Ann Vasc Dis Vol. 16, No. 2; 2023; pp 142–145

Online April 28, 2023
doi: 10.3400/avd.cr.22-00075

Case Report

Preceding Aortic Bare Stenting for Visceral and Limb Malperfusion before Proximal Surgical Repair of Stanford Type A Aortic Dissection

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Mesenteric malperfusion is a fatal complication of acute aortic dissection, which should rapidly be repaired. However, the optimal treatment strategy remains controversial in patients with type A aortic dissection. We report on a case with aortic bare stenting for visceral and lower limb malperfusion prior to the proximal repair. The visceral and limb reperfusion was obtained after aortic bare stenting and proximal repair was successfully performed. This technique can be an alternative option for visceral malperfusion due to type A aortic dissection. However, careful patient selection is required considering the risk of new dissection and rupture.

Keywords: aortic dissection, aortic bare stent, malperfusion

Introduction

Malperfusion is a severe complication of acute aortic dissection and visceral malperfusion including mesenteric malperfusion is sometimes fatal.[1] Since intestinal necrosis and ischemia of the lower extremities can cause an irreversible metabolic acidosis, immediate reperfusion is required to save the life. On the other hand, stroke, cardiac tamponade, and rupture are also critical complications of type A aortic dissection. In the case of complicated type B aortic dissection, superior mesenteric artery (SMA) bypass using the great saphenous vein or stent placement in the SMA is performed.[2,3] Treatments for limb malperfusion include anti-anatomical bypass such as femoral-femoral artery bypass and axillary-femoral artery bypass and stenting at the iliac artery. The aortic fenestration may improve both visceral and limb malperfusion, but the influence of the large entry is unclear in type A aortic dissection.[4,5] In addition, proximal repair is sometimes ineffective for static obstruction, and malperfusion syndrome itself perpetuates an inflammatory cascade stemming from end-organ ischemia that may significantly impair operative success. Therefore, the optimal treatment strategy for the malperfusion remains controversial in patients with type A aortic dissection. We herein report on a case with aortic bare stenting for visceral and lower limb malperfusion prior to the proximal repair of acute type A aortic dissection. Informed consent was obtained from the patient regarding the publication of this case report.

Case Report

A 76-year-old woman visited emergency outpatient with complaint of severe chest and bilateral leg pain. Physical examination revealed the absence of pulses of the bilateral femoral arteries and motor function of lower limbs. By enhanced computed tomography (CT), she was diagnosed with acute Stanford type A aortic dissection and transferred to our institution for emergent surgery. Her blood pressure and heart rate were 150/50 mmHg and 90 beats/min, respectively. Laboratory tests were as follows: white blood cells, 1.39×104/μL; hemoglobin, 13.0 g/dL; platelet count, 13.9×104/μL; fibrinogen/fibrin degradation products D-dimer, 46.4 μg/mL; C-reactive protein, 0.15 mg/dL; creatinine, 0.64 μmol/L; total bilirubin 0.7 mg/dL; aspartate aminotransferase, 19 U/L; alanine aminotransferase, 13 U/L; lactate dehydrogenase, 262 U/L; creatine kinase (CK), 79 U/L; brain natriuretic peptide, 34.9 pg/mL; low density lipoprotein cholesterol, 102 mg/dL; blood sugar, 264 mg/dL; and HbA1c, 6.6%. There was no ischemic change in the electrocardiograms.

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Received: July 13, 2022; Accepted: March 28, 2023
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Enhanced CT showed the intimal flap from the ascending aorta to the bilateral iliac arteries. The true lumen of the aorta was collapsed and the terminal aorta was occluded. In addition, SMA was dissected and a combined static and dynamic stenosis was observed (**Fig. 1**). Emergency surgery was performed under the diagnosis of acute type A aortic dissection with malperfusion syndrome.

We decided to implant the aortic bare stent at the abdominal aorta before the proximal aortic repair to improve blood flow of the visceral organs and lower extremities as soon as possible. The left femoral artery was exposed simultaneously with the full median sternotomy. The 16 Fr sheath was inserted from the left femoral artery and aortic bare stent (36 mm, 164 mm) (Zenith Dissection device, Cook Medical, Bloomington, IN, USA) was deployed at the terminal aorta. The aortogram showed improved blood flow of the SMA and left lower limb; however, blood flow to the right lower extremity was poor. Therefore, the iliac bare stent (12 mm, 60 mm) (SMART, Cordis Corp., Miami Lakes, FL, USA) was implanted at the right common and external iliac artery from the right femoral artery. The time of lower body intervention was

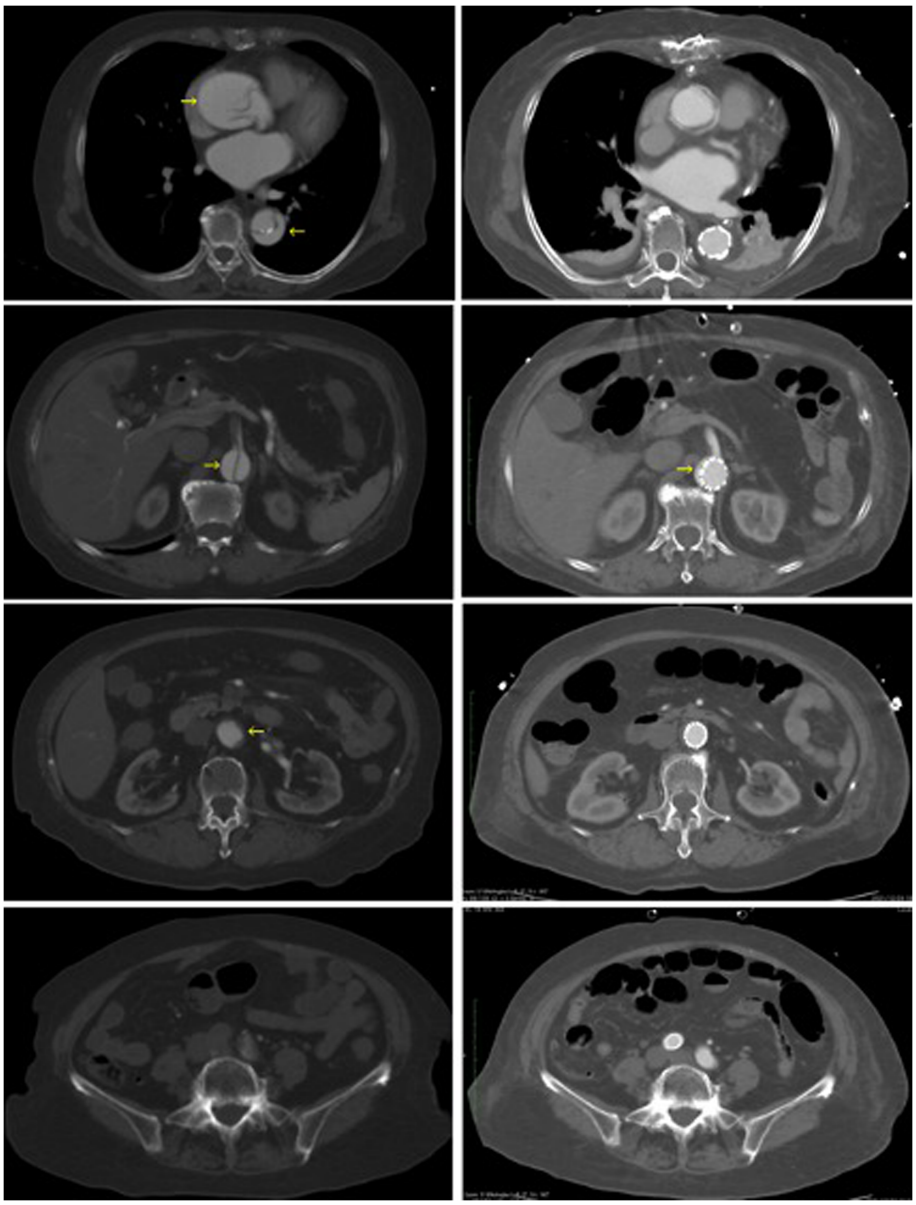

Fig. 1 Left: Preoperative CT shows acute type A aortic dissection with SMA dissection and bilateral limb ischemia because of the true lumen collapse. The arrows point to the false lumen. Right: Postoperative CT shows adequate true lumen expansion. SMA and bilateral iliac arteries were well enhanced.
CT: computed tomography; SMA: superior mesenteric artery

35 min. The aortography showed that blood flow of both lower extremities improved. After the large sheath was removed and replaced with the 20 Fr arterial cannulae, the cardiopulmonary bypass was established. Cooling was initiated with a target nasopharyngeal temperature of 28°C. After the ascending aorta was clamped and transected, the cardiac arrest was obtained by administration of crystalloid cardioplegia from the bilateral orifices of coronary arteries. Proximal aortic reinforcement was performed with Teflon felt. Under circulatory arrest with 28°C, the entry of the ascending aorta was excluded and selective antegrade cerebral perfusion was initiated. The aortic arch was transected between the brachiocephalic and common carotid artery. The open stent (27 mm, 120 mm) (Frozenix, Japan Lifeline, Ichihara, Japan) was inserted from the distal end of the brachiocephalic artery. The left carotid artery and left subclavian artery were reconstructed by the fenestration technique.[6] Distal anastomosis was done with four-branched prosthetic graft (28 mm) (J-graft, Japan Lifeline, Ichihara, Japan), and antegrade systemic perfusion through the rim of the graft was resumed. The brachiocephalic artery and proximal aorta were reconstructed step by step.

Operation, cardiopulmonary bypass, and circulatory arrest time was 257, 120, and 31 min, respectively. The maximum of CK was 1800 U/L and decreased to the 300 U/L on the third postoperative day. Postoperative course was uneventful and she was discharged after 30 days of rehabilitation. The postoperative CT angiogram shows the good perfusion of the lower extremities (**Fig. 2**).

Discussion

Mesenteric malperfusion leads to intestinal necrosis within about 4 h and ischemia of the lower extremities can cause myokidney metabolism syndrome even after reperfusion for more than 3 to 4 h. Therefore, these severe malperfusion should be repaired as soon as possible. Several articles suggested that mesenteric revascularization before aortic repair improved prognosis.[7–9] In this case, the time from onset of the acute aortic dissection was 3.5 h at the admission and motor disorders of the lower limbs were observed. By the aortic bare stent, visceral branches and lower limbs were rapidly reperfused. Aortic bare stent is easily and immediately implanted at the same time of the proximal aortic surgery. In addition, the access site of the aortic bare stent could be used as the cannulation site of the cardiopulmonary bypass.

The mechanisms of malperfusion can be classified into the dynamic and static obstruction.[10] Treatment of the dynamic obstruction is entry closure. Treatment of static or mixed-type obstruction needs direct treatment of the occluded vessel, in addition to the entry closure. In this case, the SMA obstruction was diagnosed mixed type. Therefore, proximal repair may be effective. If the bowel ischemia progressed after surgery, the mortality should be

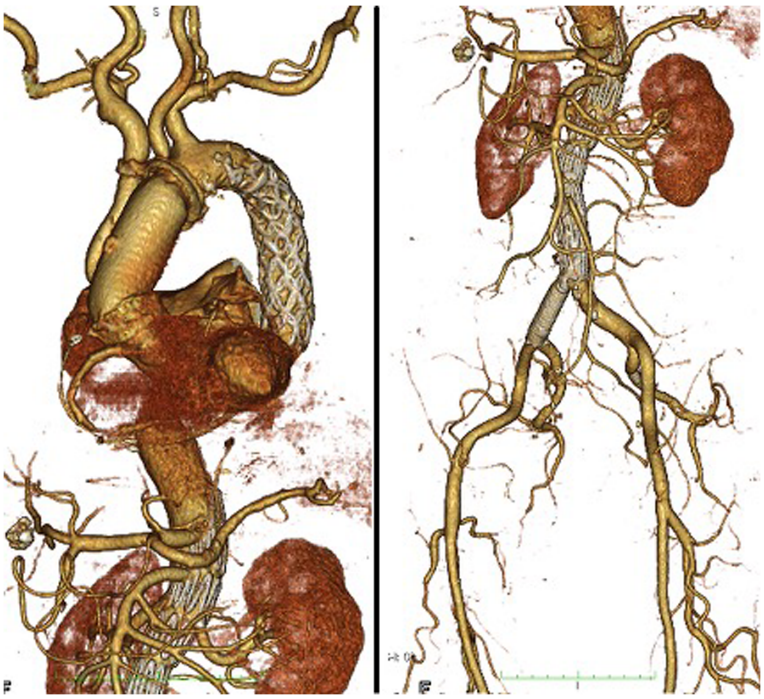

Fig. 2 Postoperative CT shows adequate true lumen expansion. SMA and bilateral iliac arteries were well enhanced.
CT: computed tomography; SMA: superior mesenteric artery

high and preceding aortic bare stenting had a potential to improve outcomes. In the case of isolated static obstruction, SMA stenting may be the first-line option. The diagnosis of intestinal ischemia is sometimes difficult and approximately 20% of patients without ischemia has an abdominal pain and intravascular ultrasound is useful for more accurate diagnosis.[11] However, bowel ischemia is a fatal complication and prompt reperfusion is required to improve the prognosis.[7,12–15] In this case, she had no abdominal symptoms, but the SMA was dissected and stenosed. In cases of lower limb ischemia, the percentage of intestinal ischemia is reported to be high.[14,15] The aortic bare stenting can enlarge the true lumen and have a potential to improve both blood flows. However, the cases with aortic hyperflexion or aneurysmal change cannot be a candidate for this option.

Although the optimal order of the repair remains controversial, the malperfusion of the visceral organs and lower limbs sometimes cannot be improved after the preceding proximal aortic repair. In these cases, multiple organ disorder cannot be prevented. Cardiopulmonary bypass by using bilateral femoral arteries may be effective in improving malperfusion, but cannot sometimes be established due to high pressure of arterial cannula with risk of switching of the lumen. We believe that the present technique is one of the effective options for malperfusion cases. However, risks of new dissection and rupture due to increased proximal false lumen pressure have to be discussed and careful patient selection is required.

Conclusion

Preceding aortic bare stenting technique has a potential to be an alternative option for malperfusion due to acute type A aortic dissection. However, long-term follow-up and prospective studies are required to assess the effectiveness.

Disclosure Statement

All authors declare no conflict of interest or financial disclosure statement.

Author Contributions

Study conception: KK, AH
Data collection: KK
Manuscript preparation: KK, AH
Critical review and revision: all authors
Final approval of the article: all authors
Accountability for all aspects of the work: all authors

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