Percutaneous Aortic Fenestration for Symptomatic Type B Aortic Dissection

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Semin Intervent Radiol 2017;34:220–224.

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Minimally invasive endovascular techniques have increased in popularity over the past decade, becoming the first-line therapy for managing aortic lesions requiring intervention. Several studies show improved short-term outcomes in patients receiving endovascular management over the more traditional surgical repair.^{1–3} Long-term outcomes for surgical fenestrated aortic repair have been well described and this technique well tolerated in good surgical candidates.³ Considering not all patients with acute type B aortic dissections can be managed using stent grafts due to incompatible vascular anatomy (e.g., megacava, dissection proximity to branch vessels, inadequate seal, and unsuccessful decompression of the false lumen), aortic fenestration remains an important treatment option for patients suffering from complicated acute type B aortic dissections and can be performed percutaneously.

Clinical Case

A 64-year-old woman with a history of chronic type B aortic dissection presented with recent onset of postprandial abdominal pain and weight loss.

Computed tomographic angiography (CTA) demonstrated type B aortic dissection with an intimal aortic dissection flap extending from the proximal descending aorta into the pelvis with marked compression of the true lumen (►Fig. 1). The celiac trunk, superior mesenteric artery, and renal arteries arose from the true lumen. The right iliac and common femoral arteries were also perfused by the true lumen. Given the chronicity of the dissection and patient comorbidity, both surgical repair and endovascular stent graft were considered poor options. Instead, percutaneous fenestration was pursued.

The right common femoral artery was catheterized and a 40-cm 7F Balkan sheath was inserted (Cook). A catheter was advanced into the aorta and an aortogram was performed (►Fig. 2a) confirming that the catheter was within the compressed true lumen of the aortic dissection. Using CTA anatomy as a guide, the tip of the sheath was directed

posteriorly and left-ward at the level of the T12 vertebral body (►Fig. 2b) above the origin of both celiac axis and superior mesenteric artery. A sheathed needle from a Rosch-Uchida TIPS set (Cook) was used to puncture from the true lumen into the false lumen under fluoroscopic guidance. Contrast was injected during real-time fluoroscopy (►Fig. 2c) to confirm entry into the false lumen. A guidewire was then advanced into the false lumen and serial angioplasty of the fenestration was performed using 8- and 10-mm angioplasty balloon catheters (Mustang, Boston Scientific) until pressure differential between true and false lumens was abolished (►Fig. 2d). The catheters were then removed and hemostasis was achieved. The patient's symptoms rapidly resolved and a follow-up CTA showed simultaneous filling of both true and false lumens.

Discussion

Most type B aortic dissections can be treated medically with antihypertensive medications and β -blockers. Symptomatic dissections are treated using several different techniques. Acute symptomatic dissections may be treated using a stent graft to close the entry site of the dissection, compress the false lumen, and restore blood flow to the branch and peripheral arteries perfused by the true lumen. Chronic dissections are more difficult to treat using stent grafts because the dissection flap becomes stiff and fibrotic. In these patients, aortic fenestration is an option.

Long-term outcomes for surgical aortic fenestration are well described. Trimarchi et al³ showed surgical aortic fenestration is an effective and durable approach for managing complicated acute type B aortic dissections and this technique is associated with low complication rates, and absence of aneurysmal enlargement. Moreover, no repeated interventions related to the surgical fenestration procedure after a median follow-up of 10 years in 18 patients. Additionally, Panneton et al⁴ and Pradhan et al⁵ more recently described similar results.

Fig. 1 CTA of aortic type B dissection. (a) CTA showing the true lumen compressed anteriorly. (b) CTA showing smaller, compressed true lumen on the right of the false lumen which is larger and poorly opacified.

Fig. 3 CTA of aorta after percutaneous fenestration. Axial images (a, b) show equivalent perfusion of both true and false lumens.

Fig. 2 Percutaneous fenestration. (a) Aortogram from true lumen showing compression and perfusion of visceral arteries. (b) Fluoroscopic image showing vascular sheath in true lumen of aorta. (c) Fluoroscopic image after puncture through dissection flap. The tip of the catheter is now in false lumen. (d) Fluoroscopic image showing angioplasty of fenestration.

Fig. 4 Illustration shows windsock effect of false lumen prior to treatment. Blood enters through the site of the dissection near the arch and becomes “trapped” in false lumen because there is no exit. This leads to enlargement of the false lumen and compression of the true lumen.

The false lumen of an aortic dissection may function similar to a windsock. Blood passes into the false lumen via a proximal entry site near the arch and dilates this lumen because there is no point of egress. A fenestration simply creates an egress route and enables parallel flow in both lumens. Typically, after fenestration, the true lumen appears to enlarge, the false lumen decompresses, and both fill simultaneously on CTA (► **Figs. 3–6**).

Fig. 6 Coronal reconstruction of CTA before (a) and after (b) fenestration.

Fig. 5 Illustration of percutaneous aortic fenestration.

Percutaneous fenestrated aortic repair offers advantages in managing patients with chronic aortic dissections compared with surgical intervention with direct aortic replacement, including avoidance of a thoracotomy and aortic cross-clamping and relative ease of aortic exposure. In our patient, percutaneous aortic fenestration was chosen due to symptoms of chronic mesenteric ischemia thought to arise from compression and limited flow in the true lumen which supplied mesenteric vasculature. It is important to note that our patient did not suffer from aneurysmal disease in which case, aortic replacement would be indicated.⁴

As demonstrated in this case, endovascular aortic fenestration provides an effective, efficient, and safe treatment option for patients with symptomatic chronic type B aortic dissections.

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