Ruptured Thoracoabdominal Aneurysm Treatment With Modified Chimney Stent Graft

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A 76-year-old woman presented with symptomatic contained-ruptured thoracoabdominal aneurysm at the level of the superior mesenteric artery (SMA) and the hepatic artery origin from the SMA. The chimney technique for celiac trunk, SMA, and right renal artery (periscope configuration) was performed. An endovascular leak from the distal landing zone of the SMA stent graft was treated using a second modified stent graft with the SMA branches preservation. The 18-month follow-up computed tomography angiography demonstrated the aneurysm exclusion, no endovascular leak, and visceral and renal arteries patency.

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Open repair of thoracoabdominal aortic aneurysms (TAAA) has evolved significantly over the last decades, but still remains a challenging procedure in vascular surgery. High morbidity and mortality rates have been reported even in high-volume centers [1]. The hybrid approach for TAAA was considered less invasive, but this was not confirmed in clinical practice [2]. Total thoracic endovascular repair has become an alternative to the open surgical or hybrid treatment of TAAA [3]. Fenestrated and branched endovascular grafts require from 4 to 6 weeks for manufacture, so the surgeon-modified devices offer another treatment option in emergency settings [4]. Several techniques have been described to preserve visceral revascularization during total endovascular repair of ruptured or symptomatic TAAAs with the off-label use of off-the-shelf devices [5–7].

We report a novel approach to preserve the visceral revascularization during thoracic endovascular repair using the chimney technique with a modified stent graft, and the 18-month follow-up results.

A 76-year-old woman presented with back pain. Her medical history included chronic obstructive pulmonary disease and congestive heart failure (ejection fraction of 40%). Contrast-enhanced computed tomography angiography (CTA) demonstrated a 53-mm contained-rupture thoracoabdominal aneurysm at the level of the superior mesenteric artery (SMA). The SMA presented early branching (24 mm), and the hepatic artery originated from this vessel (Figs 1A, 1B).

Under local anesthesia, after systemic heparinization administration, through the right percutaneous femoral approach, a 26-21-100 mm Gore cTag endoprosthesis (WL Gore & Assoc, Flagstaff, AZ) was deployed for the aneurysm exclusion. Two 7 × 10 mm Viabahn stent grafts (WL Gore) were implanted in the celiac trunk and the SMA, through the open right and left brachial access, respectively. Each Viabahn stent graft was reinforced with a 7 × 80 mm Protégé stent (GPS/Everflex; ev3 Endovascular, Plymouth, MN). A 6 × 50 mm Viabahn stent graft was deployed in the right renal artery (RA) in a periscope configuration using the left percutaneous femoral approach and was reinforced with a 7 × 40 mm Protégé stent (Figs 2A, 2B). The left RA stenting was not necessary, because the distance between the two RAs (19 mm) offered good sealing for the thoracic endovascular graft.

Endovascular graft and stent ballooning were performed in a kissing fashion. Completion angiography demonstrated the aneurysm exclusion, no endovascular leak, and visceral and renal arteries patency (Fig 2C). The 1-month CTA revealed an endovascular leak from the distal landing zone of the SMA stent graft, with TAAA shrinkage (maximum diameter of 49 mm; Figs 2D, 2E). A second intervention was performed. Through the left brachial access, two 0.014-inch Pilot guidewires (Abbott Vascular Devices, Abbott Park, IL) were used to cannulate the SMA branches because of the vessel aberrant anatomy (Fig 3A). Considering the small distance (<2 cm) available before the hepatic artery origin, a 6 × 50 mm Viabahn stent graft was introduced over the two Pilot guidewires after the stent tip removal (Figs 3B, 3C). The SMA selective angiography demonstrated no endovascular leak and SMA branches patency (Fig 3D). The postoperative course was uneventful. The patient was discharged on a regimen of oral double antiplatelet therapy (clopidogrel 75 mg per day for 3 months and aspirin 100 mg per day indefinitely). The patient underwent CTA control before discharge, at 1, 6, 12, and 18 months after the second procedure. The 18-month follow-up CTA confirmed the aneurysm exclusion and aneurysm sac shrinkage (maximum diameter of 35 mm; Fig 3E).

Comment

Open surgical treatment of TAAA continues to be a demanding procedure, associated with mortality rates of 5% to 14% in referral centers [1]. In the emergency setting, the mortality rate reported of 48% renders this complex intervention almost prohibitive, especially in high-risk patients [4]. The less invasive hybrid approach, in contrast, failed to demonstrate better results in terms of morbidity and mortally rate in several experiences reported [2, 3]. The widespread use of endovascular technology and the continuous improvement of technical

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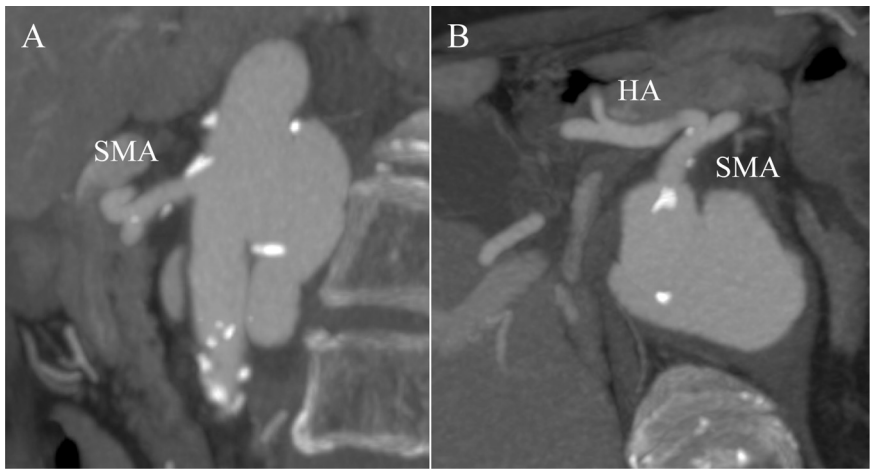

Fig 1. (A) Preoperative computed tomography scan, lateral view (SMA = superior mesenteric artery). (B) Preoperative computed tomography scan, axial view. (HA = hepatic artery; SMA = superior mesenteric artery.)

skills in the endovascular field extended the benefits of the total endovascular approach to patients with aortic aneurysms involving the visceral vessels. The fenestrated and branched devices, with their limited availability in emergency, were in these circumstances substituted by the off-label use of readily available materials in the chimney and sandwich configurations [5, 6].

The sandwich technique was not used in our patient because a single thoracic endovascular graft was sufficient for the aneurysm exclusion. The chimney technique

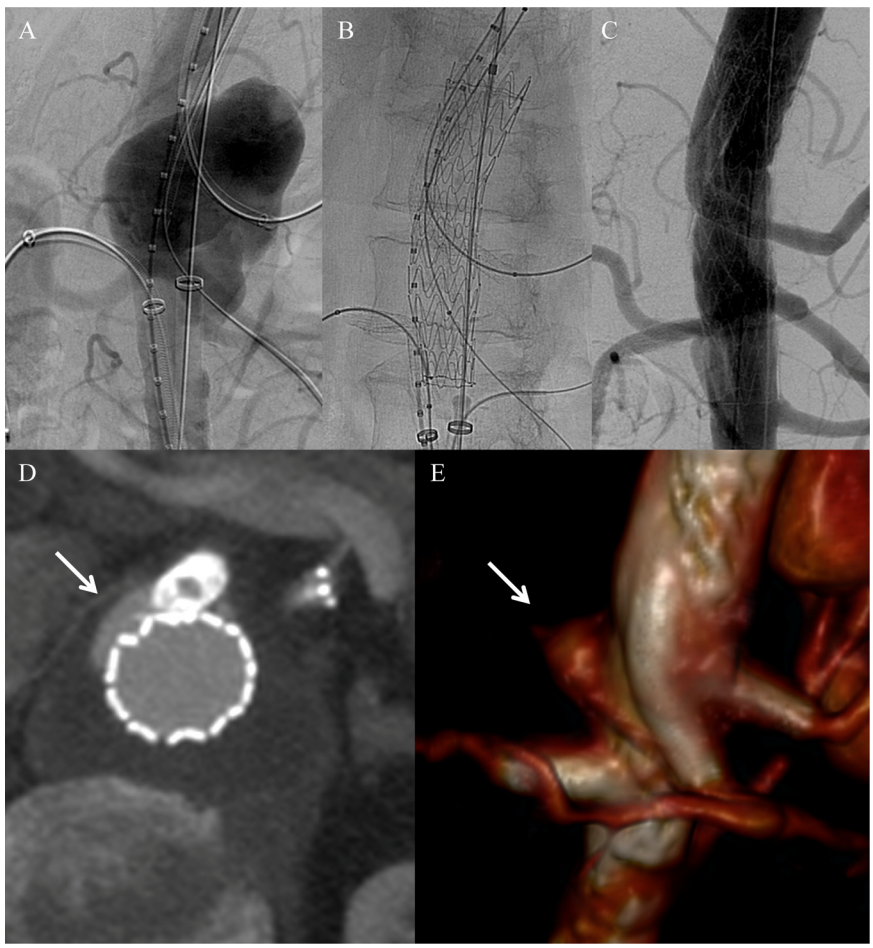

Fig 2. (A) Angiography. (B) Thoracic endovascular graft and celiac trunk, superior mesenteric artery (SMA), and right renal artery stent graft deployment. (C) Completion angiography. (D) First month follow-up computed tomography angiography, axial view (arrow indicates endovascular leak from SMA stent graft). (E) First month follow-up computed tomography angiography, three-dimensional reconstruction (arrow indicates endovascular leak from SMA stent graft).