger back-up support with a guidewire through the 6-Fr Ansel-1 right femoral sheath. A 4-Fr multipurpose catheter was inserted from the left popliteal sheath. A 0.014-inch guidewire and a 0.018-inch guidewire were advanced into the SFA to cross the SFA-CTO in a retrograde manner. These two wires failed to pass through the occluded segment. After the failure to pass the wire via the retrograde approach, the two guidewires were

applied into the SFA in an antegrade manner. These wires also failed to cross the occluded SFA. We placed a 0.014-inch antegrade wire as a landmark for the proximal true lumen and a 0.018-inch antegrade wire as a landmark for the proximal false lumen. A Conquest pro 8-20 wire (ASAHI INTECC, Nagoya, Japan) was used to try to penetrate the lesion and successfully crossed the occluded left SFA in a retrograde fashion (Fig. 2).

This extra stiff wire was subsequently drawn out into the right femoral sheath by a gooseneck snare (EV3, Minnesota, USA). Bijou 2.0-20 (Boston Scientific, Massachusetts, USA), Savvy 2.0-20 (Cordis, New Jersey, USA) balloon, and Marverick-2 1.5-15 (Boston Scientific, Massachusetts, USA) were used to try to cross the occluded SFA. However, these too failed to pass the occlusion when inserted in both the antegrade and retrograde fashions. After confirming the position of the 0.014 crossed guidewire in the true lumen of the left SFA by duplex ultrasonography, a Brockenbrough needle was advanced through the left popliteal sheath. This Brockenbrough needle successfully pierced and recanalized the occluded SFA (Fig. 3). After cross-

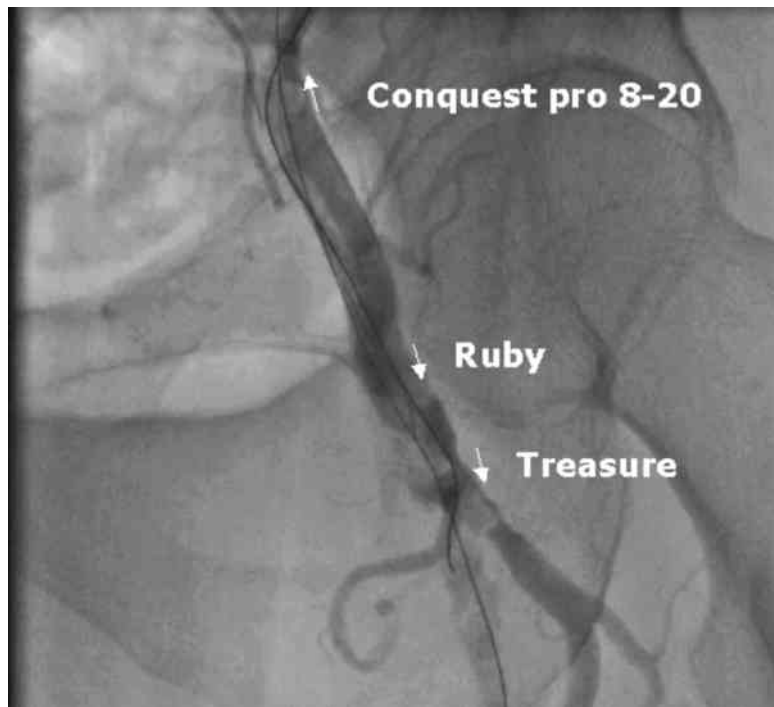


Fig.2 Bidirectional multi-wire manipulation

A 0.014-inch guidewire (Ruby) which could not penetrate the occluded lesion in an antegrade manner was retained as a landmark for the proximal true lumen. A 0.018-inch guidewire (Treasure) which went into the dissected lumen in an antegrade manner was retained as a landmark for the proximal dissected lumen. By using these landmarks, the Conquest pro 8-20 guidewire could penetrate the occluded lesion in a retrograde manner through the popliteal sheath.

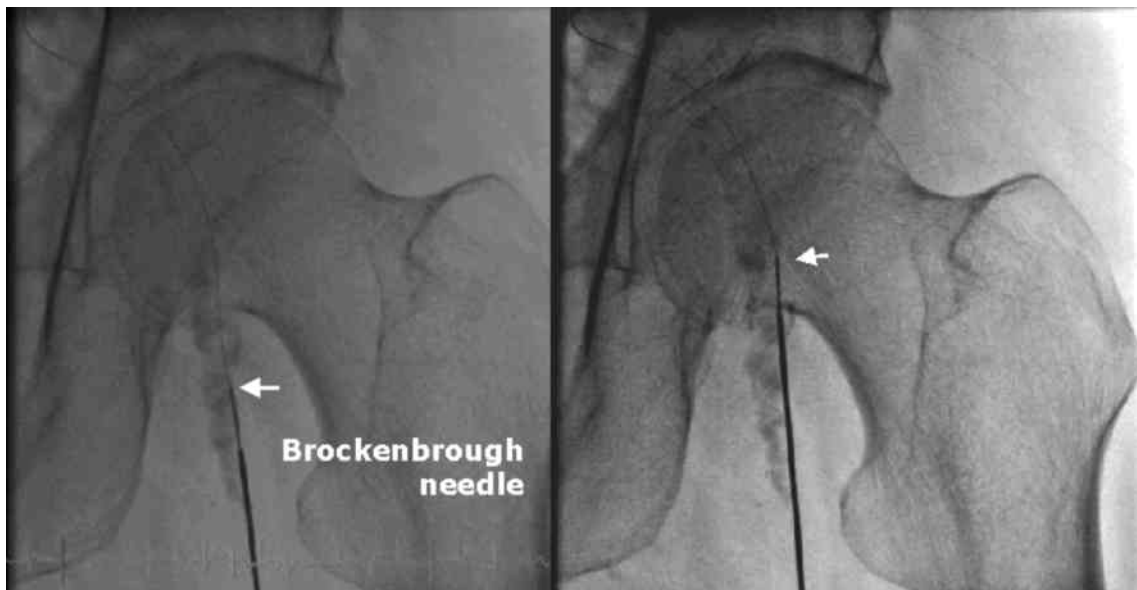


Fig.3 Penetration of the occluded lesion with a Brockenbrough needle through the 0.014 inch wire  
A white arrow indicates the tip of the Brockenbrough needle. The Brockenbrough needle was advanced from the distal to proximal SFA via the popliteal artery.



Fig. 4 Final angiogram

ing the left SFA with a Brockenbrough needle, a Savvy 2.0-20 balloon easily crossed the lesion in a retrograde fashion and successfully dilated the lesion. After the replacement from the 4-Fr popliteal sheath to a 6-Fr popliteal sheath, two SMART stents (7.0-80 mm and 8.0-80 mm) (Cordis) were implanted into the SFA. Postdilatation was performed by a Synergy 5.0-40 balloon (Boston) to dilate the calcified SFA lesion, with a final pressure up to 24 atm (Fig. 4).

Following the successful stent placement in the SFA-CTO, the patient was free from rest pain and claudication. The ankle-brachial index of his left limb was 1.05 at 18 months after treatment. Follow-up angiography revealed a minor stent fracture without significant stenosis (Fig. 5).

### III Discussion

In this case, we applied a Brockenbrough needle to penetrate a dense calcification in an occluded SFA. This is the first case presentation of the use of a Brockenbrough needle to penetrate an occluded SFA.

To cross the CTO, we needed a triple wire

approach. This strategy is based on the coronary CTO technique<sup>1)</sup>. Recently, wires and balloon catheters have been improved and developed with the same technologies as the coronary devices. Thus we could attempt to treat CTO of the SFA using the same approach as in the case of coronary arterial occlusion. Using these guidewires, the chance of true lumen penetration of the chronic occlusion may increase. In a severely calcified occlusion, however, situations in which no balloon catheters can pass the occlusion even after successful wire passage are likely to increase, as in our case.

Rotablator is a very effective tool to treat arterial stenosis and occlusion due to calcification<sup>2)</sup>. However, to apply the Rotablator, Rota wire has to be inserted. In order to replace Rota wire, the microcatheter or over-the-wire balloon must be passed through the occlusion. In our case, it was not possible to pass the microcatheter and the over-the-wire balloon catheter. Therefore, the Rotablator in this case was not practical.

Laser atherectomy may be another option in this kind of case<sup>3)4)</sup>. However, the effectiveness and the safety of laser atherectomy in the treatment of

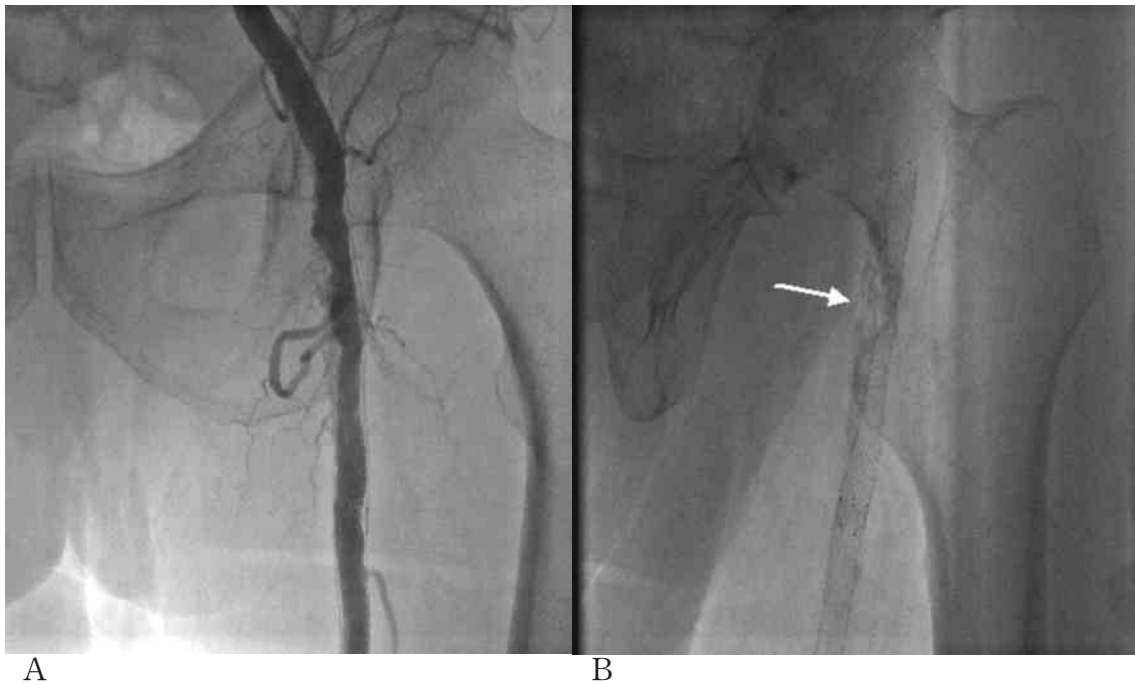


Fig. 5 Follow-up angiogram at 18 months after the procedure

A : No significant in-stent restenosis is present.

B : A type-1 fracture of the stent is seen at the proximal end of the lesion (white arrow).

calcified lesions has not yet been clarified ; moreover, the technique is not available in most countries.

The Brockenbrough needle is simple, and commonly used. We tried to penetrate the true lumen of this occluded SFA. From the retrograde approach, even after the wire successfully passed the lesion, balloon catheters could not cross the calcified occluded lesion. However, a Brockenbrough needle, which was inserted from the retrograde route through the popliteal artery, easily passed the lesion. The use of the Brockenbrough needle may be accompanied by the risk of perforation. However, the SFA is ideal for using the Brockenbrough needle via the popliteal artery because the SFA is a straight vessel. Moreover, we confirmed the position of the wire using duplex ultrasonography, and therefore the risk of perforation in this case was extremely low. The needle only followed the wire which was assumed to be in the true lumen.

Treatment of a bent SFA-CTO with Brockenbrough penetration may be dangerous, as the risks of perforation may be higher, especially without confirmation of the wire position. Duplex ultrasonography or intravascular ultrasonography are needed for confirmation of the wire position before Brockenbrough penetration.

Sub-intimal angioplasty<sup>5)</sup> is a well-known strategy for the treatment of SFA-CTO. However, even if we had applied sub-intimal angioplasty in this densely calcified lesion, the Nitinol self-expandable stent might not have expanded and might have recoiled because of the presence of dense calcifications even after successful balloon dilatation.

We introduced the successful use of a Brockenbrough needle to penetrate an occlusion with dense calcium in this paper. This method may be one of the options for treating a densely calcified SFO-CTO.

**References**

- 1) Saito S : Different strategies of retrograde approach in coronary angioplasty for chronic total occlusion. *Catheter Cardiovasc Interv* 71 : 8-19, 2008
- 2) Dorros G, Iyer S, Zaitoun R, Lewin R, Cooley R, Olson K : Acute angiographic and clinical outcome of high speed percutaneous rotational atherectomy (Rotablator). *Catheter Cardiovasc Diagn* 22 : 157-166, 1991
- 3) Rastan A, Sixt S, Schwarzwald U, Kerker W, Burgelin K, Frank U, Noory E, Gremmelmeier D, Branzan D, Hauswald K, Brantrier R, Schwarz T, Zeller T : Initial experience with directed laser atherectomy using the CLiRpath photoablation atherectomy system and bias sheath in superficial femoral artery lesions. *J Endovasc Ther* 14 : 365-373, 2007
- 4) Biamino G : The excimer laser : science fiction fantasy or practical tool ? *J Endovasc Ther* 11 : II 207-222, 2004
- 5) Bolia A, Miles KA, Brennan J, Bell PR : Percutaneous transluminal angioplasty of occlusions of the femoral and popliteal arteries by subintimal dissection. *Cardiovasc Intervent Radiol* 13 : 357-363, 1990

(2010. 11. 19 received ; 2011. 1. 17 accepted)

---