Chimney and sandwich stent grafts for hybrid repair of type A dissection late after a Bentall for Marfan syndrome

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Central Message

Chimney and sandwich grafts to facilitate hybrid repair of type A aortic dissection for a Marfan syndrome patient after Bentall surgery.

See Editorial Commentaries page 1194 and 1195.

See Editorial page 958.

Video clip is available online.

Open surgical treatment for aortic pathology in patients with Marfan syndrome (MFS) is well established, with excellent mid- and long-term results. For patients with MFS with previous cardiovascular surgery and new-onset type A aortic dissection, however, traditional open repair involving re sternotomy and total arch replacement with reimplantation of the great vessels is challenging and carries a high risk of adverse clinical outcomes.¹ With a great advancements in recent thoracic endovascular aortic repair technology, innovative hybrid operations combining open and endovascular techniques hold promising potential to expand treatment options.² We describe here our initial experience of the chimney and sandwich technique to facilitate the hybrid repair of type A aortic dissection late after Bentall surgery in a patient with MFS.

CLINICAL SUMMARY

A 33-year-old male patient with known MFS presented in the emergency department with persistent chest and back pain for the previous 3 days. The patient had undergone elective aortic root and mechanical valve replacement 10 years ago. Computed tomography angiography (CTA) confirmed the diagnosis of type A aortic dissection with the primary entry tear at the arch (Figure 1). The dissection ranged from the distal ascending aorta to the iliac arteries, and the proximal part of innominate artery and left common carotid artery (LCCA) was affected.

Because of patient's refusal to undergo reopen surgery and a complex repeated surgical setting with high risk, a less-invasive hybrid treatment strategy was accepted as reasonable by interdisciplinary consensus. First, a LCCA-left axillar artery bypass was created with 6 mm of Gore-Tex graft (W. L. Gore and Associates, Newark, Del), lead through the costoclavicular passage. Then, the first (distal) thoracic stent graft (red, tapered 28 mm-24 mm × 15 cm; Valiant Captiva, Medtronic, Minneapolis, Minn) was introduced from the right femoral artery and deployed at the proximal descending aorta. The second (proximal) thoracic stent graft (blue, straight 34 mm × 15 cm, Valiant Captiva; Medtronic) was inserted into the previous ascending synthetic graft. As the chimney grafts, two 10 mm × 80 mm Fluency Plus covered stents (green; Bard Peripheral Vascular, Tempe, Ariz) were delivered from the right brachial and innominate artery into the ascending graft. Another 2 Fluency grafts (yellow, 12 mm × 80 mm; 10 mm × 80 mm) were delivered from the LCCA into the endolumen of the first (distal) thoracic stent graft.

After the second (proximal) thoracic stent graft was deployed successfully at the intended position, the

FIGURE 1. Preoperative, A, transverse, B, sagittal, and C, 3-dimensional volume-rendered computed tomography angiography demonstrating the type A aortic dissection with a primary entry tear at the arch.

precisely positioned stent grafts from the innominate artery and the LCCA were deployed, and the covered stents for the LCCA was sandwiched between the 2

thoracic stent grafts (Figure 2, A). The left subclavian artery was occluded by a 10-mm double-disk vascular occluder. On the angiography at completion, we

FIGURE 2. A, The diagram of hybrid arch repair and chimney/sandwich techniques: I, proximal transverse section; II, distal transverse section; red, the distal thoracic stent graft; blue, the proximal thoracic stent graft; green, the chimney stent graft; yellow, the sandwich stent graft. B, Postoperative computed tomography angiography of 5 days and 30 days showing complete sealing of the primary entry tear with patent chimney, sandwich, and LCCA-LAA bypass grafts (Gore-Tex). POD, Postoperative days; LCCA, left common carotid artery; LAA, left axillary artery.

VIDEO 1. The procedures of hybrid arch repair and chimney/sandwich techniques. Video available at <http://www.jtcvsonline.org>.

recognized a type III endoleak from the overlap zones between the 2 thoracic stent grafts (Video 1). The postoperative course was uneventful, and predischarge CTA 5 days after surgery showed complete sealing of the primary entry tear with patent chimney and sandwich grafts. At 30 days follow-up, the patient was asymptomatic, and CTA confirmed the patency of the supra-arch grafts (Figure 2, B).

DISCUSSION

An endovascular solution for patients with MFS remains controversial because of its limited durability and high risk of stent graft–related complications and reinterventions.^{3,4} In our patient, the proximal and distal landing zones for

the second (proximal) thoracic stent graft and the intra-aortic landing zones for the chimney and sandwich grafts were within prostheses, which would decrease the risk of possible injury to the fragile aortic wall exerted by the radial force of stent grafts. In addition, endoleaks after thoracic endovascular aortic repair with 1 or more supra-arch endoprostheses are common, with a reported occurrence of 11%-30%, and most were handled conservatively.⁵ Our patient also presented with a persisted type III endoleak 30 days after surgery; however, no signs of arch aneurysmal enlargement and any exacerbation of the endoleak were observed.

A carotid-to-carotid bypass grafting might be an alternative to limit the number of parallel stent grafts for decreasing the risk of endoleaks in this case; however, we used 2 supra-arch endoprostheses because of the dissection of the proximal innominate artery and LCCA and the concern of the long-term patency of a carotid-to-carotid bypass. Life-long imaging surveillance is mandatory, and future coil embolization might be a reliable option for the endoleaks. To our knowledge, this is the first reported case of a hybrid treatment for new-onset, type A aortic dissection in patients with MFS with a previous Bentall procedure. Although further staged repairs are required in our case, this endovascular technique could be an effective and life-saving treatment option for high-risk repeated surgical patients with MFS.

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