Endovascular treatment of an aberrant right subclavian artery aneurysm with use of the Zenith iliac plug

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Aberrant right subclavian artery aneurysms are rare but demonstrate a propensity toward rupture; thus, early elective repair is mandated. Novel endovascular modalities are available to offer less-invasive treatment for a patient population with increasing comorbidities. We report a case of a 65-year-old woman with an aberrant right subclavian artery aneurysm causing dysphagia lusoria. The aneurysm was excluded proximally at Kommerell's diverticulum with a Zenith iliac plug and excluded distally by surgical ligation combined with a right carotid-subclavian artery bypass to preserve extremity perfusion.

Aberrant right subclavian artery (ARSA) aneurysms are extremely rare. When present, they can be clinically silent or cause symptoms such as dysphagia, shortness of breath, or chest pain. ARSA aneurysms are prone to rupture, with death rates in acute rupture reported as high as 50% (1). Therefore, they should be electively repaired when discovered.

Open surgical repair of ARSA aneurysms usually requires thoracotomy and aortic grafting, which can be contraindicated in high-risk patients with multiple comorbidities. Endovascular repair of ARSA aneurysms has been reported, with or without adjunctive surgical bypass (2–4). We report an endovascular approach using a Zenith iliac plug (Cook Medical Inc., Bloomington, IN) combined with a carotid-subclavian artery bypass in the treatment of an ARSA aneurysm at Kommerell's diverticulum.

CASE REPORT

A 65-year-old woman with multiple comorbidities was admitted to the hospital with chest pain and syncope. Her medical history included coronary artery disease with coronary bypass grafting, sinus node dysfunction requiring pacemaker implantation, chronic obstructive pulmonary disease, hypertension, and a history of recurrent syncope. On review of systems, she complained of dysphagia of several years' duration.

The patient underwent an extensive workup of her symptoms, which included a contrast material–enhanced computed tomography (CT) scan of the chest. This demonstrated an ARSA with a proximally placed aneurysm of 2.1 cm maximum diameter that was compressing the esophagus. Dedicated CT angiography with reconstruction was obtained, showing the ARSA aneurysm originating from the posterior aspect of the aortic arch in close proximity to the left subclavian artery *(Figure 1)*. In addition, the aneurysm had a wide origin (21 mm) and no neck. Another significant finding was an anomalous origin of the left vertebral artery off of the aortic arch, which was close to the origin of the ARSA aneurysm.

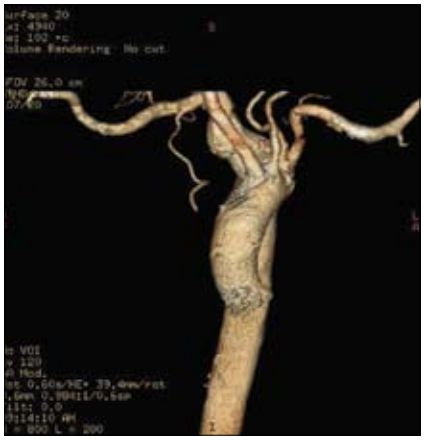

Figure 1. ARSA aneurysm originating off the posterior aspect of the aortic arch.

Elective treatment of this aneurysm was planned because of its symptomatic nature and propensity for spontaneous rupture. Because of the patient's medical comorbidities, it was felt that she would not tolerate a thoracotomy. Instead, we chose to utilize a novel endovascular technique to exclude the aneurysm proximally.

The patient was taken to an endovascular suite, and general anesthesia was initiated. Arch arteriography was performed percutaneously via the right common femoral artery to evaluate the anatomy *(Figure 2)*. A standard supraclavicular incision was made to expose the right subclavian artery and prepare for eventual right carotid-subclavian artery bypass. A 5F sheath was then inserted in the right subclavian artery, and a 0.035 wire was passed retrograde through the aneurysm into the descending thoracic aorta. The 5F sheath was upsized to a 16F sheath, and the patient was systemically heparinized.

After adequate heparinization, a 24-mm Zenith iliac plug was inserted through the 16F sheath and placed at the origin of the ARSA. It was then deployed under direct fluoroscopic vision

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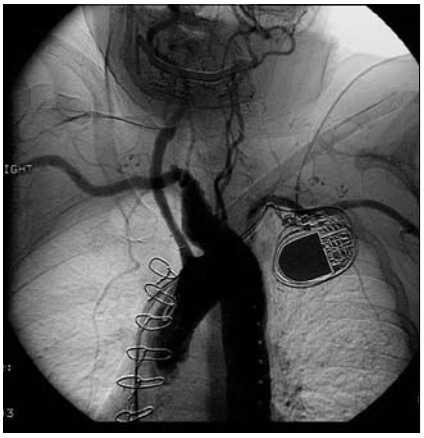

Figure 2. Initial angiogram showing the ARSA aneurysm.

Figure 3. CT angiogram at 1 month showing exclusion of the ARSA aneurysm.

without complication. The delivery device was then removed and the right subclavian artery was ligated just proximal to the right vertebral artery to complete the exclusion of the aneurysm. A completion angiogram was performed, which did not show any filling of the ARSA aneurysm. To complete the procedure, a right carotid-subclavian artery bypass was performed in standard fashion using 7-mm polytetrafluoroethylene.

No morbidity was observed after the operation. The patient was discharged home the next day. On 1-month follow-up, CT angiography demonstrated excellent placement of the iliac plug device, successful exclusion of the ARSA aneurysm, and a patent right carotid-subclavian artery bypass *(Figure 3).*

DISCUSSION

ARSA was first described in 1735 at autopsy by Hunauld (1). In 1794, Bayford described a patient with dysphagia secondary to esophageal compression by an ARSA and coined the term "dysphagia lusoria" (2). The ARSA is reported to be the most common intrathoracic major arterial anomaly, having an incidence of 0.4% to 2% (3).

When ARSAs become aneurysmal, they can be asymptomatic or cause symptoms such as dysphagia, shortness of breath, or chest pain (5). These rare aneurysms can be fatal if not treated promptly.

Several treatment options exist for an ARSA aneurysm. Surgical repair of ARSA aneurysms using various techniques has yielded perioperative mortality rates of 18% to 25% (1, 6). In addition, some patients do not have the option of open surgical repair because of an inability to tolerate thoracotomy.

Endovascular treatments are available as an alternate to surgery. Davidian et al (2) successfully excluded an ARSA aneurysm through intraluminal placement of a covered stent graft in the ARSA. This approach was not feasible in our case because of the wide short neck of the aneurysm, which would have been an inadequate proximal landing zone.

We previously reported two cases of ARSA aneurysm exclusion by placement of a TAG endoprosthesis (Gore Medical, Flagstaff, AZ) (3). In both cases, left carotid-subclavian artery bypasses were performed because the origin of the left subclavian artery was covered in addition to the right subclavian artery. Right carotid-subclavian artery bypasses were not performed, and neither patient developed symptoms of upper-extremity ischemia. Our patient could potentially have been treated in this manner as well. However, placement of a thoracic endograft would have covered the dominant left vertebral artery since it had an anomalous origin off the aortic arch near the right subclavian artery. This would have necessitated a vertebral transposition or bypass in addition to carotid-subclavian artery bypass.

Hoppe et al (4) excluded an ARSA aneurysm percutaneously by placement of Amplatzer septal occluders proximally and distally to the aneurysm. The patient returned in the early follow-up period with symptoms of right-hand ischemia and underwent a right carotid-subclavian artery bypass.

To our knowledge, our case is the first in the literature to use a Zenith iliac plug device for proximal ARSA aneurysm exclusion. It is intended for endovascular occlusion of iliac arteries during endovascular repair of abdominal aortic aneurysms. The device comes in 14-, 16-, 20-, and 24-mm configurations.

CONCLUSION

The present case shows that an ARSA aneurysm with the appropriate anatomy can be successfully treated with a Zenith iliac plug combined with surgical ligation for aneurysm exclusion. We believe this to be a novel technique that is minimally invasive and avoids thoracotomy. It adds to a growing armamentarium of endovascular treatments for ARSA aneurysms.

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