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Case Reports

Open Repair of a Complicated Late Endoleak Induced by Another Endoleak

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A 66-year-old man had an enlarging aortic aneurysm sac after an endovascular aortic replacement procedure that had been performed at another institution 4 years previously; it was without any endoleak but was complicated by the occlusion of the left limb, requiring cross-femoral bypass. Current computed tomography revealed dilatation of the proximal neck and the right common iliac artery. A type Ib endoleak was found from the distal end of the right limb of the endograft, possibly secondary to the dilatation of the artery around it; it then pressurized and caused the dilatation of the juxtarenal aorta around the proximal landing zone and induced a concomitant type Ia endoleak. The patient was operated on owing to the risk of rupture. Pelvic ischemia was a concern during decision-making. The patient underwent removal of the endograft and replacement of a bifurcated aortoiliac and femoral graft with good outcome. Midline laparotomy and a supraceliac clamping approach enable the removal of endografts with suprarenal fixation and revascularization of internal iliac arteries. Open repair offers a definitive solution for complicated endoleaks when endovascular options could be risky and ineffective. ***(Tex Heart Inst J. 2022;49(6):e207542)***

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Endoleak remains the most consequential weakness of endovascular aortic replacement (EVAR) and the leading cause of late open conversion in 62% to 80% of the cases,[1,2] with type I being the most common (42%-62%).[1,2] Concomitant endoleaks occur in 9.5% of patients[1]; however, endoleaks have been reported to be higher (42.5%) in patients with graft or limb thrombosis.[2] Late type I endoleaks are most commonly caused by aneurysmal degeneration of the seal zones or graft migration.[3] This case report discusses a complicated case of late endoleak after EVAR that had been successfully treated with open repair.

Case Report

A 66-year-old man presenting with buttock pain was referred to our hospital owing to an enlarging aortic aneurysm sac. The patient had undergone an EVAR procedure 4 years previous at another hospital. He also had had a cross-femoral bypass procedure when the left limb of the endograft could not be placed properly, which resulted in occlusion of the left common iliac artery. The dimensions of the endoprosthesis that was implanted were as follows: trunk, 36-20 mm (proximal aortic and distal iliac sizes); ipsilateral leg extension, 28-28 mm (proximal and distal iliac); and contralateral leg (left), 16-13 mm (proximal and distal iliac).

His initial control computed tomography (CT) scan after the EVAR procedure revealed a good proximal aortic neck and distal right iliac seating without endoleak (Fig. 1A and Fig. 1B). The diameters of the proximal aortic and distal iliac seating zones were 3 and 2.5 cm, respectively. The abdominal aortic aneurysm (AAA) sac diameter was 6.6 cm. The patient had no further follow-up until the fourth year. Because the patient developed buttock pain, an abdomen CT scan was obtained, which revealed dilatation of the proximal neck (6 cm) with perigraft thrombus at the juxtarenal aorta in addition to dilatation of the right common iliac artery (4.9 cm) (Fig. 1C and Fig. 1D). There was type Ib endoleak from the distal end of the right limb of the endograft. The

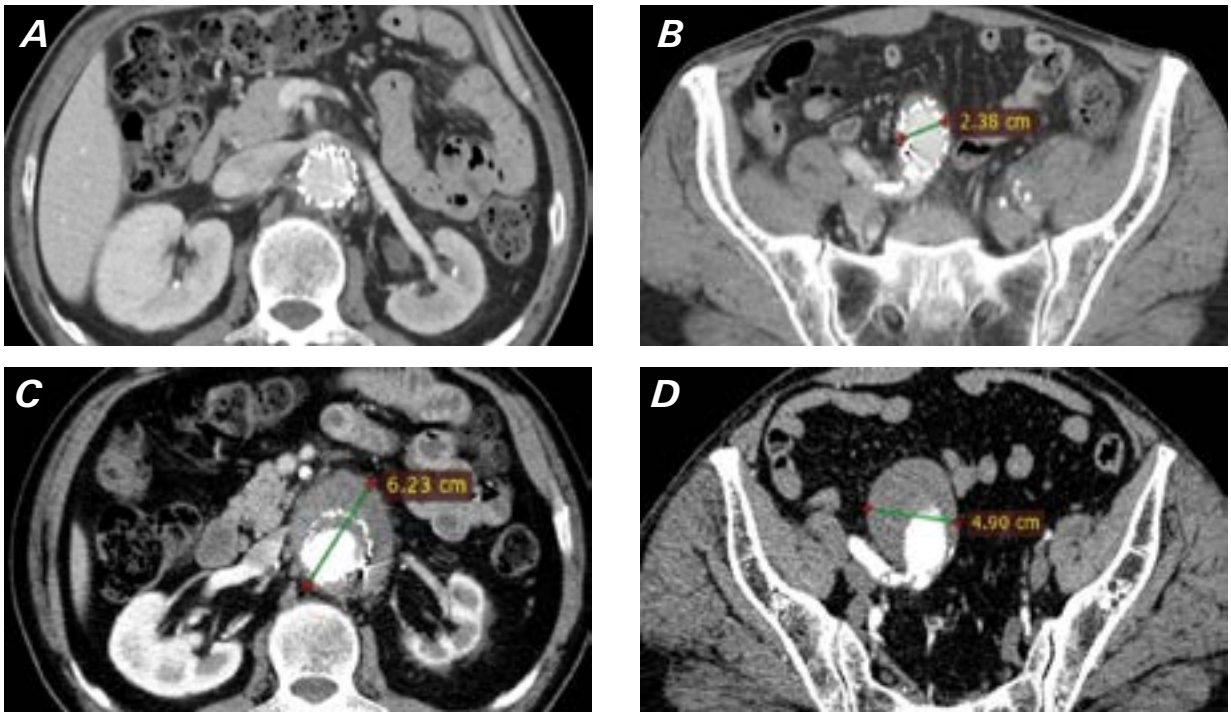

Fig. 1 *Computed tomographic images obtained after the EVAR procedure 4 years apart. Note that the* ***A****) proximal neck and the* ***B****) distal right iliac leg of the graft had been properly placed and was in good position immediately after the EVAR procedure. Dilatation and thrombus formation at the* ***C****) juxtarenal aortic wall and* ***D****) dilatation of the right common iliac artery 4 years later.*

EVAR, endovascular aortic replacement.

barbed wires were extending toward the orifice of the superior mesenteric artery (SMA), and the left limb of the endograft was kinked and occluded. A patent cross-femoral graft was seen (Fig. 2A and Fig. 2B). An enlarging AAA sac (7.6 cm) was noted. As discussed below, the decision to perform an open repair was made. Informed consent for the operation and the use of data for research and publication purposes was obtained.

Operative Technique

Under general anesthesia in the supine position, a midline laparotomy incision was made. First, the aneurysm sac was exposed and examined. Supraceliac aortic clamping was deemed appropriate because there was no neck of aorta for a safe anastomosis and the barbed wires were extending up to the orifice of the SMA. The supraceliac aorta and the internal and external right iliac arteries were clamped. The aneurysm sac was entered, and the right limb of the endograft was free floating. Type Ia endoleak at the proximal neck was noticed due to the observation of the blood flow between the graft and the enlarged aortic neck. The left limb of the endograft was transected at the level of the orifice of the left common iliac artery and was ligated. The endograft was removed by cutting the barbed wires with a wire cutter. Remnants of the wires that had pierced the aortic wall around the orifice of the SMA were removed one by one. The proximal neck of the native aorta was examined, and good-quality aortic tissue distal to the orifices of the SMA and the renal arteries was discovered and used to construct a safe anastomosis. The proximal part of a 20-mm bifurcated aortoiliac and femoral graft was sutured to the aortic neck using a strip of felt to buttress the anterior part of the anastomosis. The clamp was removed from the supraceliac aorta to be placed on the graft. The right limb of the bifurcation graft was anastomosed to the right common iliac artery just at the bifurcation to perfuse both external and internal branches. The left inguinal incision was made, and the left limb of the bifurcation graft was tunneled retroperitoneally to this site. The femorofemoral graft was ligated and partially removed. The left limb of the bifurcation graft was then anastomosed to the left common femoral artery by using the hood of the previous femorofemoral graft.

Patient made a good recovery and was discharged in a week without any complications. On follow-up, he remained in good condition. A follow-up CT scan obtained 6 months after the operation showed

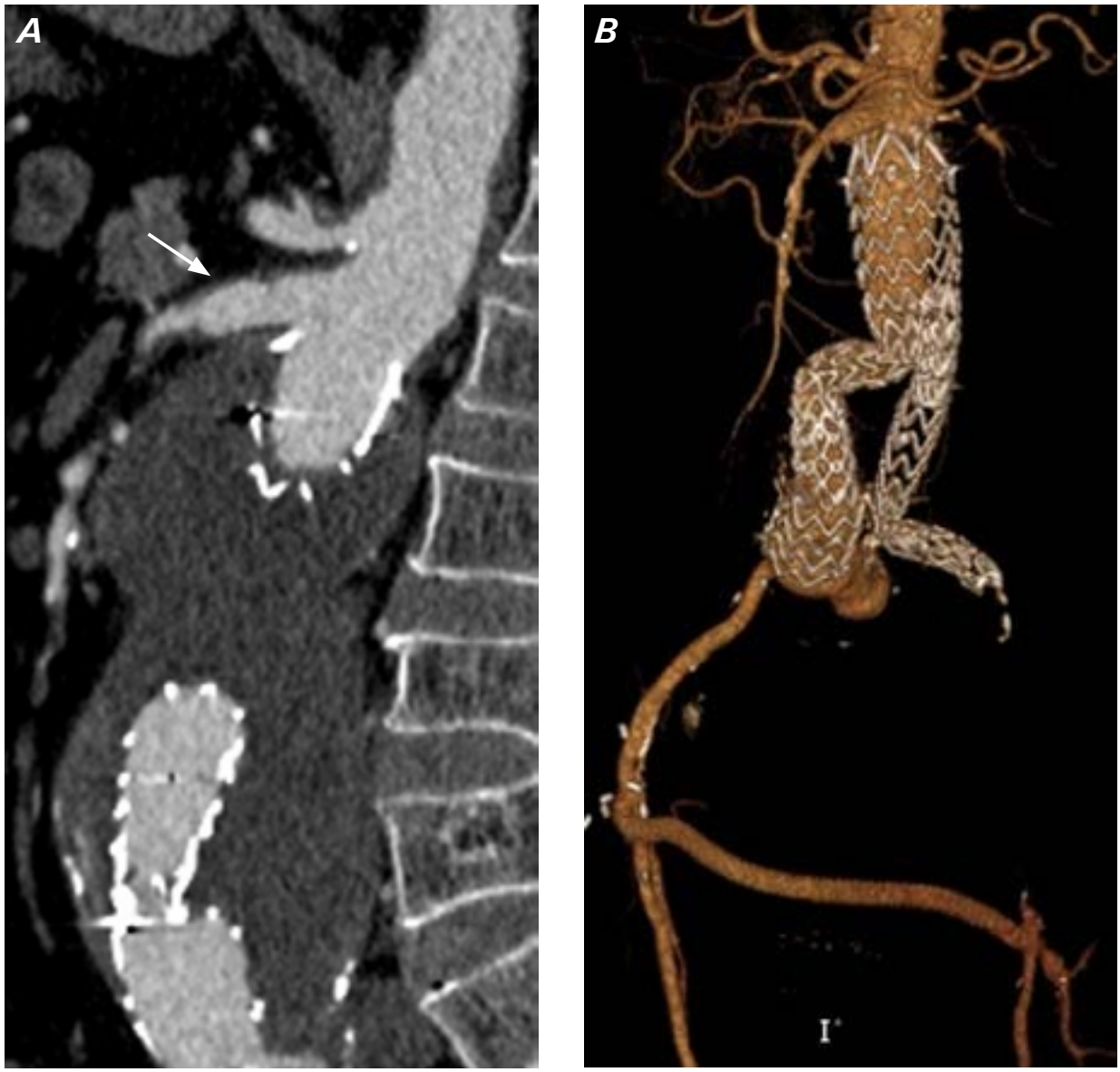

Fig. 2 *Computed tomographic images of the patient at presentation that shows* ***A****) a large abdominal aortic aneurysm sac with barbed wires extending toward the orifice of the superior mesenteric artery (arrow) in a sagittal image. The kinked and occluded left limb of the endograft and a patent cross-femoral graft are seen in* ***B****) a 3-dimensional image.*

excellent anatomical repair without any stenosis, kinking, or leakage (Fig. 3).

Discussion

There are several ways to manage a patient with an enlarging aneurysm resulting from an endoleak. The first choice is the endovascular solution. In this case, an extension graft to the right leg of the endograft could have been placed. This option carries the risk of occlusion of the right internal iliac artery, which could cause colonic and pelvic ischemia because of the already-occluded contralateral iliac arteries. Additional procedures to close the proximal endoleak would be very complicated, necessitating special grafting by means of snorkel or fenestrated grafts.

The use of fenestrated grafts is a viable option to raise the proximal seal zone from the infrarenal aorta to a nondiseased segment of the aorta. Anatomical criteria are of paramount importance in planning such a complex intervention. Schanzer et al[4] reported a study regarding the use of fenestrated-branched EVAR (F/BEVAR) for the treatment of patients with prior EVAR failure. They compared the outcomes of patients treated after failed EVAR with those without prior EVAR. One-year survival was decreased in the failed EVAR group (86.3% vs 91.9%; P = .02), and there was a selection bias

Fig. 3 *Postoperative 3-dimensional computed tomographic image. Left anterolateral view of the implanted y-graft. Arrow shows the patient's right internal iliac artery. A remnant of the endograft in the left common iliac artery is marked by an asterisk.*

by means of anatomical suitability. They concluded that at high-volume sites with access to custom-made F/BEVAR devices, F/BEVAR was a viable first-line strategy for the treatment of EVAR failure.[4] Reportedly, the technical challenge of F/BEVAR in the presence of a prior EVAR graft includes complicating factors such as bare suprarenal stents across renal-visceral target artery origins, stents, or parallel grafts in renal-visceral target arteries, short-body EVAR grafts, endograft limbs limiting tracking and manipulation of F/BEVAR devices, and significant metal artifact.[4]

Oderich et al[5] reported good results with the use of fenestrated AAA stent grafts in a relatively small study population with incomplete 5-year follow-up. Mean (SD) freedom from secondary intervention was reported to be 63.5% (7.2%) at 5 years. Two-thirds of patients were excluded from their study because of inadequate anatomy. All patients in their study were treated for a juxtarenal AAA with an infrarenal aortic neck measuring 4 to 14 mm in length. There was no infrarenal aortic neck in our patient. Another problem is that these patient-specific custom-made grafts are not available in many countries, including the one in which this study was performed.

Snorkel/chimney EVAR can, at times, circumvent the issues related to F/BEVAR. The procedure involves gaining access for both the main aortic device as well as the target renal or visceral arteries for the chimney device. This often requires bilateral femoral artery access for the main aortic device—which was not possible in the patient in this case report—unilateral or bilateral arm access, or surgical conduit to facilitate catheterization of the renal and/or visceral arteries. The overall complication rate of 3 and 4 snorkel/chimney grafts was found to be higher both in the immediate term and in the follow-up compared with 1 or 2 snorkels.[6] Durability is another concern, considering the age of the presenting patient. In addition, continued surveillance imaging should be performed, which may not be met with great patient compliance.

The second choice is the surgical approach, which comes with the advantages of addressing both endoleaks and preserving pelvic circulation. Although retroperitoneal incision could give better exposure of the suprarenal abdominal aorta for clamping and possible reimplantion of the renal arteries, the right internal iliac artery can be best exposed through a midline laparotomy incision. Therefore, we used midline incision and supraceliac aortic clamping.

Although supraceliac aortic clamping has been found to be associated with higher postoperative mortality because of possible visceral and renal ischemia,[3,7] it does provide excellent exposure of the juxtarenal aorta for the evaluation of visceroarenal artery orifices and of the aortic tissue quality for a safe anastomosis. It also enables the removal of suprarenal fixation wires without damaging the intimomedial layer.

A comparison of the previous and current CT images and the operative findings were suspicious for a type Ib endoleak that occurred at the distal landing zone of the right limb of the endograft possibly secondary to the dilatation of the artery around it, which then pressurized the rest of the abdominal aneurysm cavity. It was noted that the right leg of the endograft was free floating, whereas the endoleak site at the proximal seal zone was narrow. Dilatation of the right common iliac artery might have been caused by overflow because it supplied blood to both lower extremities. The pressurized and dilated aneurysm sac caused the dilatation of the aorta around the proximal landing zone and induced a concomitant type Ia endoleak and perigraft thrombus formation.

Endovascular aortic replacement has revolutionized the way aortic aneurysms are treated. However, in a minority of cases, its early and late complications continue to pose substantial problems and expose patients to serious risks. In this case, technical problems during the endograft replacement procedure necessitated the use of extra-anatomic bypass grafting in the early phase. Dilatation of the aneurysm sac caused endoleaks, or vice versa, in the late phase, which required a more complicated operation. Long-term surveillance after EVAR procedure is critical for the detection of potentially life-threatening complications. Midline laparotomy and supraceliac clamping approach enables safe removal of endografts with suprarenal fixation and revascularization of internal iliac arteries. Open repair offers a definitive solution for complicated endoleaks when endovascular options could be risky and ineffective.

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References

1. Kouvelos G, Koutsoumpelis A, Lazaris A, Matsagkas M. Late open conversion after endovascular abdominal aortic aneurysm repair. *J Vasc Surg.* 2015;61(5):1350-1356. doi:10.1016/j.jvs.2015.02.019
2. Perini P, Gargiulo M, Silingardi R, et al. Twenty-two year multicentre experience of late open conversions after endovascular abdominal aneurysm repair. *Eur J Vasc Endovasc Surg.* 2020;59(5):757-765. doi:10.1016/j.ejvs.2020.01.011
3. Turney EJ, Steenberge SP, Lyden SP, et al. Late graft explants in endovascular aneurysm repair. *J Vasc Surg.* 2014;59(4):886-893. doi:10.1016/j.jvs.2013.10.079
4. Schanzer A, Beck AW, Eagleton M, et al; US Multicenter Fenestrated/Branched Aortic Research Consortium. Results of fenestrated and branched endovascular aortic aneurysm repair after failed infrarenal endovascular aortic aneurysm repair. *J Vasc Surg.* 2020;72(3):849-858. doi:10.1016/j.jvs.2019.11.026
5. Oderich GS, Farber MA, Schneider D, et al; Zenith Fenestrated Study Investigators. Final 5-year results of the United States Zenith Fenestrated prospective multicenter study for juxtarenal abdominal aortic aneurysms. *J Vasc Surg.* 2021;73(4):1128-1138. doi:10.1016/j.jvs.2020.08.128
6. Donas KP, Lee JT, Lachat M, Torsello G, Veith FJ; PERICLES Investigators. Collected world experience about the performance of the snorkel/chimney endovascular technique in the treatment of complex aortic pathologies: the PERICLES registry. *Ann Surg.* 2015;262(3):546-553; discussion 552-553. doi:10.1097/SLA.0000000000001405
7. Scali S, Beck AW, Chang CK, et al. Defining risk and identifying predictors of mortality for open conversion after endovascular aortic aneurysm repair in the vascular quality initiative. *J Vasc Surg.* 2016;63(4):873-881.e1. doi:10.1016/j.jvs.2015.09.058