Early calcification of a Carpentier-Edwards Perimount mitral valve in an elderly woman

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In mitral valve surgery, the valve is replaced when repair is not feasible. Mechanical or biologic prostheses are the options. Mechanical valves have extended durability but require life-long anticoagulation. Bioprostheses do not require anticoagulant therapy, but they have a limited life because of structural valve deterioration, necessitating reoperation.

Carpentier-Edwards Perimount (CEP) bioprostheses (Baxter Healthcare Corporation CardioVascular Group, Irvine, Calif) are a reliable choice for valve replacement, especially in elderly patients, because they avoid the need for anticoagulation and its associated morbidity. Recent studies in long-term follow-up show low rates of structural valve deterioration among patients older than 60 years at implantation. We report here early mitral bioprosthesis calcification in an elderly woman that produced clinical symptoms of valve stenosis, necessitating reoperation.

Clinical Summary

A 75-year-old woman with history of arterial hypertension, hypercholesterolemia, and chronic atrial fibrillation, in New York Heart Association functional class III, underwent mitral valve replacement for mitral stenosis. Preoperative echocardiography and catheterization confirmed valvulopathy, showed good contractile function of the left ventricle, and revealed normal coronary arteries. The native valve was excised and replaced with a 29-mm CEP pericardial bioprosthesis. The patient made an uneventful recovery and was discharged on the fifth postoperative day.

After the valve replacement, the patient's functional class improved. One year later, she was operated on to resect an epidermoid neoplasm in the tongue but otherwise appeared to be in good health. However, 45 months later she reported fatigue, dyspnea with rest, and orthopnea. Physical examination discovered a new cardiac murmur at the apex. Echocardiography and cardiac catheterization revealed a calcified prosthetic stenosis with median transvalvular gradient of 31 mm Hg, an estimated valve area of 0.9

cm², and severe pulmonary hypertension (pulmonary artery systolic pressure 78 mm Hg, pulmonary capillary wedge pressure 52 mm Hg). Hyperparathyroidism was eliminated as a cause of bioprosthesis calcification, because the patient's calcium (9 mg/dL [normal values 8.8-10.5 mg/dL]) and phosphate (4.3 mg/dL [normal values 2.5-4.9 mg/dL]) blood levels were normal, and there were no calcium deposits at other organ sites.

The patient was accepted for repeated mitral valve surgery. At operation, the CEP valve leaflets were found to be rigid and completely infiltrated by calcium, with limited opening movement (Figures 1 and 2). The bioprosthesis was explanted and replaced with a 27-mm St Jude Medical mechanical valve (St Jude Medical Inc, Minneapolis, Minn). The patient made an uneventful recovery from this second operation.

Discussion

Structural deterioration is the principal complication of biologic valves and the main cause of reoperation. Structural valve deterioration is defined as any change in valve function resulting from an intrinsic abnormality causing stenosis or regurgitation (it excludes infected or thrombosed valves as determined on explantation and includes changes intrinsic to the valve, such as wear, calcification, leaflet tear, and stent creep).¹ Pericardial valves, like porcine ones, are vulnerable to two types of structural failure: leaflet tearing and calcification.² Early calcification of bioprostheses has been described in the younger age group, in patients taking calcium supplements or with calcium metabolism disorders, and in different types of bioprostheses (pericardial valves are less prone to calcification than are porcine valves). Calcium deposits are associated with the adsorption of proteins and phospholipids and with platelet deposition.³

CEP valve leaflets are bovine pericardium, fixed without pressure in glutaraldehyde and designed by computer-generated leaflet sizing according to stent size so that commissural stress is minimal. The tissue of these prostheses is treated with the surfactant polysorbate 80, an antimineralization agent that reduces calcification by extraction of phospholipids from the valve tissue.

Marchand and associates,⁴ in their long-term evaluation study of these prostheses at 15 years, recommended the use of the CEP because it seems to be free of structural failure caused by leaflet tearing and has low levels of structural valve deterioration from calcification in patients older than 60 years. In patients older than 70 years the results seem excellent, with 100% both actual and actuarial freedoms from explantation for structural valve deterioration.

Early failure of a bioprosthesis from calcification is exceptional in elderly patients.⁵ We did not find in the literature any other cases

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Figure 1. Carpentier-Edwards Perimount valve explanted. It was rigid, heavily calcified, with minimal open movement of the 3 cusps.

of early calcification affecting the CEP bioprosthesis in an elderly patient. Our patient had normal calcium and phosphate levels, and we did not find calcifications affecting other organs (eg, bone and kidney), so hyperparathyroidism was excluded as the cause of prosthesis calcification.

After this experience and after reviewing the studies about long-term follow-up with the CEP valve, we still think that this prosthesis could be the first choice for valve replacement in an elderly patient. Although it is a rare complication, however, valve failure from calcification can appear at any time after implantation in any patient, even the oldest. Periodically clinical follow-up and serial echocardiography will permit a prompt detection of structural valve deterioration and allow suitable treatment in individual cases.

Figure 2. X-ray analysis of the bioprosthesis explanted. Extensive calcium deposits are evident in the cusps.

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