

INTERVENTION AND SURGERY

THE FOUR CORNERS: CLINICAL VIGNETTE CORNER

Concomitant Right Atrial Hemangioma Resection With LVAD Implantation

First-in-Human Experience



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ABSTRACT

Cardiac hemangiomas are exceedingly rare, comprising only 5% to 10% of benign cardiac tumors. We report a patient with a large right atrial mass and end-stage heart failure with severe left ventricular dysfunction. Echocardiography revealed a mass obstructing tricuspid inflow. Contrast-enhanced computed tomography and cardiac magnetic resonance confirmed a 100 mm × 96.5 mm × 104 mm lobulated mass. Simultaneous tumor resection and left ventricular assist device implantation were performed. Histopathologic examination confirmed a cardiac hemangioma. The patient showed significant improvement and remained alive at 3-year follow-up, with only minor gastrointestinal bleeding episodes. (JACC Case Rep. 2024;29:102860) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

A 50-year-old man with nonischemic dilated cardiomyopathy presented with severe dyspnea and orthopnea. Three years earlier, he was deemed ineligible for heart transplantation because of elevated pulmonary vascular resistance (PVR) and was recommended for placement of a left ventricular assist device (LVAD), which he declined.

On this current presentation, his vital signs were as follows: blood pressure, 85/55 mm Hg; heart rate, 110 beats/min; and oxygen saturation of 90% on room air. Physical examination revealed cold extremities, distended jugular veins, bibasilar rales, and grade 3 bipedal pitting edema.

TAKE-HOME MESSAGES

- This case demonstrates the feasibility of simultaneous tumor resection and LVAD implantation in patients with complex cardiac conditions.
- Cardiac hemangiomas, although benign, can cause significant hemodynamic disruption by inducing functional valve stenosis, thus necessitating timely and effective intervention.
- Multimodality imaging is essential for accurately differentiating benign from malignant cardiac tumors and plays a pivotal role in guiding treatment decisions, especially in complex cases where ensuring adequate life expectancy is critical before LVAD implantation.

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the [Author Center](#).

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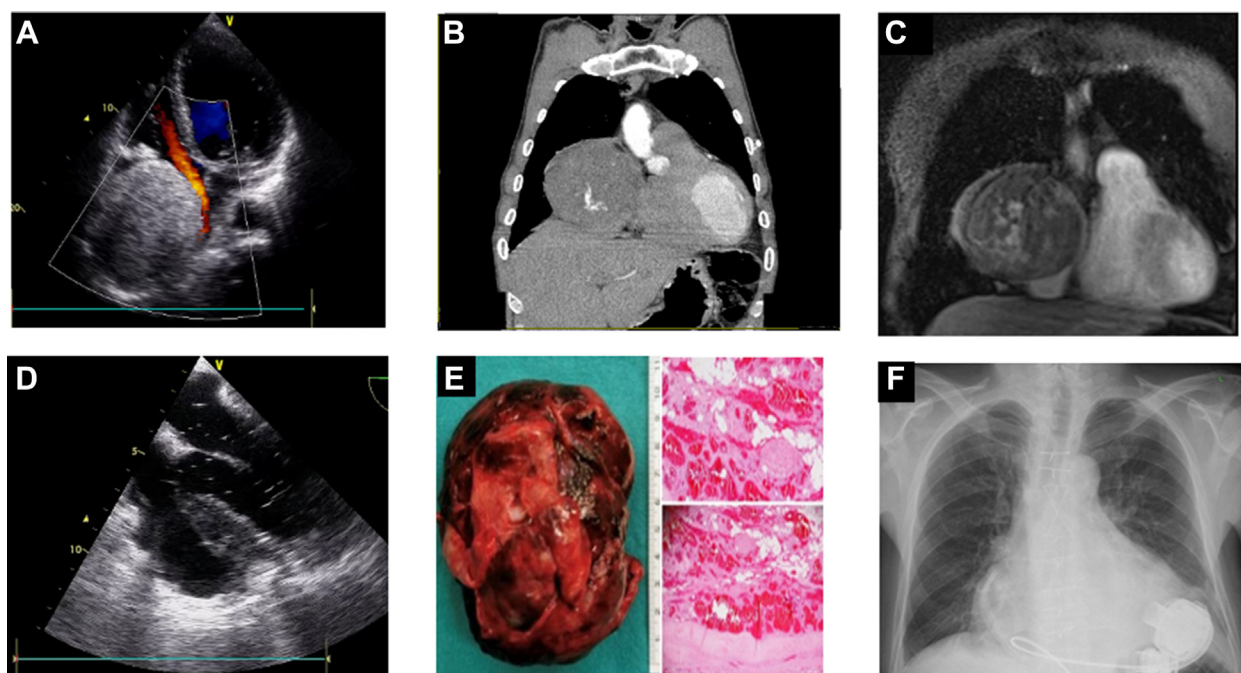
**ABBREVIATIONS
AND ACRONYMS****CT** = computed tomography**LVAD** = left ventricular assist device**PVR** = pulmonary vascular resistance

Laboratory tests revealed anemia (hemoglobin, 10.5 g/dL) and renal dysfunction (estimated glomerular filtration rate, 56 mL/min/1.73 m²). Transthoracic echocardiography (**Figure 1A**, **Video 1**) detected a left ventricular ejection fraction of 15%, moderate mitral regurgitation, elevated pulmonary artery pressure, and a large echogenic right atrial mass obstructing tricuspid inflow.

Contrast-enhanced computed tomography (CT) (**Figure 1B**) confirmed an 84 × 105 mm right atrial mass causing cavitory obliteration. Cardiac magnetic resonance (**Figure 1C**, **Video 2**) showed a well-circumscribed 100 mm × 96.5 mm × 104 mm mass, isointense on T1-weighted images and hyperintense on T2-weighted images, with intense, prolonged post-gadolinium enhancement indicative of a vascular tumor.^{1,2} The absence of pericardial invasion or metastasis on thoracic CT, abdominal magnetic resonance imaging, and brain CT supported a benign hemangioma diagnosis. Angiosarcoma was ruled out for lack of necrosis, invasion, metastasis, heterogenous hyperintensity, and characteristic “sunray” contrast enhancement.³

Other differential diagnoses, including cardiac myxoma and paraganglioma, were excluded on the basis of location and the absence of typical imaging features.³

Given strong imaging evidence favoring a benign tumor and the urgency of addressing advanced heart failure, catheter biopsy was not pursued. The right atrial mass caused tricuspid inflow obstruction and right-sided heart failure, thus making delayed surgery inadvisable. Multiple staged surgical procedures were not

FIGURE 1 Multimodality Imaging, Surgical Specimen, and Outcome of Right Atrial Hemangioma With LVAD Implantation

(A) Transthoracic echocardiography image demonstrating a large, isoechoic mass occupying the entirety of the right atrial cavity. This mass significantly obstructed tricuspid inflow, resulting in a stenotic effect, as evidenced by the high-velocity turbulent jet visible on color Doppler imaging. (B) Contrast-enhanced computed tomography (coronal plane) image showing a mass in the right atrium with central nodular contrast enhancement. (C) Contrast-enhanced magnetic resonance image of the thorax showing a large, well-defined, lobulated mass in the right atrium. The mass measured approximately 100 mm × 96.5 mm × 104 mm and demonstrated central nodular contrast enhancement, and it appeared mildly heterogeneous and hyperintense on T2-weighted images and isointense on T1-weighted images. (D) Intraoperative transesophageal echocardiography image obtained after surgical excision of the right atrial mass demonstrating the immediate postresection state of the right atrium. (E) Gross pathology specimen of the resected cardiac tumor originating from the right atrium that weighed 199 g and measured 7.5 cm × 7 cm × 7 cm. The specimen displayed an irregular, nodular appearance with soft consistency and was predominantly brown, with areas of hemorrhage. Histopathologic examination revealed multiple vascular channels of varying sizes lined by endothelial cells, surrounded by connective tissue stroma. The tumor exhibited extensive hemorrhage and focal areas of adipose metaplasia without evidence of atypia, pleomorphism, or necrosis. The remaining right atrial tissue appeared homogeneous and gray, indicating benign cardiac muscle tissue. (F) Postoperative chest radiograph demonstrating the successfully implanted left ventricular assist device.

feasible because of the patient's poor functional status. Therefore, a single-stage procedure combining tumor resection and LVAD implantation was recommended.

With the patient under general anesthesia, femoral arterial and venous cannulation was established for extracorporeal circulation. Through a median sternotomy, a 10-cm encapsulated mass originating from the right atrial free wall was visualized, causing weakening of the wall. The mass was excised en bloc, and right atrial reconstruction was performed using an autologous pericardial patch (Videos 3 and 4). Intraoperative transesophageal echocardiography confirmed complete resection and restoration of tricuspid inflow (Figure 1D).

An LVAD (HeartMate 3, Abbott) was implanted following standard protocols (Video 5). The ascending aorta was side-clamped, and the outflow graft was anastomosed from end to side through a 4-cm aortotomy. After deairing and ensuring hemostasis, the patient was weaned from cardiopulmonary bypass, and the chest was closed. He was transferred to the intensive care unit for postoperative care.

Histopathologic examination confirmed a 199-g, 95 mm × 90 mm × 85 mm cardiac hemangioma composed of congested vascular channels and adipose metaplasia without malignant features (Figure 1E).

The patient's postoperative course was uneventful. Chest radiography (Figure 1F) showed a successfully implanted LVAD. The LVAD settings and medical therapy were optimized, and the patient was discharged after a 10-day hospital stay. At 6-month follow-up, right-sided heart catheterization showed improved hemodynamics and normalized PVR, thereby making him eligible for heart transplantation. However, because of his improved functional status, he declined listing for transplantation. At 3-year follow-up he remained alive without major adverse events, although minor gastrointestinal bleeding episodes occurred without requiring transfusion.

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KEY WORDS cardiac hemangioma, cardiac tumor, heart failure, left ventricular assist device, tricuspid obstruction

APPENDIX For supplemental videos, please see the online version of this paper.