Combination of the Chimney Technique and an iliac-branched device for the repair of a failed EVAR

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Abstract:

Long-term complications of endovascular aortic aneurysm repair (EVAR) has been a reality since this method exists more than 2 decades, while a complex endovascular approach may be usually demanded in these cases. We present an 83-year old male patient, with a failed EVAR, applied 5 years ago. Computed tomography angiography revealed a large increase in aneurysm diameter (93mm) due to endoleak type Ia (ET Ia) and bilateral type Ib, caused by proximal neck dilatation and bilateral common iliac artery enlargement. An aortic graft extension, using a thoracic endograft, and 3 parallel grafts for both renal and superior mesenteric arteries were used to deal with the ET Ia. An iliac branched device for the preservation of the left internal iliac artery as well as coiling of the right one and extension to the external iliac were used to treat ET Ib. The patient was discharged the 6th post-operative day and the post-operative 1st year of follow-up was uneventful.

INTRODUCTION

The number of cases with failed endovascular aneurysm repair (EVAR) will increase over the upcoming years as the number of patients being treated is augmented.[1] During follow-up, proximal neck dilatation may be present in almost 25% of patients previously treated with EVAR. Neck aneurysmal evolution is related to worse clinical outcomes, due to a higher incidence of type Ia endoleak (ET Ia), migration, and the need for re-intervention.[2] In the iliac sealing zone, iliac diameter may exceed graft diameter in mid-term follow-up in up to one third of patients and may be associated with endograft retraction and ET Ib evolution.[3] In such cases, the application of different available treatment modalities may have an important impact in patients' outcomes.[1] Endovascular management with newer techniques and devices, as iliac branched devices, endoanchors, fenestrated and branched devices offer an alternative minimally invasive approach in the confrontation of EVAR complications. Herein, we report a case of an 83-year-old male, with a failed EVAR, treated with a combination of the chimney technique and iliac-branched device. This report has been approved by the Ethics Committee of the Hospital.

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CASE REPORT

An 83-year old male, with a medical history tobacco use, hypertension, dyslipidemia, coronary artery disease with decreased ejection fraction (EF 35%), and chronic obstructive pulmonary disease presented 5 years after EVAR. He has been treated for an infra-renal abdominal aortic aneurysm of 85mm, associated to iliac aneurysms of 21-23mm, using a bifurcated endoprothesis with a long main body (Treovance, Bolton, Sunrise, USA) (Figure 1). A month later, the aneurysm sac had already begun to shrink at 79mm. The patient was incompliant to the surveillance protocol and presented 5 years afterwards due to diffused abdominal pain. Computed tomography angiography revealed an ET Ia due to neck dilatation without graft migration, sac expansion at 93mm and bilateral ET Ib due to iliac aneurysms (Figure 2). Extreme aortic and iliac tortuosity and the emergency setting precluded any treatment with fenestrated or branched devices. (Figure 3). Considering the complex anatomy, patient's general status and the emergent character of the case, a proximal extension using a short thoracic endograft with 3 parallel grafts for visceral vessels (two renals and superior mesenteric artery (SMA)), was decided to achieve sealing to the proximal part. Taking into account the presence of the previous long main body endograft (100mm) and the large supra-renal diameter, the decision to use a thoracic graft of 38mm in diameter seemed rational (oversize 27%). A decision to use an iliac branched device for the preservation of the left internal iliac artery (IIA) and a coil embolization for the right IIA in conjunction to an iliac limb extension to the right external iliac artery (EIA) was also made.

Figure 1. An 83-year old male has been treated, five years ago, for an infra-renal abdominal aortic aneurysm of 85mm, associated to iliac aneurysms of 21-23mm, using a bifurcated endoprothesis (Treovance, Bolton, Sunrise, USA). He was lost to follow-up since then and presented to the outpatient clinic due a CTA revealing aneurysms expansion.

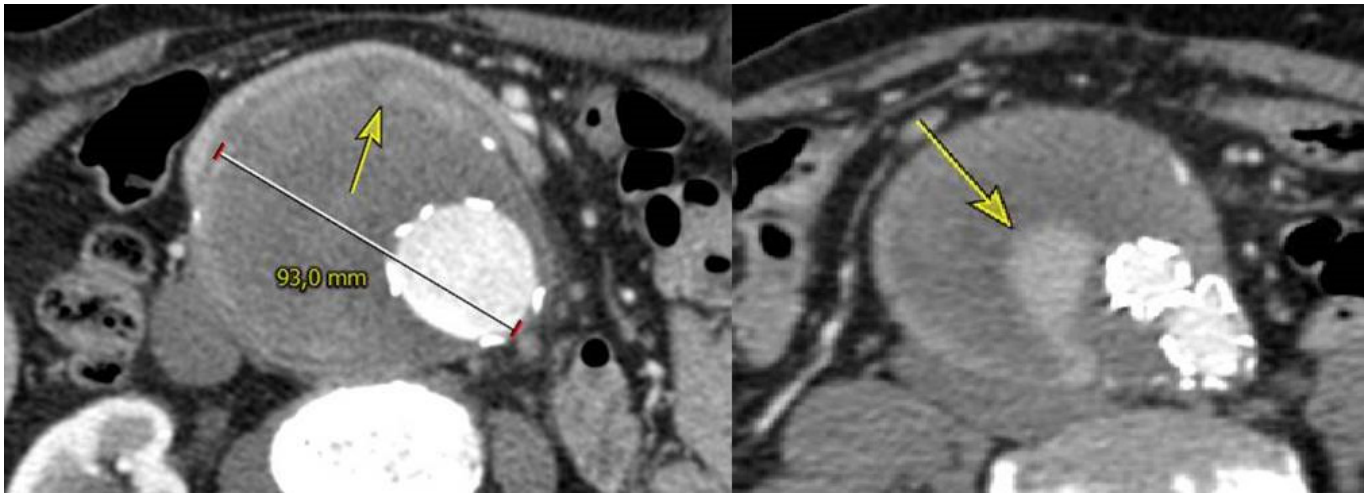

Figure 2. Computed tomography angiography revealed an ET Ia due to neck dilatation without graft migration and sac expansion at 93mm. The yellow arrows highlight the presence of the endoleak.

Figure 3. Due to large aneurysm diameter, which precluded any fenestrated or branched device, as well as the presence extreme aortic and iliac tortuosity and patient's general status, a proximal extension using a short thoracic endograft with 3 parallel grafts for the revascularization of the visceral vessels.

Access was achieved using both axillary and femoral arteries. Due to the high tortuosity, via the left common femoral artery, a crossover 0.035 PTFE wire was extracted to the right axillary artery using a snare. The left IIA was catheterized from above and the iliac-branched device was deployed (Iliac Branched Endoprothesis, Gore, Newark, USA). A self-expanding covered stent (13x50mm, Viabahn, Gore, Newark, USA) was applied as a bridging stent into the left IIA. Parallel covered stents (Be-Graft, Bentley, Innomed, Germany) were deployed into both renal arteries (RA) and SMA to achieve perfusion of kidneys and bowel. All three splanchnic vessels were catheterized from above. The thoracic endograft was inserted from the right femoral artery and deployed up to the celiac trunk (38x38x100, Relay, Bolton, Sunrise, USA). All target vessel stents were relined using self-expanding stents to preserve patency (E-luminexx, Bard, Covington, USA) (Figure 4). Subsequently, using the left axillary artery, the right IIA was catheterized and embolized using coils (10x20mm, Bolton Medical, Sunirise, USA). Finally, an additional limb extension, down to the EIA, was used to seal the iliac aneurysm (Excluder, 16x14.5x120mm, W. L. Gore & Associates, Newark, USA). The completion angiography showed no endoleak and all stents were patent. The operation duration was 240 min, contrast used was 180ml and radiation exposure (dose area product) was 606mGy (102 min).

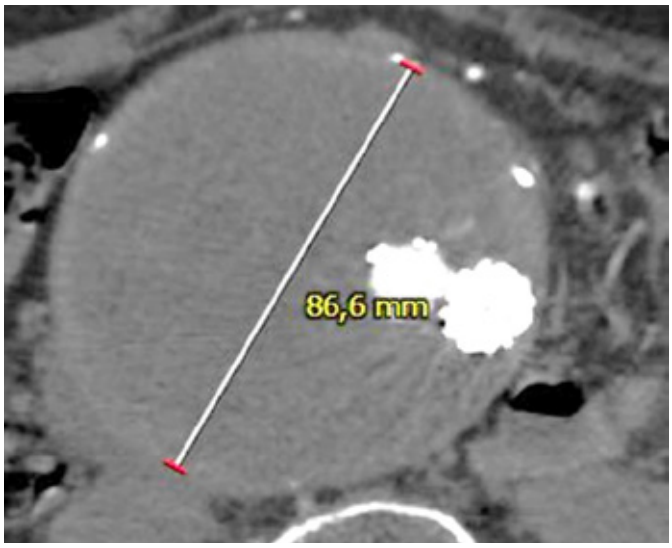

Figure 4. The left IIA was catheterized from above and an iliac-branched device was deployed. A self-expanding covered stent was applied as a bridging stent into the left IIA (**red circle**). Parallel covered stents were deployed into both renal arteries and SMA. Pre-discharge CTA confirmed all target vessels and IIA patency.

Pre-discharge CTA revealed the presence of a small gutter endoleak. The patient was discharged the 6th post-operative day without any complication recorded. First-month follow-up with CTA confirmed the resolution of the gutter endoleak and a sac diameter decreased at 86mm. Follow-up at 6 and 12 months revealed no complication, with complete sac exclusion and patent visceral and IIA stents, while there is a moderate shrinkage of the sac to 79mm (Figure 5).

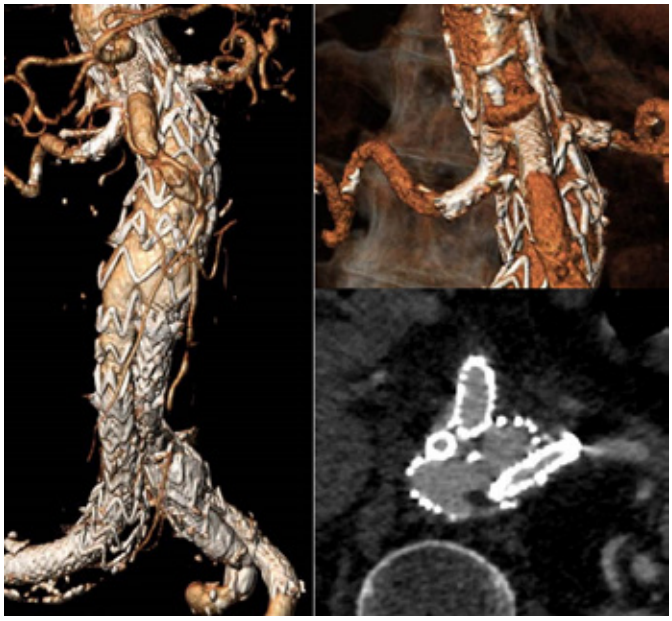

Figure 5. Follow-up at 1 month revealed no complication, with complete sac exclusion and shrinkage. No endoleak was depicted.

DISCUSSION

Proximal neck diameter increases after EVAR, mainly due to the continuous evolution of the aneurysmal disease.[4] In the majority of patients, the aortic neck is suspected to present an increase of 5.9 ± 9.3% during the early follow-up.[4] In this case, the patient was treated for an intact aneurysm of 83mm. Sac diameter begun to decrease during the early post-operative period. However, due to patient's non-compliance with the follow-up protocol, no further information was available for the next 5 years. At presentation, an important neck dilatation affected the proximal sealing and contributed to an ET Ia development. Nevertheless, aneurysmal evolution may also affect distal sealing and evoke a concomitant common iliac artery expansion.[5] In this patient, iliac dilatation resulted in a bilateral ET Ib which further affected sac remodeling. Iliac dilatation and endograft migration may be detected in patients treated with EVAR, especially when the initial iliac diameter exceeds 24mm.[3]

Current guidelines recommend the use of endovascular means for the management of endoleaks as the first line treatment choice.[6] Type I endoleaks (ET Ia and b) should be treated as soon as possible; using coil or glue embolization, proximal extension with a chimney or conversion to a fenestrated or branched endografts in case of proximal leak or distal extension of the iliac limb with or without IIA preservation; in selected cases down to the EIA.[7] Especially, in this elder patient, an endovascular approach would be the safest solution due to his multiple comorbidities. In high comorbid elder patients, endovascular treatment is associated with acceptable mortality while the re-intervention rate is comparable to younger patients.[8]

Neck degeneration and graft migration after EVAR may set the indication for proximal extension using different endovascular approaches; such as fenestrated and branched devices, parallel grafts (chimney technique) and endo-staplers.[1,9,10] In any case, the endovascular management of proximal neck dilatation is associated with lower 30-day and aneurysm related mortality.[1] After a careful evaluation of the pre-operative CTA and due to the symptomatic aneurysm expansion, a proximal extension using the parallel grafts technique was used in this patient. Important neck dilatation, proximal aortic diameter and tortuosity precluded any other endovascular technique than chimney EVAR. This off-the-shelf approach permitted the immediate and effective treatment of this patient who presented an important sac increase associated to atypical abdominal symptoms.[11] The parallel graft technique is indicated in cases of emergent or urgent cases or when fenestrated or branched devices are not indicated or available.[6] Despite that the presence of more than two chimneys may be implicated with gutter endoleaks, the application of more than 2 parallel grafts may be a safe and durable solution in an emergent or urgent setting.[11,12]

Distally, an iliac branched device was used to preserve left IIA flow while contra-laterally, a coil embolization of the IIA associated with an EIA extension were used. No complications were recorded. The adverse anatomy, patient's age and comorbidities and potential longer operational time hampered the use of bilateral iliac branched devices. Branched devices for the preservation of the IIA seem to be safe and effective in the midterm follow-up while thrombosis is a rare, early complication that may be confronted with endovascular means.[13] The combination of complex proximal aortic endovascular repair and iliac branched devices for the management of aortoiliac aneurysmal disease can achieve good early outcomes despite an acceptably higher re-intervention rate in when compared to standard EVAR combined to IBD.[14]

CONCLUSION

The progression of the aneurysmal disease may be the Achilles's heel of aneurysm repair. Proximal and distal type I endoleaks could be managed adequately using completely endovascular means, as in this case. A failed previous standard EVAR may demand a more complicated endovascular approach.

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Conflict of interest: None

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