

CASE REPORT

BEGINNER

CLINICAL CASE

Left Brachiocephalic Perforation During Right Heart Catheterization



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ABSTRACT

Right heart catheterization is overall considered a safe procedure, although complications can arise from venous access injuries, arrhythmias, vasovagal episodes, and pulmonary artery rupture. We present a case of left brachiocephalic vein perforation during a diagnostic right heart catheterization, which was managed conservatively. (**Level of Difficulty: Beginner.**) (J Am Coll Cardiol Case Rep 2022;4:497-500) © 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/>).

HISTORY OF PRESENTATION

A 35-year-old obese woman presented with shortness of breath and acute hypoxic respiratory failure. She reported dyspnea on minimal exertion for 1 year and was in New York Heart Association functional class III. Physical examination revealed lower extremity edema and jugular vein dilation, and she was found to have bilateral interstitial opacities, suggestive of underlying interstitial lung disease (ILD). Vascular ultrasound revealed bilateral femoral deep vein thrombosis, and she was prescribed systemic anticoagulant therapy. She experienced metrorrhagia leading to discontinuation of the anticoagulant therapy,

and an inferior vena cava filter was placed. An echocardiogram revealed an estimated right ventricular systolic pressure of 73 mm Hg, moderate tricuspid regurgitation and mild mitral regurgitation, which prompted further workup for pulmonary hypertension (PH).

MEDICAL HISTORY

The patient's medical history was significant for essential hypertension, uncontrolled diabetes mellitus, obesity, attention-deficit/hyperactivity disorder, and recurrent cellulitis. She had recently completed a 6-week course of intravenous daptomycin for cellulitis. She described exposure to phentermine for at least 6 months, along with dextroamphetamine/amphetamine (Adderall).

LEARNING OBJECTIVES

- To review the presentation perforation of the brachiocephalic vein during endovascular procedures, such as right heart catheterizations.
- To review therapeutic modalities for management of this procedural complication.

DIFFERENTIAL DIAGNOSIS

Her dyspnea was thought to be related to ILD, PH, and fluid overload. Her ILD was thought to be related to nonspecific interstitial pneumonia or drug-induced pneumonitis (associated with daptomycin). Although

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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](#).

Manuscript received February 23, 2022; accepted February 27, 2022.

**ABBREVIATIONS
AND ACRONYMS**

- BCV** = brachiocephalic vein
- ILD** = interstitial lung disease
- LIJ** = left internal jugular
- PH** = pulmonary hypertension
- RHC** = right heart catheterization
- SVC** = superior vena cava

the main suspicion was for PH in the setting of ILD (World Health Organization [WHO] group 3 PH), she also had risk factors for WHO group 1 PH (exposure to phentermine and prescription stimulants), WHO group 2 PH (obesity, diabetes mellitus, and essential hypertension), and WHO group 4 PH (chronic thromboembolic PH given the deep vein thrombosis).

INVESTIGATIONS

The result of an extensive autoimmune work-up was negative, including testing for antiphospholipid syndrome. A CT angiogram was negative for pulmonary embolism.

We decided to proceed with a right heart catheterization (RHC) to hemodynamically characterize this patient's PH phenotype. A central venous sheath, 7-F, was placed in the left internal jugular (LIJ) vein under real-time ultrasound guidance using a modified Seldinger and micropuncture technique. We chose to perform the procedure in LIJ because the patient had undergone a right jugular access for inferior vena cava placement the day before. Cannulation of the LIJ was successful on the first attempt, proper positioning of the guidewire was performed under fluoroscopy, and after placement of the venous sheath, blood was aspirated from the side port, confirming proper intravascular access. A 7-F thermiodilution catheter was introduced through the venous sheath, and the catheter was advanced in the direction of the superior vena cava and the right atrium

(RA); however, the catheter couldn't pass beyond the superior vena cava. A 0.025-inch fixed core wire was used for further advancement, but the effort was unsuccessful. A venogram (hand-injection through the thermiodilution catheter) revealed absence of passage into the right atrium and concerns for extravasation into the mediastinal space (Figure 1, Video 1). The procedure was aborted.

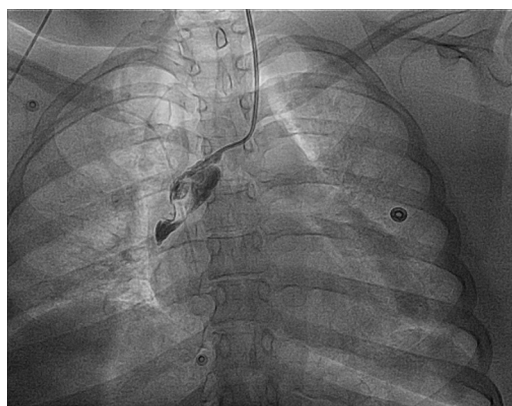
MANAGEMENT

A stat echocardiogram showed no evidence of pericardial effusion or hemopericardium. We then performed an immediate CT scan of the chest with contrast material, which revealed an area of contrast material leak at the level of the brachiocephalic vein (BCV, at LIJ and subclavian vein junction), with evidence of contrast material in the anterior mediastinum surrounding the right atrium (Figures 2 to 5). The patient was in a hemodynamically stable condition and asymptomatic. Consultation with vascular medicine and cardiothoracic surgery resulted in a recommendation of conservative management. The patient was treated expectantly, with no further complications.

DISCUSSION

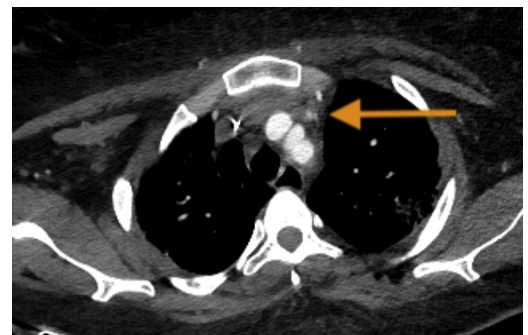
RHC provides unique physiological and hemodynamic data of the cardiopulmonary unit and is considered the gold standard test for the diagnosis of PH. Complications related to RHC are rare, with a serious complication rate of 1.1%.¹ Complications arise from venous access, hematomas at the puncture site, pneumothoraces, arrhythmias, vasovagal episodes, and pulmonary artery perforation.²

FIGURE 1 Venogram



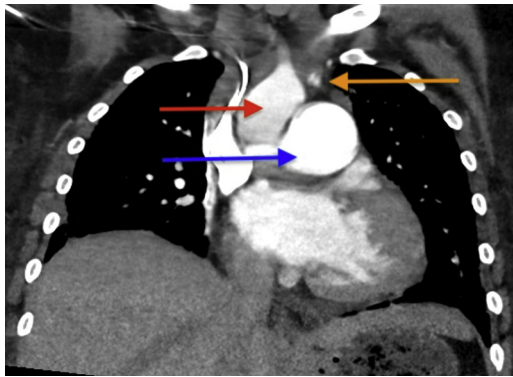
Venogram revealing absence of dye into right atrium, and extravasation into mediastinal structures.

FIGURE 2 Computed Tomography: Axial View



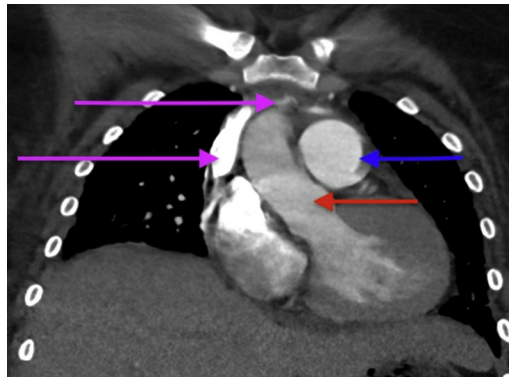
Axial CT image of the chest demonstrating the origin of the contrast leak (orange arrow) in the distal brachiocephalic vein.

FIGURE 3 Computed Tomography: Coronal View



Coronal CT image of the chest demonstrating the origin of the contrast leak (**orange arrow**) in relation to the aorta (**red arrow**) and pulmonary artery (**blue arrow**).

FIGURE 5 Computed Tomography: Coronal View



Coronal CT image of the chest demonstrating mediastinal extravasation (**purple arrows**) along the right side of the aorta (**red arrow**). Pulmonary artery is indicated by the **blue arrow**.

BCV perforation is an infrequent mechanical complication reported during the placement of central venous catheters³ and dialysis catheters⁴ as well as during electrophysiologic procedures.⁵ These complications are more common when the LIJ is the site of access.⁶ Management of BCV perforation includes conservative management with close surveillance for individuals who are in hemodynamically stable condition and have relatively small anterior mediastinal hematomas (<5 cm). For more severe injuries, surgical sternotomy or thoracotomy³ as well as endovascular coiling have been described.⁴

The means of preventing BCV perforation include use of ultrasound and fluoroscopy for cannulation and confirmation of guidewire positioning, confirming

intravascular access by aspirating blood from the catheter without difficulties, and reassessment if difficulties on further advancing the catheter arise. Early identification of the complication allowed us to halt the procedure and prevent further injury. Owing to the venous nature of the disease, conservative management was deemed sufficient, and the patient was discharged from the hospital subsequently.

FOLLOW-UP

The patient was given treatment for ILD with immunosuppressants. After improvement in her respiratory status, she was discharged home. No further complications from the BCV injury were found.

CONCLUSIONS

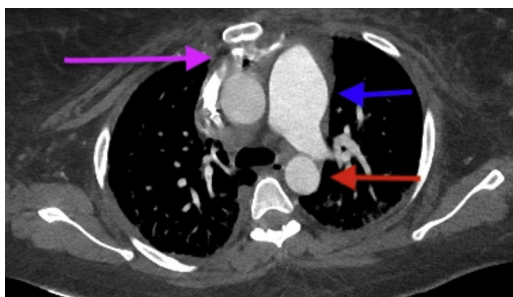
RHC is overall considered a safe procedure, with a minimal incidence of serious complications. Perforation of the BCV is possible during RHC, and its identification is important to provide timely treatment and prevent further injury.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

Dr Bernardo has served on a scientific advisory board for Janssen Pharmaceuticals. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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FIGURE 4 Computed Tomography: Axial View



Axial CT image of the chest demonstrating the site of mediastinal extravasation (**purple arrow**) in relation to the aorta (**red arrow**) and pulmonary artery (**blue arrow**).

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KEY WORDS brachiocephalic vein perforation, complication, mediastinal extravasation, right heart catheterization

APPENDIX For a supplemental video, please see the online version of this article.