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Successful Endovascular Isolation of a Huge True Anterior Tibial Artery Aneurysm by the Bi-directional Approach in a Young Patient

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ABSTRACT:

Anterior tibial artery aneurysms (ATAAs) are relatively rare entities. Most ATAAAs are pseudoaneurysms resulting from trauma, infection, or iatrogenic injury. We observed a 33-year-old woman with a huge true ATAA who did not have any potential cause of pseudoaneurysm or risk factors for atherosclerosis or connective tissue disorder. Endovascular isolation by the bi-directional approach was successfully performed, and the ATAA was totally excluded from the afferent blood flow. Distal flow of the anterior tibial artery was preserved, and pulsation of the dorsal pedis artery was also well preserved. Her postoperative course was uneventful, and follow-up ultrasonography and magnetic resonance imaging revealed the ATAA shrinkage.
INTRODUCTION

Most anterior tibial artery aneurysms (ATAA s) are pseudoaneurysms resulting from trauma, infection, or iatrogenic injury. We describe a minimally invasively treated case of an ATAA in a young woman who had no such causes of pseudoaneurysm. A written informed consent for publication of the case details was obtained from the patient.

CASES REPORT

A 33-year-old woman without a history of smoking was admitted to our hospital due to a pulsatile mass on her right lower leg. She noted that the mass had been present for 2 years, and her clinical examination revealed pulsatile swelling with no sensory, motor, or circulatory deficits and no pain or skin color change around the swelling (Fig. 1). She did not have any leg symptoms such as claudication or compression. She had a past medical history of patent ductus arteriosus, and no history of trauma or surgery of the leg. She also had no history of infection. Ultrasonography revealed a clear boundary and a low echoic mass, measuring 39.3 mm in width and 62.5 mm in length (Fig. 2A, B), in the
right tibialis anterior muscle with arterial blood flow. Enhanced computed tomography (CT) and magnetic resonance imaging (MRI) revealed an ATAA with mural thrombus (Fig. 2C, D). The pedal arch was also shown in MRI (Fig. 2E).

On the day of admission, her blood pressure was 119/76 mmHg; pulse rate was 85 bpm; and her temperature was 36.8\(^\circ\)C. Her right leg was not swollen or reddish, and a pulsatile mass was palpable on the anterior tibial muscle. Her laboratory data, including C-reactive protein, erythrocyte sedimentation, rheumatoid factor, and anti-nuclear antibody, revealed no specific findings. She also did not have any skin diseases or other symptoms.

She underwent endovascular isolation of the ATAA using transcatheter coil embolization. With the patient under local anesthesia, an antegrade transfemoral 6.5 Fr. guiding catheter was advanced (Medikit, Tokyo, Japan). An initial angiogram revealed the ATAA and trickle flow distal to the aneurysm (Fig. 3A). The posterior tibial artery and peroneal arterial flow were normal down to the ankle, and the pedal arch and digital arteries were clearly observed. An antegrade 0.014” guidewire
Gladius, ASAHI INTECC, Aichi, Japan) could not be led distal to the ATAA due to the large aneurysm cavity and tortuosity; therefore, the dorsal pedis artery was retrogradely punctured and an 18 gauge intravenous cannula was advanced with a hemostasis valve (HAEMOSTATIC VALVE II, TERUMO, Tokyo, Japan). The guidewire and microcatheter (Excelsior 1018, Stryker, Tokyo, Japan) were led to the ATAA (Fig. 3B); two detachable coils (6 mm × 20 cm, 5 mm × 20 cm; Target XL, Stryker, Tokyo, Japan) were placed on the distal anterior tibial artery (ATA) to the ATAA, and four coils (two pieces, 6 mm × 20 cm, one piece, 5 mm × 20 cm, one piece, 3 mm × 9 cm; Target XL, Stryker, Tokyo, Japan)) were placed on the proximal ATA to the ATAA (Fig. 3C). After endovascular isolation, the ATAA was totally excluded from the afferent blood flow (Fig. 3D). The distal flow of the ATA was preserved through the retrograde flow (Fig. 3E). Mass pulsation was promptly resolved.

Her postoperative course was uneventful, and she was discharged on postoperative day 1. No sensory or motor dysfunction was observed. There was a palpable pulse in the right dorsal pedis artery. Six months after the operation, ultrasonography and MRI revealed aneurysm
shrinkage (Fig. 4A), regardless of a little delayed flow in the aneurysm from collaterals (Fig. 4B).

**DISCUSSION**

Most cases of crural artery aneurysmal degeneration result from trauma, iatrogenic injuries, or infection, and the consequence is usually a pseudoaneurysm (1-6). Because of its rarity, the incidence has not been described to date (2, 7). True aneurysms due to atherosclerosis are extremely rare, especially in young patients. Known risk factors for atherosclerosis include smoking, diabetes mellitus, male sex, hypertension, and hyperlipidemia; however, our patient had none of these risk factors. Representative rheumatologic disease related to vasculitis are Bechet or nodular polyarteritis, however, our case did not have stomatitis aphthosa, genital ulcer, and skin disease. She also had no signs of other connective tissue disorder or vasculitis. The etiology in our case still remains unclear.

ATAAs can be asymptomatic or present with swelling, pain, rupture, embolism, thrombosis, bruising, or complications such as tibial
nerve palsy due to compression (4, 5). They can be diagnosed by performing non-invasive ultrasonography, enhanced CT, or MRI, although digital subtraction angiography has been traditionally accepted to be the gold standard (3) (8).

There is no consensus on the treatment indication for crural artery aneurysms; however, symptomatic ones should be treated. Even an asymptomatic aneurysm with thrombus should be treated to avoid distal embolization (2). Surveillance is sufficient for asymptomatic small aneurysms such as those less than three times the normal vessel size without thrombus (2).

Due to the rarity of this aneurysm, various interventions have been reported and there is no consensus about the methodology to treat crural aneurysms (2-4, 6, 7, 9). Open surgical ligation with reconstruction has been reported and is superior at maintaining blood flow to the lower limb (2, 7, 10-12). Simple ligation without reconstruction could also be considered in patients who with enough collateral flow (9). The other instance in which open surgery may be superior is if there are compressive symptoms and the patients may benefit from evacuation of
the mural thrombus in the aneurysm sac. However, open surgery has the potential to cause deep peroneal nerve damage, which could cause severe motor dysfunction.

The endovascular approach does not damage adjacent nerves. The choice of endovascular treatment depends on the size, location, and type of aneurysm. Coil embolization could not preserve direct flow to distal site from the aneurysm. A covered stent could preserve blood flow and exclude the aneurysm at the same time; however, it is not allowed by Japanese health insurance. The other limitation to covered stent is that there are no data to support patency of a covered stent in the tibial artery. Moreover, commercially available covered stent is too large for the tibial artery, and even a small covered coronary stent would be inappropriate in this case, where the aneurysm was over 6cm in length. Based on the same reason simple ligation without reconstruction can be performed, coil embolization would be acceptable for patients with sufficient collateral flow. However, giant aneurysms require several coils for packing, resulting in increased medical expenses.

Endovascular isolation involves the embolization of vessels both
distally and proximally to the aneurysm, leading to occlusion (13, 14). In our case, this technique was performed because of the huge aneurysm size, and there were no remarkable branches from the aneurysm. Eventually, only 6 coils were needed to isolate the aneurysm. The antegrade approach to the distal region of the aneurysm using a controllable microcatheter (LEONIS Mova, Sumitomo Bakelite, Japan) did not help due to the tortuousness; therefore, an additional retrograde approach was performed by dorsal pedis artery puncture. This technique has been well documented to improve the rates of recanalization for peripheral arterial disease (15), which could be easily applied in this case.

In our case, the aneurysm was successfully occluded with the distal flow preserved, and no nerve injury or other complications were experienced. Pathological findings of a resected surgical specimen would have helped understand the etiology; however, our treatment can be beneficial for non-atherosclerotic patients even though periodic surveillance is necessary.

CONCLUSION
This report aimed to emphasize the rare case of a large ATAA and the treatment options. Isolation by the bi-directional approach would be a feasible option in young patients without vascular diseases.

DISCLOSURE

We all have no conflict of interest to declare.
**FIGURE CAPTIONS**

Fig. 1 The arrows show a pulsatile mass on a right tibia (arrows). No skin color change or eruption was noted.

Fig. 2A, B The ultrasonography show the anterior tibial artery aneurysm with a mural thrombus.

Fig. 2C The computed tomography angiogram showing the patent posterior tibial artery and peroneal artery.

Fig. 2D The magnetic resonance imaging showing the anterior tibial artery aneurysm with a mural thrombus.

Fig. 2E The magnetic resonance imaging showing the pedal arch.

Fig. 3A An initial angiogram showing the ATAA, and the patent posterior tibial artery and peroneal artery.
Fig. 3B The retrograde approach was performed by dorsal pedis artery puncture.

Fig. 3C Endovascular isolation was successfully performed by the bi-directional approach.

Fig. 3D The anterior tibial artery aneurysm was completely isolated. The posterior tibial artery and peroneal artery were well preserved.

Fig. 3E The retrograde filling of the distal ATA after the embolization.

Fig. 4A The ultrasonography showing thrombosed and shrinked ATAA.

Fig. 4B The magnetic resonance imaging showing the retrograde flow of the distal ATA and a little flow in the ATAA.
REFERENCES


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