

Iatrogenic Diversion of Superior Vena Cava Into Left Atrium

Tarun Jain, MD¹; Jamil F. Borgi, MD²; James C. Lee, MD¹; Karthikeyan Ananthasubramaniam, MD¹

¹Department of Cardiovascular Medicine, Henry Ford Hospital, Detroit, Michigan

²Department of Cardiac Surgery, Henry Ford Hospital, Detroit, Michigan

A 72-year-old woman presented at our hospital with symptoms of a cerebrovascular accident (CVA). Her medical history included repair of a sinus venosus atrial septal defect (SVASD) at age 4, dual-chamber pacemaker placement for complete heart block at age 60, and multiple CVAs. Her blood oxygen content was 86% on room air, and cardiac auscultation revealed a soft systolic flow murmur at the left sternal edge. An electrocardiogram (ECG) showed paced rhythm with right bundle branch block (Fig. 1A), and a chest radiograph showed a pacemaker wire protruding into the left ventricle (LV) (Fig. 1B). On a transthoracic echocardiogram (TTE), a saline contrast bubble study through the patient's left forearm showed bubbles appearing first in the left atrium (LA) and then in the LV, with no shunting

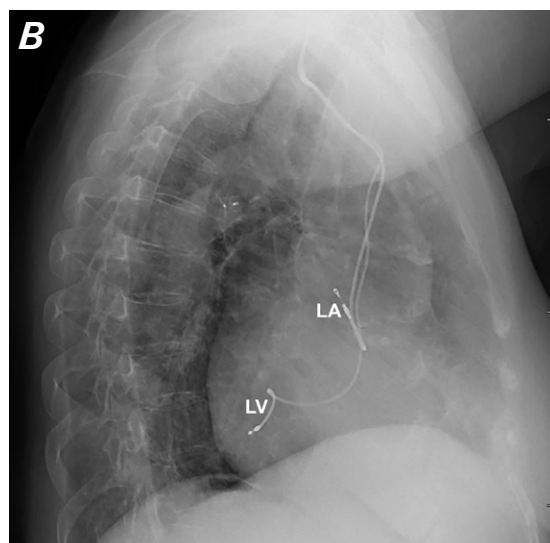
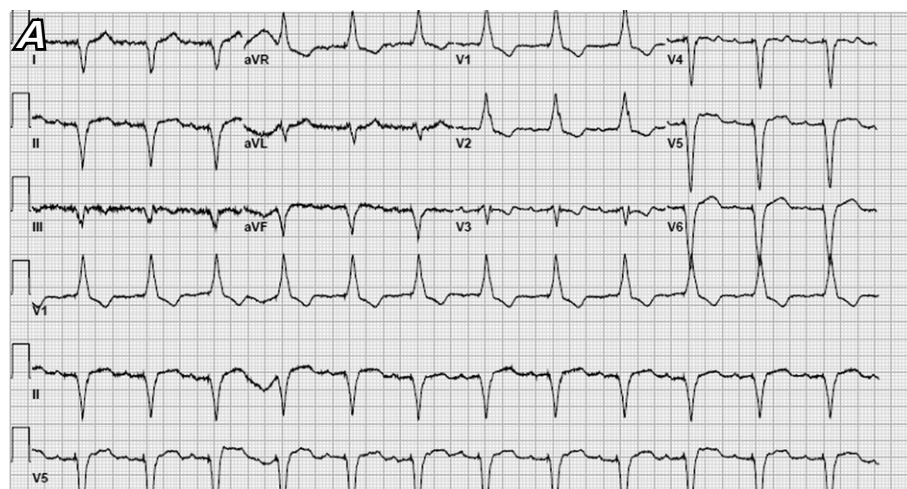


Fig. 1 **A)** Electrocardiogram shows paced rhythm with right bundle branch block. **B)** Chest radiograph shows a pacemaker wire protruding into the left atrium (LA) and left ventricle (LV).

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Corresponding author:

Tarun Jain, MD, Department of Cardiology, Riverside Medical Center, 350 N. Wall St., Kankakee, IL 60901

E-mail: tjain@rhc.net

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(Fig. 2). A transesophageal echocardiogram (TEE) showed a single superior vena cava (SVC) draining into the LA (Fig. 3) with no shunting, as well as anomalous right pulmonary venous drainage into the SVC. A 3-dimensional TEE showed a pacemaker wire protruding into the LV (Fig. 4). A thoracic computed tomogram confirmed the ECG, TTE, and TEE findings (Fig. 5). Three months after the patient recovered from her CVA, she underwent elective double-patch repair of the anomalous SVC and right pulmonary venous drainage, removal of the old pacemaker leads, and placement of a new dual-chamber pacemaker.

Comment

During the patient's childhood SVASD repair, a baffle was created between the SVC and LA instead of between the SVC and right atrium. Later, her pacemaker was placed incorrectly in the LV through this baffle. A

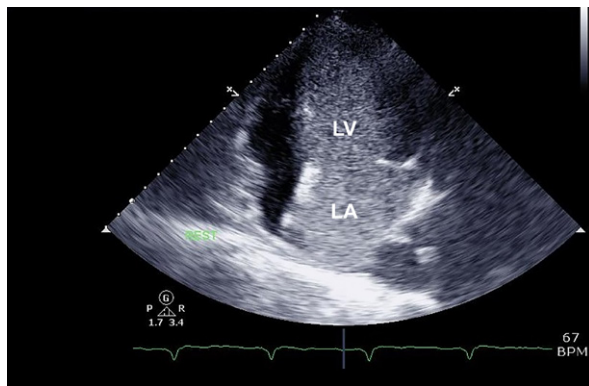


Fig. 2 Transthoracic echocardiogram (apical 4-chamber view) shows saline contrast bubbles in the left atrium (LA) and left ventricle (LV).

Supplemental motion image is available for [Figure 2](#).

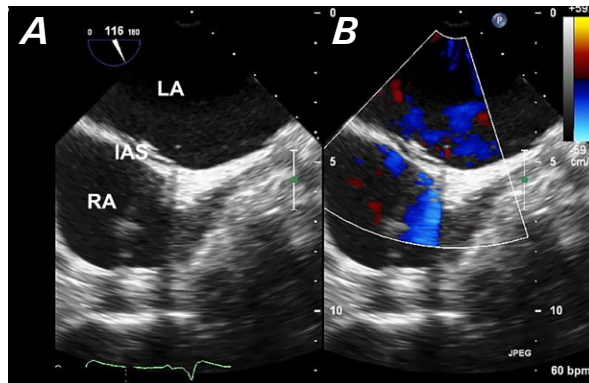


Fig. 3 Transesophageal echocardiograms (bicaval view) show **A**) no communication and **B**) no color flow between the superior vena cava and right atrium (RA).

IAS = interatrial septum; LA = left atrium

Supplemental motion image is available for [Figure 3](#).

dual-chamber paced rhythm normally shows left bundle branch morphology on an ECG; however, our patient's ECG showed right bundle branch morphology, suggesting that the pacemaker lead was protruding into the LV.

Adult patients with an SVC-to-LA diversion present with either cyanosis or chronic hypoxemia, and they are at high risk for systemic embolization.¹ Thus, intravenous infusions through the veins of the upper extremities should be avoided or be done with use of air filters.^{1,2}

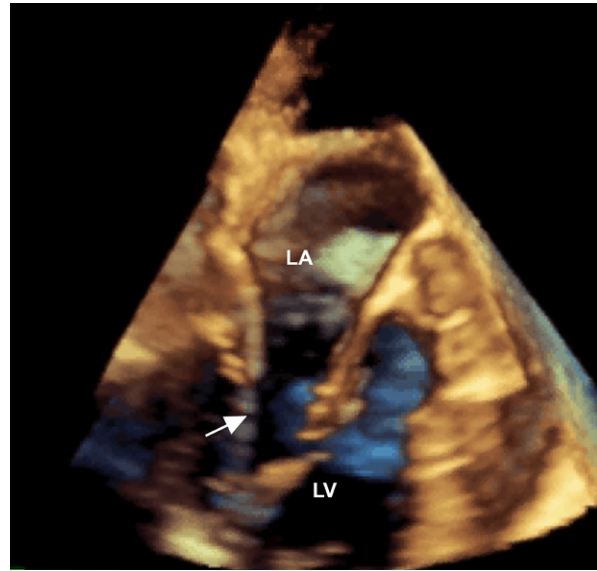


Fig. 4 Three-dimensional transesophageal echocardiogram shows a pacemaker wire (arrow) protruding into the left ventricle (LV).

LA = left atrium

Supplemental motion image is available for [Figure 4](#).



Fig. 5 Thoracic computed tomogram shows the superior vena cava draining into the left atrium (white arrowhead), anomalous right pulmonary venous drainage into the superior vena cava (white arrow), the inferior vena cava draining into the right atrium (black arrowhead), and a pacemaker wire protruding into the left atrium (asterisk) and left ventricle (black arrow).

Regardless of clinical presentation, surgical correction is indicated upon diagnosis.³ In our patient, TTE and TEE were important in diagnosing an anomalous iatrogenic diversion of blood flow from the SVC into the LA, and computed tomography was crucial in delineating its anatomy.

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