Dual true and false lumen stent graft technique for endovascular repair of isolated common iliac artery aneurysm in chronic type A10 dissection

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ABSTRACT

A 52-year-old man presented with a chronic type A10 aortic dissection with subsequent aneurysmal degeneration of the left common iliac artery measuring up to 4.6 cm. He had previously undergone hemiarch replacement, which was complicated by renal failure. Owing to the presence of the growing aneurysm, he was unable to be listed for renal transplantation. He declined open operative repair. A novel dual true and false lumen stent graft technique using thoracic endografts was performed to successfully exclude the aneurysm. Follow-up imaging demonstrated aneurysm sac regression, with the patient subsequently undergoing renal transplantation. (J Vasc Surg Cases Innov Tech 2022;8:756-9.)

The treatment of chronic descending aortic dissection largely focuses on treating the aneurysmal degeneration of the thoracic and abdominal aorta. A rare but challenging scenario is the development of a common iliac artery (CIA) aneurysm (CIAA), without significant visceral aortic aneurysmal degeneration. Typical endovascular treatment involves stent grafting the true lumen (TL), with selective treatment of the false lumen (FL) encouraging FL thrombosis and aortic remodeling.1 We present a case in which a dissection-associated CIAA was treated using a dual TL and FL stent graft technique to exclude the aneurysm. The patient consented to image and case detail publication.

CASE REPORT

The patient is a 52-year-old man with renal failure, hypertension, obesity, and chronic type A10 dissection. Upon his presentation 6 years ago, he underwent an open repair with aortic valve resuspension and hemiarch replacement with Dacron. His post-operative course was complicated by renal failure requiring hemodialysis. During the renal transplant evaluation, he was noted to have a stable 3.2-cm infrarenal aorta, but an enlarging left CIAA measuring 4.6 cm (Fig 1). He was subsequently removed from the transplant list until the aneurysm was repaired.

He was evaluated by two vascular surgeons who recommended open repair with an aortobi-iliac bypass. As a third opinion at our institution, we also recommended an open repair. However, given the increased morbidity and mortality risk, he was adamant about exploring endovascular options. Although aneurysmal, the infrarenal aorta was stable in size and we elected to treat the CIAA with continued surveillance of the abdominal aorta. After extensive review, we presented a dual stent graft technique placing thoracic stent grafts into both TL and FL to exclude the aneurysm. The patient was informed that this use of thoracic stent grafts deviates from the US Food and Drug Administration-approved instructions for use.

PROCEDURE

Computed tomography angiography (CTA) evaluation was completed, and centerline reconstruction was performed using TeraRecon software (TeraRecon, Durham, NC). The patient had a complex dissection involving the entire visceral aorta with multiple fenestrations in the septum (Fig 2). The infrarenal aorta demonstrated active flow in both the TL and FL. The right CIA was perfused by the TL, and the left CIAA was perfused by both the TL and FL. The septum terminated with a large fenestration approximately 1 cm above the left iliac bifurcation providing adequate sealing length (Fig 3).

The left common femoral artery (CFA) was accessed percutaneously, and the FL was selected. A Volcano Visions Intravascular Ultrasound device (Koninklijke Philips N.V, Cambridge, MA) was used to obtain diameter measurements and confirm positioning within the FL. The distal stent was ballooned with a Coda...
balloon (Cook Medical, Bloomington, IN) to disrupt the fenestration and achieve a seal. On the contralateral side, a tapered 26 mm × 21 mm × 10 cm Gore CTAG device was deployed in the right CIA. Additional straight 26 mm × 10 cm and 31 mm × 10 cm Gore CTAG devices were deployed in the right (TL) and the left (FL), respectively, to cover the fenestrations in the infrarenal septum, achieving a seal in the infrarenal aorta. The dual stents were ballooned using the Gore Molding Balloon in a kissing fashion for equal expansion. Completion aortogram through the TL and FL demonstrated perfusion to both lumens and flow preservation to the bilateral iliac arteries (Fig 4). Arterial pressure measurements in the left CFA before and after stent deployment remain unchanged.

The patient did well and was discharged on postoperative day 1 without intensive care needs. At the 10-month follow-up (Fig 5), CTA demonstrated exclusion of the aneurysm without evidence of an endoleak. Furthermore, the left CIAA sac had regressed from 4.6 to 4.0 cm (Fig 6). The patient then underwent renal transplantation with a right external iliac artery anastomosis, chosen purposefully for its perfusion via the TL.

**DISCUSSION**

Although most patients presenting with acute, uncomplicated descending aortic dissections are initially treated with medical therapy successfully, 40% of patients may develop aneurysms of the dissected thoracic and/or abdominal aorta, subsequently requiring intervention.2,3 Isolated CIAA secondary to aortic dissection requiring repair is rare and size criteria for their treatment reflect those of CIAAs without associated dissection.4,5 Standard endovascular repair of dissection-associated aortic aneurysms typically involves placement of a stent graft into the TL to cover the main entry tear. This process excludes and depressurizes the FL, promoting thrombosis and remodeling.6 In previously treated type A dissections with chronic descending dissections, this
approach often requires addressing the challenge of preserving perfusion to the great vessels as hemiarch repair ends at the innominate artery. In a patient with an isolated CIAA, the traditional approach is open surgical repair. However, when considering a totally endovascular option, using this novel technique using dual lumen stent grafts allows for exclusion of the CIAA. This obviates the need for complex endovascular repair involving the aortic arch and avoids risk of stroke and paraplegia.

**Fig 3.** Centerline imaging illustrating the end of the dissection septum just proximal to the left iliac bifurcation and the planned distal landing zone of the left common iliac stent.

**Fig 4.** Completion angiogram of the repaired left common iliac artery aneurysm (CIAA) with dual lumen stent grafts in the true lumen (TL) (right) and false lumen (FL) (left).

**Fig 5.** Three-dimensional rendering of the repaired left common iliac artery aneurysm (CIAA) and stent graft configuration at the 10-month follow-up.
Although a covered stent technique deployed to maintain perfusion to the FL has been described to treat thoracic and visceral aortic aneurysms, to our knowledge there have been no reports of a similar technique used to treat an aortic dissection-associated CIAA. The objective of this technique is to cover as many fenestrations in the infrarenal dissection septum as possible, as well as to seal in the infrarenal aorta and in the TL of the bilateral CIAs. The FL and TL were sized approximately 1:1, taking into consideration the size limitations of commercially available stent grafts. We specifically selected stent grafts from the same device company to match the radial force of the self-expanding stents. Covering multiple fenestrations introduces the risk of stent graft thrombosis resulting in lower extremity malperfusion. This was evaluated to be a low risk, given that the FL typically has a higher pressure than the TL and that there were extensive suprarenal fenestrations in the septum maintaining perfusion to both lumens. Malperfusion, however, could be addressed with a concurrent right-to-left femoral-femoral artery bypass. Furthermore, if this intervention fails or a significant visceral aortic aneurysm develops, this repair does not exclude open reconstruction.

This approach offered a minimally invasive option for a patient with renal failure eager for transplant re-enlistment. Several requisite anatomic features particular to this case included a visceral aorta large enough to accommodate two thoracic stent grafts, adequate perfusion to both lumens through more proximal fenestrations in the dissection septum, and a healthy CIA proximal to the iliac bifurcation for landing the stent graft. The long-term outcomes for this technique are unknown. Close follow-up is essential and include multiphasic CTA scans at 30 days, 6 months, and 1 year in accordance with the Society for Vascular Surgery and Society for Thoracic Surgery reporting standards for aortic dissections.

**CONCLUSIONS**

Isolated CIAs after descending aortic dissections are uncommon. Open surgical repair remains the standard and most durable therapy. However, in select patients dual stent grafting of the TL and FL to exclude the aneurysm can be a viable minimally invasive option, understanding that this solution has unproven long-term results and informed patient discussion regarding durability is necessary.

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