A Case of Patent Ductus Arteriosus in an Elderly Patient Treated by Thoracic Endovascular Aortic Repair

Yuki Orimoto, MD,1 Hiroyuki Ishibashi, MD,1 Ikuo Sugimoto, MD,1 Tetsuya Yamada, MD,1 Yuki Maruyama, MD,1 Makiyo Hagihara, MD,2 and Tsuneo Ishiguchi, MD1

The patient described herein was a 75-year-old female. Echocardiography showed patent ductus arteriosus (PDA). Heart failure symptoms gradually appeared, and she was referred to our department for treatment. Contrast-enhanced computed tomography (CT) revealed a tubular structure communicating between the aortic arch and pulmonary artery trunk, suggesting adult PDA. Thoracic endovascular aortic repair (TEVAR) was performed to close PDA. Completion angiography confirmed the disappearance of PDA. Post-TEVAR CT revealed no endoleak. The patient was discharged from the hospital on the 11th day after surgery. TEVAR is more useful and less invasive for adult PDA than conventional open surgery.

Keywords: patent ductus arteriosus (PDA), thoracic endovascular aortic repair (TEVAR)

Introduction

Patent ductus arteriosus (PDA) is diagnosed during childhood in many cases and is treated by arterial-duct ligation or closure under thoracotomy. PDA is rarely diagnosed in adulthood. Arterial-duct ligation or closure under thoracotomy in adults may lead to the rupture of PDA due to arteriosclerosis, calcification, or the formation of aneurysms, which is in contrast to the favorable outcomes reported in children. Invasive surgery with cardiopulmonary bypass, equivalent to surgery for aortic arch aneurysms, is required. We herein report a case of thoracic endovascular aortic repair (TEVAR) for PDA in an elderly patient.

Case Report

A 75-year-old female consulted a local clinic with cold symptoms. Tachycardia and cardiac murmurs were detected, and echocardiography showed PDA. Heart failure symptoms gradually became exacerbated, and she was referred to our hospital. Her height and body weight were 149 cm and 52.5 kg, respectively. Continuous murmurs were heard in the thoracic region. Chest X-ray revealed a protrusion in the left second arch (pulmonary artery trunk) and the enhancement of a pulmonary vascular shadow. The cardio-thoracic ratio (CTR) was 66%. Electrocardiography did not show any abnormal findings. Echocardiography revealed PDA with a diameter of 8 mm and high shunt flow (Vmax: 600 cm/sec). Dilatation of the left ventricle and atrium suggesting left heart loading was observed. Right heart catheterization revealed a left-to-right shunt with an increase in pulmonary arterial pressure. The pulmonary to systemic blood flow ratio (Qp/Qs) was 2.1. On saturation, O2 step-up of the pulmonary artery was observed. Contrast-enhanced computed tomography (CT) revealed an arterial duct communicating between the aortic arch and pulmonary artery that measured 14 mm in diameter (Fig. 1a). The pulmonary artery trunk measured 55 mm and showed marked dilatation involving the left and right pulmonary arteries (Fig. 1b). The distance between the left subclavian artery and arterial duct was 20 mm. The aortic diameter at a tributary of the subclavian artery was 27 mm, and that of the thoracic descending aorta was 25 mm (Fig. 2). Arterial-duct closure by the placement of a stent graft at zone 3 was considered possible. Surgery was performed under general anesthesia. A pigtail catheter was inserted from the left brachial artery, and digital subtraction angiography (DSA) was performed. Blood flow from the aorta to the pulmonary artery was clearly confirmed. TEVAR using CTAG 31 mm–15 cm (W.L. Gore & Associates,
disappearance of the PDA shunt with improvements in left heart loading. Postoperative fever persisted, leading to a loss of appetite; however, her condition gradually improved. The patient was discharged from the hospital on the 11th day after surgery. One year after the surgery, plain CT confirmed that the diameter of the pulmonary trunk had been reduced to 42 mm. The current condition of the patient is favorable in the absence of palpitations and heart failure symptoms.

Discussion

PDA is diagnosed during childhood in many cases, and is treated by arterial-duct ligation or closure under thoracotomy. Although PDA is rarely diagnosed in adulthood, it is often complicated by heart failure, pulmonary arterial hypertension, arterial calcification, or the formation of an aneurysm in such cases. Therefore, arterial-duct ligation or closure under thoracotomy in adults may lead to the rupture of PDA due to arteriosclerosis, calcification, or the formation of aneurysms, which is in contrast to the favorable outcomes reported in children. Invasive surgery with cardiopulmonary bypass, which is equivalent to surgery for aortic arch aneurysms, is required. On the other hand, endovascular approaches using Amplatzer PDA closure or coil embolization are less invasive than open surgery. A limited number of hospitals perform these procedures in Japan. When the arterial duct diameter is smaller than 12 mm, the complete closure rate achieved by Amplatzer PDA closure is high (98%–100%). Coil embolization is indicated for an arterial duct diameter smaller than 4 mm. However, when the arterial duct diameter is larger than 12 mm, the risk of aberration is high; therefore, coil embolization is indicated for an arterial duct diameter smaller than 2 mm in Japan, and Amplatzer PDA closure for that smaller than 12 mm. Since the arterial duct diameter in the present case was 14 mm, these procedures were not...
indicated. Open surgery is relatively invasive; therefore, treatment with a stent graft was selected. If atherosclerosis is absent in the aortic wall proximal/distal to PDA, favorable sealing may be achieved; therefore, TEVAR may be useful in this case. Even if minor endoleak persists, decreases in the left and right shunt volumes may lead to improvements in heart failure symptoms. In the present case, the distance from the left subclavian artery was 20 mm, and the diameter of the proximal landing zone was 27 mm; therefore, TEVAR at zone 3 was possible. If PDA is located near the left subclavian artery, coverage of the left subclavian artery after confirming the patency of the left vertebral artery may be required in some cases. We selected a CTAG device, which is flexible and may fit well along the distal aortic arch curve. In 2001, Roques et al. described the application of a stent graft to treat this disease for the first time.  7) This procedure is available for patients for whom Amplatzer’s PDA closure is not indicated, including our patient, and adult PDA patients with aortic aneurysms. Several recent studies described patients treated by arterial duct closure with a stent graft. 8–10) In the future, the low profile of a stent graft delivery system may lead to increase in the number of patients undergoing TEVAR for PDA in adults. On the other hand, concerns have also been expressed over TEVAR. For example, the cost might be higher than that for open surgery. In the present case, the total cost was 2824,570 yen: Therefore, the cost of open surgery is lower if postoperative course is good. However, the present procedure, TEVAR for adult PDA, was completed within only 86 min. It was much less invasive than traditional open surgery using cardiopulmonary bypass.

Conclusion

We herein reported a case of TEVAR for PDA in an elderly patient. If Amplatzer PDA closure or coil embolization is not appropriate, TEVAR is more useful and less invasive than conventional open surgery.

Disclosure Statement

The authors have no conflicts of interest to declare.

Authors’ Contributions

HI and TI decided on the operation plan. YO, HI, MH, and TI performed the surgery. YO, HI, IS, TY, and YM conducted postoperative management. All authors read and approved the final manuscript.

References


