A Technique of "Chimney Nellix" for the Management of Type 1a Endoleak After EVAR

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ABSTRACT

This report presents 3 procedures with visceral "chimney stenting" in conjunction with an endovascular aneurysm sealing (EVAS) device, known as chEVAS, for treatment of type 1a endoleak. It includes the first published chEVAS in a patient with previous fenestrated endovascular aneurysm repair (FEVAR). Cases include an 80-year-old man 8 years after FEVAR for a juxtarenal abdominal aortic aneurysm (AAA); an 85-year-old woman 9 months after endovascular aneurysm repair (EVAR) for a ruptured infrarenal AAA; and an 84-year-old woman 3 months after EVAR for a symptomatic infrarenal AAA. Technical success was achieved in all cases, with 1 postoperative death. The remaining 2 patients had no residual type 1a endoleak at 10 and 14 months respectively.

ABBREVIATIONS

AAA = abdominal aortic aneurysm, chEVAS = endovascular aneurysm sealing device in conjunction with "chimney stents," EVAR = endovascular aortic aneurysm repair, EVAS = endovascular aneurysm sealing, FEVAR = fenestrated endovascular aneurysm repair

INTRODUCTION

Repair of type 1a endoleaks after endovascular aortic aneurysm repair (EVAR) is complicated by the presence of the existing graft, difficult visceral vessel access, and unfavorable aneurysm morphology. One method of repair uses the Nellix (Endologix, Irvine, California) endovascular aneurysm sealing (EVAS) device in conjunction with "chimney stents" (so-called "chimney EVAS" or chEVAS), although such use of the Nellix device is outside the current recommended instructions for use (1–4). Repair of type 1a endoleaks after fenestrated endovascular aneurysm repair (FEVAR) presents further complexity, for which there are few ideal solutions described in the literature and none using chEVAS. This series presents 3 patients treated with chEVAS, including 1 patient who was treated for a type 1a endoleak after FEVAR.

CASES SERIES

Between June and September 2016, 3 patients were treated in our institution for type 1a endoleak. All patients were treated with chEVAS consisting of 2 or 3 chimney stents in conjunction with Nellix EVAS stent-grafts. All procedures were performed in an angiography suite with a multidisciplinary team led by a specialist vascular surgeon. Institutional review board approval for retrospective review of these patients was not required at our institution.

Preoperative Features

Patient 1: An 80-year-old man with a large type 1a endoleak 8 years after FEVAR (Cook Medical, Bloomington, Indiana)

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Table 1. Baseline Details

	Patient 1	Patient 2	Patient 3
Age (years)	80	85	84
Sex	Male	Female	Female
Maximal aneurysm sac size (mm)	65	59	70
Medical history	Ischemic heart disease, paroxysmal atrial fibrillation, aortic stenosis, hypertension, smoker	Chronic obstructive pulmonary disease, hyperparathyroidism, hypertension	Hypertension, chronic renal failure
Existing Graft	Two-vessel (renal) FEVAR with SMA "scallop"	Endurant (Medtronic) EVAR	Excluder (W.L. Gore & Associates) EVAR

EVAR = endovascular aortic aneurysm repair; FEVAR = fenestrated endovascular aortic aneurysm repair; SMA = superior mesenteric artery.

with bilateral renal artery fenestrations and a superior mesenteric artery (SMA) scallop (Table 1). Endovascular repair options were complicated by the relation of the endoleak to the SMA scallop, a large SMA infundibulum, and extensive atheromatous disease of the entire SMA (Fig 1). A tortuous and calcified left subclavian artery and diseased right common femoral artery presented potential difficult access. The celiac artery origin was heavily calcified and severely stenotic; therefore, sacrifice of this vessel was planned to simplify the procedure. Three-vessel chEVAS with "chimney stents" to bilateral renal arteries and SMA was planned.

Patient 2: An 85-year-old woman with a type 1a endoleak 9 months after endovascular aneurysm repair (EVAR) for a ruptured abdominal aortic aneurysm (Table 1). Endovascular repair would require sealing into the suprarenal aortic segment. There was concern about difficulty cannulating the renal arteries, with thin-slice computed tomography (CT) images suggesting bare-metal stent struts of the original stent-graft overlying the renal ostia. Furthermore, the iliac vessel size was inadequate to allow access for the main body of available fenestrated devices. A 2-vessel (bilateral renal arteries) chEVAS was planned, with the benefit of keeping covered stent and stent-graft components unopened until the renal arteries were successfully cannulated, making the success of the procedure as a whole more likely.

Patient 3: An 84-year-old woman with a type 1a endoleak 3 months after EVAR for a symptomatic abdominal aortic aneurysm (Table 1). An attempt to use Aptus Heli-FX Endoanchors (Medtronic, Minneapolis, Minnesota) to secure the stent-graft to the aneurysm neck and seal off the endoleak was unsuccessful. The top of the Gore Excluder (W.L. Gore & Associates, Newark, Delaware) was at the same level as the top of the left renal artery ostium (Fig 2), preventing cannulation of the left renal artery from a femoral approach. Iliac vessel size was insufficient for access of the main body of a fenestrated device. A plan was made for a 3-vessel (SMA and bilateral renal arteries) chEVAS.

Procedural Details

Access was achieved via bilateral common femoral artery (CFA) punctures and left subclavian access via open cutdown. A conduit graft was anastomosed end to side to the left subclavian artery for Patient 3, to enable access for 3 sheaths. Renal arteries and the SMA were cannulated anterogradely and sheaths placed into the visceral vessels. In Patient 1, renal artery cannulation was assisted by a compliant balloon being transiently inflated in the infrarenal aorta to deflect the wire and catheter into the existing renal covered stents (Fig 3). Covered stents were then deployed into each of the target visceral vessels. Operative details are summarized in Table 2. Selection of covered stents was based on the degree of angulation of visceral arteries. Balloon-expandable V12 covered stents (Maquet, Rastatt, Germany) were deployed in downward-angled vessels, with self-expanding Viabahn covered stents (W.L. Gore & Associates) preferred in the other cases to avoid kinking of the stent.

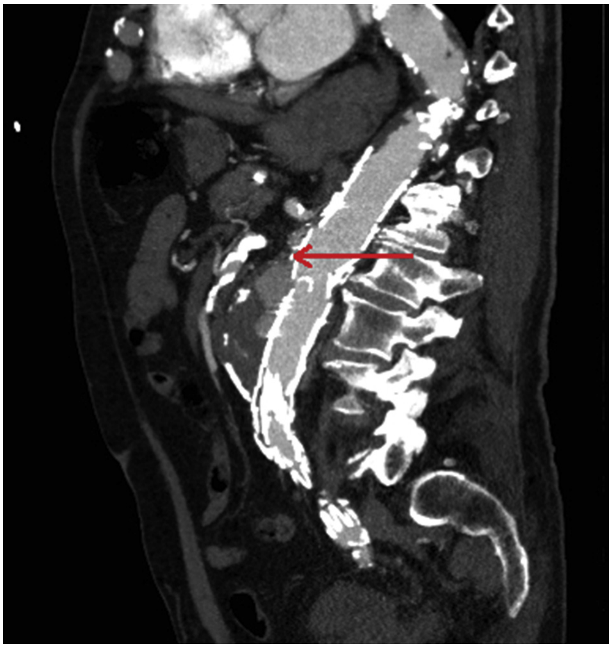

Figure 1. Sagittal computed tomography angiogram image demonstrating a type 1a endoleak (arrowed) originating from around the superior mesenteric artery scallop at the proximal end of the existing fenestrated endovascular aneurysm repair graft.