» **Case Report** «

Endovascular Treatment of Type Ib Endoleak after Evar Using the IBD Device: A Case Report

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In the modern endovascular era, abdominal aortic aneurysm repair is still not free of complications with re-interventions following endovascular aneurysm repair (EVAR) being more common than with open surgical repair. A variety of endovascular, open surgical and combined techniques were described according to the anatomical considerations and general health of the patient to achieve the best possible result after these complications. In cases of type Ib endoleak following aorto-uni-lateral EVAR for an abdominal aortic aneurysm, the use of the internal branched device (IBD) constitutes a safe and effective technique.

Keywords: abdominal aortic aneurysm, type Ib endoleak, internal branch device

Introduction

Although the mortality rate of endovascular repair of abdominal aortic aneurysms (AAAs) is comparable to open surgical repair, a higher rate of secondary interventions has been reported with the former technique. In most cases re-interventions are due to endograft complications such as endoleaks, graft migration, iliac limb occlusion, etc. These complications can be avoided by fixation of the graft in the sealing zone. In 15% to 30% of cases, infrarenal AAA may be associated with common iliac artery (CIA) dilation or aneurysm¹ which in the short term can provide a short distal sealing zone. Moreover, particularly in ectatic iliac arteries, significant dilatation of the CIA post-endovascular aneurysm repair (EVAR) can lead to type Ib endoleak, one of the

most frequent complications requiring re-intervention after EVAR. Thus, continued clinical and imaging follow-up is mandatory.² New methods and innovative devices have been used in order to treat these complications and additionally prevent from internal iliac artery (IIA) obstruction which can lead to morbidity due to the pelvic ischemia such as hip and buttock claudication, colonic ischemia, perineal or spinal ischemia, sexual impotence and buttock necrosis.³

In the patient referred here, a combined femoral and axillary access was required in type Ib endoleak after previous aorto-uni-lateral EVAR. Our case is significant for the additional technical manipulations and materials necessary to complete the procedure and to manage peri-procedural complications.⁴

Case Presentation

A 78-year-old male patient was referred to our clinic for endovascular repair of type Ib endoleak diagnosed by CT angiography two months after aorto-uni-lateral EVAR for a 9.2 cm AAA with request to preserve his last IIA (Figs. 1 and 2a). His past medical history included hypertension, coronary artery disease and coronary bypass surgery. There was also a significant 5.4 cm aneurysm of the right CIA, an aneurysm of the left CIA 3.2 cm, 1.6 cm aneurysmal dilation of the right IIA, obstruction of the left CIA, IIA and external iliac artery (EIA) after a stent implantation nine years earlier. The patient had undergone an aorto-uni-iliac EVAR and a femoro-femoral right to left bypass to establish reperfusion of the left leg two months ago.

In this patient, arterial blood supply to the pelvic organs was derived only from the right IIA. Thus, in order to maintain it, the use of the internal branch device (IBD) was decided as an endovascular approach. The device was ordered based on Cook Zenith TFLE leg extension (William Cook Europe, Bjaeverskov, Denmark), with a 45 mm long main body and a proximal and a distal diameter of 12 mm. The straight side branch, 8 mm in diameter and 21 mm long, was attached to the tube in a 30° angle and fitted with a preloaded indwelling wire.

The patient received general anesthesia since the catheterization of the IIA had to be done through his left axillary

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Fig. 1 Pre-operative 3D reconstructive CT angiography (CTA) showing the aorto-uni-lateral EVAR into the right common iliac artery with type Ib endoleak and the occluded left common, external (EIA) and internal iliac artery (IIA). EVAR: endovascular aneurysm repair

artery. After open exposure of the right femoral artery the IBD (Zenith Branch Graft – Iliac bifurcation, ZBIS-12-45-41, Cook) was advanced and partially deployed so as the distal edge of the iliac branch to open up about 1 cm above the orifice of the IIA. Through the left axillary access, the preloaded guide wire was snared (Entrio® Snare system, Hatch Medical, L.L.C, Medical Device Technologies, Inc., Gainesville, FL, USA) and used as a pull-through and through wire for the advancement of the shuttle sheath up to the distal edge of the iliac branch. A 45 cm 12F Flexor guiding sheath (Check-Flo® Introducer, ANSEL 1, Cook Inc., and Bloomington, IN, USA) was inserted (“pulled in” rather than “pushed in”) from the axillary artery into the descending thoracic aorta. Then an additional 10F Flexor sheath was used inside the 12F sheath, known as “trombone technique”,⁵⁾ and inserted into the iliac side branch of the IBD (Fig. 3a). This maneuver provided a more gradual and stable transition of the stent-graft into the side branch considering the extreme tortuosity of the aorta and CIA (Fig. 1). The indwelling wire was then removed in order to offer further release of the iliac branch limb and to facilitate catheterization of the IIA. After catheterization of the IIA, a stiffer wire (Amplatz super stiff, Cook Inc.) was inserted and the 10F guiding sheath advanced inside the

Fig. 2 (a) CTA after multiplanar reconstruction (MPR) with central lumen line showing the endoleak and the aneurysmatic IIA. (b) MPR with central line lumen after IBD with axial images at the level of the IBD and the stent-graft. IBD: internal branched device

Fig. 3 Drawing of the endovascular procedure showing (a) the use of two sheaths inserted from the axillary artery over the through and through indwelling wire and (b) the final result after the completion of the procedures.

IIA. In order to reduce the gap between the side branch and the orifice of the IIA, the IBD was retracted over the two rails formed by the Flexor sheath and the main introduction device. After full deployment of the EIA part of the IBD, a 9×38 mm balloon expandable stent-graft (Advanta V12, Atrium Europe, Mijdrecht, The Netherlands) was introduced and deployed into the side branch and IIA (Fig. 3b). The Advanta V12 was flared distally with a 9×40 mm balloon (Powerflex P3, Cordis Europa, Roden, The Netherlands) to achieve good sealing.

The total operative time was 150 min and blood loss 250 mL. The fluoroscopy time was 37 min and total contrast volume used 300 ml (Ultravist® (iopromide) 300 mg I/mL, Bayer HealthCare LLC).

The post-operative period was uneventful and he was discharged home asymptomatic on the fourth postoperative day. CTA follow-up at six weeks showed no endoleak, patent hypogastric blood flow and secured distal fixation of the stent graft (Fig. 2b).

Discussion

One of the most fear complications after EVAR is type I endoleak. In case of a type Ib endoleak in an iliac artery with no adequate sealing zone, mean endovascular option is the mechanical occlusion of the hypogastric artery (e.g. selective embolization and/or orifice coverage) and extension of the iliac stent-graft to the EIA. When the contralateral IIA is already occluded, it is highly recommended to keep patent the second IIA in order to avoid serious complications.³⁾

When the iliac arteries become unfamiliar or aneurismal, alternative techniques are required to achieve an adequate distal sealing zone and maintain perfusion of the hypogastric artery. These techniques typically involve endovascular, open surgical or combined procedures making the individualization the best therapeutic principle.^{6,7)} Irrespective of the technique used, type Ib endoleak is the most frequent complication occurring in up to 17% of these patients,^{8,9)} thus frequent imaging and clinical follow up is mandatory.

In our patient, maintenance of the single right hypogastric artery was absolutely necessary to maintain perfusion of the pelvic organs. One treatment option was hybrid surgery with stent-grafting extending to EIA and open repair with graft bypass from EIA to IIA. Another solution was the use of two parallel stent-grafts (sandwich technique) for both EIA and IIA inserted from ipsilateral femoral artery and axillary artery respectively.¹⁰⁾ The first option was criticized as more complicated and aggravating for the patient with increased risk for occlusion of the femoro-femoral graft because of the prolonged iliac artery clamping. The second option required also axillary access but there was an increased risk for occlusion at the proximal part of parallel stent-grafts inside the narrow (12 mm) distal part of the aorto-unilateral stent-graft.

Patient's co-morbidities and the absence of contralateral iliac approach, made IBD from the arm the only safe totally endovascular treatment option. Moreover, occlusion of the left CIA required using the left axillary artery in order to achieve the through and through access necessary for iliac branch and IIA catheterization and stent-grafting in order to achieve maximum technical success.

Conclusion

IBD stent-grafting from the "arm" though sometimes technically demanding is a safe and feasible technique that may be considered in those cases in which re-intervention for endoleak type Ib following EVAR is necessary.

Disclosure Statement

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Author Contributions

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