Selective Embolization and Surveillance of Multiple Bilateral Pulmonary Arteriovenous Malformations: A Case Report

Abstract:

Pulmonary arteriovenous malformations (PAVMs) are abnormal communications between the pulmonary arterial and venous circulations that produce intrapulmonary right-to-left shunting and may predispose patients to serious neurologic and hemorrhagic complications. Although some patients present with dyspnea, hypoxemia, or hemoptysis, PAVMs may be clinically silent and discovered incidentally. We report a 45-year-old woman with multiple bilateral PAVMs initially identified on abdominal computed tomography. Dedicated chest computed tomography angiography characterized the lesions, and agitated-saline transthoracic echocardiography confirmed an intrapulmonary right-to-left shunt. Three dominant left lower-lobe PAVMs were selectively embolized with detachable coils, with elimination of flow on completion angiography. Smaller right-sided PAVMs, whose feeding arteries were considered too small for intervention, remained stable on surveillance imaging. Recurrent epistaxis and multiple PAVMs raised suspicion for hereditary hemorrhagic telangiectasia, although available clinical criteria were insufficient for a definite diagnosis. This case demonstrates a lesion-specific, longitudinal approach to multifocal PAVMs in which embolization of technically amenable malformations is combined with surveillance of smaller residual lesions.

Keywords: pulmonary arteriovenous malformation; PAVM; embolization; pulmonary angiography; right-to-left shunt; hereditary hemorrhagic telangiectasia

Introduction

Pulmonary arteriovenous malformations (PAVMs) are direct communications between branches of the pulmonary arteries and veins that bypass the pulmonary capillary bed and produce an intrapulmonary right-to-left shunt.[1-5] Patients may present with dyspnea, hypoxemia, or exercise intolerance, but PAVMs are frequently asymptomatic and discovered incidentally.[1-3,9]

The clinical importance of PAVMs extends beyond respiratory symptoms. Loss of pulmonary capillary filtration allows thrombotic and septic material to enter the systemic circulation, increasing the risk of paradoxical embolization, ischemic stroke, and cerebral abscess; rupture may also cause hemoptysis or hemothorax.[1-3,7] Computed tomography (CT) defines the feeding artery, aneurysmal sac, and draining vein, whereas transthoracic echocardiography (TTE) with agitated saline demonstrates the physiologic right-to-left shunt.[2,3,9] Transcatheter embolization is the preferred treatment for technically amenable PAVMs.[1,3-6] We present a patient with multiple bilateral PAVMs managed by selective embolization of dominant left lower-lobe lesions and surveillance of smaller contralateral lesions.

Case Presentation

A 45-year-old woman with hypertension, anemia, and prediabetes presented to the emergency department with myalgias, fever, sore throat, and right upper-quadrant pain. She tested positive for influenza A. Abdominal CT showed no acute abdominal abnormality, but images through the lung bases demonstrated vascular-appearing nodular densities in the left lower lobe. The largest high-attenuation lesion measured approximately 14 × 10 mm, with additional smaller adjacent lesions. Dedicated outpatient chest CT angiography (CTA) was recommended.

At outpatient pulmonary evaluation, the patient reported exertional dyspnea and a chronic cough productive of clear mucus for more than one year but denied hemoptysis. Initial TTE showed a left ventricular ejection fraction of 60%-65%, no significant valvular dysfunction, and no evidence of pulmonary hypertension. Chest CTA demonstrated multiple bilateral PAVMs. Dominant left lower-lobe lesions measured 9 mm and 4 mm.

Additional lesions measured 3-4 mm in the anterior right middle lobe, 2 mm in the lateral right middle lobe, and 3 mm in the basilar right lower lobe (Figure 1).

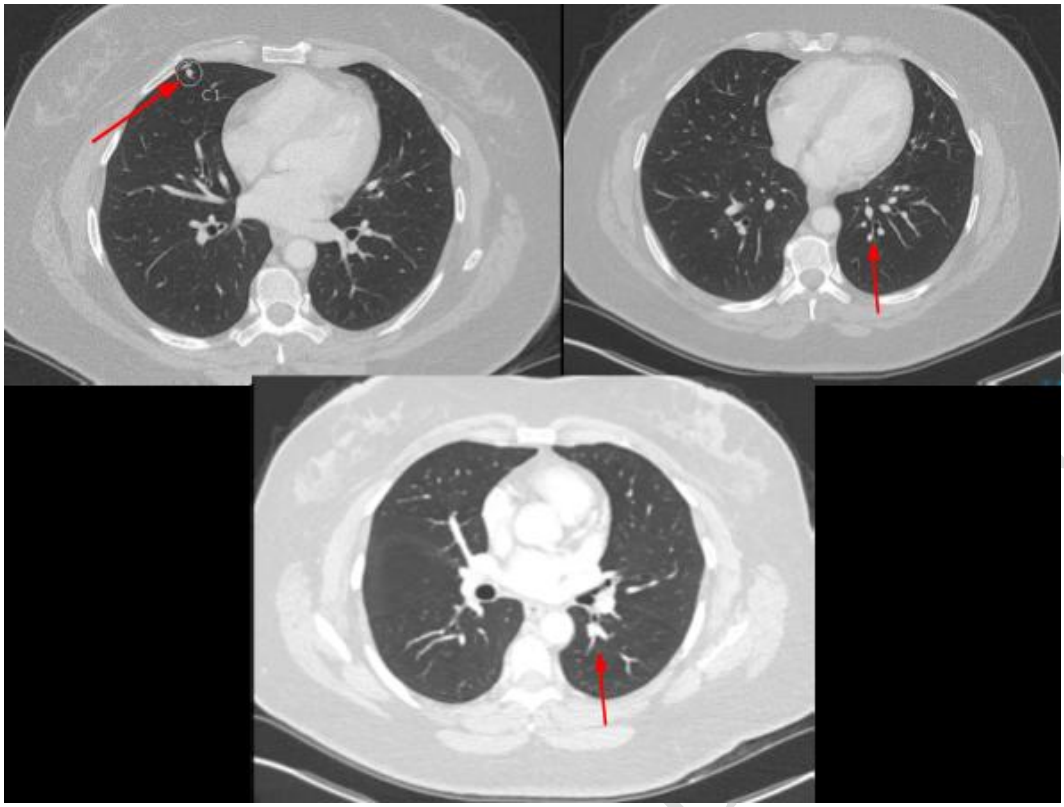

Figure 1. Axial chest CTA demonstrates multiple pulmonary arteriovenous malformations (arrows).

Agitated-saline TTE demonstrated late, brisk opacification of the left atrium and ventricle with numerous microbubbles more than five cardiac cycles after right-heart opacification, consistent with an intrapulmonary right-to-left shunt. No intracardiac shunt across the atrial septum was identified (Figure 2).

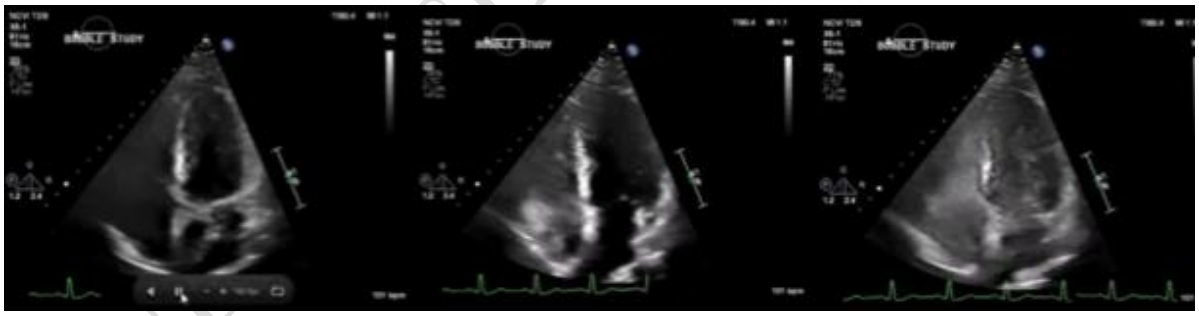

Figure 2. Agitated-saline TTE shows initial right-heart opacification followed by late, brisk left-heart opacification after more than five cardiac cycles.

Repeat CTA showed stable pulmonary vascular malformations. After interventional radiology evaluation, transcatheter embolization was recommended for the dominant left lower-lobe lesions based on their anatomy and technical accessibility (Figure 3).

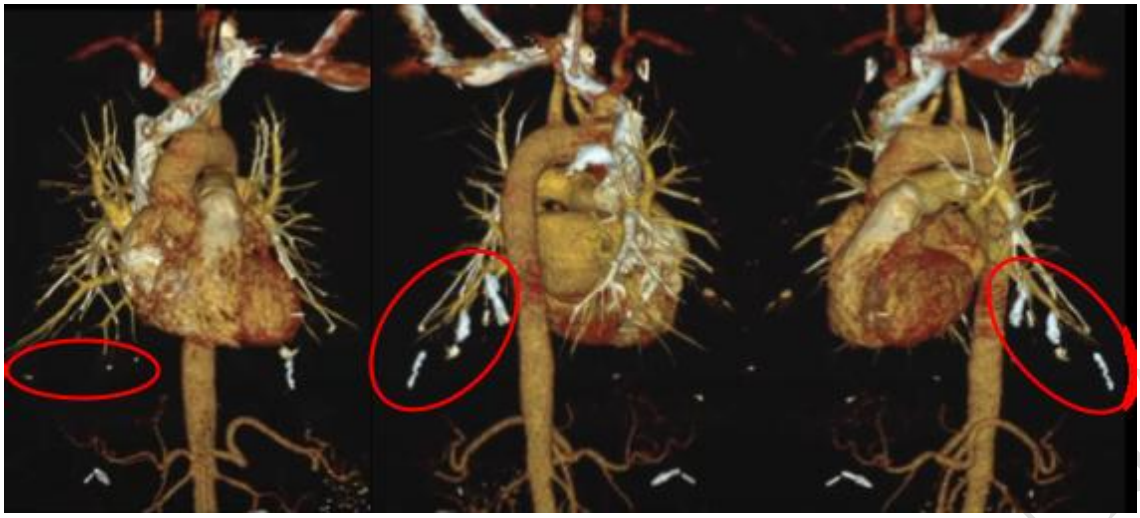

Figure 3. Three-dimensional chest CTA rendering demonstrates multiple bilateral pulmonary arteriovenous malformations.

Pulmonary angiography and embolization were performed through right common femoral venous access. A 5-French Omni Flush catheter was advanced over a 0.035-inch stiff angled Glidewire to select the left pulmonary artery. The catheter was exchanged for a 5-French Kumpe catheter over a 0.035-inch Rosen wire and advanced into the left lower-lobe pulmonary artery. A 2.8-French microcatheter was advanced coaxially over a 0.018-inch GT Glidewire to selectively catheterize three arterial branches supplying the dominant left lower-lobe PAVMs. Each feeding branch was embolized with detachable coils. Completion angiography demonstrated no residual flow through the treated malformations. The catheters were removed, and hemostasis was achieved with manual compression.

Follow-up CTA demonstrated expected postembolization changes without residual flow in the treated left lower-lobe PAVMs (Figure 4). Six small PAVMs remained in the right lung, measuring approximately 3-6 mm. At subsequent interventional radiology follow-up, their feeding arteries were considered too small for intervention. The patient remained asymptomatic, and continued imaging surveillance was recommended.

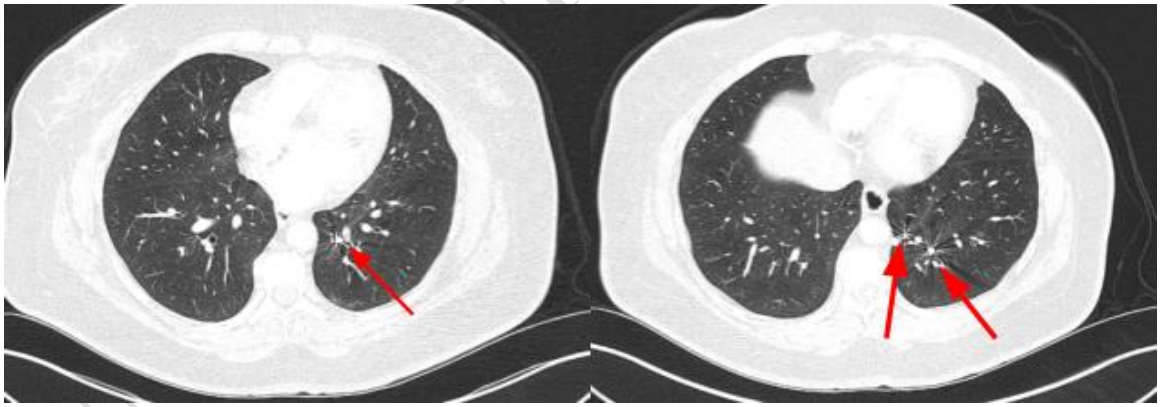

Figure 4. Follow-up chest CTA demonstrates coil embolization of the treated left lower-lobe PAVMs (arrows), without residual flow.

Discussion

This case shows how multiple PAVMs may require different management decisions for different lesions. The dominant left lower-lobe lesions were treated, while the smaller right-sided lesions continued to be observed. The decision to treat a PAVM depends on the anatomy of the lesion, the size of the feeding artery, the patient's symptoms, and whether the lesion can be safely accessed.

The PAVMs in this patient were first seen at the lung bases on an abdominal CT obtained for a nonpulmonary complaint. Dedicated chest CTA then showed the bilateral distribution of the lesions and their vascular

anatomy. CT is important because it can show the feeding artery, abnormal vascular communication, and draining vein.[2,3,9] Agitated-saline TTE provides different information by showing whether right-to-left shunting is present. Microbubbles are normally filtered by the pulmonary capillary bed, so delayed appearance in the left side of the heart supports an intrapulmonary rather than intracardiac shunt.[2,3,9] In this patient, the late, brisk filling of the left-sided chambers was consistent with the multiple PAVMs seen on CTA.

Historically, a feeding-artery diameter of 3 mm was commonly used as the threshold for treatment. With advances in microcatheters and embolic devices, smaller lesions may also be technically accessible, and neurologic complications are not limited to PAVMs above the traditional 3-mm threshold.[1,3-5] Current literature supports considering embolization for technically accessible PAVMs with feeding arteries approximately 2 mm or greater, as well as symptomatic lesions, instead of using 3 mm as an absolute cutoff.[3-5]

Three arterial branches supplying the dominant left lower-lobe PAVMs were selectively catheterized and embolized with detachable coils. Detachable coils allow controlled deployment and can be repositioned before final release.[4,5] Completion angiography showed no residual flow through the treated lesions, and follow-up CTA also showed no residual flow. The smaller right-sided PAVMs were not treated because their feeding arteries were considered too small for intervention.

Continued follow-up is important because treated PAVMs can persist or reperfuse through recanalization or recruitment of additional vascular supply. PAVMs that were not initially treated may also enlarge over time.[2-6] Long-term studies have reported repeat procedures for both recanalized treated PAVMs and enlargement of previously untreated lesions.[6] In this patient, follow-up CTA showed expected postembolization changes in the left lower lobe and stability of the untreated right-sided lesions. Continued imaging surveillance was recommended.

The presence of multiple PAVMs also raises the possibility of hereditary hemorrhagic telangiectasia (HHT), which is the condition most commonly associated with PAVMs.[1-3,7,8] The Curaçao criteria include recurrent spontaneous epistaxis, characteristic mucocutaneous telangiectasias, visceral arteriovenous malformations, and a first-degree relative with HHT.[8] Two criteria indicate possible or suspected HHT, while three or four support a definite clinical diagnosis.[8] This patient had recurrent epistaxis and pulmonary AVMs. However, there was no documented history of characteristic mucocutaneous telangiectasias, an affected first-degree relative, or confirmatory genetic testing. HHT therefore remained a possible diagnosis rather than a confirmed diagnosis. Although her epistaxis improved after PAVM embolization, this does not establish that embolization of the pulmonary lesions treated the nasal bleeding.

Conclusion

PAVMs may be discovered incidentally but remain clinically important because of the systemic effects of right-to-left shunting. In this patient, three left lower-lobe PAVMs were treated with selective coil embolization, while the smaller right-sided lesions remained under imaging surveillance. This case also shows that the management of multiple PAVMs may continue over time rather than being completed in a single procedure. Multiple PAVMs together with recurrent epistaxis should raise concern for HHT, but a definite diagnosis should not be made when the established clinical or genetic criteria are not met.

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