

Management of Aortic Root Thrombosis After Implantation of a Continuous-Flow Left Ventricular Assist Device: A Real Conundrum

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TO THE EDITOR

We present a case of aortic root thrombosis in a patient supported with a continuous-flow left ventricular assist device (LVAD), highlight the diagnostic role of echocardiography, and offer some important caveats to consider when managing this rare but potentially devastating complication in patients with an LVAD.

CASE REPORT

A 35-year-old male with a medical history of nonischemic cardiomyopathy supported with a HeartMate II continuous-flow LVAD (Abbott Laboratories, formerly Thoratec Corporation) was referred for a transesophageal echocardiogram (TEE) prior to direct current cardioversion for symptomatic atrial fibrillation. LVAD speed was set at 9,000 rpm. The patient was chronically anticoagulated with warfarin, with a therapeutic international normalized ratio (INR) level at presentation. TEE was performed and revealed no left atrial appendage thrombus. However, the aortic valve was noted to remain closed with every heartbeat. Additionally, extensive thrombus was seen in all cusps of the aortic valve, with grade 4 spontaneous echo contrast extending into the aortic root (Figures 1 and 2, videos A and B). Visualized by pulsed wave Doppler, the LVAD inflow cannula and outflow graft had normal flow.

Cardioversion was deferred because of the aortic thrombus. The patient was admitted to the hospital for close neurologic monitoring and initiation of intravenous heparin. His warfarin dose was adjusted with higher INR goals. The patient was eventually discharged with closer warfarin clinic follow-up and plans for a repeat outpatient TEE to assess for complete resolution of the aortic valve thrombus.

DISCUSSION

In patients with advanced heart failure (HF) refractory to medical therapy, LVADs increasingly are used as a bridge to transplantation or destination therapy and sometimes as a bridge to recovery.^{1–3} The optimal LVAD speed setting remains a subject of debate, and practice varies among centers, but the majority of centers consider optimal LVAD speed setting as a normally functioning LVAD that allows effective left ventricle unloading. Optimal left ventricular unloading is usually defined by clinical improvement in HF symptoms and reduced left ventricle size/volume, reduced

mitral regurgitation, midline septal position, lack of worsening right ventricular function or tricuspid regurgitation, and intermittent aortic valve opening by echocardiography.⁴ This latter goal may not always be achieved, as aortic valve opening is also affected by a variety of factors, including LVAD speed, native left ventricle function, volume status, and mean arterial blood pressure. Therefore, the aortic valve remains closed in many patients supported with continuous-flow LVADs in whom left ventricle function is poor or LVAD speed is high. Continuous and chronic aortic valve closure may lead to leaflet fusion and aortic insufficiency, as well as stasis in the aortic root and coronary sinus. Aortic valve leaflet fusion and stasis in turn may predispose patients to thrombus formation despite adequate anticoagulation and antiplatelet therapy.

In the setting of thrombus formation in the aortic root, it is important to preserve aortic valve closure to minimize the risk of thromboembolism. A higher LVAD speed should be maintained, as lower speeds may lead to sudden aortic valve opening and embolization. Management of such cases varies by center, with no

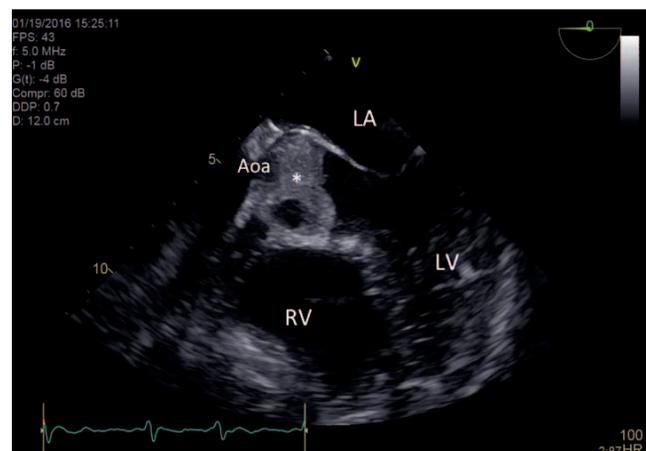


Figure 1. Transesophageal echocardiogram midesophageal 5-chamber view. The thrombus is identified by an asterisk. Aoa, ascending aorta; LA, left atrium, LV, left ventricle; RV, right ventricle.

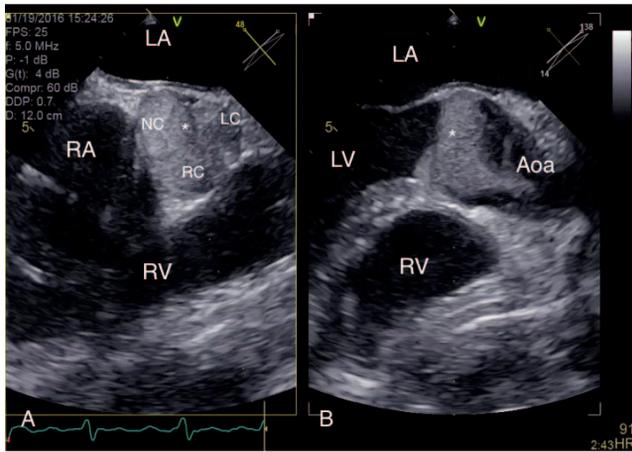


Figure 2. Transesophageal echocardiogram (A) aortic valve short-axis view and (B) long-axis view of the ascending aorta. In both views, the thrombus is identified by an asterisk. Aoa, ascending aorta; LA, left atrium; LC, left coronary cusp; LV, left ventricle; NC, noncoronary cusp; RA, right atrium; RC, right coronary cusp; RV, right ventricle.

clear guidelines regarding the use of thrombolytic agents. In our case, we elected to maintain LVAD speed at 9,000 rpm (to maintain continuous aortic valve closure) and intensified anticoagulation therapy by using

intravenous heparin and adjusting the patient's warfarin dose to support a higher than usual INR goal (target: 3.0). TEE with possible direct current cardioversion will be reattempted in a few weeks. Once the thrombus has resolved, the LVAD speed will be adjusted to allow intermittent aortic valve opening.

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