

Endovascular treatment of an aortic aneurysm and patent ductus arteriosus

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Introduction

Aortic coarctation may occasionally be associated with a second congenital disease, such as patent ductus arteriosus (PDA) (1). When diseases coexist in children or teenagers, surgical treatment is frequently recommended as far as both conditions can be addressed in a single surgery. Depending on the techniques used during the initial surgery, late complications after surgery for aortic coarctation may be the formation of an aneurysm in the descending aorta (2). Reopening of PDA has also been observed after surgical ligation (3). Re-do surgery in these cases may prove challeng-

ing in elderly patients, and endovascular techniques may be used for lower morbidity and mortality risk (4).

Case Report

A 63-year-old man presented with progressive cough and dyspnea on exertion after a large thoracic aneurysm in the post-isthmic aorta (TAA) was diagnosed on plain chest X-ray. His symptoms were first attributed to his life-long smoking habit. He had undergone surgery 35 years ago for aortic coarctation with dacron patch aortoplasty; the initial surgical protocol did not mention ligation of PDA. Angio-computed tomography (angio-CT) confirmed the presence of an 80-mm thoracic aortic aneurysm and a 7-mm PDA (arrow in Fig. 1). The ascending aorta was moderately dilated and the aortic valve was tricuspid and competent. The thoracic aorta distal to the aneurysm was significantly dilated down to the diaphragm. The left subclavian artery was dilated at the origin. Echocardiography showed normal systolic left ventricular function, moderate pulmonary hypertension (sPAP=50



Figure 1. Diagnostic angio-CT. A large saccular aneurysm of the thoracic aorta and PDA can be observed. The distal thoracic aorta is also enlarged



Figure 2. One-month follow-up angio-CT. The final result of the hybrid procedure shows a completely excluded aortic aneurysm, surgically interrupted left subclavian artery, and completely occluded PDA

mm Hg), and confirmed significant left-to-right shunting ($Q_p/Q_s=2.1$). Coronary angiography found no flow-limiting stenosis.

Endovascular treatment for both TAA and PDA was planned. To avoid potential type II endoleaks, the patient underwent surgical ligation of the left subclavian artery and left carotid–subclavian by-pass. Subsequently, he was brought intubated from the OR to the cathlab, where a dedicated Occlutech device (Occlutech® Duct Occluder, Occlutech, Helsingborg, Sweden) to close PDA was first deployed via the right common femoral vein. Video 1, 2, 3 and 4. Two endovascular Valiant Captivia grafts (EVG) (Medtronic, Santa Rosa, CA, USA) were then implanted distal to the ostium of the left carotid artery across the ostium of left subclavian artery with complete exclusion of TAA (Fig. 2). Video 5, 6 and 7. Cerebrospinal fluid (CSF) was repeatedly aspirated for 48 h because of CSF hypertension to avoid the risk of paraplegia. He made a full recovery and was discharged on day 5 after endovascular treatment. The 3-year angio-CT follow-up confirmed complete sealing of the aneurysm with a minor type 2 endoleak through an intercostal artery, with no increase in the diameter of the aneurysm.

Discussion

Late complications after surgical repair of aortic coarctation may include aneurysm formation in the post-isthmic thoracic aorta. They are rare after subclavian flap aortoplasty, but are more common after dacron patch aortoplasty (2), such as that observed in our case. Aneurysm formation carries the risk of rupture and sudden death, whereas re-do surgery leads to a 14% in-hospital death rate or morbidity because of paraplegia or bleeding (4). Small series of this high-risk surgical group of patients have been successfully treated by endovascular stent-graft placement with lower peri-procedural morbidity or mortality (4).

Meanwhile, PDA with a non-dilated descending aorta was treated with EVG insertion in elderly patients to avoid the risk of rupture of a calcified duct on percutaneous intervention (5), with good short-term result and no residual endoleaks (6). Some reports describe percutaneous PDA closure with Amplatzer devices in patients with thoracic aortic aneurysms leaving the latter untreated (7). Occasional reports mention exclusion of both thoracic aortic aneurysm and PDA with stent-graft insertion in the aorta (8), sometimes using open chest surgical techniques (9).

Considering the high risk of surgical complications in our patient, we decided to treat TAA and PDA using endovascular techniques. Isolated EVAR was not considered an option in our case because of pulmonary hypertension due to a large 7 mm PDA; closure of PDA was considered necessary to avoid type II endoleaks from the aneurysm. For the same reason, the left subclavian artery was ligated.

Covering of the whole descending thoracic aorta and exclusion of the left subclavian artery by EVAR frequently leads to CSF hypertension, which is associated with a risk of spinal cord ischemia and paraplegia (10). Close monitoring of CSF pressure and continuous drainage, as necessary, may mitigate this risk, similar to that observed in our case.

Conclusion

We present the case of a patient with late thoracic aneurysm formation after aortic coarctation surgery associated with PDA. Endovascular treatment was successfully performed immediately after surgical left subclavian debranching. The 3-year angio-CT follow-up showed persistent optimal result of endovascular exclusion in both conditions.

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Video 1. Diagnostic angio

Video 2. Snared wire in PA

Video 3. PDA occluder deployment

Video 4. PDA occluder deployed

Video 5. First Valiant EVG deployment

Video 6. Second Valiant Captivia deployed

Video 7. Final angiographic result.

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