Transaortic, video-assisted removal of a mobile left ventricular apical thrombus in a patient with aortic stenosis and severe left ventricular dysfunction

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Left ventricular thrombi are frequently encountered in patients with large anterior myocardial infarctions and significant anterior wall hypokinesis or akinesis. These clots occur in the acute or chronic phase of an infarction and are secondary to stagnant flow in the akinetic segment.^{1,2} They can occur in the settings of left ventricular aneurysm³ and ischemic cardiomyopathy.

We encountered a patient with severe aortic stenosis, coronary artery disease, and severe left ventricular dysfunction. Intraoperative transesophageal echocardiography (TEE) demonstrated a protruding, mobile thrombus in the apex of the left ventricle that was not present on the patient's preoperative echocardiogram. Because this was a discrete, mobile, fresh thrombus, we felt it prudent to remove it to reduce the patient's risk of perioperative stroke.

CLINICAL SUMMARY

The patient was a 76-year-old woman with a recent non-ST elevation myocardial infarction, progressive exertional dyspnea, and severe acute on chronic systolic and diastolic heart failure. Transthoracic echocardiography 2 months before surgery did not demonstrate a mobile thrombus in the left ventricle. It demonstrated severe diastolic dysfunction with severe global left ventricular dysfunction with an ejection fraction (EF) of 20%. The patient had severe aortic stenosis, with calcified, immobile leaflets, a mean aortic valve gradient of 57 mm Hg, and a peak flow velocity across the valve of 5.3 m/s. Estimated pulmonary artery systolic pressure was 60 mm Hg, with normal right ventricular function. Coronary arteriography revealed a 70% proximal left anterior descending coronary artery stenosis.

Although the patient was at elevated risk with standard surgery, she did not meet the criteria for transcatheter aortic valve replacement. She therefore underwent aortic valve replacement and coronary artery bypass grafting. Intraoperative

Transaortic view of left ventricular apical thrombus.

Central Message

A novel approach to address the intraoperative finding of a mobile left ventricular clot.

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TEE revealed anteroapical akinesis, an EF of 10% to 15%, moderate to severe right ventricular dysfunction, and a large, mobile left ventricular apical thrombus (Figure 1). The patient was placed on cardiopulmonary bypass. Care was taken to avoid manipulating the left ventricle during cannulation to avoid mobilizing the apical thrombus. Retrograde cardioplegia was delivered for myocardial protection.

After removal of a heavily calcified aortic valve, a 5-mm deflectable tip Olympus ENDOEYE endoscope (Olympus America, Center Valley, Pa) was placed through the aortotomy into the left ventricle to visualize the thrombus (Figure 2). With a long, angled ring forceps, the bulk of the clot was removed (Figure 3). Residual thrombus was removed with Randall stone forceps (Figure 4). The left ventricular apex was irrigated copiously under direct vision to remove all residual thrombus and debris. The left anterior descending coronary artery was bypassed with a saphenous vein graft. The ostium of the right coronary artery was markedly narrowed by calcium, so the right coronary artery was bypassed with a saphenous vein graft as well. The valve was replaced with a size 23 Carpentier Edwards (Edwards Lifesciences Corp, Irvine, Calif) bovine pericardial valve, and the aorta was closed.

The first attempt at weaning the patient from cardiopulmonary bypass was unsuccessful so an intra-aortic balloon pump was placed. She was successfully weaned from cardiopulmonary bypass with an intra-aortic balloon pump and inotropic support.

FIGURE 1. Transgastric 2-chamber transesophageal echocardiographic view, demonstrating a large, mobile thrombus (arrows).

A repeat intraoperative TEE revealed improved left ventricular function, with an EF of 25% to 30%. There was no evidence of residual left ventricular thrombus, right ventricular function was improved, and the aortic valve prosthesis was functioning well. The patient's postoperative course was prolonged but uneventful, and she was discharged on postoperative day 13 without neurologic complications. PredischARGE transthoracic echocardiography revealed improved left ventricular systolic function, with an EF of 40% to 45%. The patient had anticoagulation with warfarin because she had a hypokinetic apical segment with stagnant flow, and it is our practice to administer anticoagulation to patients with left ventricular thrombus. At 3 years' follow-up, the patient is doing very well.

FIGURE 2. Transaortic view of the left ventricular apical thrombus with a 5-mm high-definition Olympus ENDOEYE endoscope.

FIGURE 3. Extraction of the bulk of the apical thrombus with a long curved ring forceps.

DISCUSSION

It is important to recognize the presence of left ventricular thrombus in patients undergoing heart surgery. Intraoperative TEE can identify these thrombi, and one should minimize manipulation of the left ventricle. Most often, these are mural thrombi that are laminated along the wall of the ventricle and are not mobile.⁴ The majority are not surgically removed, because attempted extraction of embedded left ventricular mural thrombus is fraught with the risk of fragmentation and embolization.⁴ A mobile protruding thrombus, however, poses a particular risk for intraoperative or postoperative embolization.^{5,6} Removal of these thrombi during cardiac surgery has been described through left ventriculotomy, and this may be most appropriate for a left ventricular aneurysm that requires treatment.⁷⁻⁹ Left ventriculotomy through an acute myocardial infarction, however, poses technical challenges in closing friable myocardium and may contribute to left ventricular dysfunction.

Tsukube first described transaortic video-assisted removal of a mobile left ventricular thrombus.¹⁰ A mediastinoscope

FIGURE 4. Extraction of the residual remnants of the thrombus with Randall stone forceps.

has been passed across the mitral valve to extract a left ventricular thrombus.¹¹ Video-assisted approaches have been described to remove left ventricular tumors from transaortic and transmitral approaches.^{12,13}

The 5-mm scope can be placed across a normal aortic valve without traumatizing the leaflets as well. It is optimal to insert the scope over the top of the left coronary cusp, away from the septum, and to angle the flexible tip toward the apex. The advantage of the 5-mm scope is that it allows adequate room for unencumbered use of other instruments to extract the thrombus, as well as a wider range of visibility inside the ventricle. Randall stone forceps, originally designed for common bile duct exploration, are ideally suited because they have varying degrees of curvature for reaching the apex of the ventricle.

We report a useful technique for removal of a mobile left ventricular thrombus with a transaortic video-assisted endoscopic approach. This technique provides an alternative to a left ventriculotomy when a protruding mobile left ventricular thrombus is found on intraoperative TEE.

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EDITORIAL COMMENTARY

Just try the experiment

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The article in this issue of the *Journal* by Williamson and colleagues¹ from the Lahey Hospital represents an intriguing and clever solution to what is becoming an increasingly common scenario in modern cardiothoracic surgery—the older patient with mixed, advanced cardiovascular disease. Williamson and colleagues sought out a method that could effectively address the concomitant problems of valvular disease, atherosclerosis, and severe heart

Preserved cardiac specimen demonstrating thrombus layering inside the left ventricle.

Central Message

Consider and explore multiple treatment options for complex, advanced cardiovascular disease.

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