Overcoming Difficult Vascular Access in EVAR

Low-profile devices may increase the applicability of EVAR to patients with challenging vascular anatomy.

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Anatomic constraints for endovascular aortic aneurysm repair (EVAR) are being reduced with evolving technology. However, vascular access continues to limit the feasibility of EVAR in some patients. Selection of the primary access route is influenced by vessel diameter, tortuosity, and atherosclerotic plaque. Unsuitable iliofemoral arterial anatomy predisposes to access site complications and represents a relative contraindication to EVAR. We report the case of a patient with an infrarenal abdominal aortic aneurysm (AAA) and a previously failed EVAR attempt, which was a result of extremely poor vascular access, who we subsequently repaired endovascularly using the Zenith low-profile AAA endovascular graft (Cook Medical, Bloomington, IN) as part of the multicenter investigational device exemption study.

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CASE REPORT

An 80-year-old man with a history of chronic renal insufficiency, previous myocardial infarction, hypertension, and chronic obstructive pulmonary disease presented for surgical evaluation of an asymptomatic infrarenal AAA several months after an attempted EVAR at an outside institution, which was unsuccessful due to poor iliofemoral access and an inability to deliver the stent graft. Preoperative contrast-enhanced computed tomographic angiography of the chest, abdomen, and pelvis showed a 5.3-cm infrarenal AAA. The minimal luminal diameters of the right and left external iliac arteries were 4.8 and 6.4 mm, respectively. Severe bilateral iliac artery calcification was also noted, with mod-

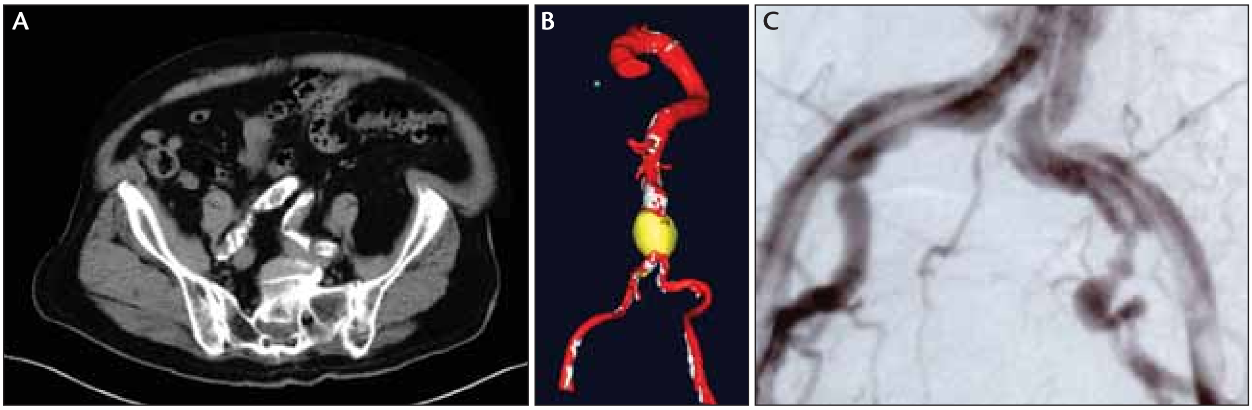

Figure 1. Tortuosity and significant calcification of the access vessels as seen on a representative slice of the unenhanced axial computed tomographic angiogram (A), three-dimensional reconstruction (B), and conventional angiogram (C).

Figure 2. Completion angiogram showing the excluded aneurysm.

erate right iliac and severe left iliac artery tortuosity (Figure 1). Given the patient's multiple comorbidities, an endovascular approach was preferred.

Groin dissection was difficult given the extensive peripheral vascular disease, as well as scar tissue from previous femoral exposures. Thus, a small anterior segment of the common femoral artery was dissected free bilaterally, allowing for purse-string sutures to be placed on both femoral arteries. With some difficulty, a stiff wire was able to be placed into the calcific, tortuous right iliac vessels. A 30- X 84-mm Zenith low-profile device was delivered through the right iliac artery and deployed. The 16- X 72-mm contralateral limb was then delivered with much difficulty, due to the iliac disease and tortuosity, through the left iliac system and was deployed. A 16- X 60-mm limb was brought in and deployed on the ipsilateral side to complete the stent graft. A completion angiogram showed aneurysm exclusion with good flow through both iliac arteries (Figure 2). The patient's postoperative course was uncomplicated. He was discharged home on postoperative day 5. Follow-up imaging showed continued exclusion of the aneurysm and no evidence of endoleak.

DISCUSSION

Current-generation stent graft deployment systems are characterized by large-diameter introducer sheaths (18–24 F). Introduction and navigation of these large-caliber systems through small, heavily diseased, and tortuous vessels can present challenges and potentially preclude EVAR. Furthermore, there is an increased risk of procedure-related complications. Injury to access vessels has been reported to occur in up to 5% to 17% of cases and may involve atheroembolism, thrombosis, dissection, or rupture.[1-4]

Although it is not the most common factor for exclusion, inadequate vascular access continues to be a source of patient exclusion from EVAR. A previous report from our institution examined the impact of exclusion criteria on patient selection for EVAR.[5] Of 307 patients treated for AAAs between 1998 and 2000, a total of 103 patients were excluded from EVAR based on anatomic criteria. Within this group, unsuitable access vessel anatomy was the second most frequent reason for rejection. Small iliac arteries (47%) and extreme tortuosity of the iliac arteries (10%) were most commonly cited. Rose et al[6] showed similar findings in their assessment of the anatomic suitability of ruptured AAAs for EVAR. Characteristics related to aneurysm neck morphology were again chief among reasons for exclusion in this study, but severe tortuosity of the external iliac arteries (15%) served as a notable factor for exclusion from the endovascular approach to aneurysm repair. Moreover, gender-related differences in iliac artery morphology may preclude widespread applicability of EVAR in female patients given that females have significantly narrower iliac arteries independent of maximum aneurysm diameter compared to men.[7]

Greater recognition and understanding of anatomic constraints has led to the development of various techniques to facilitate iliofemoral access in patients with poor vascular anatomy. Traditional methods include the use of iliofemoral conduits, angioplasty, brachiofemoral guidewire access, vessel straightening, excision or relocation of redundant iliac arteries, and aorto-uni-iliac stent graft deployment in conjunction with a femorofemoral bypass.[3,8-11]

Low-profile delivery systems, such as the one used in our case, represent a new innovation in the endovascular approach to aneurysm repair. These devices provide a novel strategy for treating patients with abdominal aortic or aortoiliac aneurysms compounded by poor vascular access. By significantly reducing the diameter of the delivery system, low-profile devices extend the minimally invasive benefits of EVAR to a broader subset of patients whose therapeutic options are otherwise limited. As such, fewer patients with AAAs will be excluded from EVAR, and the need for adjunctive procedures will be minimized. In addition, access-site complications may be reduced.

CONCLUSION

Low-profile devices represent a significant advancement in endovascular technology and widen the availability of EVAR to include many patients with poor vascular access. Such devices serve as important additions to the vascular surgeon's armamentarium as they relate to the management strategy of EVAR in the setting of difficult iliofemoral arterial anatomy. ■

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1. Tillich M, Bell RE, Paik DS, et al. Iliac arterial injuries after endovascular repair of abdominal aortic aneurysms: correlation with iliac curvature and diameter. Radiology. 2001;219:129-136.
2. Fernandez JD, Craig JM, Garrett HE Jr, et al. Endovascular management of iliac rupture during endovascular aneurysm repair. J Vasc Surg. 2009;50:1293-1299; discussion 1299-1300.
3. Murray D, Ghosh J, Khwaja N, et al. Access for endovascular aneurysm repair. J Endovasc Ther. 2006;13:754-761.
4. Beebe HG, Kritpracha B, Serres S, et al. Endograft planning without preoperative arteriography: a clinical feasibility study. J Endovasc Ther. 2000;7:8-15.
5. Carpenter JP, Baum RA, Barker CF, et al. Impact of exclusion criteria on patient selection for endovascular abdominal aortic aneurysm repair. J Vasc Surg. 2001;34:1050-1054.
6. Rose DF, Davidson IR, Hinchliffe RJ, et al. Anatomical suitability of ruptured abdominal aortic aneurysms for endovascular repair. J Endovasc Ther. 2003;10:453-457.
7. Velazquez OC, Larson RA, Baum RA, et al. Gender-related differences in infrarenal aortic aneurysm morphologic features: issues relevant to Ancure and Talent endografts. J Vasc Surg. 2001;33(2 suppl):S77-84.
8. Criado FJ, Wilson EP, Abul-Khoudoud O, et al. Brachial artery catheterization to facilitate endovascular grafting of abdominal aortic aneurysm: safety and rationale. J Vasc Surg. 2000;32:1137-1141.
9. Parodi JC, Palmaz JC, Barone HD. Transfemoral intraluminal graft implantation for abdominal aortic aneurysms. Ann Vasc Surg. 1991;5:491-499.
10. Abu-Ghaida AM, Clair DG, Greenberg RK, et al. Broadening the applicability of endovascular aneurysm repair: the use of iliac conduits. J Vasc Surg. 2002;36:111-117.
11. Makaroun MS, Dillavou ED, Kee ST, et al. Endovascular treatment of thoracic aortic aneurysms: results of the phase II multicenter trial of the Gore TAG thoracic endoprosthesis. J Vasc Surg. 2005;41:1-9.