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CASE REPORT

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Aortic valve bypass for high-risk patients with symptomatic aortic stenosis: A case report

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Abstract

There are a significant number of symptomatic aortic stenosis (AS) patients not referred to the traditional methods for some complex conditions. We described a case of a 61-year-old female with severe symptomatic AS, calcific small aortic annulus (16.6 mm), narrow porcelain ascending aorta (aortic root: 14.6 mm, internal diameter: 14.0 mm), chronic renal insufficiency, and a history of the previous sternotomy for mechanical mitral valve replacement and coronary artery bypass grafting who underwent aortic valve bypass (AVB) with favorable results. AVB has been proposed as a complementary to surgery operation of aortic valve replacement and transcatheter aortic valve implantation in high-risk AS patients.

KEYWORDS
aortic valve bypass, aortic valve stenosis, apicoaortic conduit

1 | INTRODUCTION

Aortic valve bypass (AVB) is a surgical procedure to widen the area of the left ventricular tract by constructing a valved conduit through the cardiac apex and the descending aorta. It has been considered that AVB is an alternative technique to traditional methods for high-risk aortic stenosis (AS) patients since there is no need for sternotomy, aortic cross-clamping, cardioplegic cardiac arrest, incision of ascending aorta, and minimal use of cardiopulmonary bypass (CBP).[1,2] In recent decades, with the broad application of transcatheter aortic valve implantation (TAVI) in patients with symptomatic AS rejected for surgery operation of aortic valve replacement (SAVR), AVB is fading away from the operation room for several disadvantages, including thoracotomy, myocardial injury in the left ventricle and flow competition in the aorta. Moreover, it is difficult to obtain apical borer and stented apical connector in many healthcare facilities, which limit the clinical application of AVB. However, there are still a number of patients with symptomatic AS are not referred to SAVR and TAVI. Here, we report the case of a high-risk symptomatic AS female with contraindications to SAVR and TAVI, in whom favorable results were obtained after constructing AVB.

2 | CASE

A 61-year-old female suffering from aggravating chest distress and shortness of breath for a year was admitted to our Department of Cardiology. The patient with a history of chronic renal insufficiency had undergone mechanical mitral valve replacement (MVR) and coronary artery bypass grafting (CABG) 7 years before admission. On physical examination, her blood pressure was 90/57 mmHg, heart rate was 84 bpm. Lung breaths sounded clear. Cardiac examination revealed a grade 4/6 systolic murmur and a diastolic murmur in the auscultation area of the aortic valve. Transthoracic echocardiography showed calcified aortic valve with small aortic annulus for a diameter of 16.6 mm, as well as severe stenosis and moderate regurgitation, accompanied by hypokinesis of the left ventricular wall, the peak flow velocity of 4.28 m/s, peak across aortic valve gradient

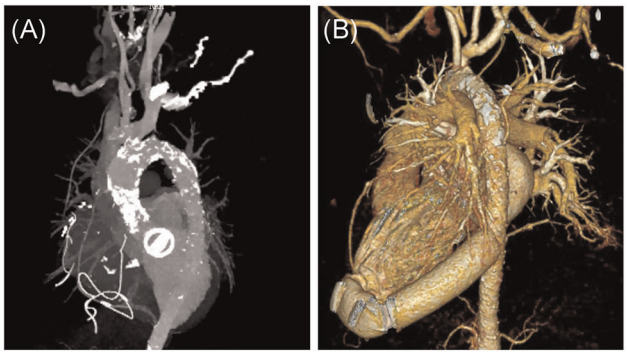

FIGURE 1 (A) Preoperative three-dimensional computed tomography (3D-CT) reconstruction showed severe and diffuse calcifications of the coarctated ascending aorta. (B) The postoperative 3D-CT reconstruction showed a mechanical valved conduit connecting the apex of the left ventricle to descending aorta

of 73.4 mmHg, mean gradient of 44 mmHg, and a calculated aortic valve area of 0.33 cm^2. The left ventricular end-diastolic diameter was 67.1 mm. The left ventricular ejection fraction was 26%. Three-dimensional (3D) thoracic computed tomography (CT) reconstruction showed severe and diffuse calcifications of the coarctated ascending aorta and aortic arch (Figure 1A), with an aortic root diameter of 14.6 mm and an internal diameter of 14.0 mm. The calculated European system for cardiac operative risk evaluation (EuroSCORE) II mortality was 72.04%.

Under general anesthesia, the patient was placed in the right decubitus position with hips externally rotated to allow access to the left femoral vessels. CPB was established between the left femoral artery and vein. A left lateral thoracotomy was performed through the sixth intercostal space to show both the left ventricular apex and the descending thoracic aorta. After systemic heparinization, the descending aorta was clamped, to which a 23-mm mechanical valved conduit was sewn in an end-to-side fashion. Under ventricular fibrillation induced with hypothermia of 25°C, the left ventricular apex was opened and the aortic valve was repaired through the direct apical incision. Then a 26-mm vascular tube graft was anastomosed to the apical incision by 2-0 polypropylene sutures with Teflon felt pledgets. Finally, the two grafts were anastomosed together end-to-end with a continuous 4-0 polypropylene suture.

Postoperatively, the patient was treated with double therapy consisting of warfarin and aspirin. The patient was extubated 21 h after the operation and was discharged from the hospital on Day 18 after surgery in good condition. The predischarge echocardiography showed a decreased pressure gradient across the aortic valve (peak: 29 mmHg, mean: 11 mmHg) and an ejection fraction of 47.82%, with the left ventricular end-diastolic diameter of 54.6 mm. 3D reconstruction based on contrast-enhanced CT demonstrated a valved apicoaortic conduit with fluent blood flow (Figure 1B). One year after surgery, this patient has resumed a normal and productive life with the relief of symptoms and good patency of the valved bypass vessels.

3 | DISCUSSION

For adults suffering from symptomatic AS, SAVR is recommended in those at low risk (EuroSCORE II < 4%), while the TAVI is considered to be a choice for patients who are not suitable for SAVR, especially for those suitable for transfemoral access.[3] AVB is regarded as a good option for reducing the left ventricular overload by connecting the left ventricular apex and descending aorta in patients with contraindications to SAVR and TAVI.

SAVR was not considered to be possible in this case due to a number of reasons including an extremely high surgical risk (EuroSCORE II 72.4%), severe calcification, frailty, history of previous MVR and CABG through sternotomy and a very small aortic annulus. TAVI was not suitable in this case due to an extremely small annular size (16.6 mm). To widen the total area of the left ventricular tract and decrease the cardiac afterload, we finally performed a surgical procedure of AVB and aortic valvuloplasty in consideration of the severe stenosis and moderate regurgitation of the aortic valve. Due to the absence of apical borer and stented apical connector, we opened the left ventricular apex directly with a sharp knife and reinforced the apical–vascular anastomosis by using inner and outer Teflon felt strips. CPB was used to remain a field devoid of blood.

A theoretical risk of the AVB procedure is the possibility of flow subtraction with cerebral hypoperfusion ascribed to the competition between the antegrade and retrograde flow from two ventricular outputs. In a recent study, Benevento et al.[4] showed that the blood flow distribution after AVB depends on the effective orifice area of the stenotic aortic valve and apicoaortic valved conduit implanted. Mantini et al.[5] reported that the flow redistribution after AVB does not compromise cerebral blood supply. Another serious complication is aortic thrombosis at the level of flow stagnation caused by the collision of two blood flows, which is more likely to happen when the retrograde flow is dominant and antegrade/retrograde flows are equivalent. The recommendation is that patients who underwent AVB receive long-term strict anticoagulation.[6]

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CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

ETHICS STATEMENT

Approval for this study was obtained from the local research ethics board. Written informed consent was obtained from this patient.

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