Heavily calcified chronic total occlusion of common iliac artery successfully treated with Tornus microcatheter and rotational atherectomy

Masahiko Hara, MD, Masami Nishino, MD, PhD, Ken Matsuoka, MD, and Yoshio Yamada, MD, PhD,
Sakai, Osaka, Japan

A 58-year-old man who required long-term hemodialysis was referred to our institution for the management of life-limiting intermittent claudication of the right lower extremity. The diagnostic arteriography demonstrated heavily calcified chronic total occlusion in the right common iliac artery. The lesion was successfully treated with the combination of a Tornus microcatheter (Asahi Intecc, Aichi, Japan) and rotational atherectomy. We describe in this article a niche application of the Tornus microcatheter and the effect of the combination technique of it with rotational atherectomy in peripheral interventions. (J Vasc Surg 2008;48:758-60.)

There are still some cases of failure to recanalize chronic total occlusion (CTO) during peripheral interventions, despite the use of newly available devices.1 One of the causes of failure is the inability to cross the lesion with a balloon angioplasty catheter. The use of the Tornus microcatheter (Asahi Intecc, Aichi, Japan) to overcome this limitation has recently been approved by the United States Food and Drug Administration (Fig 1).2 We describe a patient with a heavily calcified CTO of the common iliac artery (CIA) that could not be crossed with a 1.5-mm balloon angioplasty catheter but was successfully treated by combination of a Tornus microcatheter and rotational atherectomy.

TECHNICAL NOTE

A 58-year-old man, who required long-term hemodialysis and had a history of stent implantation in the left CIA, was referred to our institution for the management of life-limiting Fontaine class III intermittent claudication of the right lower extremity. The ankle-brachial index showed low values of 0.67 in the right leg, and diagnostic arteriography demonstrated a heavily calcified CTO in the right CIA. After a cardiovascular interventionist and vascular surgeon provided a detailed explanation of all therapeutic choices, he decided to undergo endovascular interventions.

Initially, we inserted a 4F sheath in the left common femoral artery from which we advanced a 4.2F pigtail catheter (Goodman, Aichi, Japan) into the terminal portion of the aorta for contrast medium injection during the intervention (Fig 2, a). Then, the retrograde right common femoral approach was performed with a 6F sheath. We could cross the lesion with an 0.018-inch Astato guidewire (Asahi Intecc; Fig 2, b), using a 4.2F internal mammary artery catheter (Goodman, Aichi, Japan) for guidance and a 2.4F Progreat microcatheter (Terumo, Tokyo, Japan) for additional backup force. However, neither the Progreat microcatheter nor the 2.0- × 20-mm Savvy balloon catheter (Cordis, Warren, NJ) was able to cross the lesion. The lesion was also resistant to crossing with a 1.5- × 6-mm over-the-wire Sprinter coronary balloon catheter (Medtronic, Minneapolis, Minn), even though a “buddy wire” technique3 was attempted using a 0.014-inch ATHLETE RUBY guidewire (Japan Lifeline, Tokyo, Japan). We therefore removed the 0.018-inch guidewire and the 1.5- × 6-mm coronary balloon catheter. A 2.1F Tornus penetration microcatheter was advanced into the vessel by rotating the device counterclockwise, using the 0.014-inch guide- wire, and we were finally able to cross the lesion (Fig 2, c).

Because the attempt to advance a 1.5- × 6-mm coronary balloon catheter after removing the Tornus microcatheter was unsuccessful, we recrossed the lesion with the Tornus microcatheter to exchange the guidewire to RotaWire floppy (Boston Scientific, Natick, Mass), which is compatible with Rotablator (Boston Scientific), because of its stiffness. Rotational atherectomy and balloon angioplasty were performed using a 1.75-mm Rotablator (Fig 2, d), a 6.0- × 20-mm Savvy balloon catheter (Boston Scientific), and a 7.0- × 20-mm Opta Pro compliant balloon (Cordis).

According to quantitative assessments using intravascular ultrasound (IVUS; Volcano, Rancho Cordova, Calif; Fig 3, a and b), we implanted a 7.0- × 57-mm Express balloon-expandable nitinol stent (Boston Scientific). Because IVUS identified stent under-expansion, we used a 9.0- × 20-mm balloon at a pressure of 8 atm as a postdilatation technique. The pressure gradient across the lesion became 10 mm Hg, and final IVUS demonstrated round symmetrical expansion of the stent and sufficient aortic lumen, with a minimum stent diameter of 7 mm (Fig 3, c and d). Final arteriography showed satisfactory morphologic results (Fig 2, c). The ankle-brachial index increased from 0.67 to 1.06 in the right extremity and was main-
tained at a 3-month follow-up examination. The patient was free of symptoms during this period.

DISCUSSION

Patients undergoing treatment for symptomatic peripheral arterial disease may often present with CTO, and there are still some cases of failure to recanalize the lesion, despite advances in technology. Diffuse severe calcification, which may often be present in patients receiving long-term hemodialysis, may be one of causes of procedural failure after successful guidewire passage, although it is rare. These limitations, which are common in percutaneous coronary intervention (PCI), have led to the development of new devices. The Tornus microcatheter and rotational atherectomy device are among these new technologies.

The Tornus microcatheter is made of eight pieces of stainless steel wire rope in a spiral structure that provides high penetration power through its screwing effect. Because the Tornus microcatheter gaps the lesions after passing through it, this device may facilitate subsequent balloon catheter crossing. It is also designed for device-associated guidewire exchanges for rotational atherectomy, as in this patient, and has been shown to be effective in the treatment of CTO during PCI.

The development concept of the Tornus microcatheter is totally different from the development concept of true-lumen re-entry devices such as the OutBack LTD (Cordis) and Pioneer (Medtronic, Santa Rosa, Calif). However, the Tornus microcatheter may have the potential to facilitate true-lumen re-entry from the subintimal space by supporting the guidewire. Besides, it is assumed to be safe in clinical use because it is designed to self-destruct at the proximal part of the shaft to avoid vessel injuries if excessive rotational force is applied. The limitation is that the handling time should be limited because the wire lumen of this catheter is always exposed to the blood due to clearance gaps between each single wire, which may lead to thrombus formation in the catheter and may result in restriction of the wire movement. A larger-profile 2.6F Tornus 88 Flex is also available.
Although no studies have been published about the Tornus microcatheter and only a few about rotational atherectomy in peripheral interventions, these devices are useful for heavily calcified CTOs in PCI. Microembolization in rotational atherectomy usage can occasionally be seen in an elevation of creatinine kinase during PCI; however, because the peripheral arterial bed is much larger than the coronary bed and most particulate debris is enough small to avoid distal embolization in theory, we speculated that we could use this device without too much trouble even though its usage is off-label.

In the present case, we finally succeeded in recanalizing a heavily calcified CTO using a combination of the Tornus microcatheter and rotational atherectomy. IVUS has also contributed to the interventional success. In our experiences, the ideal stent diameter in heavily calcified lesions for both sufficient recanalization and prevention of complications may be 70% to 80% of the length of the reference diameter measured by IVUS. We also treated the lesion by inflating a balloon carefully and gradually. If the balloon inflation causes pain, a suboptimal result should be accepted because it may imply an overexpansion of the artery and may be a sign of rupture. Stent grafts should be available for the management of rupture or perforation. Laser atherectomy also may be useful to facilitate crossing of CTOs even though its effectiveness for the treatment of highly calcified lesions is still unknown.

CONCLUSION

We have reported a heavily calcified CTO of the CIA that was successfully treated by a combination of a Tornus microcatheter and rotational atherectomy. We believe that this combination technique may be useful and effective for heavily calcified CTO lesions during peripheral interventions. Further studies are needed to confirm our conclusions.

REFERENCES


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