An Infectious Pseudoaneurysm Caused by Ventricular Septal Defect Occluder in Patent Ductus Arteriosus Closure in a Two-Year-Old Child

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Summary
We present a case of an infectious pseudoaneurysm after patent ductus arteriosus (PDA) closure with a ventricular septal defect (VSD) occluder in a two-year-old child. The aneurysm grew rapidly but was successfully removed in time and the patient survived. To our knowledge, this is the first report of an infectious pseudoaneurysm caused by VSD occluder in PDA closure.

Key words: Aneurysmal dilatation, Infectious endocarditis, Transcatheter

Aneurysmal dilatation of ductus arteriosus has been considered a rare but potentially fatal abnormality. It can be either congenital or acquired as a complication of surgical ligation of patent ductus arteriosus (PDA) or after a ductal infection. And the congenital ones were much commoner than the acquired ones. In the early days, the surgical method for PDA was excision, which was replaced by occluder nowadays. There were case reports on ductus arteriosus aneurysm in PDA excision.1,2) However, to our knowledge, this is the first report of pseudoaneurysm caused by PDA occluder.

Case Report
A two-year-old girl (weighing 10.5 kg) presented with a week history of cough. A physical examination revealed a continuous murmur at the second left intercostal space. Transthoracic echocardiogram revealed a PDA (Figure 1).

The patient underwent right heart catheterization. A 5 French (Fr) sheath was inserted into the right femoral vein, followed by a 5-Fr MPA1 catheter, and right-sided pressures were recorded. The catheter was removed, flushed, and then inserted into the right femoral artery. The left-sided pressures were then recorded.

The patient was found to have a funnel-shaped PDA (5 mm pulmonary end diameter, 13 mm aortic end diameter and 8 mm length) with preprocedural shunt and Qp:Qs of 4.1:1 (Figure 2). Right heart catheterization demonstrated a pulmonary arterial pressure of 90 mmHg/50 mmHg (mean 63 mmHg) with a mean pulmonary capillary wedge pressure of 7 mmHg. The pulmonary vessel resistance was 459 dynes·sec·cm⁻².

A 14 mm muscular ventricular septal defect (mVSD) occluder (Starway Medical Technology, China) was advanced to the site of the PDA through a 9 Fr delivery system. Its subsequent deployment closed the PDA. Postprocedural pulmonary arterial pressure was recorded as 50 mmHg/30 mmHg (mean 37 mmHg). Postoperative transthoracic echocardiogram (TTE) found no residual shunt. 0.5 g Cefazolin was given prophylactically 40 minutes before the procedure and 11.5 hours after the procedure. The postoperative examinations were normal and the patient was discharged. However, the patient came down with a fever of 40°C 15 days after the procedure and was transferred from a local hospital to ours. The high fever has been lasting and no response for medicines with Vancomycin and Meropenem for 2 weeks at local hospital. TTE showed that the occluder seemed to "drop" into the main pulmonary artery. The cardiac computed tomographic angiography revealed an aneurysmal dilatation of the ductus arteriosus with a maximum diameter of 30 mm (Figure 3, 28*30 mm). The white blood cell counts were normal for 2 weeks of treatment with medicine at the local hospital. However, the percentage of neutrophils and C-reactive peptide were elevated (89.61% and 49.20 mg/L, respectively). Staphylococcus was isolated from her blood test. It was suspected as an infectious pseudoaneurysm.

An urgent surgery was performed within two hours after the admission. The operation was performed under deep hypothermia and cardiopulmonary bypass with a median sternotomy. The ascending aorta was blocked and the rectal temperature dropped to 25°C by hypothermia. The cardioplegic solution was infused into the root of the ascending aorta. And then the circulation was suspended.

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while the heart stopped beating. The main pulmonary artery was incised and it was observed the occluder had protruded and obstructed the pulmonary artery, so the occluder was removed. A piece of pericardium patch was sutured with 5/0 prolene to repair the neck of the aneurysm, and the circulation and temperature were recovered. The junction of left and right pulmonary artery was sutured with 5/0 prolene and tied a knot. The pericardium patch was sutured with 5/0 prolene to repair the lesion of pulmonary artery. The clamp of the ascending aorta was loosened and the heart resumed sinus rhythm. The inside wall, outside wall, and adjacent tissue of the aneurysm were scrubbed with Povidone iodine repeatedly, and the necrotic tissue was cleared. The vancomycin and tazocin were put in the aneurysm. The patient was closed up and separated from cardiopulmonary bypass gradually. Teicoplanin was administered (100 mg intravenously) for one month. The patient remained asymptomatic, and TTE results were normal during the follow-ups for fourteen months.

Discussion

The patient had not observed an aneurysm in the month before the surgery. The maximum diameter of the aneurysm was 30 mm after 35 days, and it grew at the minimum speed of 30/35 mm/days (0.86 mm/day). The prognosis of aneurysm was rather dangerous and many patients died from the bleeding secondary to the rupture of aneurysm.3,4) Only those aneurysms could be stable and calcified gradually in the minority of patients. Although the inflammatory tissues surrounding the aneurysm might be difficult to be repaired, the aneurysm in this report grew very rapidly. Hence, our team decided to perform the emergency surgery. Fortunately, the aneurysm was excised promptly and the patient survived.

Although sternotomy for PDA can be safely performed in children,5) transcatheter closure could avoid
sternotomy and shorten the length of hospital stay with fewer complications. Transcatheter closure of PDA has been constantly evolving since 1967.6 It has become the first choice for PDA treatment nowadays. The Amplatzer Duct Occluders are used and achieve desired effects in most cases. For large PDAs, the Amplatzer mVSD occluder is an effective choice yet, particularly for those complicated with severe pulmonary arterial hypertension.7,10 The mVSD occluder manufactured in China is similar to the Amplatzer occluder. We choose the mVSD occluder because the duct in our case was large and the pulmonary pressure was high. Thus, the mVSD occluder of appropriate size was chosen according to a 1:1 ratio of the diameter of the arterial duct of the aorta end and the diameter of occluder’s waist.

The infectious endocarditis is a rare complication following the PDA closure. The patient was given antibiotic as preventive measure in the present case. The patient had no infectious symptoms in the early postprocedural time, but she got a fever two weeks later, which might not support the septicemia associated with the catheter. It’s more likely to be the bacteria migrating from somewhere else on the body. In our opinion, the mVSD occluder involved may injury the endothelium of partial vessels and made the local tissues being infected by the bacteria easily. This results in the infectious pseudoaneurysm indirectly.

This aneurysm might be attributed to the closure of PDA, because the occluder caused the mechanical injury against blood vessels and induced inflammation eventually.12 It’s recommended that the trauma of operative site should be observed carefully after the clinical intervention in case of aneurysms, which will be helpful to protect patients against fracture of the aneurysm.

Disclosures

Conflicts of interest: On behalf of all authors, the corresponding author states that there is no conflict of interest.

References