Role of Echocardiography in the Diagnosis of Aorto-Right Ventricular Fistula: A Rare Complication of Surgical Aortic Valve Replacement Successfully Closed by Bovine Pericardial Patch

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INTRODUCTION

Aortic stenosis is associated with considerable mortality and morbidity for which no pharmacologic therapy is yet available. Aortic valve replacement is the mainstay of treatment and can be done either via the transcatheter approach or surgically. Aortocardiac shunt is a complication rarely associated with surgical aortic valve replacement (SAVR). We report a case of aorto–right ventricular (AoRV) fistula diagnosed on echocardiography and computed tomographic (CT) angiography after SAVR.

CASE PRESENTATION

A 60-year-old white man presented to our institution with exertional dyspnea, light-headedness, and intermittent palpitations. His cardiac history was remarkable for calcific bicuspid aortic valve with stenosis and third-degree heart block, for which he had undergone implantation of a dual-chamber permanent pacemaker 2 years before the current presentation. Physical examination detected a grade 4/6 harsh systolic murmur that was heard best at the right upper sternal border. His lungs were clear. Transthoracic echocardiography (TTE) revealed severe aortic valve stenosis, with a mean gradient of 30 mm Hg, dimensionless index of 0.23, and calculated valve area of 0.79 cm^2. Also noted was a decreased left ventricular ejection fraction of 42%. Transesophageal echocardiography (TEE) confirmed severe aortic valve stenosis and mild ascending aortic dilation. A preprocedural CT scan revealed a heavily calcified aortic valve (Figure 1). Cardiac catheterization did not reveal hemodynamically significant coronary artery disease. SAVR was done using a 23-mm Mosaic bioprosthesis (Medtronic, Minneapolis, MN). To properly implant the valve, extensive intraoperative debridement around the annular cusps was required. Intraoperative TEE was felt to show a possible small subaortic ventricular septal defect, which at the time was felt to be insignificant. One day after the procedure, the patient had worsening shortness of breath and a dramatic increase in oxygen requirement. On physical examination, a continuous murmur was heard throughout the precordium and distended neck veins. Diffuse lung crackles were heard on auscultation. Chest radiography showed bilateral pulmonary opacities consistent with congestive heart failure. On TTE, a shunt with continuous flow between the right sinus of Valsalva and the right ventricle was seen, and the right atrium and right ventricle were more dilated than they had been on intraoperative TEE. Given these new findings, bedside TEE was repeated (Figure 2, Videos 1 and 2). Results of TEE confirmed the findings on TTE, showing continuous color and spectral Doppler flow originating from the aorta to the right ventricle (Figure 3). Pulmonary artery pressure was elevated, and left ventricular ejection fraction had decreased even further to 25%. The prosthetic valve itself appeared normal and well seated, with no paravalvular or central leaks. Retrospective review of intraoperative transesophageal echocardiographic images showed continuous flow from the aortic root to the right ventricle along the interventricular septum rather than through it. This shunt visually appeared much smaller than that visualized on postoperative TTE and TEE, which were performed as a result of the patient being decompensated. CT scanning was performed using gating, retrospective, using a dual-source cardiac CT scanner to rule out additional anatomic abnormalities. Heart rate at the time of scan was 60 beats/min. It was 86 beats/min at the time of initial noncontrast scanning, but the patient received an intravenous β-blocker to reduce heart rate before the contrast portion of the CT examination. It showed a 5.0- to 5.5-mm defect between the right sinus of Valsalva and the right ventricle (Figure 4). Also noted was mild dilation of the right atrium, the right ventricle, and the pulmonary artery.

Surgical exploration revealed a slitlike area that originated 1 mm superior to the sewing ring of the prosthesis, about 1 cm from the right coronary ostium, toward the pulmonary artery. The slit was closed by anchoring a bovine pericardial patch over the proximal portion of the valve's sewing ring, after which intraoperative TEE revealed no further evidence of the intracardiac shunt. The patient was discharged home in stable condition. Six days after discharge, he developed paroxysmal atrial flutter. Heart rate was controlled, and the patient was started on warfarin. Follow-up TTE at 1, 4, and 8 months showed no intracardiac shunting, with normal prosthetic valve function.

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Figure 1 Pre-SAVR CT image showing aortic valve (AoV) calcifications.

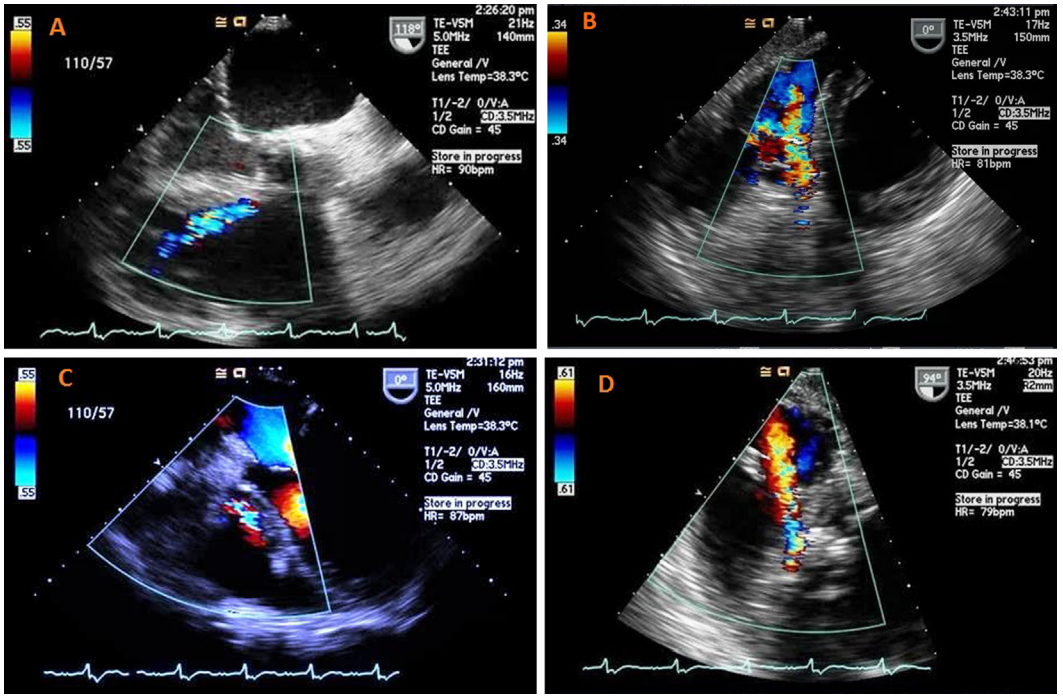

Figure 2 Color flow Doppler showing continuous flow through AoRV fistula. **(A)** Modified midesophageal, three-chamber view; **(B,D)** deep transgastric views; and **(C)** right ventricular–focused four-chamber views.

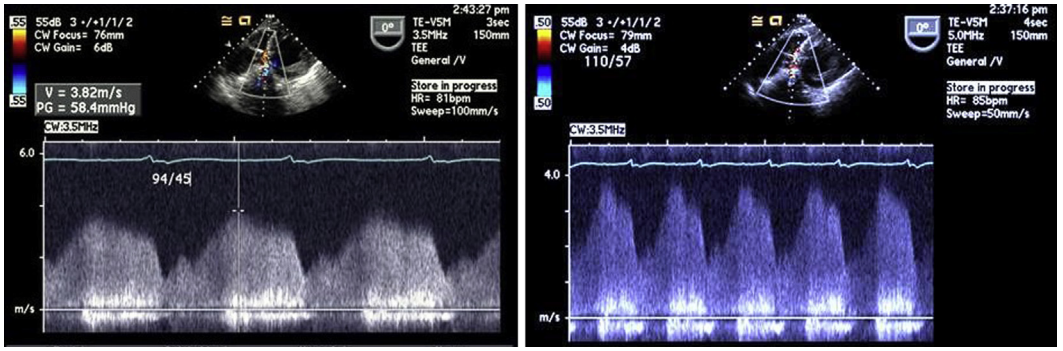

Figure 3 TEE showing a high-velocity, unidirectional left-to-right shunt on transgastric transesophageal views.