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Three-vessel fenestrated and bilateral iliac branched graft repair of a juxtarenal aortic aneurysm with bilateral common iliac aneurysms

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ABSTRACT

We describe a patient with large bilateral common iliac artery aneurysms as well as a large juxtarenal abdominal aortic aneurysm successfully treated by a novel approach. The procedure, completed in one setting, involved this sequence: positioning and deployment of bilateral iliac branch grafts with appropriate internal iliac limbs; insertion of a three-vessel fenestrated proximal device with cannulation and stenting of the left renal artery; and positioning and deployment of a bifurcated endograft and two mating limbs to the bilateral iliac branch device. The procedure was completed with percutaneous access; the patient recovered well and was discharged on postoperative day 1. (J Vasc Surg Cases and Innovative Techniques 2018;4:166-9.)

Common iliac artery aneurysms often occur in patients with abdominal aortic aneurysms.[1] Advancements in endograft device design and approval of new technologies have provided vascular surgeons with more options for managing and treating complex aortic aneurysmal disease.[2] Bilateral common iliac artery aneurysms have conventionally been treated effectively with endovascular aneurysm repair (EVAR).[3] In this situation, a conventional infrarenal bifurcated endograft is often used to facilitate proximal seal in the aorta. Coil embolization of the ipsilateral internal iliac artery and extension into the external iliac provide the distal seal and effective exclusion of the iliac aneurysm. Recently, a Food and Drug Administration (FDA)-approved iliac branch endoprosthesis (IBE; W. L. Gore & Associates, Flagstaff, Ariz) has been used to treat this pathologic process with preservation of the internal iliac artery.

The use of any EVAR device is predicated on the ability to obtain an adequate proximal seal within the infrarenal aorta. In the situation of a juxtarenal aneurysm, the proximal seal may not be obtainable with conventional infrarenal endograft devices. Open surgical repair is a successful method of treatment of juxtarenal abdominal aortic aneurysms.[4,5] The repair of juxtarenal abdominal aortic aneurysms is complex because of increased cardiac stress, the potential for renal ischemic complications, and the need to place the graft close to the origins of the renal arteries, which offers technical challenges of adequate surgical exposure and aortic control.[6] In addition to these approaches, vascular surgeons at our institution have been using fenestrated EVAR (FEVAR) to repair juxtarenal aneurysmal disease for more than a decade. These procedures involve the use of the only FDA-approved fenestrated device (Zenith fenestrated endovascular graft [ZFEN]; Cook Medical, Bloomington, Ind) or physician-modified endografts under an FDA investigational device exemption for treatment of juxtarenal aneurysms.

We describe a case in which both FEVAR and an IBE were necessary to successfully repair bilateral common iliac aneurysms and a juxtarenal aortic aneurysm in an elderly patient. The patient was not a good candidate for open repair but was anatomically suited for an endovascular repair with FDA-approved FEVAR and iliac branching devices. The patient's consent to publish the case and images was obtained.

CASE REPORT

A 77-year-old man with a history of coronary artery disease was referred to our institution for evaluation of an asymptomatic 5.3-cm juxtarenal abdominal aortic aneurysm (infrarenal neck length, 0.9 cm) and large bilateral common iliac aneurysms (right, 4.5 cm; left, 5.6 cm; Fig 1). The patient was a poor candidate for open repair because of underlying severe chronic obstructive pulmonary disease and history of congestive heart failure. A preoperative computed tomography (CT) scan revealed paired small right renal arteries and high-grade stenosis of the left renal artery. However, he did meet anatomic criteria for FEVAR and an IBE. The perivisceral

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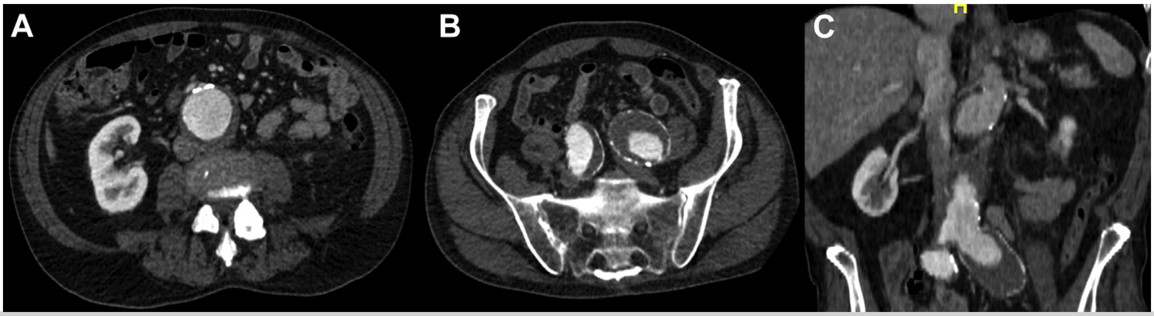

Fig 1. Juxtarenal abdominal aortic aneurysm in the context of bilateral common iliac aneurysms. Computed tomography (CT) visualization of the large juxtarenal abdominal aortic aneurysm **(A)** and large bilateral common iliac aneurysms **(B)**. Imaging revealed that the right renal arteries were small, and there was high-grade stenosis of the left renal artery **(C)**.

neck was uniformly 22 mm in diameter, and with FEVAR, we would obtain 4.2 cm of proximal seal. If we had difficulty in placing the first IBE or the procedure took excessive time, we would place only one IBE and coil embolize the contralateral internal iliac artery and extend our graft into the external iliac artery. The concept of a staged repair was also discussed if we encountered issues with placement and deployment of the IBE.

We thought that the sequence of performing the IBE first followed by FEVAR would allow easier passage of the ZFEN graft as the issue of graft dislodgment would be low with an IBE device. Therefore, the patient underwent the procedure in the following sequence. Initial femoral access with preclosure using a suture-mediated closure device (Prostar; Abbott Vascular, Santa Clara, Calif) was established, and angiography was performed. The initial IBE was a 23 mm × 12 mm × 10 cm bifurcated device (W. L. Gore & Associates) and was positioned in the left iliac artery. The left internal iliac artery was selected from the contralateral side, and a 12F sheath (DrySeal; W. L. Gore & Associates) was advanced into the artery. A 12- × 7-mm internal iliac limb was then deployed. This sequence was repeated on the right side. Subsequent arteriograms depicted both bifurcated iliac devices deployed in the proper position with patent internal and external arteries (Fig 2).

Through the right access, a three-vessel fenestrated 26- × 124-mm ZFEN proximal device was delivered. Perivisceral angiography was performed, which revealed the target vessels including a stenotic left renal artery that was not clearly apparent on preoperative CT angiography. The ZFEN device was deployed, and careful selection of the left main renal artery was prolonged because of underlying high-grade stenosis. Once the stenosis was traversed, the wire was easily advanced into the main segmental arteries. The catheter was then advanced and exchanged for a Rosen wire, and left renal stenting commenced with a 6- × 22-mm Atrium iCAST stent (Maquet, Hudson, NH). The proximal portion of the stent was flared with a 9- × 2-mm balloon. The superior mesenteric artery fenestration had crossing struts and was not stented. The right renal fenestration was large and left unstented to accommodate perfusion into two small (3-mm) paired accessory renal arteries emanating directly from the aorta.

Fig 2. Intervention technique. Arteriogram indicating both bifurcated iliac devices and an open branch vessel.

A standard infrarenal bifurcated device (Gore Excluder, 28.5 × 14.5 × 12 mm) was positioned into the ZFEN proximal device and deployed. Finally, two bridging stents (Gore Excluder contralateral limb, 27 mm × 10 cm on the right and 27 mm × 14 cm on the left) were used to complete the procedure with maximal overlap of the endovascular devices. Completion arteriography and completion intraoperative dynamic CT imaging depicted perfusion of all branches without evidence of endoleak. Total procedure time was 164 minutes, fluoroscopy time was 36.2 minutes, and total contrast material was 132 mL. Successful percutaneous closure was completed bilaterally.

The patient had an uneventful recovery and was discharged on postoperative day 1. Follow-up CT angiography 1 week postoperatively showed a technically intact and functional repair without evidence of endoleak and good perfusion of all target vessels (Fig 3).

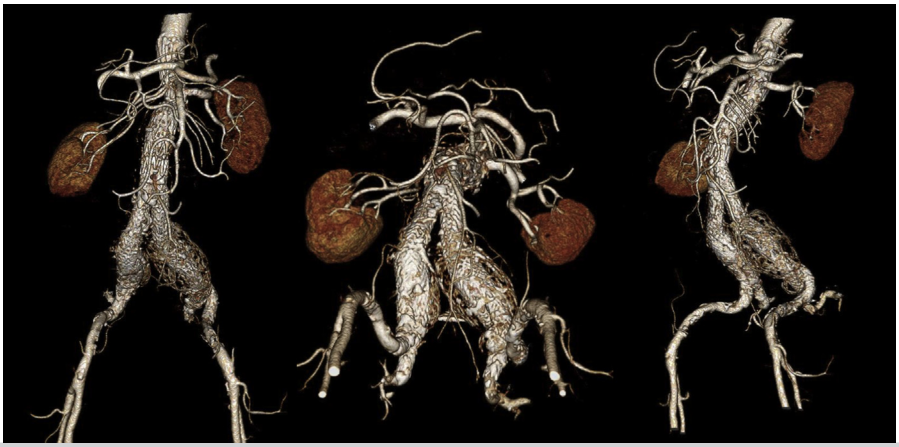

Fig 3. Postoperative outcome. Computed tomography (CT) angiography reconstruction displaying a technically intact and functional repair.

DISCUSSION

The treatment of aneurysmal disease has been rapidly evolving as a result of advances in technology, new techniques, and improvement of vascular specialists' proficiency.[2,6] The method of repair is determined by a patient's anatomy, medical risk factors, and preferences as well as by the surgeon's experience.

When open surgical repair is contraindicated because of the patient's advanced age and therefore higher operative risk, endovascular repair is considered.[7] A study that analyzed a single center's 10-year experience in 157 consecutive procedures with iliac branch devices concluded that iliac branched endografting is performed with a high technical success rate and should be considered a first-option treatment in patients who are unsuitable for standard endovascular aortic repair.[8] These iliac branch devices minimize the technical complexity of the repair and therefore improve the safety of the procedure.[9]

In comparison to open repair, fenestrated stent grafts and iliac branch devices reduce ischemia time to the viscera and the kidneys. Fenestrated branched techniques have been introduced for the treatment of juxtarenal aneurysms.[10] Short- and intermediate-term results of endovascular repair with fenestrated and branched endografts are favorable, which supports their continued safe use in the management of aneurysmal disease.[11,12] Endovascular treatment of aneurysmal disease has improved patient outcomes by reducing morbidity, lowering the rate of surgical complications, and shortening the length of hospital stay.[13]

It is uncommon for a patient to have anatomy suitable for bilateral IBEs as well as FEVAR; however, this patient did fulfill the requirements of each device. Numerous variations for treating this patient with endovascular techniques exist, and he could have been approached differently. At our institution, we believe strongly in preserving blood flow to the pelvis if possible and performing FEVAR to improve the proximal seal. We do not routinely perform "debranching" procedures as well as "chimney and snorkel," and therefore this approach to the patient may be unusual at other institutions. Also, the concept of "staged" repair should be discussed. As stated before, the advantage of EVAR is that it does not need to be completed at once in an asymptomatic patient. If the procedure were to have been prolonged in the IBE portion, we could have stopped and returned for the FEVAR portion; but as witnessed by the operative time, fluoroscopy time, and contrast material, it was expeditious and amenable to a single-stage procedure.

CONCLUSIONS

We describe the endovascular technique of successful exclusion of a juxtarenal abdominal aortic aneurysm in the context of large bilateral common iliac aneurysms. The procedure entails a higher device cost. However, the patient was discharged on postoperative day 1 with both hypogastric arteries preserved, and he avoided a fairly high risk open procedure with potential buttock claudication, which underscores the value of this procedure. In addition, these devices are readily available to all vascular surgeons and do not require modification. The technique we describe expands the armamentarium for treating patients with complex aneurysmal disease.

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