Embolization of an Aberrant Right Subclavian Artery Aneurysm with Amplatzer Vascular Plug without Bypass

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Int J Angiol 2012;21:237–240.

Abstract

Keywords

- endovascular procedure
- endovascular repair
- aneurysm
- artery
- percutaneous
- subclavian
- vessel repair

Aberrant right subclavian artery (ARSA) aneurysms are rare, but the risk of rupture and thromboembolism is high, with a postrupture mortality rate of 50%. 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. We report a case of an 80-year-old woman resenting with an asymptomatic 4 cm ARSA aneurysm who underwent a completely endovascular treatment of the aneurysm using an Amplatzer vascular plug II (St. Jude Medical Inc., St. Paul, MN).

Aberrant right subclavian artery (ARSA) aneurysms are rare, but the risk of rupture and thromboembolism is high, with a postrupture mortality rate of 50%. Open surgical repair of ARSA aneurysms requires thoracotomy and aortic grafting, which can be problematic in high-risk patients with multiple comorbidities. Endovascular repair of ARSA aneurysms has been reported, with and without adjunctive surgical bypass.¹ There have been several case reports of hybrid treatment utilizing a combination of a carotid-subclavian artery bypass followed by coverage of the subclavian artery orifice using endovascular stent graft.^{2–4}

We report a case of an 80-year-old woman presenting with an asymptomatic 4 cm aberrant right subclavian artery aneurysm who underwent a completely endovascular treatment of the aneurysm using an Amplatzer vascular plug (AVP) (St. Jude Medical Inc., St. Paul, MN) extending distal to the aneurysm into the aortic infundibulum with complete thrombosis of the aneurysm with preservation of right upper extremity blood flow via retrograde flow via vertebral artery.

Unlike a previous report,⁵ our patient did not require adjunctive extra-anatomical surgical revascularization.

Patient History

The patient is an 80-year-old woman with a history of chronic obstructive pulmonary disease, atrial fibrillation, and an asymptomatic right aberrant subclavian artery aneurysm which had been followed over a 2-year period. During this time, it had increased in size from 2 to 4 cm. She had no complaints of dysphagia or signs of upper extremity embolic disease. Due to the size of the aneurysm, she was advised to undergo repair. She underwent preprocedure medical, cardiac, and pulmonary evaluation (→Fig. 1).

Methods

Right axillary cutdown inferior to the lateral border of the clavicle was performed, and proximal and distal control of the axillary artery was obtained.

Fig. 1 Coronal view of preoperative computed tomography scan showing right aberrant subclavian artery aneurysm.

Access to the right common femoral artery was achieved using a micropuncture kit and a 6-French sheath was placed over a 0.035-in guidewire. Under fluoroscopy, a 5-French pigtail marker catheter was advanced into the aortic arch of the thoracic aorta. The patient was given 4,000 units bolus of heparin.

Micropuncture technique was again used to place a 7-French 35-cm sheath at the axillary artery cut down site, with the tip advanced over a 0.035-in guidewire, under fluoroscopic observation into the aortic arch. Following aortography, a 22-mm AVP II was positioned and deployed successfully with the proximal disc in the infundibulum at the origin of the right subclavian artery and the distal end just proximal to the right vertebral artery. The middle lobe of the occlusion device was within the aneurysm.

Completion angiography via the right groin access confirmed the plug to be in good position. There was successful occlusion of vessel with reversal of flow in the right vertebral artery which provided antegrade flow into the right subclavian and axillary artery (► **Figs. 2 and 3**).

Intraoperative physical examination revealed a weakly palpable pulse with a biphasic Doppler signal in the axillary

Fig. 3 Post-Amplatzer vascular plug II deployment. Note filling of right subclavian artery via right vertebral artery.

and brachial artery with a weakly palpable radial artery pulse. It was therefore decided not to surgically revascularize the right upper extremity. The patient was extubated and transferred to the recovery room in stable condition.

On postoperative follow-up at 1 month, patient had no symptoms of right arm ischemia and had a palpable right radial artery pulse. She was neurologically intact and a repeat computed tomography (CT) scan of the chest demonstrated the AVP to be in place and a thrombosed right subclavian artery aneurysm.

On 9 months follow-up visit, patient was still asymptomatic, with a palpable right radial pulse and normal neurological examination. A repeat CT scan revealed a completely thrombosed right subclavian artery aneurysm with no evidence of flow within aneurysm sac and decrease in aneurysm sac size from 2.5 to 4 cm (► **Figs. 4–6**).

Discussion

ARSA occurs in ~0.5 to 1.0% of the population, being the most common intrathoracic major arterial anomaly.⁶ This was first described in 1735 by Hunauld during autopsy. In 1794,

Fig. 2 Initial aortogram showing aberrant right subclavian artery aneurysm.

Fig. 4 Three-month follow-up computed tomography scan showing Amplatzer vascular plug II in place, thrombosed subclavian artery aneurysm.

Fig. 5 Nine-month follow-up computed tomography scan showing thrombosed aneurysm, decreased sac size with Amplatzer vascular plug II in place.

Bayford coined the term “dysphagia lusoria,” referring to dysphagia secondary to esophageal compression by an ARSA. When ARSAs become aneurysmal, which occurs in up to 60% of patients,¹ they can be asymptomatic or cause symptoms such as dysphagia, shortness of breath, or chest pain.

Open surgical strategies have been used for the correction of ARSA aneurysms. These interventions have yielded perioperative mortality rates between 18 and 25%.^{7,8} With the progression of minimally invasive techniques, combined surgical and endovascular approaches have achieved success with lower complication rates.^{2,9,10} In some instances, wholly

endovascular interventions have been effective³ although the need for subsequent procedures is common.

AVPs, on the other hand, have been shown to have very limited recanalization or endoleak development.^{11,12} Furthermore, AVPs have shown particular advantage for treatment/embolization of aneurysms with large diameters and short implantation zones.¹³

Davidian et al successfully excluded an ARSA aneurysm through intraluminal placement of a covered stent graft in the ARSA.¹ This approach was not feasible in our case because of the wide short neck of the aneurysm and a notably large diameter at the base of right subclavian infundibulum as it emerged from the aorta, which would have been problematic to attempt to use as a proximal landing zone.

The challenge in achieving endovascular occlusion and thrombosis with the unique alternating contour of this aneurysm was successfully met with the three segmented AVP II. In fact, a prior case report described the successful occlusion of an ARSA with two Amplatzer septal occluders.¹⁴ Bypass surgery for perfusion of the right upper extremity was necessary in that case. We were prepared to perform bypass surgery in our patient as well; however, it was not necessary. Perfusion of the right extremity via the right vertebral artery was adequate. On subsequent follow-up, patient remained asymptomatic with good arm perfusion.

Conclusion

We report a case repair of an ARSA aneurysm using an Amplatzer vascular plug II. As retrograde flow in the vertebral artery provided adequate perfusion of the extremity, treatment was completely endovascular.

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Fig. 6 Three-dimensional reconstruction of 9-month follow-up computed tomography scan.

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