septum and the aortic valve, compared with the preoperative MRI of 22 mm (Fig 1). Postoperative electric cardiography showed normal sinus rhythm. Postoperative echocardiography showed that the flow velocity across right ventricular outflow tract was 3.0 m/s. One year and 4 months later, an echocardiogram showed that the velocities across the right and left ventricular outflow tracts were 2.1 and 2.0 m/s, respectively. Aortic valve regurgitation was not significant during follow-up.

Comment

As reported by Dearani and colleagues [6], LVOT stenosis is a major morbidity in Rastelli-type repair for TGA/PS at long-term follow-up. PRT for TGA/VSD with PS could be an adjunct to avoid this postoperative morbidity. As shown by MRI in our case, a more natural LVOT was obtained by the use of PRT because of the parallel transfer of the aortic root, even with the double switch operation. The advantages of this operation include no requirement for coronary transfer. This technique also enables preservation of the aortic root structure and avoids the risk of aortic root dilatation caused by the incision around it. The risk of reintervention for right ventricular outflow tract stenosis is also diminished if an autologous pulmonary valve structure is preserved. The indications for how this technique should be applied to the TGA/VSD complex need to be determined; a pulmonary root that is too small is not an indication. Then, the PRT technique does not accommodate LVOT, especially at less than 50% of the normal diameter of the pulmonary valve. Moreover, an excessively large pulmonary root is a concern. PRT for a pulmonary root that is too large could cause kinking of the coronary arteries or aortic valve deformity because of excessive parallel transfer of aortic root. We attempted to use proper supplements for the defect of the pulmonary root to avoid these disadvantages. Careful attention should be paid during removal not to injure the pulmonary valve. An incision should be placed just around the pulmonary annulus to avoid injury of the pulmonary valve and other surrounding tissues. The main pulmonary artery should be opened to confirm the pulmonary valve annulus during removal.

It is unknown whether the length between the top of the interventricular septum and the aortic valve will become shorter (a straighter LVOT) in the future. Further examinations should be performed at long-term follow-up to investigate the morphology of LVOT after PRT.

References

successful management of an infected thoracic aortic aneurysm with endovascular repair followed by a delayed open surgical procedure.

A 70-year-old man with diabetes mellitus was referred to our hospital for management of thoracic aortic aneurysm. He had a 6-day history of high-grade fever and back pain, and bloody sputum was identified just before admission to our hospital. *Klebsiella pneumoniae* had already been detected in a blood culture, and antibiotic treatment had been initiated in the previous hospital. Physical examination revealed a blood pressure of 164/56 mm Hg and a heart rate of 68 beats/min. The white blood cell count was 20,300/μL, and the C-reactive protein level was 14.3 mg/dL. Enhanced computed tomography (CT) showed a large thoracic aortic arch aneurysm with diffused gas inclusion, which was much larger than that seen 3 days before (Fig 1). A diagnosis of impending rupture of the infected aortic arch aneurysm was confirmed. We decided to perform endovascular repair as a bridge procedure to prevent lethal rupture, followed by continuation of medical therapy for infection. With the patient under general anesthesia, urgent thoracic endovascular repair (TEVAR) was performed with the use of a Cook Zenith TX2 34- × 30- × 150-mm (Cook Medical, Bloomington, IN) thoracic endovascular stent graft through the right common femoral artery. The proximal left subclavian artery was occluded by coils to prevent potential type II endoleak. Persistent chest pain radiating to the back subsided immediately after TEVAR, and the patient’s inflammatory signs, including white blood cell count and C-reactive protein level, returned to almost normal levels within 5 days after the operation. Postoperative CT showed no endoleaks (Fig 2). A second-stage open operation was performed 2 weeks after TEVAR. The patient’s chest was entered through a standard midline sternotomy along with a left thoracotomy at the fourth intercostal space. After the establishment of cardiopulmonary bypass, the stent graft was explanted with relative ease, followed by debridement of the aortic wall and surrounding tissues while the patient was under circulatory arrest with selective cerebral perfusion, at a rectal temperature of 25°C. The aortic arch was replaced with a four-branched gelatin-impregnated Dacron graft (Gelseal four-branch plexus; Vascutek, Terumo, Renfrewshire, UK) soaked in a rifampicin solution (Wako Pure Chemical Industries, Osaka, Japan). The coils were also resected, and the proximal left subclavian artery was closed. The left axillary artery was reconstructed from the second branch of the four-branched Dacron graft. Finally, the prosthetic graft was covered with the omental flap. Bacterial culture from the aneurysmal wall demonstrated no bacteria, probably owing to preoperative antibiotic treatment. A postoperative CT scan showed correct graft replacement (Fig 3). The patient was discharged without any recurrent signs of infection.

**Comment**

An infected aortic aneurysm is a rare but life-threatening condition, and it remains clinically demanding to treat. An open operation for infected aneurysm carries significant mortality and morbidity, resulting from patient instability caused by sepsis or rupture [3–5]. The operative mortality is especially higher in patients with infected aneurysms involving the suprarenal or thoracic aorta compared with infrarenal involvement [3]. However, Oderich and colleagues [6] reported that the late outcome was favorable, with no aneurysm-related death and a low related complication rate.

Recently, several reports have described acceptable early outcomes of endovascular repair for infected aortic aneurysm [1, 2]. However, they mentioned mainly abdominal aneurysms, and the long-term result is still
unknown. Stent graft placement in the infected field may not be optimal, and its acceptability remains controversial. The gold standard of treatment for an infected thoracic aortic aneurysm is still surgical debridement of infected tissue followed by in situ revascularization or extraanatomic grafting with long-term antibiotic therapy. Endovascular repair should be an alternative for high-risk patients or used as a bridge while they await an open procedure.

In the present case, extraanatomic repair was considered to be inappropriate because the aneurysm was in the distal arch, and the aortic arch was heavily calcified. Therefore, we performed in situ replacement of the aortic arch with a rifampicin-bonded prosthetic graft. The use of a rifampicin-bonded graft has been associated with favorable outcomes for graft infection, and this has recently been applied to the treatment of infected aortic aneurysms [7].

 Sugimoto and colleagues [8] reported that timely surgical intervention after control of sepsis provided excellent outcomes, whereas the mortality rate of patients with sepsis or rupture was high. Although it is needless to say that preoperative medical treatment is crucial, the risk of lethal rupture always exists even when antibiotic therapy is given; that is the dilemma of the treatment of an infected aortic aneurysm. In this regard, the bridge use of TEVAR to prevent early rupture and temporarily stabilize the patient's condition before a second-stage open operation can be a reasonable treatment option. We consider this strategy beneficial to patients with an infected thoracic aortic arch aneurysm. It decreases the risk of perioperative complications related to cardiopulmonary bypass with the patient under circulatory arrest, and it prevents the recurrence of infection, compared with a one-stage corrective open operation.

References