Late endoleak after endovascular repair of an abdominal aortic aneurysm with multiple proximal extender cuffs

Yehuda G. Wolf, MD, Bradley B. Hill, MD, Thomas J. Fogarty, MD, Paul R. Cipriano, MD, and Christopher K. Zarins, MD, Stanford, Calif

Late onset graft or attachment site–related endoleaks may be hazardous, and early identification of patients at risk is important. We describe a patient who underwent implantation of a bifurcated stent graft 5.5 cm below the renal arteries because of a technical error with three extender cuffs implanted proximally to bridge the gap. During the 1st year, aneurysm diameter decreased from 68 to 52 mm. After 1 year, the patient had an acute endoleak develop, which originated between two of the extender cuffs and which was accompanied by severe abdominal pain and reexpansion of the aneurysm. This endoleak was treated with insertion of an additional bifurcated stent graft within the extender cuff segment. The patient has been subsequently followed for 6 months and has had no endoleak or symptoms, and aortic diameter has decreased once again to 55 mm. (J Vasc Surg 2002;35:580-3.)

Late onset graft or attachment site–related endoleaks are uncommon but may be associated with rapid expansion and an increased risk of rupture. Although studies have focused on early and persistent endoleaks, these have not been shown to predict late onset endoleak or other clinical endpoints. Because identification of patients at risk for late endoleak is important, characterization of predictors for such events is desirable. We describe here a patient who underwent endovascular aneurysm repair, early in our experience, and had three extender cuffs implanted proximal to the bifurcated graft module. The patient had a late acute endoleak develop, which may be a consequence of the configuration of the stent graft and the marked decrease in aneurysm size.

CASE REPORT

A 68-year-old man underwent endovascular repair of a 68-mm infrarenal abdominal aortic aneurysm with a bifurcated stent graft (AneuRx, Medtronic, Santa Rosa, Calif). Aneurysm neck length was 12 mm, and the distance from the renal arteries to the aortic bifurcation measured 152 mm. The main bifurcated module that measured 165 mm in length was inserted through the right femoral artery and deployed 5.5 cm below the intended site because of a technical error. Three overlapping extender cuffs measuring 3.75 cm in length were placed to bridge the gap from the endovascular graft to the origin of the renal arteries (Fig 1, A, B). On the early follow-up computed tomographic (CT) scans, no endoleak was seen (Fig 2, A). During the ensuing year, the maximal diameter of the aneurysm decreased to 52 mm (Fig 2, B) and aneurysm volume decreased from 300 to 200 mL. During this period, the distance from the renal arteries to the aortic bifurcation on cross-sectional CT image results decreased by 5 mm and the upper margin of the stent graft remained within 2 mm of its original position relative to the renal arteries. Thirteen months after the procedure, the patient had sudden onset of severe abdominal pain. Abdominal radiogram results showed increased curvature of the graft at the region of the proximal extender cuffs (Fig 1, C). CT scan results showed a large endoleak originating at the level of the extender cuffs and the aneurysm returned to its baseline maximal diameter (68 mm) and volume (Fig 2, C). Duplex ultrasound scan results showed misalignment of the extender cuff, with the body of the main graft module (Fig 3, A) and a large endoleak originating at that site (Fig 3, B). Arteriographic results showed a similar picture of misaligned grafts and a large endoleak (Fig 3, C).

An additional bifurcated AneuRx stent graft was implanted within the original one and served to stop the endoleak (Fig 1, D). This graft was deployed just below the renal arteries and spanned the length of the extender cuffs. After deployment, abdominal pain stopped immediately. The patient has been subsequently followed for 6 months. He has had no symptoms or endoleak, and aneurysm dimensions decreased once again (diameter to 55 mm and volume to 192 mL; Fig 2, D).

DISCUSSION

The patient reported here underwent treatment early in our experience with the AneuRx stent graft, and the primary bifurcated stent graft module was inadvertently deployed below the neck of the aneurysm. Increased experience with this device enabled us to avoid this complication in subsequent patients. Nonetheless, the strategy we used to recover from this and the subsequent outcome provide some lessons for endovascular aneurysm repair. We chose to insert three overlapping proximal extender cuffs, each 3.75 cm in length, to bridge the gap to the...
level of the renal arteries. Although this resulted in exclusion of the aneurysm sac and no endoleak, the columnar support inherent in the main module of the AneuRx stent graft was absent in this configuration.

By all parameters, the endovascular procedure was effective in treating the aortic aneurysm. There was no early endoleak and aneurysm size decreased. During the 1st year after the procedure, the aneurysm decreased in diameter by 16 mm, which is above the 90th percentile for the highest rate of decrease and the largest absolute decrease in aneurysm diameter. Other investigators who use endovascular grafts without columnar support have reported that, in addition to a reduction in aneurysm diameter, there is shortening of the aneurysm along the longitudinal axis. This has resulted in distortion of the endovascular graft with kinking and dislodgment. In this patient, there was freedom of movement between the extender modules of the stent graft and the infrarenal aorta shortened by 5 mm. This resulted in an increased curvature of the stent graft, which may have placed it under increased stress as reported by Harris et al. Although the main module of the AneuRx stent graft is designed to withstand this stress, the presence of multiple proximal extender cuffs in this patient was associated with multiple junctions that may move, become dislodged, and create an endoleak. In addition, the lack of columnar support, particularly with increased angulation, may increase the risk of graft migration, although we have not seen it in this patient.

In cases in which stent graft devices lack columnar support and circumferential hoop strength throughout their length, a rapid and large decrease in aneurysm volume may be the cause of stent graft distortion. The likelihood of this specific complication, which may result from
rapid decrease in aneurysm size, may be increased in the absence of an early endoleak, rather than in the presence of one. Therefore, close follow-up examination with serial imaging studies should be performed on all patients after endovascular aneurysm repair, irrespective of endoleak status, and markers for graft distortion should be sought before the development of acute endoleak or occlusion.

After the patient had acute symptoms develop with evidence of a new onset endoleak and reexpansion of the aneurysm, he was treated on an emergent basis. A new bifurcation AneuRx stent graft was deployed within the series of extender modules, thus sealing the endoleak and providing continuous structural support from the renal arteries to the iliac arteries. Indeed, this solution could have been used at the time of the initial procedure when the primary module was deployed about 5 cm below the renal arteries. It is important to note, however, that with the AneuRx stent graft, a second primary module, which

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Fig 2. Cross-sectional computed tomographic (CT) scan images obtained at several time points were all taken at same axial level. A, CT scan 1 month after endovascular repair shows thrombosed aneurysm sac around stent graft. Sac measures 68 mm in its maximal transverse diameter. B, Follow-up CT scan obtained routinely after 12 months shows thrombosed aneurysm sac, which has decreased in size. C, CT scan obtained emergently after onset of abdominal pain shows large endoleak and acute expansion of aneurysm. D, CT scan 2 months after repair of endoleak shows completely thrombosed aneurysm sac. Two layers of stent graft are evident.
is deployed within a previous one, protrudes at least 3.5 cm and if the distance from the renal arteries is less than that, this strategy cannot be used. Other investigators have treated new onset endoleaks, which were related to the stent graft, with strategies focused on eliminating the endoleak rather than addressing the fundamental structural issue of the stent graft. This proved unsuccessful and resulted in aneurysm enlargement and rupture. Increase in aneurysm size rather than an endoleak per se is the primary indicator of an unsuccessful aneurysm repair and should be treated with endovascular or open surgical repair as appropriate.

In summary, we present a patient with a late endoleak originating at the junction of multiple proximal extender cuffs and a simple procedure to restore stability. This case shows the importance of long-term follow-up examination with careful monitoring of aneurysm size and stent graft configuration.

REFERENCES


Fig 3. A, Grayscale ultrasound scan obtained at time of endoleak shows misalignment of grafts. B, Color-flow duplex ultrasound scan shows endoleak originating at that site. C, Aortogram shows large endoleak arising at site disengagement between lowest extender cuff and main bifurcation module.