

IMAGING VIGNETTE

CLINICAL VIGNETTE

Syncope Due to Iatrogenic Cava Vein Obstruction



Rare Complication of Cardiac Implantable Electronic Device Leads

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ABSTRACT

A 77-year-old female patient with multiple pacemaker leads experienced hypotension and syncope during right heart catheterization. Imaging studies revealed a stenotic inferior vena cava with superior vena cava obstruction and well-developed retrograde collateral vessels, suggesting that balloon obstruction of the sole venous return site caused low cardiac output leading to syncope. (J Am Coll Cardiol Case Rep 2024;29:102347) © 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 77-year-old female patient undergoing hemodialysis was hospitalized for localized pacemaker pocket infection. Multiple pacemaker leads had been implanted via bilateral subclavian veins 28 and 40 years ago due to lead fracture. The patient's left ventricular ejection fraction was 14%, and a right heart catheter was performed for hemodynamic evaluation. During the examination, the inflated 8 mm balloon catheter failed to advance from the inferior vena cava (IVC)-right atrial (RA) junction. Systemic arterial pressure plunged from 100 mm Hg to 50 mm Hg, and the patient subsequently lost consciousness; the pressure recovered and the patient regained consciousness soon after the catheter was pulled back to the IVC (**Figure 1A**).

Because this series of events was reproducible, venous angiography was performed, which revealed narrowing of the IVC-RA junction with an estimated diameter ≤ 4 mm (**Video 1, Supplemental Figure 1**). Subsequent contrast-enhanced computed tomography imaging showed total occlusion of the superior vena cava and massive retrograde collaterals from the upper body flow into the right atrium through the stenotic IVC-RA junction (**Figure 1B, Video 2**). The patient underwent pacemaker generator removal as her condition precluded open-heart surgery to excise the old leads. Leadless pacemaker implantation was initially considered a compromise due to the patient's poor general condition. However, because of the lack of access routes into the right ventricle, an epicardial pacemaker was placed after antibiotic treatment.

Multiple transvenous lead implantation could cause a central venous obstruction, presumably induced by inflammatory reactions due to mechanical friction between the leads and endothelium, and thrombus formation.¹ Acquired IVC stenosis is commonly caused by thrombosis, tumor, or external compression, and it is rarely affected by the pacemaker lead. However, a previous report described an IVC occlusion due to a

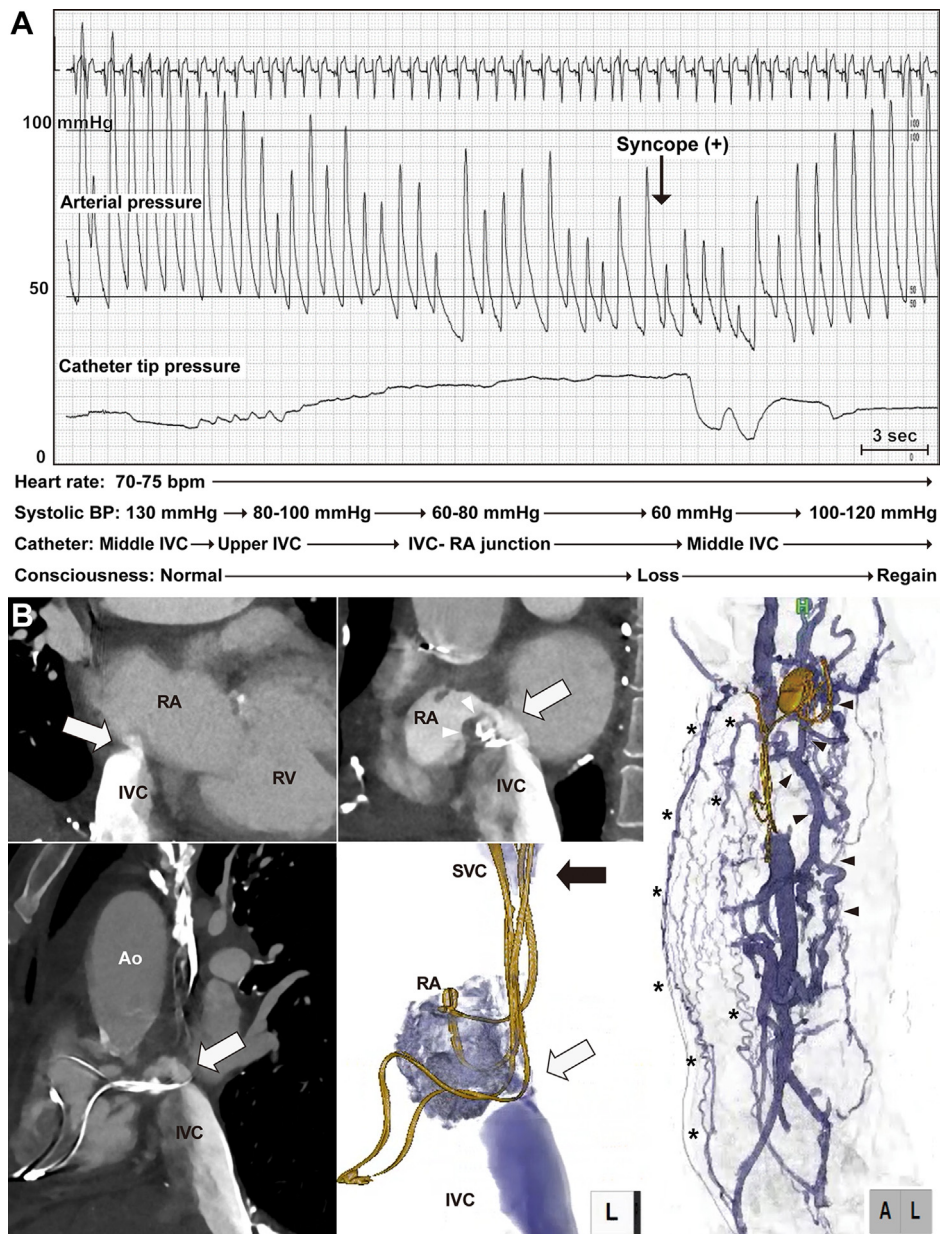
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**ABBREVIATIONS
AND ACRONYMS****IVC** = inferior vena cava**RA** = right atrial**RV** = right ventricle

thrombus that developed from the small loop of the right ventricular (RV) lead located close to the IVC-RA junction.² In the current case, two RV leads were running close to the IVC-RA junction, and massive calcification around the leads and adhesive tissue with the right atrium caused simultaneous stenosis of the IVC-RA junction. Abundant collateral circulation alleviated the symptoms that could have resulted from central venous obstruction and allowed chronic hemodialysis through an upper

FIGURE 1 Findings During Right Heart Catheterization and on Computed Tomography Images

(A) Pressure tracing during right heart catheterization; arterial pressure plunges before syncope. (B) Contrast-enhanced computed tomography. The junction of the inferior vena cava (IVC) and right atrium (RA) is stenotic (white arrow) due to calcification and adhesive tissue around the right ventricular leads (white arrowhead). The occlusion of the superior vena cava (SVC) (black arrow) and well-developed collateral vessels (asterisks: chest wall collaterals; black arrowheads: retrograde azygos system). Ao = aorta; BP = blood pressure; RV = right ventricle.

arm arteriovenous shunt;³ however, the balloon occlusion of the sole venous flow return pathway led to decreased cardiac output and syncope.

Although the number of patients with cardiac implantable electronic device implantation is increasing, long-term transvenous lead placement can induce potential hemodynamic instability and rare leadless pacemaker ineligibility conditions.

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KEY WORDS calcification, collateral circulation, dialysis, pacemaker, superior vena cava obstruction

 **APPENDIX** For a supplemental figure and videos, please see the online version of this paper.