

Transesophageal Echocardiographic Evaluation of Perioperative Systolic Murmur in Aortic Pathology

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Development of a new systolic murmur in patients following a Bentall procedure with a prosthetic or homograft aortic valve usually indicates an aortic valve-related complication. Here, we report new etiologies of a loud systolic murmur in patients with aortic disease. One patient developed a new loud systolic murmur as an initial manifestation of acute type A aortic dissection without any complication, and two patients developed a loud systolic murmur as the major manifestation of aortic graft failure following aortic root surgery. Auscultation of a new loud systolic murmur in the upper chest in patients with known aortic disease should alert one to a complication within the ascending aorta. [Rev Cardiovasc Med. 2003;4(2):112–116]

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Patients with type A aortic dissection often present with symptoms of chest pain and no remarkable findings on cardiac examination. The development of a new murmur can be due to aortic insufficiency from acute retrograde extension of the dissection^{1,2}; a systolic ejection flow murmur from increased forward aortic valve flow resulting from aortic insufficiency³; acute myocardial infarction complicated by mitral or tricuspid regurgitation⁴; or, in rare instances, from an aorto-cameral fistula⁵ or aortic rupture into the right⁶⁻⁸ or left⁹ atrium or pulmonary artery.¹⁰ Development of a new systolic murmur in

Table 1
Clinical Patient Data

Patient	Age, y	Sex	Past History	Presentation	Cardiac Exam	Surgical Findings	Pathology
1	19	M	Marfan's syndrome; systemic lupus erythematosus	Acute chest and back pain	Harsh III/IV systolic murmur in the 2nd right intercostal space and supra- sternal area radiating to carotids	Aortic aneurysm; Type A aortic dissection from sinotubular junction to proximal aortic arch	Myxoid degeneration of media; mild myxoid degeneration; aortic valve cusps
2	32	M	Marfan's syndrome; Bental procedure for type A aortic dissection	New loud systolic precordial murmur 24 hours post- Bental procedure; 10 hours post- resuscitated cardiac arrest from pericardial tamponade	as above	No reoperation; post-development of systolic murmur	Cystic medial necrosis aorta; myxoid degeneration; aortic valve cusps at original surgery
3	49	M	Marfanoid syndrome; Dacron aortic graft placement 6 months previously	Recurrent embolic phenomenon since aortic surgery; TIAs; amaurosis fugax right eye; emboli to hand and feet (Figure 3E)	as above	Diphtheroid vegetations within the aortic graft; kink in the graft	Dense fibrocollagenous plaque with acute inflammation and abscess formation; calcific thrombotic material; diptheroids growth on culture

M, male; TIA, transient ischemic attack.

patients following a Bental procedure with a prosthetic or homograft aortic valve usually indicates an aortic valve-related complication.^{11,12} Here, we report new etiologies of a loud systolic murmur in patients with aortic disease. One patient developed a new loud systolic murmur as an initial manifestation of acute type A aortic dissection without any complication, and two patients developed a loud systolic murmur as the major manifestation of aortic graft failure following aortic root surgery.

Case Reports

Patient 1, who presented with acute chest and back pain, had an ascending aortic aneurysm observed on both transesophageal echocardiography (TEE) and magnetic resonance

imaging (MRI). While awaiting surgery to treat the aortic aneurysm, he developed another episode of chest pain with the new clinical findings listed in Tables 1 and 2. The patient underwent a Bental procedure with a St. Jude's aortic valve (St. Jude Medical, St. Paul, MN), following which, the systolic murmur was no longer apparent. The patient was discharged 30 days after the surgical procedure.

Patient 2, who had a history of Marfan's syndrome, presented with a type A aortic dissection and underwent a Bental procedure with placement of an aortic Dacron graft and a St. Jude's aortic valve. BioGlue surgical adhesive (CryoLife Inc., Atlanta, GA) was used to seal the false lumen. Within 24 hours post-surgery, a new loud, harsh, systolic

murmur was heard in the aortic area, radiating to both the carotid and subclavian arteries. Findings with this episode are listed in Tables 1 and 2. This patient eventually died after prolonged hospitalization complicated by disseminated intravascular coagulation, thrombotic thrombocytopenic purpura, adult respiratory distress syndrome, and renal failure.

Patient 3, who had a history of Marfanoid syndrome and replacement of ascending aorta with a Dacron graft in another hospital 6 months previously, presented at our institution with embolic episodes and a new loud systolic murmur. Findings at presentation and clinical course are listed in Tables 1 and 2. The patient was discharged following an uneventful second aortic surgery.

Table 2
Echocardiographic Findings

Patient	Aorta	Aortic Valve	Aortic Graft	Color Doppler	CW Doppler	PW Doppler
1	5.7-cm aortic root. Acute type A aortic dissection, flap above right coronary ostium extending to aortic arch not involving major vessels (Figure 1A, 1B)	Trileaflet; thinned leaflets	None (native aorta)	Moderate AI, mild MR, moderate TR	No gradient across aortic valve or within ascending aorta	Turbulent signal with multiple fine oscillations within true lumen at aortic root (Figure 1C, 1D), ascending aorta (Figure 1E, 1F), aortic arch and innominate artery (Figure 1G, 1H)
2		Normally functioning St. Jude's aortic valve without gradient across the valve	Dacron graft ascending aorta (Figure 2A, 2B, white arrowheads); linear dissection flap distal to graft anastomosis (Figure 2A, 2C, white arrows); circumferential flap within true lumen at the distal anastomotic site (Figure 2A, 2C, white star). Flap opened during systole and closed during diastole.	Markedly aliased systolic flow within the true lumen around the circumferential flap (Figure 2B, 2D, asterisk). Aliased flow in innominate artery on TTE (Figure 2E).	43 mm Hg systolic gradient across distal ascending aortic graft (Figure 2F)	Gradient originated at the site of circumferential flap on PW Doppler
3		Normally functioning native repaired valve without gradient across the valve	Large, irregular dense structures within distal Dacron ascending aortic graft; shelf within the distal graft (Figure 3A, white arrow heads); mobile nodularities within distal aorta on TTE (Figure 3C, white arrowheads)	Markedly aliased systolic flow around echodensities (Figure 3B)	36 mm Hg systolic gradient across distal ascending aortic graft (Figure 3D).	

CW, continuous-wave; PW, pulsed-wave; AI, aortic insufficiency; MR, mitral regurgitation; TR, tricuspid regurgitation; TTE, transthoracic echocardiography.

Discussion

We report three patients with acute type A aortic dissection who presented with new-onset systolic murmur. In one patient this occurred before and in the two others following surgery for aortic dissection with either Bentall procedure or Dacron aortic replacement. In all three patients, systolic murmur appeared to be due to turbulent blood flow within the true lumen, thus producing a supra-valvular stenosis-like physiology

(patient 1) or anatomy (patients 2 and 3), with radiation to the carotid arteries. Both post-surgical patients (2 and 3) had a gradient across the site of anastomosis that caused the harsh systolic murmur; however, in patient 1, no significant gradient within the ascending aorta was detected.

In patient 1, pulsed-wave Doppler showed multiple fine oscillations throughout the ascending aorta, proximal aortic arch, and aortic great vessels, suggesting that the systolic

murmur was due to the fine vibration of the dissection flap from turbulent blood flow within the large true lumen of a dilated aortic root (Figure 1). Aortic regurgitation severity had not changed before or after the development of this murmur and, therefore, it could not be attributed to turbulence from an increased systolic ejection flow. In patient 2, turbulence at the distal aortic anastomosis may have resulted from the surgical technique producing the

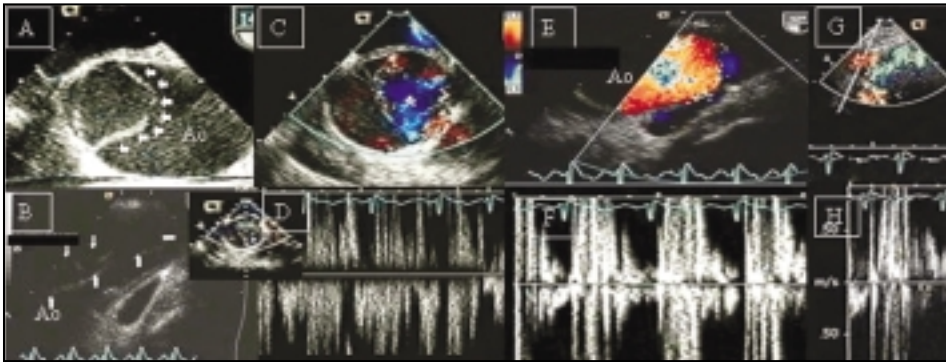


Figure 1. Photographs of transesophageal echocardiogram (A–F) and transcutaneous ultrasound (G, H) of the aortic root, aortic arch, and left innominate artery obtained following the development of a second episode of acute chest pain in patient 1. (A, B) A dissection flap within the aortic root extending into the aortic arch (white arrows). (C, D) Color Doppler and pulsed-wave Doppler images obtained within the true lumen at the aortic root, showing evidence of turbulent systolic blood flow. (E, F) Color and pulsed-wave Doppler images obtained within the true lumen of the distal ascending aorta (Ao), showing evidence of turbulent systolic blood flow. (G, H) Color and pulsed-wave Doppler images obtained within the innominate artery, showing evidence of turbulent systolic flow within the innominate artery.

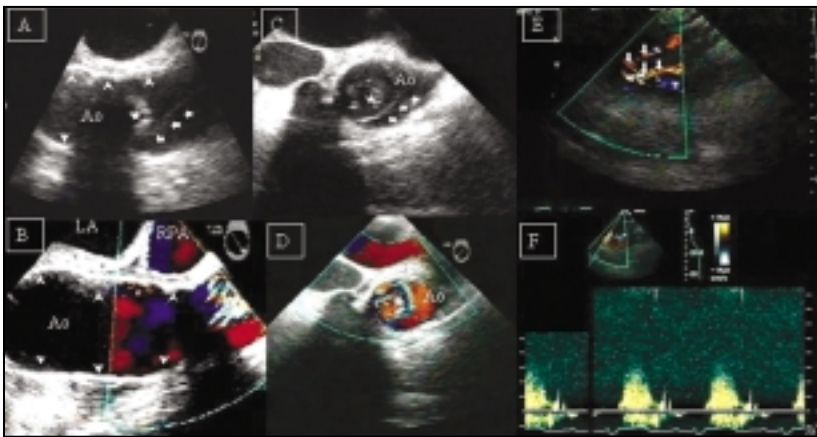


Figure 2. Photographs of the transesophageal echocardiogram of the aortic root, ascending aortic graft, and aortic arch obtained after the Bentall procedure in patient 2. Ascending aorta (Ao), ascending aortic graft (A and B, white arrowheads), dissection flap distal to distal aortic anastomosis (A and C, white arrows), and a centrally located circumferential flap (A and C, white star) are shown. Turbulent systolic blood flow within the circumferential flap causing opening of the flap is shown in longitudinal (B, black asterisk) and cross-sectional (D, white asterisk) views. Color Doppler image of the aortic arch and proximal great aortic vessels shows turbulent blood flow in all vessels (E, white arrows). Continuous-wave Doppler imaging revealed a gradient of 43 mm Hg across the distal ascending aorta (F).

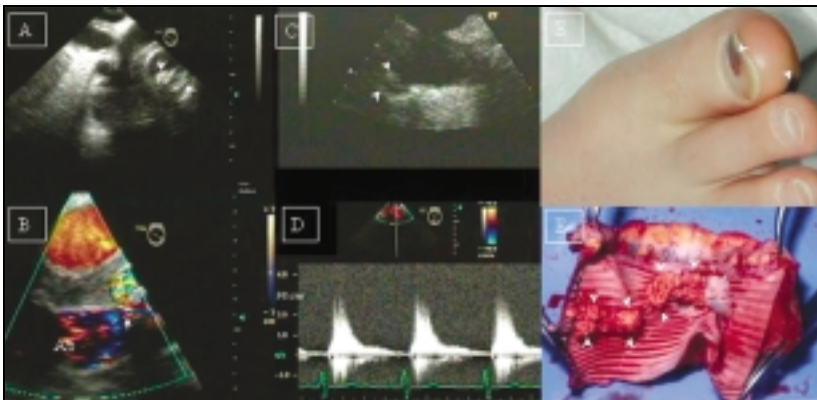


Figure 3. Photographs of the transesophageal and transthoracic echocardiograms (A–D) obtained in Patient 3. Transesophageal cross-sectional views through the mid-ascending aortic graft showing irregular echo-dense structures within the aortic graft (A, white arrowheads) and turbulent blood flow on color Doppler image within ascending aorta entering a shelf within the aortic graft (B, white arrow). Mobile echo densities in the distal ascending aorta are shown by transthoracic echocardiography on suprasternal view (C, white arrowheads). Continuous-wave Doppler revealed a gradient of 36 mm Hg across the distal ascending aorta (D). Photograph of right foot obtained at the time of presentation shows hemorrhagic lesions on the big toe (E, white arrows). Photograph of transected aortic graft shows multiple vegetations within the graft (F, white arrows).

continuous-wave Doppler gradient and vibration of the flap, which acted as a valve, although a vegetation could not be totally excluded (Figure 2). No significant systolic gradient was present across the St. Jude's aortic valve to account for the systolic murmur in this patient. Patient 3 had a kink in the aortic

graft along with a vegetation just proximal to the kink that produced the continuous-wave Doppler gradient and the murmur (Figure 3). No other etiology of systolic murmur could be identified in these patients.

The malignant clinical course in these patients with known aortic disease who developed new systolic

murmur suggests that this finding should lead to further work-up, including TEE and MRI, to arrive at a diagnosis.

Auscultation of a new loud systolic murmur in the upper chest in patients with known aortic disease should alert one to a complication within ascending aorta. ■

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Main Points

- Development of a new systolic murmur in patients following a Bentall procedure with a prosthetic or homograft aortic valve may indicate an aortic graft-related complication.
- New systolic murmur in patients with known aortic disease indicates further work-up, including transesophageal echocardiography and magnetic resonance imaging, to arrive at a final diagnosis.
- Auscultation of a new loud systolic murmur in the upper chest in a patient with known ascending aortic disease should alert one to the development of acute type A aortic dissection.