without impairing coronary flow or degrading the function of either the aortic or the mitral valve.

References

Chimney Technique for Aortic Dissection Involving an Aberrant Right Subclavian Artery
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We report a case involving a ruptured acute type B aortic dissection originating from an aberrant right subclavian artery (ARSA). A thoracic stent-graft was deployed in the distal arch close to the origin of the ARSA; the entry site at the origin of the ARSA was embolized with metallic coils. Perfusion of the left subclavian artery was preserved without a surgical bypass by using a chimney graft. This procedure is a feasible and less invasive strategy for high-risk sternotomy patients and is an effective strategy for acute aortic dissections involving an ARSA.


An aberrant right subclavian artery (ARSA) is the most frequent anatomic variation associated with the aortic arch, with a reported incidence of 0.5% to 2% [1, 2]; 60% of patients with ARSA have a Kommerell diverticulum (KD) and an increased risk of rupture and dissection [3, 4]. Moreover, the association of an ARSA with a complicated acute type B aortic dissection, without a KD, is extremely rare, as in the present case. Such variations lead to additional challenges in repairing any associated ruptures, resulting in the need for novel approaches, particularly in high-risk patients such as the individual described in the present case.

The patient was a 72-year-old woman who had a history of hypertension, chronic atrial fibrillation, chronic obstructive pulmonary disease, and thyroid cancer and was admitted to our hospital because of the sudden onset of chest and upper back pain. Her computed tomographic (CT) angiography showed an acute type B aortic dissection from the distal arch to the infrarenal abdominal aorta. Furthermore, an intimal flap extended into an ARSA that arose from the aortic arch, distal to the origin of the left subclavian artery (Fig 1A).

The dissection was uncomplicated and was managed with medical therapy. However, 4 days later the patient complained of upper back pain and a chest radiograph showed left-sided hemithorax; hematologic analysis showed severe anemia (hemoglobin level, 8.3 g/dL), and aortic rupture from a false lumen (Fig 1B) was diagnosed. Detailed analysis of the new CT angiography led to the consideration that the large entry site at the origin of the ARSA was the primary entry site and that the reentry site into the abdominal aorta was small. This resulted in increased pressure in the false lumen and accounted for the rupture into the left thorax (Fig 1C).

Because of the patient’s age and high surgical risk, less invasive endovascular therapy was selected for closing the origin of the ARSA at its primary entry site. In this case, to obtain an adequate proximal landing zone and to seal the origin of the ARSA, the proximal edge of a stent graft was deployed over the left subclavian artery. However, because the patient had an anatomic particularity, placement of the stent graft proximal to the left subclavian artery may have reduced blood flow to both vertebral arteries and led to brain stem ischemia. Therefore, perfusion of the left subclavian artery was preserved using an Excluder iliac extender (W. L. Gore and Associates, Newark, DE) as a chimney graft.

After a guidewire and a 22-Fr introducer sheath were inserted into the true lumen through the right common femoral artery, under transesophageal echocardiographic guidance, a TAG stent-graft (34 × 150 mm; W. L. Gore and Associates) was inserted. A 12-Fr introducer sheath was inserted through the left brachial artery. The Excluder iliac extender (16–14.5 × 70 mm) was introduced and positioned at the proximal edge of the TAG stent graft. Angiography was performed to confirm the positioning (Fig 2A). The TAG stent-graft was juxtaposition with the left common carotid artery, and the Excluder iliac extender was subsequently deployed. The TAG stent grafts were not dilated with a balloon because of the fragility of the aorta, and the Excluder iliac extender was dilated with an Equalizer balloon (Boston Scientific, Natick, MA). Finally, the origin of the ARSA was embolized with metallic coils. Postoperative CT angiography, conducted at the conclusion of the surgery, showed a patent left subclavian stent graft without endoleaks (Fig 2B). The patient did not experience perioperative stroke or spinal cord ischemia.

Follow-up CT angiography performed 3 months after surgery confirmed the patency of the left subclavian stent graft and the absence of endoleaks. There was almost complete thrombosis in the proximal part of the false lumen, but the false lumen of the abdominal aorta remained patent because of the second entry site (Fig 2C).
Fig 1. (A) Preoperative three-dimensional computed tomograms showing a type B aortic dissection and an aberrant right subclavian artery arising from the aortic arch, distal to the origin of the left subclavian artery (arrow). (B) Radiograph showing the left-sided hemothorax. (C) Computed tomograms showing the ruptured dissection, the entry site (arrow), the true lumen (T), and the false lumen (F).

Fig 2. (A) Angiogram obtained just before deployment of the stent-grafts, showing the entry site (dotted arrow) and the proximal edge of the Excluder iliac extender (dashed arrow), positioned adjacent to the proximal edge of the TAG stent-graft (solid arrow). (B) Postoperative three-dimensional computed tomography showing the occlusion of the origin of the ARSA and the absence of endoleaks; the flow to the right subclavian artery was maintained by the adverse flow from the right vertebral artery. (C) Three-dimensional computed tomography obtained at the 3-month follow-up, showing the absence of endoleaks and showing the patent left subclavian artery.
Comment

The development of endovascular stent-graft technologies has provided various surgical strategies for ARSA. To date, hybrid endovascular procedures that use debranching bypass for preservation of the subclavian arteries have been reported [5–7]. However, to our knowledge this is the first report of an endovascular treatment using the chimney technique for acute type B aortic dissections originating from an ARSA.

The chimney technique can be used for complete endovascular treatment of various aortic arch pathologies, including aortic arches with anatomic peculiarities, as in this case. Moreover, this technique utilizes commercially available devices and does not require modifications to the devices. Therefore, it can be used in emergency cases such as for rupture of aortic arch aneurysms or acute complicated aortic dissections. In conclusion, we believe that endovascular treatment performed using the chimney technique will become an effective strategy for acute aortic dissections involving an ARSA.

References


Aortic Arch Replacement Through a Left Thoracotomy for Right-Sided Aortic Arch Aneurysm With Complete Vascular Ring

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Right-sided aortic arch with retroesophageal left subclavian artery and left ligamentum arteriosum is the second most common vascular ring. Aneurysms of the arch in its retroesophageal portion are rare. The surgical repair of a retroesophageal arch aneurysm poses a significant challenge because no single approach provides access to the whole arch and all of its branches. We describe a 39-year-old patient with aneurysmal dilatation of the retroesophageal arch who presented with airway obstruction. The arch aneurysm was repaired with a staged approach. A right-sided carotid-subclavian artery bypass was performed, followed by distal ascending aorta and aortic arch replacement under hypothermic circulatory arrest through a left thoracotomy.


A 39-year-old man with a medical history of hypertension, non-insulin-dependent diabetes, and tobacco abuse presented with a several-week history of progressive cough and shortness of breath. Computed tomography angiography demonstrated a complete vascular ring formed by a right-sided aortic arch with retroesophageal left subclavian artery and left-sided ligamentum arteriosum. There was a 5.6-cm aneurysmal dilatation of the retroesophageal arch (Fig 1). The aneurysm caused significant extrinsic compression of the membranous portion of the trachea and the esophagus, which were contained within the vascular ring.

The first branch from the ascending aorta was the left common carotid artery, followed by the right common carotid artery, right subclavian artery, and finally the left subclavian artery (Figs 2, 3; Video 1). The aneurysmal dilatation with a focal dissection was located between

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Video 1 can be viewed in the online version of this article [http://dx.doi.org/10.1016/j.athoracsur.2013.04.117] on http://www.annalsthoracicsurgery.org.