Natural History of a Carpentier-Edwards Pericardial Aortic Valve Replaced after 25 Years for Structural Valve Degeneration

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INTRODUCTION

Structural valve degeneration (SVD) is one of the main drawbacks of bioprosthetic valves (BPs), limiting their durability after aortic valve replacement (AVR).[1] Few BP remain functional beyond 20 years after implantation. We herein report on the exceptional durability of a Carpentier-Edwards (CE) pericardial BP excised after 25 years in a 77-year-old man for severe regurgitation due to SVD.

CASE PRESENTATION

In February 2020, a 77-year-old man presented to our center with worsening dyspnea and peripheral edema. His medical history included AVR at another hospital in 1995 with a CE Perimount BP at the age of 53 years for bicuspid valve stenosis, dilated cardiomyopathy, chronic obstructive pulmonary disease, and paroxysmal atrial fibrillation. Data from transthoracic echocardiography (TTE) obtained from his referring cardiologist in 2009, 2011, and 2017 revealed transprosthetic mean gradients of 14, 17, and 19 mm Hg, respectively, with no regurgitation. In December 2018, the patient was admitted in the cardiology unit of our center for symptoms of heart failure. Transesophageal echocardiography showed a transprosthetic peak and mean gradients of 20 and 11 mm Hg, respectively. The prosthetic valve effective orifice area was calculated at 1.2 cm^2 using the continuity equation method, for a left ventricular outflow tract diameter measured in midsystole of 22 mm (Figure 1). The left ventricular ejection fraction was 30%, with a left ventricular end-diastolic diameter of 70 mm. The examination also revealed dilatation of the root (particularly the noncoronary [NC] sinus) and ascending aorta (AA) at 48 and 53 mm, respectively (Figure 1). The valve leaflets were thickened with a mild to moderate intraprosthetic regurgitation (Video 1). However, because of the presence of ventricular dyssynchrony on echocardiography secondary to complete left bundle branch block, a cardiac resynchronization therapy pacemaker was implanted following the recommendations of the electrophysiology team.

At his clinical follow-up in March 2019 with his referring cardiologist, the patient reported alleviation of his symptoms, especially dyspnea. TTE showed a transprosthetic mean gradient of 13 mm Hg. The left ventricular ejection fraction was measured at 45%, and there was mild to moderate intraprosthetic regurgitation.

Upon his readmission in February 2020, he was afebrile. Physical examination showed an aortic regurgitation murmur and lower extremity edema. Laboratory investigations revealed normocytic anemia with hemoglobin at 11.9 g/dL (normal range, 13.3–17.2 g/dL) and a C-reactive protein level of 2.7 mg/L (normal range, <5 mg/L). Electrocardiography showed a paced rhythm at 60 beats/min. Chest radiography showed an enlarged heart. There were thickened valve cusps and severe prosthetic regurgitation on TTE. Transesophageal echocardiography suggested a partial disinsertion of the NC cusp with severe regurgitation (Figure 2; Videos 2 and 3). There was also moderate tricuspid and mitral valve insufficiency. Coronary angiography did not demonstrate any coronary artery obstructive lesions. Chest computed tomography confirmed an aortic root and AA aneurysm at 48 and 58.4 mm, respectively (Figure 3). Several blood cultures were negative. The option of transcatheter aortic valve implantation (TAVI) was not considered in the context of a very mobile disinserted cusp, with an aortic root and AA aneurysm. Therefore, despite the patient's high surgical risk (logistic European System for Cardiac Operative Risk Evaluation II score > 50%), an open redo surgery was decided.

The patient underwent combined AVR with a 27-mm CE Magna Ease BP with a replacement of the NC sinus and the AA with a 32-mm Valsalva Dacron graft (Figure 4). Postoperative TTE showed a well-functioning BP with a mean gradient of 6 mm Hg.

The excised BP showed significant pannus on the sewing ring, with thickened and mildly calcified leaflets. A tear was also seen at the base of the NC cusp (Figure 4). There was no abscess, nor vegetations. The valve culture was negative.

The patient was progressively weaned off inotropic and vasopressor support and discharged from the intensive care unit on day 8 after surgery. He was transferred to a rehabilitative facility on day 24 after surgery. He reported significant alleviation of his symptoms, and his last follow-up 2 months after the surgery was excellent.

DISCUSSION

SVD is an inevitable complication of BP implantation. It is a multifactorial process that includes patient characteristics (such as younger age),[2-4] cardiovascular risk factors, and valve-related factors (transvalvular gradient, patient-prosthesis mismatch, valve design).[5] Currently there are variable definitions of SVD.[6-8] According to the recent European Association of Cardiovascular Imaging

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Keywords: Aortic bioprosthesis, Long-term durability, Structural valve degeneration, Redo surgery, Transcatheter valve replacement

Conflicts of interest: The authors reported no actual or potential conflicts of interest relative to this document.

2468-6441

https://doi.org/10.1016/j.case.2020.08.005

VIDEO HIGHLIGHTS

Video 1: Transesophageal echocardiography in December 2018 showing mildly thickened leaflet with a mild intraprosthetic regurgitation.

Video 2: Three-dimensional transesophageal echocardiography in February 2020 showing the disinsertion of the NC leaflet of the aortic bioprosthesis.

Video 3: Transesophageal echocardiography in February 2020 showing severe intraprosthetic regurgitation.

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guidelines, SVD is defined using the following criteria: (1) an increase in mean gradient ≥10 mm Hg (possible SVD) or ≥20 mm Hg (significant SVD) during follow-up, with a concomitant decrease in effective orifice area and abnormal valve leaflet morphology and mobility, and/or (2) new onset or worsening of transprosthetic regurgitation.[9] SVD of pericardial valves has been reported to develop mainly as a result of calcifications with ensuing stenosis.[10,11] However, in our case the leaflets were thickened and mildly calcified, and a tear was found at the base of the NC cusp, resulting in a severe regurgitant jet. The etiology of the patient clinical condition was the result of a severe SVD and not prosthetic valve infective endocarditis. Signs of SVD were present in 2018 with thickened valve leaflets and mild to moderate regurgitation. Ultimately, the aortic prosthesis degenerated with occurrence of a leaflet tear and severe regurgitation within 1 year.

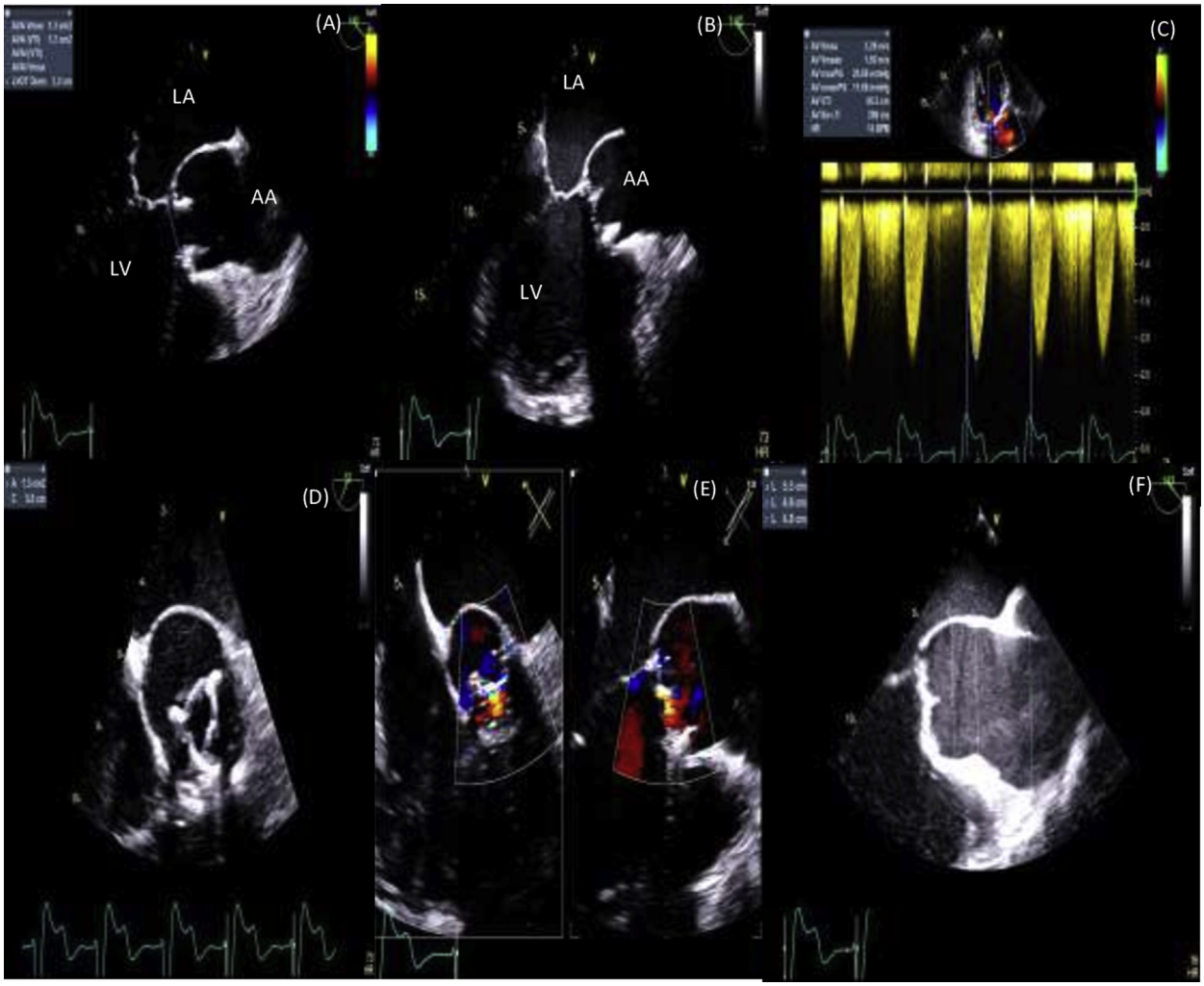

Figure 1 Transesophageal echocardiography performed in 2018 showing thickened valve leaflets but without major restricted prosthetic valve opening **(A)** and closure **(B)**. The prosthetic valve effective orifice area is calculated at 1.2 cm^2 using the continuity equation method **(A)**. Continuous-wave Doppler across the bioprosthesis showing peak and mean gradients of, respectively, 20 and 11 mm Hg at a heart rate of 74 beats/min **(C)**. The prosthetic valve geometric orifice area is measured at 1.3 cm^2 by planimetry **(D)**. Mild to moderate intraprosthetic regurgitation at diastole **(E)**. Root and AA aneurysms measured at 48 and 53 mm, respectively **(F)**. *LA*, Left atrium; *LV*, left ventricle.

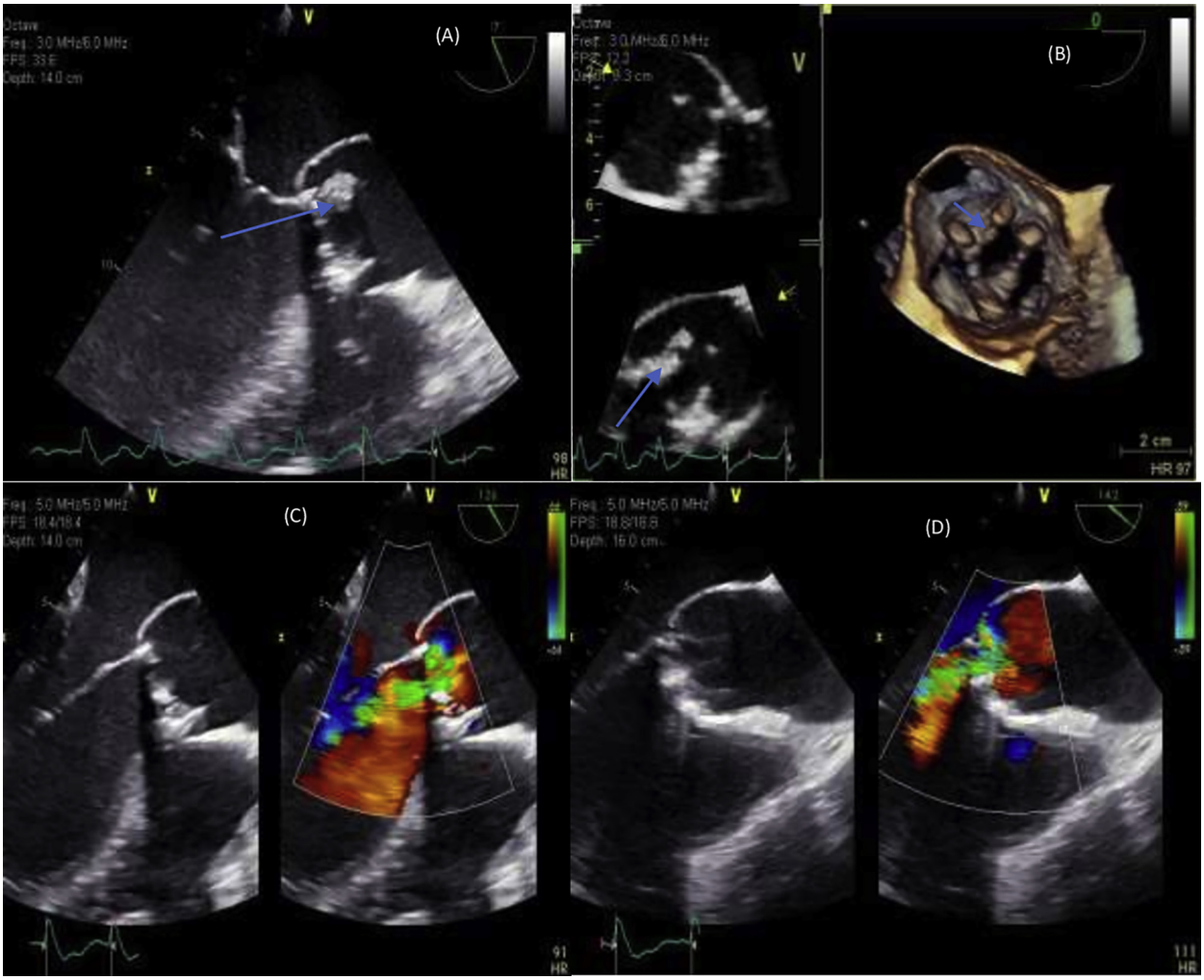

Figure 2 Transesophageal echocardiography performed in February 2020 showing markedly thickened leaflets with a partial disinsertion of the NC leaflet on two-dimensional and three-dimensional (*blue arrow*) imaging **(A, B)**, resulting in severe intraprosthetic regurgitation **(C**, **D)**.

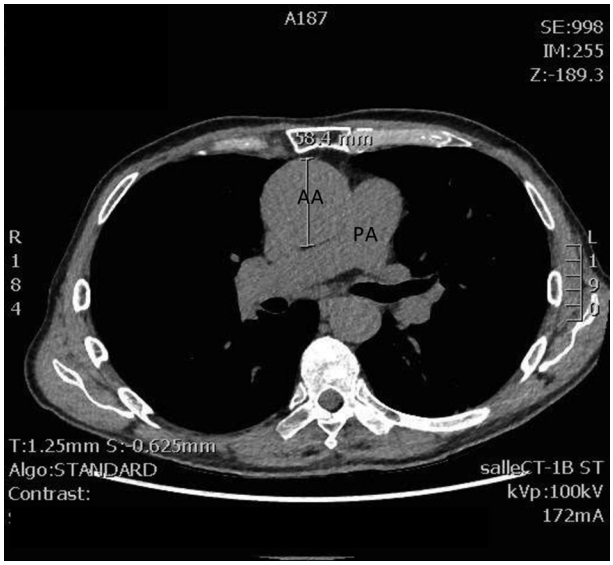

Figure 3 Chest computed tomography showing the AA aneurysm. *PA*, Pulmonary artery.

In recent times, there has been an increase in the use of aortic BP, even in younger patients, mainly because of the quest to avoid chronic anticoagulation therapy and the possibility of less invasive therapies such as TAVI at the time of BP failure.[5,12] But in our case, TAVI was not an option, and despite the patient's high surgical risk, he successfully underwent combined AVR and AA replacement surgery. Data on the durability of aortic bioprostheses at 20 years of follow-up are limited. Moreover, some studies have real median follow-up of <10 years, despite mentioning follow-up periods of ≥20 years.[13-15] Therefore, reports on redo AVR of the aortic pericardial valve beyond 20 years are uncommon.

CONCLUSION

We report on the exceptional durability of an aortic CE BP excised after 25 years for SVD.

SVD led to leaflet thickening and tear of the NC cusp with severe regurgitation. Proper annual echocardiographic follow-up is indicated in patients with long-lasting BP to detect SVD. Although our patient was not eligible for valve-in-valve TAVI, this alternative will probably

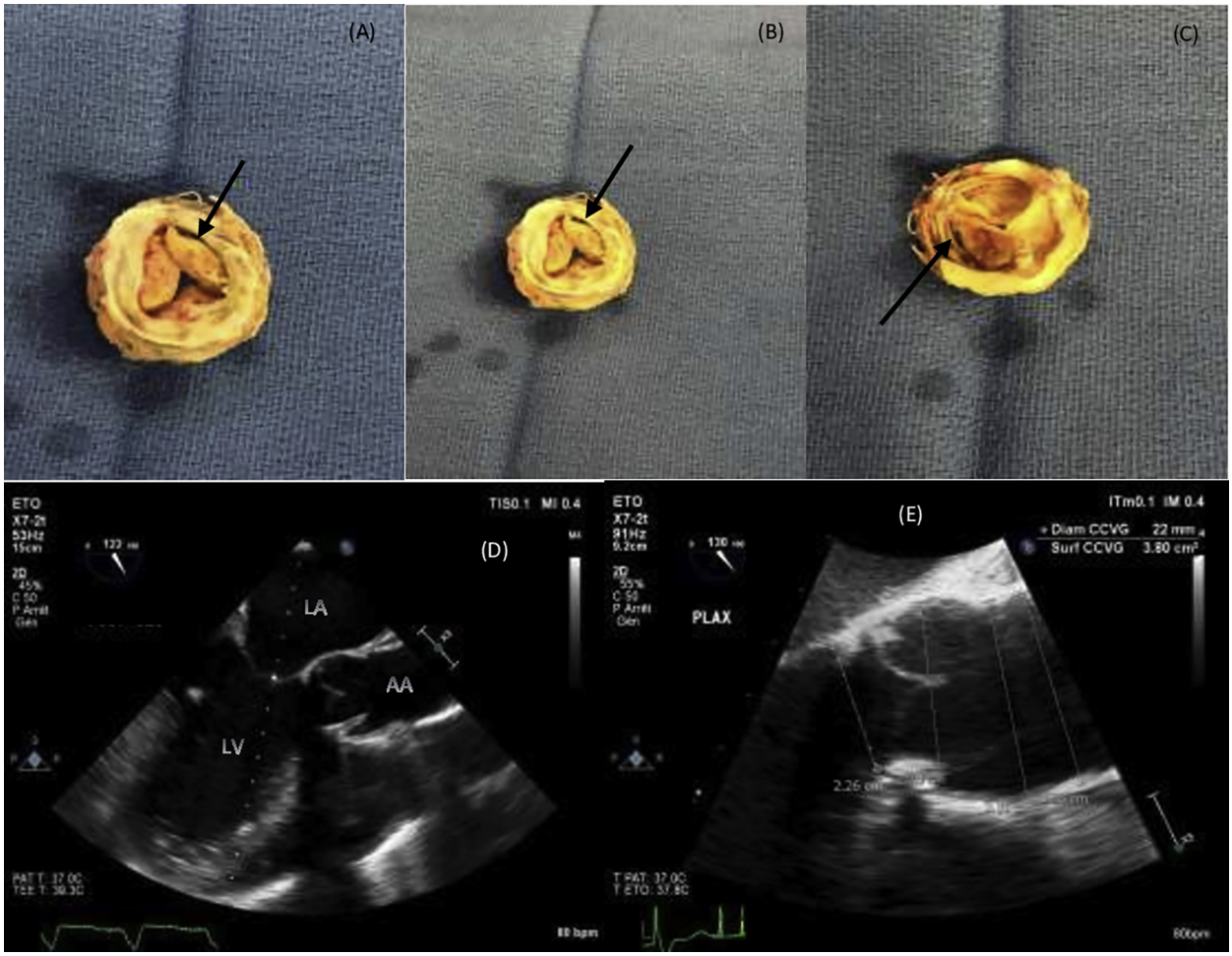

Figure 4 Explanted Carpentier-Edwards pericardial aortic bioprosthesis with pannus overgrowth and fibrosis in the sewing ring. We can also see thickened valve leaflets with a disinsertion of the base of the NC leaflet (*black arrow*; **A–C**). Postoperative transesophageal echocardiography showing AVR with a normal functioning bioprosthesis and the replacement of the NC sinus and the AA with a Dacron graft **(D, E)**. *LA*, Left atrium; *LV*, left ventricle.

reduce the morbidity and mortality associated with SVD in selected patients in the coming years.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at https://doi.org/10.1016/j.case.2020.08.005.

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