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CASE REPORT

INTERMEDIATE

CLINICAL CASE

Coil Embolization as a Life-Saving Treatment for Pulmonary Artery Perforation Secondary to Large-Bore Catheterization

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ABSTRACT

We present a case of left pulmonary artery perforation during mechanical thrombectomy for treatment of pulmonary embolism. The patient's condition became hemodynamically unstable, with massive hemoptysis requiring intubation and multiple vasopressor agents. Prompt balloon tamponade and 0.035-mm coil embolization halted the extravasation. Coil embolization can be a lifesaving treatment for large vessel perforations. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2023;21:101964) © 2023 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 62-year-old woman presented to the emergency department with a 2-day history of progressive shortness of breath. Accompanying symptoms included palpitations, chest heaviness, and dizziness. She described mild pedal edema that had begun approximately 1 week earlier. An initial evaluation revealed sinus tachycardia, normal blood pressure, and hypoxia requiring 4-L supplemental oxygen by nasal cannula.

LEARNING OBJECTIVES

- To quickly identify and manage pulmonary artery perforations in the cardiac catheterization laboratory.
- To consider coils as an option for treatment of pulmonary artery perforation.

A transthoracic echocardiogram demonstrated normal left ventricular ejection fraction at 60% to 65%, D-shaped septum consistent with right-sided volume overload, and dilated right ventricle with reduced systolic function. The right ventricular/left ventricular ratio was >0.9. Laboratory evaluation revealed a platelet count of 44,000 μL, troponin of 0.32 ng/mL, and B-type natriuretic peptide of 488 pg/mL. An electrocardiogram demonstrated a S1Q3T3 pattern.

MEDICAL HISTORY

The patient's medical history included hypertension and colorectal cancer, for which she had undergone resection 4 months earlier. She was actively undergoing oral chemotherapy. She did not describe

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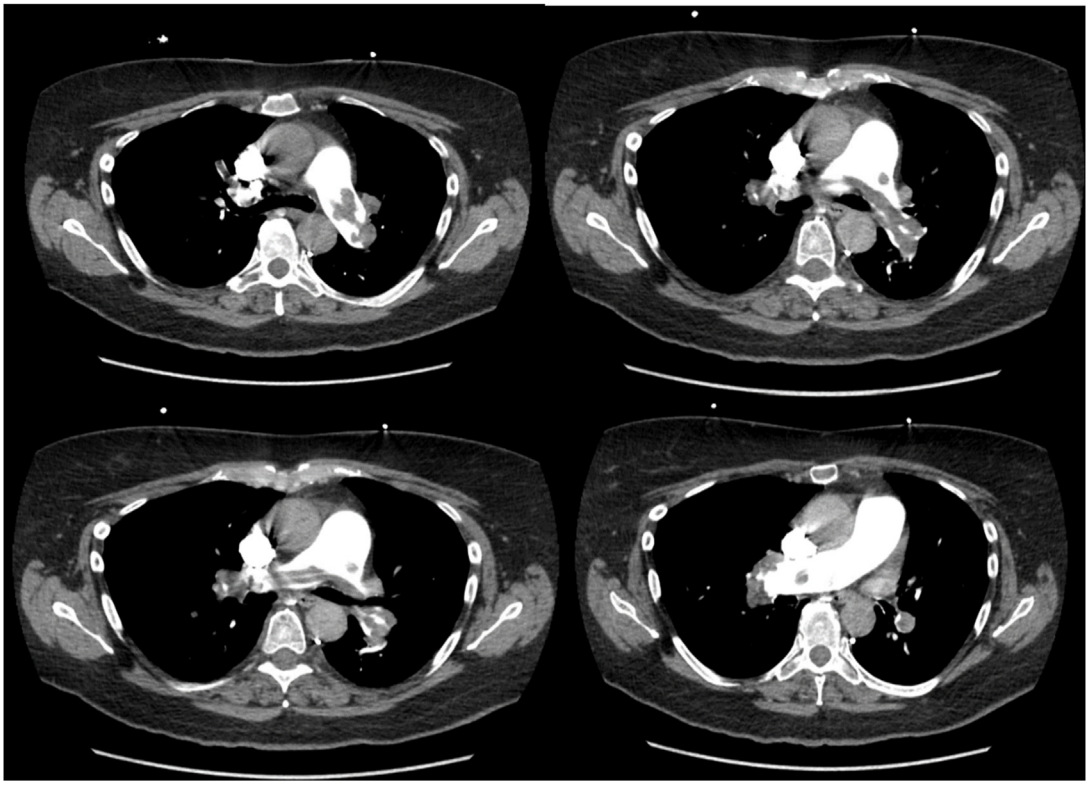
FIGURE 1 Pulmonary Artery CTA



Computed tomography angiography of the pulmonary trunk demonstrating large saddle embolus of the main, right, and left pulmonary trunk.

any prior personal or family history of deep venous thrombosis or thrombophilia.

DIFFERENTIAL DIAGNOSIS

The major differential diagnoses included submassive pulmonary embolism, pneumonia with pulmonary hypertension, metastasis of the malignancy, and acute myocardial infarction.

INVESTIGATIONS

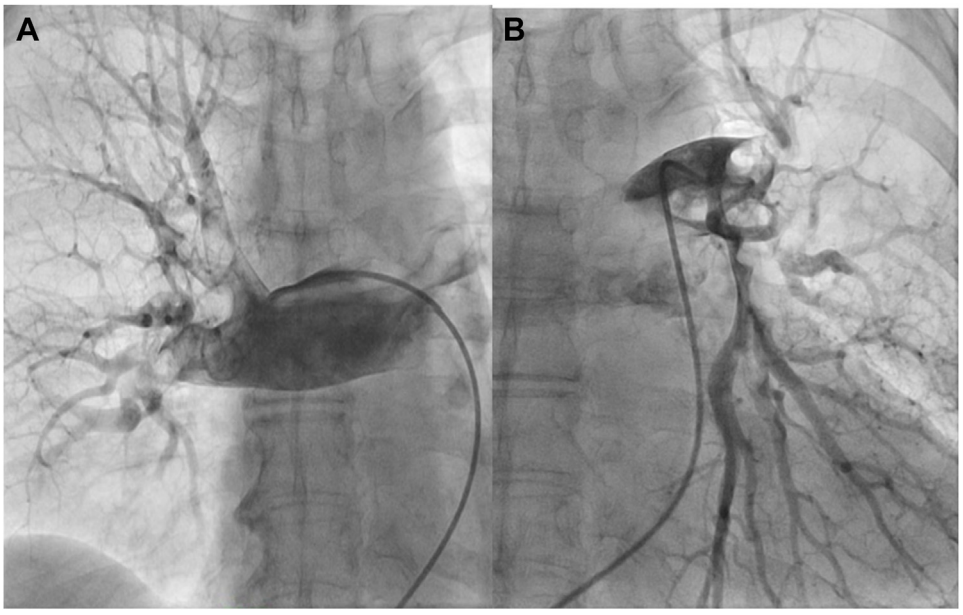
Computed tomography angiography demonstrated a large and extensive pulmonary embolism with saddle embolus across the main pulmonary trunk extending into the left and right pulmonary arteries (**Figure 1**, Videos 1 and 2). Using a 260-cm J-tipped wire and a diagnostic JR-4 catheter, the right heart was navigated, and the wire was placed up into the left pulmonary artery. The JR-4 catheter was exchanged for a pigtail catheter, and pulmonary angiography was performed in the right and left pulmonary arteries. Angiography demonstrated a large thrombus burden extending from the main pulmonary trunk into the lobar arteries bilaterally (**Figure 2A and 2B**).

MANAGEMENT

A Supracore wire (Abbott) was placed in the right pulmonary artery through the pigtail catheter and exchanged for a 20-F Flowtriever catheter (Inari). Mechanical thrombectomy was performed, and multiple thrombi were aspirated from the right pulmonary artery (**Figure 3**).

The catheter was then redirected into the left main pulmonary trunk using a pigtail catheter and the Supracore wire. Owing to extreme tortuosity with a high anterior takeoff, the 20-F catheter would not advance distally. The 20-F was exchanged for a smaller 16-F device, but this still would not advance distally. At this time, the 20-F curved system was not available, and we wanted to maintain the same large-bore aspiration modality because of the large

FIGURE 2 **Pulmonary Angiography**



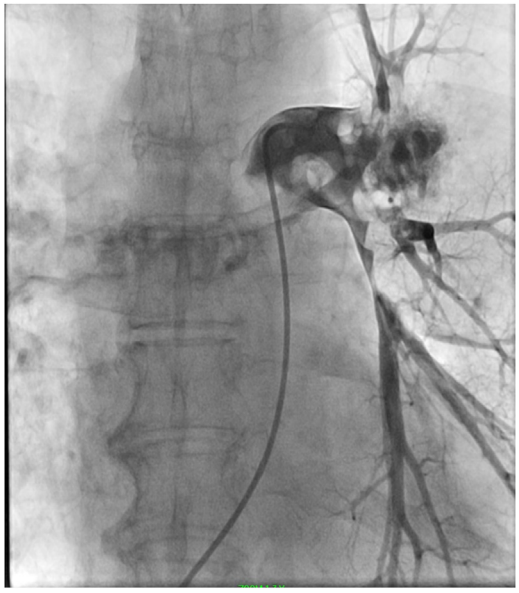
(A) Angiography of the right pulmonary artery with filling defect in the upper, middle, and lower lobes. **(B)** Angiography of the left pulmonary artery with filling defect in the upper, middle and lower lobes.

FIGURE 3 **Pulmonary Artery Thrombectomy**

Results of mechanical thrombectomy from the right and left main pulmonary arteries.

thrombus burden. The Supracore wire was then exchanged for a stiff Amplatz wire (Cook) and advanced into the left inferior lobar artery through the 16-F catheter with the inner dilator in place. While the inner dilator was being walked out, the large-bore catheter inadvertently moved forward, and the stiff wire came back. The patient immediately began to have hemoptysis and went into circulatory shock, requiring vasopressor agents. She was emergently intubated, during which major airway hemorrhage was observed. Immediately upon the development of symptoms, angiography was performed through the Inari catheter and demonstrated large extravasation from the left main pulmonary artery just above the lingular branch (**Figure 4**, Video 3). We immediately inserted and advanced a 10-mm × 40-mm Armada peripheral balloon (Abbott) and inflated to 12 atm and kept it in the left main artery close to the extravasation site. Anticoagulation was reversed with protamine. Given that coils were not immediately available in the catheter laboratory, they were obtained from the interventional radiology suite. The interventional radiologist on call joined us for collaboration. A 6-F multipurpose diagnostic catheter was inserted alongside the balloon catheter through the sheath and advanced to the area of the perforation. The balloon was deflated and pulled back into

FIGURE 4 Pulmonary Perforation

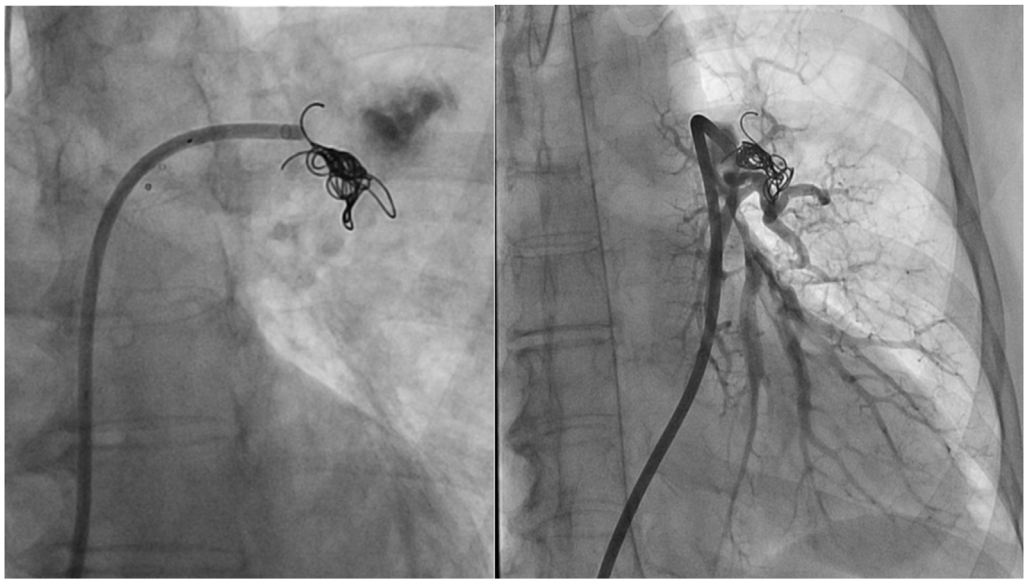


Angiography of the left pulmonary artery demonstrating perforation of the mid branch and extravasation of contrast material in the extravascular space.

the main trunk. We subsequently then placed 4 10-mm 0.35 Azure coils (Medtronic) into the left main pulmonary artery to achieve hemostasis at the site of perforation (**Figure 5**, Video 4). The patient's condition stabilized with the immediate resolution of her hemoptysis. Anticoagulation was withheld overnight.

The next day in the intensive care unit, the patient became hypotensive and hypoxic. She received transfusions of multiple units of packed red blood cells and was again given vasopressor agents. A repeated computed tomography angiogram demonstrated decreased thrombus burden in the right side and similar thrombus burden on the left side without active signs of bleeding. She was brought back to the catheterization laboratory, a Lightening 12 (Penumbra) catheter was used for thrombectomy, and a large, organized thrombus was suctioned from the left pulmonary artery (**Figure 3**). We chose an alternative thrombectomy because of the known tortuosity of the left pulmonary artery. The Lightening catheter offers better ease in navigation, an atraumatic tip, and less aggressive aspiration because we were concerned regarding newly delivered coils. To avoid the coils, a multipurpose catheter was used to place a guidewire into the inferior lobe to track the aspiration catheter.

FIGURE 5 Post Coil



Coil embolization of the left pulmonary artery with successful tamponade of extravasation of blood into the lungs.

The patient's condition then improved and stabilized after aspiration. She was weaned from pressor support and was extubated the next day. She was discharged from the hospital on day 7.

DISCUSSION

Pulmonary artery catheterization is becoming increasingly widely used for multiple interventional procedures. Pulmonary artery perforations have been described as a complication of Swan-Ganz catheters, pulmonary artery thrombectomy, pulmonary valvular interventions, pulmonary artery sensor placement, and left atrial appendage occlusion.[1-3] The mortality associated with large pulmonary artery perforations is extremely high.[2] In our patient, mechanical thrombectomy was chosen because of the large thrombus burden extending from the main pulmonary artery to right and left arteries; and with concomitant thrombocytopenia, this is a safer treatment option for patients with contraindications to thrombolytic therapy or high bleeding risks.[4] However, the tortuosity of the vessel and inadvertent forward movement of the sheath resulted in left main pulmonary artery perforation. We think that the inflation of the balloon and slow flow in the vessel caused by the large thrombus burden might have helped to slow down the bleeding from the main pulmonary artery trunk. This also gave adequate time to preform coil embolization.

Possible ways to prevent this complication could be achieved by advancing the wire distally into the lower pulmonary artery for increased support or by using the 16-F FlowTreiver catheter inside the 20-F catheter. The deeper wire placement was not achieved in this case because of the high thrombus burden in the lower lobe, which prohibited advancement of the wire.

Many cardiac catheterization laboratories routinely do not keep 0.035 mm coils on the shelf. Having knowledge of the location of coils in the facility as well as staff members trained to prepare and deploy them should be standard training in any cardiac catheterization laboratory that performs large-bore pulmonary artery interventions. Balloon tamponade can be a temporary stabilizing measure during preparations for deployment of the coils.

FOLLOW-UP

A repeated echocardiogram 2 months after the initial presentation, demonstrated normal left and right ventricular size and function. There was no pulmonary hypertension; the right ventricular systolic pressure was 33 mm Hg. The patient experienced shortness of breath only with heavy exertion. She continued to take apixaban 5 mg twice daily for long-term oral anticoagulation. She continued to be functional and was doing well at the 18-month follow-up visit.

CONCLUSIONS

This case shows the importance of prompt recognition of pulmonary artery perforation with massive hemoptysis and circulatory shock during the performance of large-bore mechanical thrombectomy. Immediate balloon tamponade and subsequent coil embolization can be life-saving measures for this potentially lethal complication.

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Dr Varghese has served as a consultant for Shockwave Medical. Ms Estes has served as a consultant for Shockwave Medical. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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KEY WORDS coil embolization, large-bore catheter, perforation, pulmonary embolism, thrombectomy

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