STENT FRACTURE IN A CARPENTIER-EDWARDS SUPRA-ANNULAR PORCINE BIOPROSTHESIS IMPLANTED IN THE MITRAL POSITION

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Bioprosthetic heart valve dysfunction resulting from deterioration of its supportive stent is uncommon. Permanent inward deformation of the stent posts ("stent creep"), a phenomenon known to occur in some bioprosthetic models as the result of valve oversizing, may lead to intrinsic valve stenosis.¹ However, total disruption of the stent leading to valve dysfunction is rare, with only few reports being available in the literature.

Clinical summary. We report the case of a 55-year-old man who underwent mitral valve replacement with a size 33 mm Carpentier-Edwards supra-annular porcine bioprosthesis (Baxter Healthcare Corp, Edwards Division, Santa Ana, Calif) for rheumatic heart valve disease in 1987. Apart from this, his medical history revealed no other relevant data. He

remained free of symptoms until October 1997, when he started having shortness of breath. In December 1997 he was admitted to our hospital on an emergency basis with grade IV dyspnea and peripheral edema. A chest x-ray film showed a pattern of pulmonary edema and a double fracture in the wire stent of the mitral prosthesis (Fig 1). Echocardiography revealed moderate regurgitation of the aortic valve, mitral prosthesis, and tricuspid valve. Cardiac catheterization confirmed these findings and demonstrated moderate impairment of left ventricular function, as well as a pulmonary artery pressure of 107/50 mm Hg (mean 69 mm Hg). He was initially treated with captopril and diuretics with good response, and surgery was indicated. The patient underwent mitral and aortic valve replacement with St Jude Medical mechanical devices (sizes 33 mm and 25 mm, respectively; St Jude Medical, Inc, St Paul, Minn) and tricuspid annuloplasty. The macroscopic examination of the explanted mitral bioprosthesis disclosed moderate tissue mineralization and a severe inward deformity of one of its stent posts, causing the prolapse of an adjacent cusp (Fig 2). His postoperative course was complicated by postperfusion vasoplegic shock unresponsive to treatment, resulting in rapidly progressing multi-organ failure that led to his death in the intensive care unit on the second postoperative day.

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Fig 1. Detailed view of the pre-explantation lateral chest radiograph showing two fractures (*arrows*) in the wire frame of the mitral bioprosthesis.

Fig 2. Explanted bioprosthesis. A notorious inward deformity in one of its stent posts with protrusion of the fractured wire can be observed (*arrow*).

Discussion. Stent disruption is an extraordinarily uncommon mode of structural deterioration in bioprosthetic heart valve substitutes. For this reason, the data available in the literature on this subject are very limited. The compliant metal frame of Carpentier-Edwards bioprostheses is manufactured with Elgiloy, a corrosion-resistant alloy of cobalt and nickel (Elgiloy Limited Partnership, Elgin, Ill) that was chosen for its spring efficiency and its fatigue-resistant characteristics. To our knowledge, only one case of a mitral Carpentier-Edwards bioprosthesis malfunctioning as the result of fracturing of its Elgiloy wire frame has been previously reported.² Most of the data available on this complication refer to the experience achieved with the Wessex porcine bioprosthesis,³⁻⁵ a device no longer available for clinical use, in which the fracture of the acetyl copolymer stent was a common mode of deterioration.⁵

The mechanisms responsible for the occurrence of such fractures, which are often multiple in the affected devices,⁵ are uncertain. Computer-based studies on the Delrin stent of Hancock II porcine bioprostheses (Medtronic, Inc, Minneapolis, Minn) have identified the bases of the commissural arches of the frame as areas supporting high mechanical stresses.⁶ Fractures have a tendency to occur in these particular areas²⁻⁵ and, on these grounds, one can speculate that this phenomenon could be due to mechanical fatigue of the stent materials in areas of increased stress. This theory would also be supported by the fact that clinically relevant stent fractures are more common in valves implanted in the mitral position (where prosthetic frames must withstand greater static and dynamic stresses owing to the physiologic tridimensional dynamics of the native mitral anulus) than in those implanted at other sites.²⁻⁵

Clinical presentation is in the form of valve regurgita-

tion²⁻⁵ which, in our patient, occurred in a subacute manner 11 years after implantation. However, the reported experience with explanted Wessex bioprostheses⁵ suggests that valves with fewer than two fractures (as often occurs with devices implanted in the aortic position) have only a modest risk of deformation. In these cases, the valves may be functioning normally and, thus, the ruptured stent may be unnoticed by the observing physician and even by the explanting surgeon.

Clinical screening of fractures in the wire stent of Carpentier-Edwards bioprostheses is simple because their metal radiopaque frame can be easily visualized with a conventional chest radiograph, as illustrated by Fig 1. However, the detection of such complication in patients having bioprosthetic devices with radiolucent frames may be more difficult. Echocardiography would probably be the diagnostic method of choice in these cases.

We believe that conservative management with a close follow-up is probably the best line of action so long as the valve continues to function normally. However, if a serious deformity of the device is observed, particularly if there is any clinical evidence of valve dysfunction, replacement surgery should be considered.

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