Simultaneous Fenestration with Stent Implantation for Acute Limb Ischemia due to Type B Acute Aortic Dissection Complicated with Both Static and Dynamic Obstructions

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Stanford type B acute aortic dissection is sometimes complicated with compressed true lumen of the descending aorta (Dynamic obstruction) and stenosis of a major aortic branch (Static obstruction), which cause organ malperfusion. In such a case, medical therapy alone is usually not effective and endovascular treatments are required including stent implantation and balloon fenestration. However, it is difficult to determine which strategy should be selected, that is, only stent implantation at dissected branch or simultaneous fenestration with stent implantation. We report a case of a 54-year-old man with lower leg ischemia due to type B aortic dissection, who was successfully treated with stent implantation plus balloon fenestration. This case suggests that balloon fenestration plus stent implantation should be considered when static obstruction in the aortic branches is accompanied by dynamic obstruction in the descending aorta.

Keywords: acute aortic dissection, stent implantation, balloon fenestration, lower leg ischemia

Introduction

Stanford type B acute aortic dissection is sometimes complicated due to compression of the true lumen of the descending aorta (Dynamic obstruction) and stenosis of a major aortic branch (Static obstruction). In such a case, an appropriate treatment strategy has yet to be established. We describe successful treatment of a patient with complication due to static and dynamic obstruction, using simultaneous fenestration and stent implantation.

Case Report

A 54-year-old man with a history of hypertension presented with severe back pain. Physical examination revealed weakness of pulse on the right dorsalis pedis artery. An urgent computed tomography (CT) showed type B aortic dissection, which extended from the distal aortic arch to the bilateral external iliac arteries (EIAs). The true lumen of the descending aorta was narrowed (Fig. 1A). False lumens at the level of the superior mesenteric artery (Fig. 1B and 1C) and right EIA (Fig. 1D) were thrombosed without reentry. The patient was admitted to the intensive care unit, and antihypertensive drugs were administered.
On the third hospital day, pulse deficit was observed on the right femoral artery. CT revealed that the true lumen of right EIA was severely compressed by a thrombosed false lumen. Abdominal aortography did not show true lumen of the right EIA. Stent implantation (LUMINEXX stent: 12 × 100 mm) was performed to expand the true lumen. Subsequently, aortography confirmed recovery of blood flow and ankle-brachial index (ABI) showed 0.80 (right)/1.10 (left).

On the seventh hospital day, ABI decreased (0.56/1.00). CT demonstrated that the implanted stent in the right EIA and true lumen of the right common iliac artery (CIA), which was proximal to the stent, were compressed by a thrombosed false lumen. We implanted an additional stent (LUMINEXX stent: 12 × 10 mm) at the proximal end of the previous stent, and aortography confirmed appropriate blood flow.

On the twelfth hospital day, ABI decreased (0.70/0.89). CT revealed that the true lumen of the descending aorta had become narrower (Fig. 2A–2C), and the implanted stent in the right CIA had collapsed. We suspected that the previous two stent implantations without fenestration had caused compression of the true lumens of bilateral CIAs and the descending aorta. Aortography showed that the entry site of the aortic dissection was just distal to the origin of the left subclavian artery. Two reentry sites were observed; one was above bilateral renal arteries and the other was located at left CIA. Aortography also revealed an intraluminal pressure in the true lumen of 103/57 mmHg and in the false lumen of 119/55 mmHg of the abdominal aorta. This pressure gradient (16 mmHg) supported our hypothesis.

To eliminate the pressure gradient, percutaneous balloon fenestration was performed. A guidewire was inserted via the left femoral artery and passed through the reentry at the left CIA from the true to the false lumen (Fig. 3A). The balloon was expanded to dilate the reentry (Fig. 3B) and a third stent (E-LUMINEXX stent: 12 × 80 mm) was implanted between the true and false lumens to keep the reentry open (Fig. 3C). The pressure gradient between the true lumen (123/60 mmHg) and the false lumen (119/55 mmHg) decreased by 4 mmHg. The blood supply to the bilateral CIAs increased, and the ABI improved (0.76/1.26). Before discharge, intermittent claudication...
Fig. 2  CT confirmed that the true lumen of the descending aorta had narrowed. A: on admission, B: the ninth hospital day, C: the twelfth hospital day

Fig. 3  Balloon fenestration and stent implantation were performed. A: A guide wire was passed through the reentry at the left common iliac artery (CIA) from the true to the false lumen. B: The balloon was expanded and the stent was implanted to dilate the reentry. C: These procedures improved the blood flow to the bilateral CIAs.
disappeared, and ABI improved to 0.90/1.18. Exercise ABI performed four months after discharge also confirmed sufficient blood flow in bilateral lower legs; ABI before and after exercise was 0.98/1.12 and 0.88/1.13, respectively.

**Discussion**

Stanford type B aortic dissection is sometimes complicated with lower leg ischemia. Therapeutic options for lower leg ischemia are surgery and endovascular treatments. Endovascular treatments including stent implantation and balloon fenestration are often considered, because surgical repair such as aortic replacement of the descending aorta is technically challenging with high rates of mortality and paraplegia. When endovascular treatment is selected, the type of true lumen obstruction such as dynamic or static should be considered. In dynamic obstruction, blood flow in the true lumen decreases because of compression by high pressure in the false lumen. Balloon fenestration and/or stent-graft implantation covering the entry site of the aortic dissection is necessary to decrease the intraluminal pressure gradient. However, in static obstruction, blood supply is reduced in the true lumen at the site of the dissected aortic branches, which are compressed by the thrombosed false lumen. This type of obstruction requires stent implantation in the compressed true lumen. In addition, if central repair such as stent-graft implantation at the entry site is not performed to remove dynamic obstruction, it is difficult to determine which strategy should be selected, that is, only stent implantation at dissected branch or simultaneous fenestration with stent implantation.

The present case had both dynamic and static obstruction. Two stents were implanted in the true lumens of the external and common iliac arteries to eliminate static obstruction. However, these procedures could not resolve compression of the true lumens because dynamic obstruction caused higher blood pressure in the false lumens than in the true lumen even after two stent implantations. CT showed that the true lumen of the descending aorta became narrower, suggesting the residual dynamic obstruction had to be removed.

In conclusion, balloon fenestration plus stent implantation should be considered when static obstruction in the aortic branches is accompanied by dynamic obstruction in the descending aorta, in acute aortic dissection. Assessment of blood pressure in the false lumen with angiography helps to optimize endovascular treatments.

**Disclosures**

We have no disclosures to report.

**References**


