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Mitroflow Bioprosthesis Stent Deformation: A Rare Cause of Early Prosthetic Stenosis

Javier Gualis, Mario Castaño, Jesús Gómez-Plana, Francisco Callejo

Department of Cardiovascular Surgery, León City Hospital, León, Spain

ABSTRACT

We report the case of a severe prosthetic aortic stenosis in a 61-year-old male patient with an aortic Mitroflow LF bioprosthesis (Sorin Group) at early (6 months) postoperative echocardiographic follow-up. At reintervention, we found significant stent deformation, asymmetric orientation of the posts, and subsequent central kinking and prolapse of one leaflet. Maldistribution of pledgeted mattress sutures over the flexible stent was found to be the origin of its permanent deformation. Simple technical preventive strategies of this previously unreported complication are suggested.

INTRODUCTION

The Mitroflow pericardial prosthesis (Sorin Group, Burnaby, British Columbia, Canada) is an aortic stented tissue valve substitute with an extremely flexible stent that easily adapts to a calcified and/or small aortic annulus [Totaro 2000; Gerosa 2006]. Although this flexibility makes prosthesis implantation easier in such scenarios, it can potentially make the device more prone to deformation and, eventually, failure.

CASE REPORT

We report the case of a 60-year-old man with symptomatic severe aortic stenosis referred to our department for evaluation for surgical treatment. Associated comorbidities were type 2 diabetes mellitus, a smoking history, and severe chronic obstructive pulmonary disease with domiciliary oxygen therapy. A transthoracic echocardiography examination showed a severely depressed ventricular ejection fraction (30%) and severe aortic valve stenosis, with peak and mean transvalvular gradients of 69 and 41 mm Hg, respectively, and an effective aortic valve area of 0.9 cm^2. A coronary angiography evaluation demonstrated no significant arterial stenosis. Surgery revealed an asymmetric and severely calcified aortic annulus, with a noncoronary sinus significantly larger than the left and right coronary sinuses. Coronary ostia were abnormally positioned as well. We replaced the aortic valve with a 21-mm Mitroflow LF pericardial bioprosthesis in the supra-annular position. After careful valve resection and annular debridement, we placed interrupted pledgeted mattress sutures through the aortic annulus and then distributed them throughout the Dacron rim of the prosthesis. Both the cardiopulmonary bypass weaning and the postoperative course were uneventful, and the patient was discharged on the sixth postoperative day with a regimen of 600 mg triflusal daily.

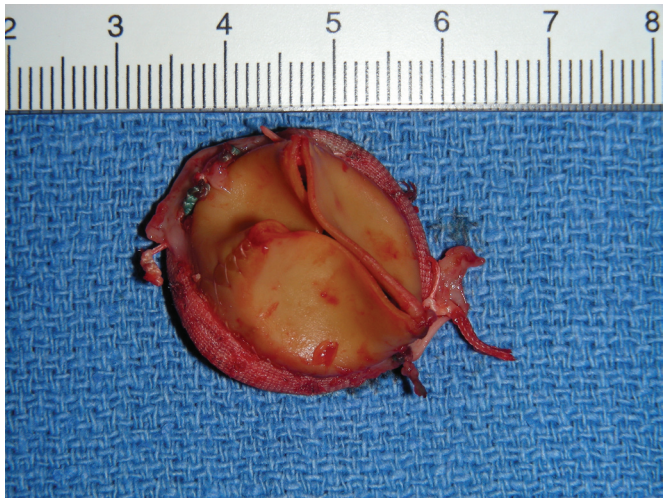

Figure 1. Asymmetric orientation of posts, central kinking, and abnormal stiffening of the right coronary sinus leaflet, along with aortic outflow tract obstruction.

Figure 2. Tridimensional permanent stent deformation as the cause of the asymmetry of both posts and the leaflet kinking.

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Correspondence: Javier Gualis, Department of Cardiovascular Surgery, León City Hospital, Altos de Nava s/n 24080, León, Spain; 0034610255085; fax: 0034987243924 (e-mail: javgua@hotmail.com).

Upon early follow-up (1 month) at the outpatient clinic, the patient was asymptomatic, but a transthoracic echocardiography evaluation showed peak and mean transprosthetic gradients of 61 and 46 mm Hg, respectively. At the 3-month follow-up, the patient complained of exertional dyspnea (New York Heart Association class III), and peak and mean transaortic gradients had increased to 74 and 50 mm Hg, respectively. Replacement of the prosthetic valve was then scheduled. At reoperation, the major finding was significantly asymmetric orientation of posts and central kinking and abnormal stiffening of the right coronary sinus leaflet (Figure 1), with subsequent aortic outflow tract obstruction. During prosthesis removal, we found that the portion of the Dacron rim involving the protruding right coronary leaflet included fewer sutures than the left coronary and noncoronary sinus rim segments. The bioprosthesis was replaced by a 19-mm bileaflet mechanical prosthesis. The postoperative course was again uneventful and the patient was discharged on anticoagulation treatment on the fifth postoperative day. Careful examination of the prosthesis in vitro showed permanent tridimensional stent deformation (Figure 2) as the cause of the asymmetry of both posts and the leaflet kinking. There was evidence of neither leaflet tearing or calcification nor stent fracture. At the 12-month follow-up, the patient remains asymptomatic with a normally functioning mechanical prosthesis and a preserved left ventricular ejection fraction.

COMMENT

Abundant clinical experience supports the widespread use of the Mitroflow stented aortic bioprosthesis as a valve substitute with good long-term follow-up in terms of structural degeneration [García-Bengochea 2006; Sjögren 2006] and valve-related events [Pomar 1998; Thulin 2000]. Excellent hemodynamic performance, especially in small aortic roots [Totaro 2000; Gerosa 2006], that is comparable in some reports with that of stentless tissue valves, tends to lead to early and significant regression of left ventricular mass, a major determinant of late mortality [García-Bengochea 2006; Sjögren 2006]. Moreover, the stent of this prosthesis is extremely flexible. This feature makes its implantation simpler in patients with significantly calcified or small aortic roots [Totaro 2000; Gerosa 2006]; however, such flexibility can potentially favor permanent stent deformation in cases of abnormal tensional forces via suture maldistribution or significantly deep aortic sinuses in a severely rigid and calcified annulus. In our case, the reoperation revealed that the portion of Dacron rim corresponding to the right coronary leaflet included fewer mattress sutures than the left coronary and noncoronary sinus rim segments. This suture distribution induced plication of the stent in the right coronary portion and proportional stretching in the other 2 segments. Consequently, the right coronary leaflet of the prosthesis kinked down to the aortic outflow tract and induced aortic valvar stenosis.

To our knowledge, no previous reports have described this rare complication. Contrarily, excellent long-term results have been reported. Although Minami and colleagues [Minami 2000] reported an actuarial 10-year freedom from structural degeneration of 65.6% ± 8.6% and 81.5% ± 5.4% among patients younger and older than 70 years of age, respectively, more recent studies have reported a 17-year actuarial freedom from this complication of >90% [Yankah 2005]. Sporadic early prosthesis degeneration causing aortic stenosis has been observed, however [Minami 2000]. Causes of early prosthesis degeneration are not detailed in these reports. We postulate that lesser degrees of stent deformation than in our case can induce increased leaflet stress and enhance tissue calcification or tearing.

In conclusion, we think that despite significant asymmetry in the length of the native aortic cusps, sutures must be distributed cautiously and equidistantly along the Mitroflow prosthetic Dacron rim to prevent stent deformation. We strongly believe that this recommendation can improve the mid- and long-term freedom from structural degeneration and reoperation of this prosthesis.

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