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Case Report

Total Endovascular Therapy of Abdominal Aortic Aneurysm, Peripheral Artery Disease, and Chronic Mesenteric Ischemia: A Challenging Case

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We presented a challenging case of a patient diagnosed with abdominal aortic aneurysm (AAA), peripheral artery disease, and chronic mesenteric ischemia (CMI). Herein, we describe the treatment in this high-risk patient diagnosed with CMI who also had critical limb ischemia and his AAA had rapidly expanded. First we performed angioplasty and celiac arterial stenting. Afterwards, we proceeded to perform balloon angioplasty of the iliac arteries and chimney endovascular aneurysm repair (Ch-EVAR) preserving the inferior mesenteric artery (IMA). The patient was discharged three days later and his IMA remained patent eighteen months post-operation. A thorough pre-operative assessment is essential in such challenging cases. Minimally invasive procedures like endovascular therapy and the chimney technique extend the prognoses in high-risk patients.

Key Words: Chimney technique, Inferior mesenteric artery, Endovascular aneurysm repair

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INTRODUCTION

Endovascular therapy is continuously gaining ground for the treatment of aortoiliac occlusive disease (AIOD). It is also the first choice of therapy for abdominal aortic aneurysms (AAAs). The prevalence of colon ischemia is estimated to be substantially lower in endovascular aneurysm repair (EVAR) than in an open surgical repair (OSR) [1]. Current recommendations suggest evaluation and treatment of symptomatic superior mesenteric artery (SMA) stenosis before EVAR or OSR and preservation of at least one internal iliac artery in order to prevent postoperative bowel ischemia following AAA repair [2]. Moreover, while chimney technique is usually utilized for juxtarenal aneurysms (to increase the proximal landing zone) or in aortic arch pathologies, it has been also described for inferior mesenteric artery (IMA) preservation in small case series/case reports [3,4]. We herein present the total endovascular treatment of a high-risk patient diagnosed with AAA, symptomatic AIOD, and chronic mesenteric ischemia.

CASE

A 65-year-old man was referred to our hospital complaining of postprandial pain. He also had an unintentional weight loss (6 kg over six months). His medical history included peripheral artery disease and coronary artery disease that were treated with percutaneous transluminal angioplasty (PTA) using the kissing stent technique (9 years ago) and coronary artery bypass grafting (15 years before). He

was also diagnosed with chronic kidney disease (stage 4, glomerular filtration rate <30 mL/min).

On evaluation, computed tomography (CT) scan revealed: i) a severe celiac artery stenosis, ii) an occluded SMA, iii) a hypertrophic IMA (proximal diameter 7.86 mm), and iv) an AAA (max diameter <50 mm). We performed digital subtraction angiography and PTA of the celiac artery using a balloon-expandable stent. The patient was discharged few days later after his postprandial pain was resolved.

Four months later, the patient was admitted to an emergency department with massive hematemesis. He underwent upper gastrointestinal endoscopy which also revealed gastric ulcer. During hospitalization, he suffered myocardial infarction (MI) and finally enrolled in a hemodialysis program. Two months later (six months after celiac artery stenting), the patient complained of lower extremity rest pain. A new CT scan revealed severe in-stent restenosis (ISR) of the iliac arteries and significantly expanded AAA (max diameter 55 mm). The patient was considered for prompt repair of the aneurysm due to critical limb ischemia (ankle-brachial index (ABI) 0.3 right leg and 0.34 left leg) and rapidly expanded AAA (>0.5 cm within six months).

Pre-operative planning and procedure

The patient was diagnosed with a patent hypogastric artery. The preservation of the IMA was considered essential because of its diameter (7.86 mm). There was a significant collateral network arising from the IMA along with an occluded SMA. The preservation of renal arteries was not considered because the patient was already in hemodialysis program. Along with ostia of the renal arteries and SMA, the proximal landing zone was ~3 cm. Preoperative planning included an a 30% oversize (31×14.5×150 mm and right limb 16×12×100 mm) (Fig. 1). Under regional anesthesia and with systematic heparization of the patient (1 mL heparin [5,000 IU]) we proceeded to surgical cut-down of both femoral arteries. We initially performed balloon angioplasty of the iliac arteries to introduce the delivery system of an endograft. We then exposed the left brachial artery and over a conventional 0,035' standard guidewire (Terumo, Tokyo, Japan). We introduced a 5-Fr vertebral catheter and a 7-Fr Arrow sheath (Teleflex Medical, Morrisville, NC, USA). Using a 0.035' Amplatz guidewire (Boston Scientific,

Fig. 2. Final angiogram showed the enlarged inferior mesenteric artery and significant collateral network arising from it.

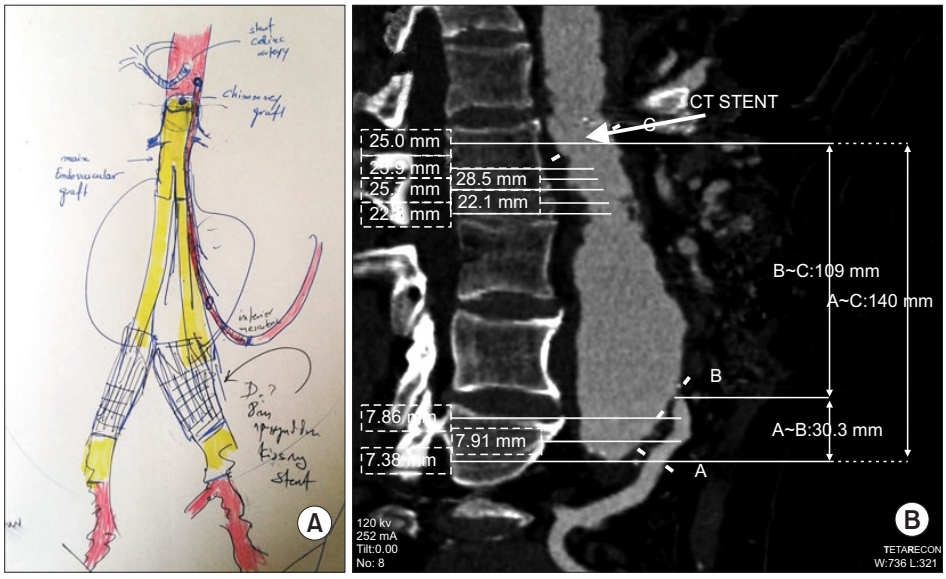

Fig. 1. Pre-operative planning and pre-operative computed tomography scan.

Natick, MA, USA), we cannulated the IMA and selective angiography was performed to visualize the IMA and its branches. We introduced and expanded a self-expandable stent graft (8×150 mm Viabahn, W.L.Gore & Associates, Flagstaff, AZ, USA) ~2 cm in the IMA to preserve the branches. A second balloon-expandable stent graft (8×60 mm BeGraft, Bentley Innomed GmbH, Hechingen, Germany) was introduced into the self-expandable stent with an overlap of approximately 3 cm to increase the radial force and minimize the risk of kinking. A standard EVAR procedure using an Excluder C3 (W.L.Gore & Associates) was followed by covering the ostia of both the renal arteries. After cannulation of the contralateral gate and contralateral limb deployment, we performed simultaneous balloon of Gore endograft and Viabahn. The proximal end of the Begraft was protruding proximally from Gore endograft (Fig. 2).

The patient was discharged three days later in good health. He showed no symptoms of ischemic colitis and his rest pain was resolved (ABI >0.5 bilateral). After eighteen months, the patient remained asymptomatic (no postprandial pain and resolution of lower extremity rest pain). CT angiography revealed patency of the IMA, absence of an endoleak, and aneurysm sac shrinkage (max diameter 4.5 cm) (Fig. 3).

Informed consent has been obtained from the patient for the publication of the case report and accompanying images.

DISCUSSION

Splanchnic circulation constitutes the celiac artery, SMA, IMA, and their collateral pathways (Arc of Riolan, marginal artery of Drummond, and meandering artery). Internal iliac arteries are the other important interconnections. The occurrence of bowel ischemia after EVAR is estimated to be <1% whereas that after OSR is ~3.6% [1]. As a result, selective reimplantation of the IMA is suggested in OSR to prevent post-operative ischemic colitis [2]. Indications of preservation could be bilateral occlusion of hypogastric artery or occlusion of SMA or of the celiac trunk. Other indications could be synchronous AAA and IMA aneurysm or a previous colon procedure where the collateral network is probably interrupted [3,4]. However, all these indications remain relative and are not well documented.

The patient had a significant collateral network along with an occluded SMA. Angioplasty of the celiac trunk was performed previously. Considering the comorbidities of the patient (recent MI and ejection fraction <40%), OSR was not an option. Hence, we decided to proceed with an endovascular therapy. The patient was already enrolled in a hemodialysis program and was also diagnosed with an occluded SMA and hence preservation of the ostia was not considered. This way we managed to increase the proximal landing zone from 0.8 cm to 3 cm. Preservation of the IMA could be achieved either with a fenestrated branched endograft or with the chimney technique. The chimney technique is readily performed unlike the fenestrated endograft (time to manufacture the endograft). The economic advan-

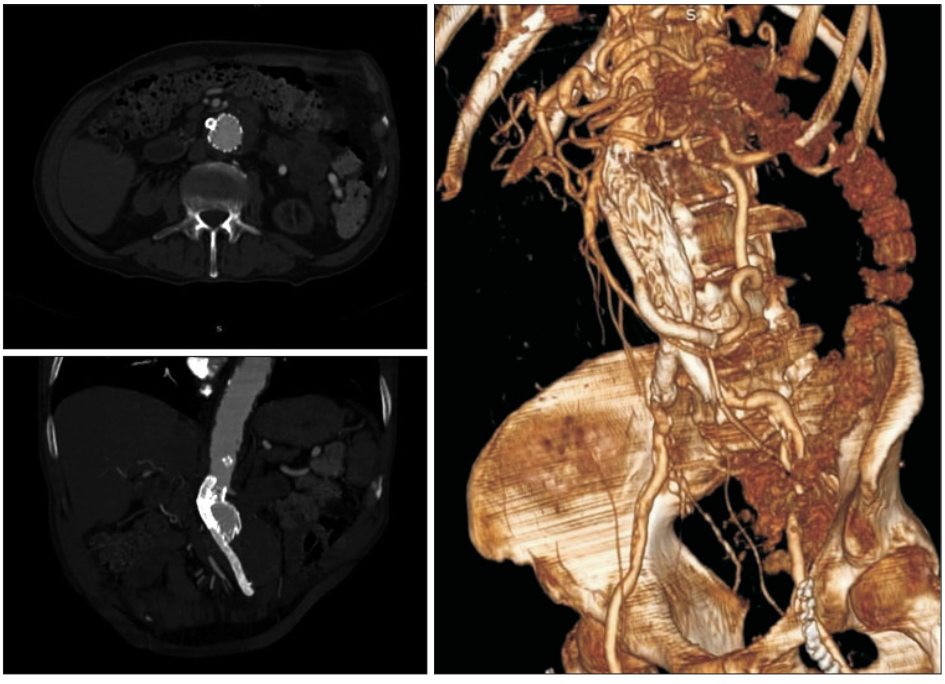

Fig. 3. Postoperative follow-up images at 1 month (left) and at 1 year (right) showed patent endograft and no sign of an endoleak.

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tage using chimney technique is obvious too. The surgeon chose endografts in proportion with radial force/flexibility and his experience with the materials. Moulding of the endograft/covered stent was performed simultaneously to prevent a pressure gradient.

The chimney technique is commonly advocated during EVAR for the preservation of the renal arteries, celiac trunk, or SMA in the aortic lesions having inadequate landing zones [5,6]. This technique has been performed for IMA preservation by other surgeons too. For example, this technique was performed on a patient diagnosed with concomitant AAA and IMA aneurysm. The chimney technique could also be preferred in patients diagnosed with AAA and bilateral occlusion of the hypogastric artery [2-4,7]. Parallel grafts have proved to be feasible and safe and the authors agree with Rancic's opinion [8] that the chimney technique should not be considered as a bailout technique but as a planned pre-operative procedure to maintain the perfusion of an artery [5,6]. The chimney technique could maintain perfusion in the IMA not only in EVAR cases but also in Covered Endovascular Reconstruction of the Aortic Bifurcation procedures for patients with high possibility of bowel ischemia.

In conclusion, pre-operative evaluation of the splanchnic circulation and careful pre-operative planning are crucial to maintain the collateral networks and to avoid bowel ischemia. The chimney technique is feasible and offers minimally invasive preservation of the IMA in patients undergoing endovascular procedures.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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AUTHOR CONTRIBUTIONS

Concept and design: all authors. Analysis and interpretation: CA, GDK. Data collection: CA, GT. Writing the article: AM, CA, GT. Critical revision of the article: AM, CA, GT. Final approval of the article: all authors. Overall responsibility: all authors.

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