Single coronary artery　with aortic valve replacement followed by aortic root replacement due to endocarditis:A case report

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Abstract

A woman with single coronary.She underwent aortic valve replacement.But aortic annulus abscess occurred 2 years later. We performed aortic root replacement and coronary artery bypass grafting using the Freestyle valve and saphenous vein graft. The patient was discharged and has visited us as an outpatient without relapse of infection.

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Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Abstract

A woman with a single coronary artery underwent aortic valve replacement for aortic stenosis. Two years later, she developed an aortic annulus abscess around the right coronary cusp and non-coronary cusp. Due to significant adhesions to the right coronary artery (RCA) caused by the abscess, separating the artery

became challenging, and there were concerns about the potential risk of future stenosis in the RCA. As a result, the patient underwent aortic root replacement and coronary artery bypass grafting using a Freestyle valve and a saphenous vein graft for the RCA. Following the procedure, the patient was discharged and remained symptom-free without any relapses of infection for 2 years.

Keywords: Single coronary artery, Prosthetic valve endocarditis, Freestyle valve

CASE PRESENTATION

The 76-year-old women had undergone aortic valve replacement using a bioprosthetic valve (CEP Magna 21 mm: Edwards LifeSciences, Irvine CA) due to aortic valve stenosis. Postoperatively, she developed complete atrioventricular block and required pacemaker implantation. She had not suffered from heart failures or infections during her outpatient follow-up after discharge, but visited her outpatient clinics two years later due to fever and general fatigue. Significant elevations of inflammatory markers were observed (WBC18.3x10$^3/\mu$l and CRP 18.6 mg/dl, respectively), and Staphylococcus capitis was detected in her blood cultures. In addition, CT imaging revealed renal infarction and splenic infarction, and aortic valve abscess was suspected on transesophageal echocardiography. The diagnosis of infective endocarditis was made, and a 6-week course of vancomycin successfully resolved the infection. She was transferred to our hospital for surgical treatment to remove aortic annulus abscess. Upon admission, her height, body weight and body temperature were 149cm and 53kg, and 36.4°C, respectively. Her blood pressure was 92/43mmHg with a regular pulse of 60 beats/min. Inflammatory markers had normalized (WBC7.90x10$^3/\mu$l and CRP 0.23mg/dl, respectively). Procalcitonin was negative. Left ventricular ejection fraction was 81%, but aortic valve insufficiency from the same site as suspected abscess cavity around right coronary cusp-non coronary cusp (paravalvular leakage) was observed without apparent vegetations. There was no significant stenosis in the coronary artery, and the right coronary artery (RCA) shared a common opening with the left coronary artery (LCA) that originated from the left coronary cusp (LCC). The RCA ran anteriorly to the aorta between the aorta and the pulmonary artery. An abscess cavity was noted adjacent to the dorsal side of the RCA (#1) (Fig. 1a, 1b).

Operative findings

The right atrium, the ascending aorta, and the anterior portion of the right ventricle were highly adherent and exfoliated. Cardiopulmonary bypass was established with cannulation of superior and inferior vena cava and ascending aorta. The cardioplegia selectively injected from the LCA easily generated cardiac arrest, and thereafter, a retrograde coronary perfusion was performed every 20 minutes. After coronary peripheral anastomosis under circulatory arrest, upon observation of the aortic root, it was noted that the previously replaced prosthetic valve was partially dislocated at the non-coronary cusp annulus. During the removal of the bioprosthetic valve, pannus was identified underneath the valve, and extensive efforts were made to remove as much of the pannus as possible. The abscess cavity was open, extending from the LCC just below the LCA ostium and to the RCC in 12 o'clock direction, with the non-coronary cusp (NCC) at the center (Fig. 2). When creating a carrel patch for LCA, RCA was running within the aortic wall, and it was close to the abscess cavity located at the dorsal RCC. To prevent potential damage caused by detachment, the RCA was transected, and a bypass using the great saphenous vein on RCA #2 was created to facilitate the management of the LCA orifice. The LCC and RCC still had remaining annulus, and an everted mattress technique was used to attach a suture to the annulus. However, since there was no annulus left in the NCC, a suture was placed from the outside of the aortic wall to secure it. We selected a 21mm Freestyle valve. LCA was reconstructed by Carrelpatch method. After releasing the aortic blockage, there were recurrent episodes of ventricular fibrillation, indicating a potential perfusion abnormality in the LCA. As a result, coronary artery bypass grafting was added to the left anterior descending artery in the great saphenous vein. Under the assistance of the intra aortic balloon pumping (IABP), the cardiopulmonary bypass was safely discontinued, and the patient was successfully transferred back to the Intensive Care Unit. The total operating time was 565 minutes, with a cardiopulmonary bypass time of 366 minutes and aortic clamping time of 231 minutes. Due to the patient's stable hemodynamic status, the IABP was removed on the same day of the surgery. Postoperative daptomycin 300mg/day for 4 weeks resulted in improvement of the inflammatory response. No

bacteria were detected in the abscess tissue obtained during the surgery. A postoperative CT scan confirmed the patency of the graft. On the 32nd day after the surgery, the patient was transferred to the hospital without any abnormalities in the Freestyle valve. There was no recurrence of infection signs observed for two years.

DISCUSSIONSingle coronary artery disease is a rare congenital coronary artery malformation, with an reported incidence of 0.04-0.06% based on coronary angiography [1][2]. The Lipton classification is commonly used for classifying this disease [3]. In our case, the RCA forms a common opening in the LCC and courses within the anterior aspect of the aortic wall before following a normal trajectory, which corresponds to a classification of II-B in the Lipton classification system. Patients with a single coronary artery disease are known to have a high incidence of congenital heart disease including aortic bicuspid valve, tetralogy of Fallot, macrovascular dislocation, etc, in 40% of cases. 4) However, in the age of 76 in this case undergoing single aortic valve replacement (AVR), the findings revealed that a tricuspid aortic valve and no other anatomical abnormalities, except for the presence of a common orifice where the RCA originated from the LCC. It is important to note that even in cases without cardiac malformation, ischemic heart disease, sudden death, heart failure, and conduction disorders have been reported to occur in patients with single coronary artery disease. The pathogenesis of ischemia in such cases may be attributed to factors such as compression due to the artery running between the aorta and the pulmonary artery, or the origin of the coronary artery being at an acute angle, leading to conditions like slit-like entrance stenosis caused by the artery running within the aortic wall 5).

This case involves a single coronary artery disease classified as Lipton L II-B, where the coronary artery runs with a risk of ischemia. However, in this case, there was no evidence of myocardial ischemia during the initial AVR surgery or in the preoperative assessment for the current surgery. Due to the inability to evaluate the condition at that time, bypass surgery was not initially considered. However, during the creation of the carrel patch, we encountered significant adhesions caused by the abscess at the annulus, making it difficult to separate the RCA. In addition, the distal portion of RCA #1 was adhered to the abscess cavity, raising concerns about potential coronary artery stenosis due to the spread of inflammation. Therefore, RCA was bypassed with the great saphenous vein. In addition, due to the suspected abnormal perfusion of LCA reconstruction, indicated by the occurrence of ventricular fibrillation during cardiopulmonary bypass, a bypass was performed using the great saphenous vein to the left anterior descending artery. This occurrence might have been attributed to the flexion of the carrel patch caused by adhesion of the aortic root. In cases where severe adhesion is suspected in reoperation for single coronary artery disease, it might be more beneficial to consider performing a Pielher reconstruction to prevent the occurrence of such adverse events. In this rare case, the choice of bypass graft is crucial. The RCA has the potential to cause ischemia due to its compression between the aorta and the pulmonary artery. Unlike stenosis caused by arteriosclerosis, this type of narrowing usually allows for maintained blood flow in the coronary artery. When considering the internal thoracic artery as a graft option, there is a risk of flow competition and the need for additional revascularization (6). Therefore, we decided to use the great saphenous vein as the bypass graft instead. However, even in bypass procedures using the great saphenous vein, several cases of occlusion have been reported, and there are also reports highlighting the advantages of the unroofing method (7). In this particular case, CT and myocardial scintigraphy were performed 2 years after the surgery to confirm graft patency and rule out ischemia. However, strict follow-up will be necessary in the future.

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