Aortic Pseudoaneurysm with Fistulization into the Pulmonary Artery: A Cause of Refractory Heart Failure After Bentall Procedure

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We present the case of a patient who developed left-sided congestive heart failure several years after undergoing composite graft surgery for anulooaortic ectasia and aortic regurgitation. Transthoracic echocardiography showed markedly elevated left ventricular filling pressures and severe pulmonary hypertension. However, no underlying pathology or anatomic abnormality to explain the high filling pressures could be identified. On transesophageal echocardiography, a large aortic pseudoaneurysm was demonstrated arising from dehiscence of the distal graft anastomosis to the native aorta. A fistulous communication was noted between the pseudoaneurysm and the right pulmonary artery resulting in a large aortopulmonary shunt. This case illustrates the inherent limitations of transthoracic echocardiography in the detection of complications after composite graft surgery of the aorta. (J Am Soc Echocardiogr 2007;20:438.e5-e8.)

A 35-year-old man presented with severe orthopnea and paroxysmal nocturnal dyspnea 7 years after undergoing a modified Bentall procedure for annulooaortic ectasia and severe aortic regurgitation. On examination, he was overweight (235 lb) and in moderate respiratory distress. No marfanoid features were noted. Cardiovascular examination was remarkable for distant heart sounds and a grade 2/6 systolic ejection murmur at the base. Chest radiography showed pulmonary edema with no other abnormalities. Transthoracic echocardiography (TTE) demonstrated normal left ventricular size and systolic function with optimally functioning aortic valve prosthesis. Pulsed wave Doppler of the mitral inflow (Figure 1, A) and pulmonary vein (Figure 1, B) revealed a markedly restrictive filling pattern suggestive of severely elevated left atrial pressure. Systolic pulmonary artery pressure was estimated at 70 to 80 mm Hg. These findings suggested a cardiac cause for the patient’s dyspnea, however, no underlying pathology could be identified (Videos 1 and 2). Despite aggressive therapy, the patient remained in heart failure.

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Figure 1 Pulsed wave Doppler recording. A, Mitral inflow velocity showing restrictive physiology. Markedly elevated peak early rapid filling (E) velocity (155 cm/s) and E/atrial contraction (A) ratio with shortened deceleration time (130 milliseconds) suggestive of elevated left atrial pressure. B, Pulmonary venous flow showing attenuated systolic waveform (S) and predominant high-velocity diastolic forward flow (D).

Transesophageal echocardiography was performed for further evaluation. A large pseudoaneurysm was found arising from dehiscence of the distal graft anastomosis to the ascending aorta and
lined by a thick layer of thrombus (Figure 2, and Videos 3 and 4). Free flow was noted between the aorta and the pseudoaneurysm (Figure 3, A, and Video 5). In addition, a highly turbulent and continuous jet was seen between the pseudoaneurysm and a more posterior vascular structure suggestive of a fistulous communication with the right pulmonary artery (Figure 3, B, and Video 6).

A diagram illustrating the echocardiographic findings is shown in Figure 4.

The patient underwent a repeated modified Bentall procedure with resection of the pseudoaneurysm and closure of the fistula to the right pulmonary artery. No findings indicative of an infectious process could be identified. He made an uneventful recovery with complete resolution of heart failure symptoms.
En bloc replacement of the aortic valve, aortic root, and ascending aorta with a composite valve conduit, first described by Bentall and De Bono\(^1\) in 1968, has revolutionized the treatment of patients with annuloaortic ectasia and ascending aortic aneurysms accompanied by aortic regurgitation. Such patients require regular follow-up for early identification of potential complications. These include: (1) progression of native aortic disease leading to new aneurysms and/or dissection in other aortic segments; (2) prosthetic aortic valve dysfunction; and (3) complications involving the prosthetic conduit itself, most notably, the formation of pseudoaneurysms.

Aortic pseudoaneurysms complicating composite valve conduits result from the dehiscence of a suture line at one of 3 anastomotic sites: the proximal anastomosis at the aortic annulus, the implantation site of the coronary arteries, and the distal anastomosis between the graft and the native ascending aorta.\(^2\) Modifications introduced to the original Bentall procedure such as forgoing wrapping of the native aorta, interposition of a synthetic graft be-

**Figure 3** Transesophageal views with color Doppler imaging. **A**, Blood flow from aorta (Ao) into pseudoaneurysm (PsA). **B**, Blood flow from PsA into right pulmonary artery by fistula (F). **Thr**, Thrombus.

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**DISCUSSION**

En bloc replacement of the aortic valve, aortic root, and ascending aorta with a composite valve conduit, first described by Bentall and De Bono\(^1\) in 1968, has revolutionized the treatment of patients with annuloaortic ectasia and ascending aortic aneurysms accompanied by aortic regurgitation. Such patients require regular follow-up for early identification of potential complications. These include: (1) progression of native aortic disease leading to new aneurysms and/or dissection in other aortic segments; (2) prosthetic aortic valve dysfunction; and (3) complications involving the prosthetic conduit itself, most notably, the formation of pseudoaneurysms.

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tween the composite graft and coronary ostia, and preservation of an aortic button around the coronary ostia have lessened but not eliminated the occurrence of pseudoaneurysms.3

Among the 3 different sites where a pseudoaneurysm might form, dehiscence of the distal anastomosis appears to be the least common and the most difficult to diagnose by TTE.4 In a series that included 3 patients with pseudoaneurysms caused by distal graft dehiscence,2 none was identified by TTE, similar to the case under discussion.

Early diagnosis of aortic pseudoaneurysms is essential because of the risk of compression of nearby structures, embolization, and rupture.5,6 The latter can result in either free rupture or fistulization into various structures within the heart and mediastinum. Fistulous communication with the right pulmonary artery brought our patient to medical attention with symptoms of pulmonary congestion. An unusual aspect of our case is the absence of a continuous murmur in the setting of a large aorto-pulmonary shunt. This is likely related to the patient’s body habitus and distant heart sounds but particularly to the low gradient and relative equalization of pressures between the aorta and pulmonary artery in the setting of heart failure and severe pulmonary hypertension.

Our report illustrates the superiority of transesophageal echocardiography over TTE in the evaluation of potential complications after the Bentall procedure. We believe that transesophageal echocardiography should be an integral part of the workup in any patient with composite aortic graft in whom a complication is suggested.

REFERENCES

SUPPLEMENTARY DATA
Supplementary data associated with this article can be found, in the online version, at 10.1016/j.echo.2006.10.025.