

IMAGING VIGNETTE

INTERMEDIATE

CLINICAL VIGNETTE

# Lead Perforation Into the Left Internal Mammary Artery Causing Circulatory Collapse After Pacemaker Insertion



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## ABSTRACT

A 66-year-old woman underwent a pacemaker implantation following a symptomatic pause. The pacemaker lead inadvertently punctured the ventricle during implantation, penetrating through to the left internal mammary artery, causing slow hemorrhage. There was subsequent circulatory collapse with shock. We describe this rare yet life-threatening condition. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2022;4:315-317) © 2022 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 66-year-old female smoker with an established diagnosis of nonischemic dilated cardiomyopathy (ejection fraction: 35%; left ventricular diameter: 7.3 cm on preceding cardiac magnetic resonance) had 2 syncopal episodes leading to admission. She was on guideline-directed medical therapy including ramipril 7.5 mg and spironolactone 25 mg but was intolerant of beta-blocker therapy secondary to resting bradycardia. Preliminary workup demonstrated evidence of a urinary tract infection, which was treated with co-amoxiclav. Electrocardiogram showed left bundle branch block (QRS complex: 153 ms). Telemetry captured a symptomatic syncopal episode with a corresponding 18-second sinus pause. A decision was made to implant a semipermanent externalized system, permit resolution of the urinary infection, and then upgrade to a cardiac resynchronization device.

A semipermanent externalized system with an active fixation lead was implanted via the right internal jugular vein under fluoroscopy guidance. Pacemaker checks confirmed good acute parameters with satisfactory lead position on chest x-ray (CXR) (**Figure 1A**).

On postprocedure day 2, she had sudden pleuritic chest pain. She was initially hypertensive and tachycardiac (167/74 mm Hg; 121 beats/min). CXR showed no obvious lead displacement and a large left-sided pleural effusion (**Figure 1B**). The patient became hypotensive 15 minutes later, (83/46 mm Hg; 124 beats/min). Echocardiogram described the ventricular lead in the right ventricle (RV) with no obvious effusion. Computed tomography (CT) thorax with 3-dimensional reconstruction showed pacemaker lead erosion through the RV and pericardium with a small pericardial and large left pleural effusion. There was no aortic dissection or tamponade (**Figures 1C and 1D**). The RV lead appeared to have perforated, forming a hemothorax originating from either the RV or another intrathoracic blood vessel.

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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](#).

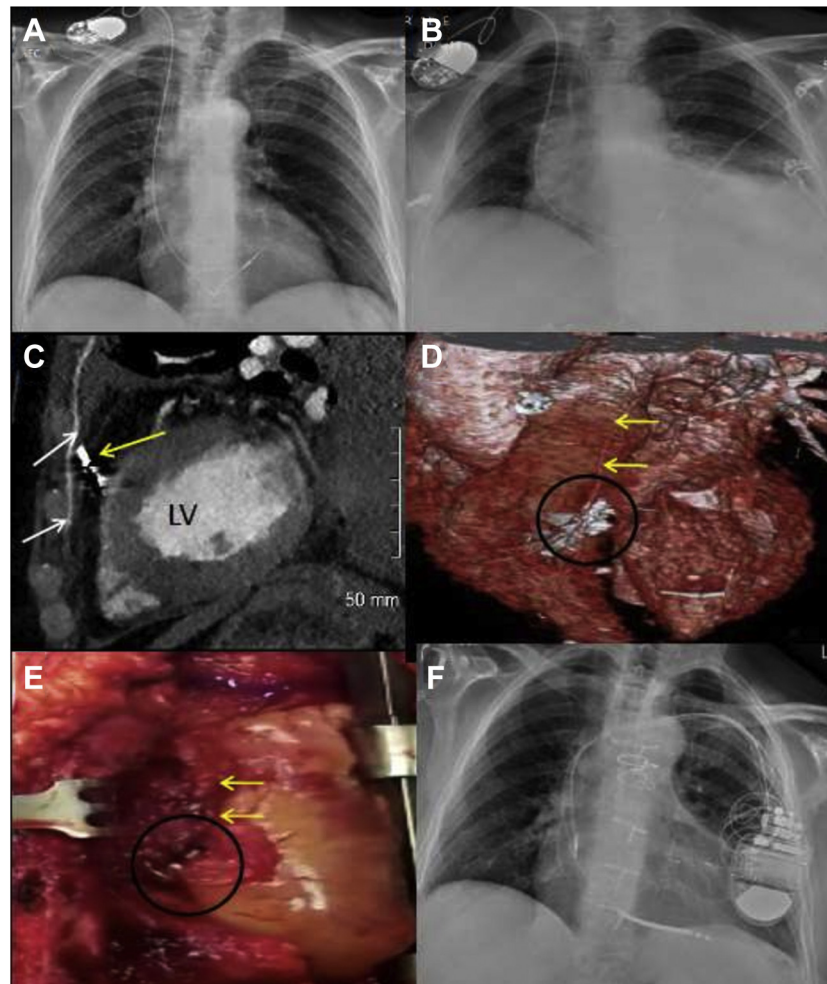
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**ABBREVIATIONS  
AND ACRONYMS****CT** = computed tomography**CXR** = chest x-ray**LIMA** = left internal mammary artery**RV** = right ventricle

After appropriate supportive measures, the perforated lead was explanted surgically. The lead had perforated through the right ventricle, piercing the left internal mammary artery (LIMA) with substantial hemorrhage (**Figure 1E**). Intraoperatively, LIMA injury was confirmed with active bleeding seen at the site and no other source of active bleeding. Epicardial leads were inserted intraoperatively to support the underlying bradycardia. A cardiac resynchronization device was later implanted via the right subclavian vein, achieving a different lead position (**Figure 1F**).

**DISCUSSION**

Lead perforation with or without tamponade following pacemaker implantation is a rare but potentially fatal complication where the lead migrates through the cardiac wall, with a cited incidence of under 0.01% to

**FIGURE 1** Internal Mammary Artery Injury Confirmation

**(A)** Chest x-ray immediately after pacemaker insertion showing satisfactory lead positioning. **(B)** Chest x-ray 46 hours after pacemaker insertion showing left-sided pleural effusion. **(C)** Computed tomography of the thorax showed the pacemaker lead (**yellow arrows**) penetrating from the right ventricle to left internal mammary artery (**white arrow**). **(D)** Three-dimensional reconstruction of computed tomography confirming the lead eroding through the right ventricle (**black circle**) and injury with bleeding from the internal mammary artery (**blue arrows**). **(E)** Thoracotomy view confirming lead erosion perforating the myocardium and pericardium (**black circle**) into the internal mammary artery (**yellow arrows**). **(F)** Final chest x-ray post-resynchronization device implantation with sternotomy sutures. LV = left ventricle.

0.96%.<sup>1</sup> Atrial and ventricular leads, despite having different tissue and lead characteristics, both carry a significant risk of perforation. Age of >80 years, female sex, steroid use before implant, body mass index of <20 kg/m<sup>2</sup>, and long procedure times have been identified as independent predictors of perforation.<sup>2</sup>

Not all perforations are clinically evident, and they may be a contained collection that is hemodynamically inconsequential. They have been reported as an incidental finding in 11.5% to 15% of cardiac CT imaging of patients with prior pacemakers.<sup>3</sup>

Traditional pacing parameter checks (threshold, sensing, impedance) may not identify slow lead perforation. Fluoroscopic views (right anterior oblique and left anterior oblique) to ensure lead attachment in the interventricular septum can prevent lead perforation and migration. Cardiac CT, CXR, and pacing checks helped define our perforation, requiring prompt surgical intervention.

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**KEY WORDS** actively fixated pacemaker lead, bradycardia, cardiac CT, cardiac pacemaker, complications