CASE REPORT

Apicoaortic valved conduit with an apical connector for aortic stenosis with a calcified aorta

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Abstract We report a case of apicoaortic bypass using an apical connector for severe aortic stenosis. A 74-year-old woman suffered from severe aortic stenosis, with a small aortic annulus and a severely calcified aorta. A valved conduit with an apical connector was placed between the left ventricular apex and the descending thoracic aorta because the risk of aortic valve replacement was high. Use of an apical connector facilitated a secure connection between the conduit and the left ventricular apex. The pressure gradient across the native aortic valve fell from 64 mm Hg before the operation to 19 mm Hg afterward. Apicoaortic bypass using the apical connector is a reliable option for relieving obstruction of the left ventricular outflow tract in the presence of aortic stenosis when aortic valve replacement is a high risk.

Key words Apicoaortic bypass · Apicoaortic conduit · Apical connector · Aortic stenosis · Calcified aorta

Introduction

Aortic valve replacement (AVR) for aortic stenosis, either with a severely calcified aorta or after coronary artery bypass grafting, is technically challenging. In such cases, apicoaortic bypass (AAB) is an alternative to AVR for relieving left ventricular outflow tract obstruction. Hancock apical left ventricular connectors (Medtronic, Minneapolis, MN, USA) are commonly used for AAB in Western countries, but experience with them is extremely limited in Japan. We report a case of AAB using an apical connector for severe aortic stenosis with a small aortic annulus and a severely calcified ascending aorta.

Case

A 74-year-old woman was brought to our hospital by ambulance, suffering from nocturnal dyspnea. She had been diagnosed with severe aortic stenosis in another hospital and had been treated medically because of high surgical risk. Once her condition stabilized at our hospital, she was reassessed. She was 150 cm in height and weighed 64 kg; her body surface area was 1.59 m². Echocardiography revealed that the aortic lesion was pure aortic stenosis without regurgitation; the diffusely calcified three cusps had restricted opening motion, and the small annulus was 17 mm in diameter. The maximum aortic pressure gradient and mean aortic pressure gradient were, respectively, 95 mm Hg and 60 mm Hg. The mitral valve was functioning normally, and the left ventricle (LV), which was concentrically hypertrophic, was contracting normally. Computed tomography (CT) revealed that the ascending aorta, including the Valsalva sinuses and the aortic valve, was severely calcified, and that the descending thoracic aorta without mural thrombus was sparsely calcified and mildly atherosclerotic (Fig. 1). Cardiac catheterization revealed that the mean
aortic pressure gradient was 64 mm Hg, the aortic valve area index was 0.29 cm$^2$/m$^2$, and the LV enddiastolic volume index and endosystolic volume index were, respectively, 75 ml/m$^2$ and 31 ml/m$^2$. Surgery was indicated for the severe aortic stenosis. We chose AAB rather than AVR because of the high surgical risk associated with AVR, which demands deep hypothermic circulatory arrest (HCA) to avoid aortic cross-clamping on the diseased aorta.\textsuperscript{1,2} Written informed consent to use a Hancock apical left ventricular connector for AAB was obtained from the patient before surgery.

During the operation, a double-lumen endotracheal tube suitable for single-lung ventilation was intubated, and the patient was placed in the right lateral semidecubitus position. A low-porosity conduit extending from an 18-mm Hancock apical LV connector (Medtronic) was soaked in 5% albumin solution and autoclaved at 125°C for 4 min. A valved conduit was made by placing a 19-mm Mosaic bioprosthesis (Medtronic) into a 22-mm Hemashield graft (Boston Scientific, Boston, MA, USA) (Fig. 2). The left thoracic cavity was opened through the fifth intercostal space, and the inferior pulmonary ligament was divided. After administering a full dose of heparin, normothermic cardiopulmonary bypass (CPB) was initiated with left femoral arterial and venous cannulation. First, the descending thoracic aorta was partially clamped, and the distal end of the valved conduit was anastomosed with a 3–0 Prolene continuous suture. The pericardium was then opened anterior to the phrenic nerve, and the apex was exposed. The configuration of the apex and ventricular septum was checked by transesophageal echocardiography, and a circle (diameter 30 mm) was marked with dye using a valve seizer at a position slightly anterior and lateral to the apex. Eleven pledgeted 2–0 Ethibond sutures entering and exiting the epicardium were placed along the marked circle, deeply but without damaging the coronary vessels, and the sutures were then passed through the collar of the apical connector. Ventricular fibrillation was induced at this stage with a pair of epicardial leads and a fibrillator. A stab wound was made with a scalpel in the center of the marked circle, and a Hancock trocar blade (Medtronic) was inserted parallel to the ventricular septum; a core of myocardium was removed. The apical connector was then inserted and secured by the above Ethibond sutures. The suture line of the collar was reinforced with a 3–0 Prolene continuous suture. Finally, the conduit of the apical connector was anastomosed to the proximal end of the valved conduit, which had already been anastomosed to the descending aorta, with a 4–0 Prolene continuous suture. The rhythm was converted electrically to sinus rhythm, and CPB was terminated. The ventricular fibrillation time was 43 min, and the CPB time was 143 min.