

Provisional extension to induce complete attachment of an endovascular repair for acute type A aortic dissection with visceral malperfusion



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PETTICOAT for visceral malperfusion before proximal repair for type A aortic dissection.

CENTRAL MESSAGE

We used the first-line PETTICOAT strategy with the Zenith Dissection Endovascular System for acute type A aortic dissection and visceral malperfusion, followed by proximal aortic replacement.

See Commentaries on pages 64 and 66.

▶ Video clip is available online.

Patients with type A aortic dissection (AAD) and mesenteric malperfusion have greater in-hospital mortality risk than patients with AAD without mesenteric malperfusion (63% vs 24%).¹ Using the PETTICOAT (provisional extension to induce complete attachment) technique as a first-line strategy before proximal repair, we resolved our patient's visceral malperfusion.

CASE REPORT

A 39-year-old man with Marfan syndrome, hypertension, and a history of substance abuse transferred to our facility with rapid-onset, sharp parasternal and abdominal pain, and copious melena. His systolic blood pressure was 170-180 mm Hg; anti-impulse therapy began. Initial laboratory results included elevated serum lactate (8.3 mmol/L) and creatinine levels (1.71 mg/dL). Computed tomography revealed a DeBakey type I aortic dissection extending from the aortic root between the left main and right coronary artery ostia to beyond the common iliac artery bifurcation (Figure 1). Dynamic malperfusion of the celiac, superior mesenteric, and

right renal arteries resulted in occlusion of these vessels. Transthoracic echocardiography confirmed AAD, mild aortic regurgitation, and absence of pericardial effusion.

Because the immediate concern was visceral malperfusion, we used the thoracic endovascular aortic repair-PETTICOAT first-line approach. Although we currently prefer to use intraoperative intravascular ultrasonography in endovascular cases, intravascular ultrasonography was not readily available at our institution at that time. In an emergency procedure, 32- × 109-mm and 34- × 161-mm covered Cook Zenith Alpha endografts (Cook Medical, Bloomington, Ind) were placed from the level of the left subclavian artery to just above the celiac artery. Follow-up angiography showed no flow into the infrarenal or visceral aorta. Therefore, a 36- × 180-mm Cook Zenith Dissection Endovascular Stent (Cook) was deployed across the visceral vessels in the true lumen. Angiography showed

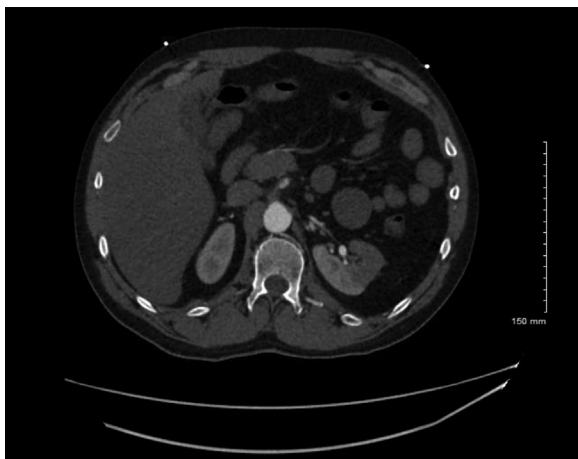


FIGURE 1. Computed tomography scan showing the visceral compromise of the superior mesenteric artery, which resulted in occlusion of the vessel.

perfusion of the visceral vessels and the remaining thoracoabdominal aorta (Video 1).

Postprocedurally, aggressive anti-impulse therapy continued. Postoperative echocardiography showed no pericardial effusion, and computed tomography confirmed successful revascularization of the celiac, superior mesenteric, and renal arteries; despite diffuse bowel-wall thickening, no pneumatosis or portal venous gas was detected. Aggressive fluid resuscitation normalized the lactic acidosis within 48 hours.

On postoperative day 6, the patient underwent definitive proximal aortic repair. Operative management included axillary artery cannulation, moderate hypothermia (24°C), and bilateral antegrade cerebral perfusion. The aortic root was replaced with a composite mechanical graft, the coronary arteries were directly reattached (modified Bentall), and the ascending aorta and hemiarch were replaced. Because right ventricular dysfunction was detected during weaning from cardiopulmonary bypass, a saphenous bypass

graft to the right coronary artery was completed on the assumption that the right coronary ostium was compromised.

Intraoperatively, the patient developed profound coagulopathy requiring massive transfusion, which led to hypoxemic respiratory failure necessitating bifemoral venovenous extracorporeal membrane oxygenation. On postoperative day 3, the patient had normal biventricular function and was weaned from extracorporeal membrane oxygenation. His serum creatinine level had normalized to 0.69 mg/dL without postoperative dialysis. The patient was discharged home on day 30 without adverse sequelae. Data regarding the case were collected by the surgical staff, and informed consent was obtained.

DISCUSSION

The PETTICOAT technique was introduced by Nienaber and colleagues² 14 years ago to treat complex acute type B aortic dissection. In 2018, the US Food and Drug Administration approved the Zenith Dissection Endovascular System for this use. The system comprises a proximal stent-graft and a distal bare-metal stent.

Open repair of acute type I aortic dissection concomitant with proximal stent-grafting and distal bare-metal stenting by the PETTICOAT technique has been previously described.³ A 2-stage strategy has been also mentioned in isolated reports.^{4,5} The Michigan aortic group, working with an interventional radiology team, pioneered upfront fenestration and stenting in one of the largest series yet reported of patients with acute AAD and visceral malperfusion.^{6,7}

What makes our case unique is the upfront use of the Zenith Dissection Endovascular System to resolve the visceral malperfusion instead of using fenestration between the true and false lumens, stenting the visceral arteries, or both. Whether this approach led to better future aortic remodeling than fenestration would have is unknown. Definitive upfront repair could have been an option if the patient's presentation had been different and his lactate level were not too high. Another important teaching point is that the relatively quick proximal aortic repair—performed 6 days after thoracic endovascular aortic repair, when the patient's lactic acid level had normalized and his metabolic acidosis had been corrected—prevents aortic rupture due to dissection.

To our knowledge, the use of the Zenith Dissection Endovascular System as a first-line approach in a patient with malperfusion due to acute AAD has not been reported before. We conclude that this approach can be life-saving for such patients.

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VIDEO 1. Use of the Zenith Dissection Endovascular System to treat visceral malperfusion in a patient with acute type I aortic dissection. Video available at: [https://www.jtcvs.org/article/S2666-2507\(20\)30335-7/fulltext](https://www.jtcvs.org/article/S2666-2507(20)30335-7/fulltext).

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