Open vascular plug placement to complete mitral valve seating in radiation heart disease

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Disclosures: Dr Johnston reports consulting role with Edwards Lifesciences LLC, KEF Healthcare, and St Jude Medical, Inc, and royalty payments from iVHR and Jace Medical LLC. All other authors have nothing to disclose with regard to commercial support.

Received for publication April 21, 2016; revisions received June 6, 2016; accepted for publication June 28, 2016; available ahead of print Sept 1, 2016.

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J Thorac Cardiovasc Surg 2016;152:e101-2

0022-5223/\$36.00

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<http://dx.doi.org/10.1016/j.jtcvs.2016.06.061>

Artistic renderings of open vascular occluder placement.

Central Message

In this report, we present a technique using vascular occluder devices to overcome technical challenges presented by radiation heart disease during double-valve replacement.

See Editorial Commentary page e103.

A 54-year-old woman with a remote history of mediastinal radiation for treatment of Hodgkins lymphoma was referred for evaluation of valvular disease and symptoms of severe dyspnea. Preoperative echocardiogram revealed severe aortic stenosis (peak gradient of 45 mm Hg and aortic valve area of 0.63 cm³), severe mitral stenosis (peak gradient of 35 mm Hg), and regurgitation (2+ to 3+), as well as moderate tricuspid regurgitation (2+ to 3+). Computed tomography of the chest revealed extensive myocardial calcification and massive mitral annular calcification (Figure 1), in addition to mild calcification of the ascending aorta. Cardiac catheterization showed a moderate lesion of the left main coronary artery at the ostium. A review of this patient's case was approved by the institutional review board as part of a larger series.

OPERATIVE PROCEDURE

A double-valve replacement with tricuspid valve repair, coronary artery bypass grafting, and possible radical reconstruction of the aorto-mitral curtain was planned. Intraoperative findings included severe calcification in the P2-P3 region extending from the papillary muscles

posteriorly to the left pulmonary veins. Despite extensive debridement of the mitral annulus, a region of confluent calcification remained in the area of P2-P3, which would not hold suture. A felt washer was used to seat a 27-mm valve; however, there was poor apposition of the valve in this P2-P3 region. Therefore, sutureless seating options were considered. With the assistance of the interventional cardiology team, a 5F short sheath was introduced directly into the operative field and placed in the space between the prosthetic valve and the mitral annulus. Two Amplatzer Vascular Plugs (AVP-2; St. Jude Medical, St. Paul, Minn),

FIGURE 1. Preoperative CT images and 3D reconstruction. A, Axial section of mitral annulus. B, 3D reconstructed view from left atrium. Calcification has been isolated with a modified thresholding technique. C, Sagittal view of severe confluent MAC and papillary muscle calcification. D, 3D reconstruction showing MAC with calcification extending into LA and LV.

FIGURE 2. Intraoperative images and artist renderings of completed Amplatzer plug placement in the P2-P3 region completing valve seating.

sized 8 and 10, were then released with the first disk in the left ventricular space and second in the left atrium, filling the defect between the sewing ring and annulus (Figure 2). The aorto-mitral curtain was reconstructed radically with a patch of bovine pericardium, allowing seating of a 23-mm aortic valve prosthesis. The pericardial patch was further extended to reconstruct the left atrial dome, left ventricular outflow tract, and ascending aorta. Transesophageal echocardiography showed no evidence of paravalvular leak.

POSTOPERATIVE FINDINGS AND FOLLOW-UP

Transthoracic echocardiogram on postoperative day 22 showed trivial mitral regurgitation due to a small central jet and no aortic regurgitation. There was no paravalvular leak, nor was there dehiscence or pseudoaneurysm in the region pericardial patch repair of the left ventricular outflow tract and aorta.

DISCUSSION

Radiation-induced heart disease increases morbidity and presents an array of technical challenges in cardiac surgery, including calcification of the mitral annulus and ascending aorta (porcelain aorta).¹⁻³ Ventricular

myocardial fibrosis, early coronary arterial disease, and pericardial involvement also are common.⁴ Paravalvular regurgitation is a major concern after valve replacement in these patients. The use of vascular plugs during open surgical procedures presents a new option to complete mitral valve seating when the annulus cannot hold suture. To our knowledge, this is the first report of intraoperative vascular plug use to partially seal the valve and to prophylactically address areas of likely paravalvular leak.⁵ Further investigation into techniques and devices for partial sutureless valve seating are warranted.

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