Endovascular Management of Type I Endoleak with Fenestrated Aortic “Cuff” and Afterwards Treatment of Endoleak Type III

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Abstract

Keywords

- abdominal aortic aneurysm
- aneurysm
- endograft placement
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- repair
- stent
- artery

Endovascular aortic repair (EVAR) has become preferable treatment of abdominal aortic aneurysms because of proven mortality reduction as well as complications reduction compared with open surgery. Endoleak remains a primary complication of EVAR, however, and occurs in 20 to 25% of the patients. EVAR patients thus undergo lifelong surveillance for the presence of aneurysm expansion and endoleaks usually via computed tomographic angiography. We describe the endovascular management of an enlarged aneurysmal sac size 3 years after EVAR due to combined endoleak of types 1 and 3. We needed to use a fenestrated aortic cuff, a main body graft extension, and an aortouniiliac converter device to seal the leak. This case highlights the potential challenges in identifying and treating type III endoleaks.

Endovascular aortic repair (EVAR) avoids the disadvantages of major surgery such as a large incision, full heparinization, extracorporeal circulation, aortic cross-clamping, interference with respiratory function, and the need for massive blood transfusions. Endoleak remains a primary complications of EVAR, however, and occurs in 20 to 25% of the patients.^{1,2} EVAR patients thus undergo lifelong surveillance for the presence of aneurysm expansion and endoleaks, usually via computed tomographic angiography (CTA).²

We describe the endovascular management of an enlarged aneurysmal sac 3 years after EVAR due to combined endoleak of types 1 and 3. We needed to use a fenestrated aortic cuff, a main body graft extension, and an aortouniiliac converter device to seal the leak. This case highlights the potential challenges in identifying and treating type III endoleaks.

Case Report

A 75-year-old man with a 5.5 cm infrarenal aortic aneurysm was electively treated in 2008 with an endovascular talent stent graft (Medtronic, Minneapolis, MN) measuring 28 mm

in diameter. The patient course was uncomplicated and the final angiography showed no endoleak. At 3 months follow-up, the size of the aneurysmal sac had increased by a few millimeters, suggesting a type II endoleak. The patient was conservatively managed and kept under observation and at 1 year follow-up the aneurysmal sac size was unchanged.

The patient was then lost to follow-up for 2 years but in 2011 a contrast-enhanced CT scan and angiography revealed a type Ia endoleak and 2 cm increase in the aneurysmal sac size (→ Fig. 1). The proximal landing zone was too short, especially on the left side where the aneurysm neck was only 5 mm long. The patient underwent endovascular treatment where a fenestrated custom-made aortic cuff with diameter of 30 × 58 mm (Cook, Bloomington, IN) and two fenestrations for the renal artery and a scallop for the superior mesenteric artery was placed according to the standard guidelines. Advanta stent grafts (Atrium, Netherlands) of 6 × 22 mm on the right side and 7 × 22 mm on the left side were placed in the renal arteries using a left femoral route. The guide wire was placed in the superior mesenteric artery through the left brachial artery to allow rapid arterial access in the event of

Fig. 1 Transbrachial abdominal angiography and contrast-enhanced CT revealed a large type 1a endoleak (arrow). Note the very short length of aneurysm neck in relation to the left renal artery. CT, computed tomography.

inadvertent closure of the mesenteric artery. After insertion, the aortic cuff and renal stent grafts were dilated but control angiography still revealed endoleak. The patient was given almost 10,000 international unit (activated clotting time (ACT) > 250 seconds) of heparin and a control CT was planned after 1 month in the belief that systemic heparinization was responsible for the endoleak.

The control CT showed a large endoleak, probably of type 3 (►Fig. 2). There was no sign of endoleak type 1 or endoleak between the renal fenestration and stent graft so we suspected that the endoleak was between the aortic cuff and the

previous stent graft. Because of the renal fenestration, we inserted a main body extension of 30 mm diameter and 58 mm length below the fenestrated cuff and without metal suprarenal fixation (Cook). Control angiography after cuff placement still showed the same degree of type III endoleak, however, with no sign of other types of endoleak. This led us to suspect that the endoleak was due to material fatigue of the old stent graft. Thus, we inserted an aortouniiliac converter device (Cook) from the left groin below the renal fenestrations, and left-to-right femorofemoral bypass was performed for perfusion of the right lower limb. The right limb of the previous stent graft was embolized with Amplatzer vascular plug (AGA, Plymouth, MA). Angiography now showed no endoleak (►Fig. 3) and a CT scan 1 year later showed no further endoleaks (►Fig. 4). Both the renal fenestrations and

Fig. 2 Contrast-enhanced CT 1 month after insertion of a fenestrated aortic cuff, showing an endoleak considered to be type III (arrow). CT, computed tomography.

Fig. 3 (Left) The endoleak remained after insertion of a graft extension (arrow). (Right) The endoleak is sealed after insertion of an aortouniiliac converter device and occlusion of the right limb.

Fig. 4 One-year follow-up CT showed no endoleak. CT, computed tomography.

the renal stent grafts were patent, and renal function was within normal limits.

Discussion

Endoleak is defined as a blood flow external to the stent graft and inside the aneurysmal sac. Classification into five categories is based on the source of blood flow.^{3,4} Types I and II are high-pressure leaks due to high blood flow from the systemic circulation into the aneurysmal sac and are associated with increased risk of aneurysmal rupture, thus requiring immediate repair.² Type II endoleaks are generally treated conservatively with follow-up.⁵ Our case of a combined type I and type III endoleak in a patient with inadequate neck length was initially treated with standard EVAR that first resulted in endoleak type II before developing types I and III. Fenestrated aortic stent graft was placed for managing type I endoleak. However, the endoleak still persisted in our case prompting the suspicion of type III endoleak. Type III endoleaks can be sealed via open surgery or endovascularly with placement of a new bifurcated endograft within the previous graft or additional stent graft with aortic extensions or aortouniliac stent grafts. Failure of any one of these options should lead the operator to consider other endovascular options before finally opting for open surgical repair.^{1,4,6} Even when our fenestrated aortic stent and aortic cuff without metal extensions failed to seal the endoleak, we chose the final endovascular option of aortouniliac stenting with femorofemoral bypass rather than open surgical repair of the endoleak. We have not seen reports in the literature mentioning such use of all available endovascular options in the one patient.

Techniques described to treat type I endoleaks include securing the attachment sites with angioplasty balloons, bare metal stents or stent-graft extensions. Oikonomou et al⁷ recently described using a fenestrated stent graft to manage a type Ia endoleak in a previously stented patient with an infrarenal aortic aneurysm.

Late type III endoleaks⁸ have been detected with various stent grafts, for example, with a Zenith Cook aortic stent graft due to a fabric tear or hole near the stent sutures,^{4,9} with an Ancure stent graft (Guidant, Menlo Park, CA)^{10,11} and an Excluder stent graft (Gore Medical, Flagstaff, AZ).¹² The first report of early type III endoleak with an ENDURANT stent graft (Medtronic) was reported by Abouliatim et al.¹³ Therefore, patients undergoing endovascular aortic repair should have lifelong follow-up, as endoleaks can be detected as late as 7 years postoperatively. Patients with documented aneurysmal expansion should be carefully monitored with suspicion of endoleak.⁸ Type III endoleak can be diagnosed by inflating a compliant balloon in the neck of the stent graft and injecting inferior to the balloon. Angiography combined with a search using guide wires and catheters has also been useful in localizing an endoleak.¹³

Conclusion

Fenestrated endovascular aortic repair is increasingly used in the management of abdominal aortic aneurysms with short necks. Patients who develop endoleak type I after standard EVAR can be effectively treated with a fenestrated stent graft. In the event of further endoleaks, we recommend other endovascular options before opting for open surgery.

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