

Bilateral Pulmonary Arteriovenous Fistulas in A Young Patient with Ischemic Stroke: A Case Report

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ABSTRACT

Pulmonary arteriovenous fistulas are uncommon vascular communications between pulmonary arteries and veins that bypass the capillary bed and generate a right-to-left shunt. They may remain clinically silent, but they are relevant in young patients with cryptogenic or apparently paradoxical ischemic stroke. This article reports the case of a 20-year-old male patient with a history of posterior-circulation ischemic stroke secondary to basilar artery thrombosis, residual motor impairment with modified Rankin score 3, and antiphospholipid syndrome under oral anticoagulation. During the diagnostic workup for suspected patent foramen ovale or atrial septal defect, intracardiac echocardiography showed an intact interatrial septum without color-Doppler shunt. Selective pulmonary angiography identified bilateral pulmonary arteriovenous fistulas with drainage to the left atrium. The right lower-lobe fistula was embolized with an Amplatzer Vascular Plug II, whereas the left-sided lesions were treated with Interlock coils. Final angiographic control showed adequate occlusion, without major procedural events. This case emphasizes the need to investigate extracardiac right-to-left shunts when intracardiac defects are not demonstrated in young patients with ischemic stroke, and it supports percutaneous embolization as a feasible therapeutic approach in appropriately selected cases.

KEYWORDS: Pulmonary arteriovenous fistula; pulmonary arteriovenous malformation; ischemic stroke; paradoxical embolism; embolization; Amplatzer vascular plug; Interlock coil.

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I. INTRODUCTION

Pulmonary arteriovenous fistulas, also described as pulmonary arteriovenous malformations, are direct abnormal communications between branches of the pulmonary artery and pulmonary vein, without an intervening capillary network. Consequently, these lesions create an intrapulmonary right-to-left shunt that may cause hypoxemia, reduced filtration of thrombotic or septic emboli, and neurological complications. Recent evidence has summarized that pulmonary arteriovenous malformations may be associated with stroke, transient ischemic attack, cerebral abscess, migraine, seizures, dyspnea, hypoxemia, hemoptysis, and hemothorax [1].

The neurological relevance of these lesions is particularly important in young patients with ischemic stroke. A contemporary review in Neurology reported that pulmonary

arteriovenous malformations may remain undiagnosed until the time of stroke, and emphasized paradoxical embolization as a central mechanism of cerebral ischemia [2]. Therefore, when a patent foramen ovale or atrial septal defect is suspected but not confirmed, pulmonary vascular malformations should be considered in the differential diagnosis of right-to-left shunt.

From a therapeutic perspective, international standards describe percutaneous embolization as a key management strategy for suitable pulmonary arteriovenous malformations, with computed tomography angiography, contrast echocardiography, and selective pulmonary angiography contributing to diagnosis, procedural planning, and follow-up [3]. In this context, the present case is relevant because bilateral pulmonary arteriovenous fistulas were identified during the workup of a young patient with

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prior ischemic stroke, and successful percutaneous closure was achieved using a combined plug-and-coil strategy.

II. CASE PRESENTATION

A 20-year-old male patient was evaluated due to a history of ischemic stroke three years earlier. The patient had residual motor impairment, a modified Rankin score of 3, and was receiving physical rehabilitation twice weekly. He also had a one-year diagnosis of antiphospholipid syndrome and was treated with acenocoumarol 2 mg every 24 hours twice weekly and 1 mg every 24 hours on the remaining days. A pulmonary arteriovenous fistula had been diagnosed in August 2024.

The relevant surgical history included tracheostomy, currently closed, and gastrostomy, currently removed, both performed in the context of the ischemic cerebrovascular event. The patient had also undergone basilar artery thrombectomy three years earlier. The index neurological event began in January 2023, when the patient was found at home with absence of movement in the four extremities except for the right hand and absence of speech. Cranial computed tomography showed posterior fossa ischemic stroke with evidence of basilar artery thrombosis. Neurological deterioration required advanced airway management, and the patient was transferred to a tertiary hospital for thrombectomy, which achieved complete reperfusion. However, the patient had residual findings compatible with incomplete locked-in syndrome.

During the initial etiological workup, transesophageal echocardiography performed on February 28, 2023, suggested a patent foramen ovale, although the anatomy was not considered suitable for percutaneous closure. After loss of follow-up and subsequent evaluation at the reporting institution, transthoracic echocardiography suggested an atrial septal communication. Cardiac catheterization and pulmonary angiography were therefore indicated to clarify the source of right-to-left shunting.

Admission laboratory values were as follows: hemoglobin 17.1 g/dL, hematocrit 49%, platelets 247,000/ μ L, leukocytes 9,370/ μ L, neutrophils 6,950/ μ L (74%), blood group A positive, glucose 97 mg/dL, urea 36 mg/dL, creatinine 0.89 mg/dL, sodium 139 mmol/L, potassium 3.8 mmol/L,

chloride 103 mmol/L, calcium 9.4 mg/dL, phosphorus 2.6 mg/dL, and magnesium 1.9 mg/dL.

III. PROCEDURAL FINDINGS AND RESULTS

Cardiac catheterization and pulmonary angiography documented coronary arteries without angiographic lesions. Left ventriculography showed a left ventricular end-diastolic pressure of 7 mmHg, end-diastolic volume of 100 mL, end-systolic volume of 44 mL, preserved global and segmental motion, and left ventricular ejection fraction of 55%. No mitral regurgitation was observed, and pullback across the aortic valve showed no peak-to-peak gradient. Subselective pulmonary angiography identified a pulmonary arteriovenous fistula arising from the right lower lobar branch and draining into the left atrium. The mean pulmonary artery pressure was 8 mmHg and pulmonary vascular resistance was 0 Wood units.

Definitive percutaneous treatment was performed on October 27, 2025. Intracardiac echocardiography with an 8-Fr AcuNav probe showed an intact interatrial septum, without aneurysm, patent foramen ovale channel, atrial septal defect, or color-Doppler shunt. Angiographic exploration identified a lateral basal segmental artery of the right lower lobe draining into the left atrium, which was embolized with an Amplatzer Vascular Plug II measuring 10 $\times$ 7 mm.

A second fistula was identified in the superior segment of the lingular artery of the left lung, with drainage into the left atrium. Embolization was performed using an Interlock 35 Cube coil measuring 6 mm $\times$ 10 cm, followed by coil-in-coil placement with two additional Interlock 35 Cube coils of the same size. Angiographic control showed total occlusion. Subsequently, selective angiography identified an additional left lower-lobe fistula dependent on the anteromedial basal artery. Embolization was performed with a Fathom–Bern 155-cm directional microcatheter and two Interlock 2D coils measuring 4 mm $\times$ 8 cm. A third coil measuring 5 mm $\times$ 15 cm was not deployed because of the risk of proximal branch loss and was recaptured. Final angiographic control showed successful occlusion, with only loss of a small distal branch close to the diaphragm measuring approximately 2 mm, without other procedural events.

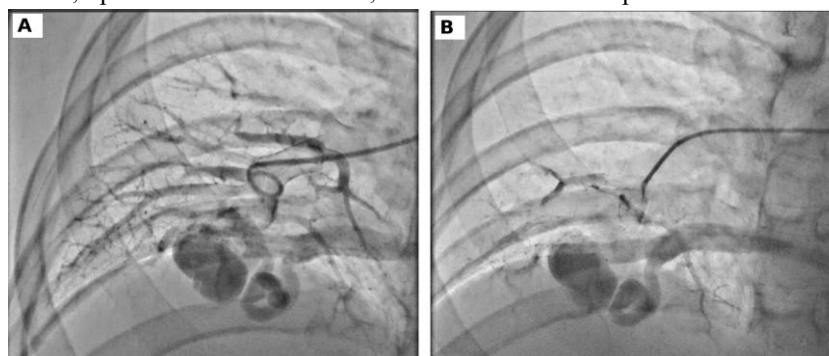


Figure 1. Selective pulmonary angiography of the right lower-lobe pulmonary arteriovenous fistula. Panel A shows the fistulous communication before occlusion; panel B shows post-deployment angiographic control after Amplatzer Vascular Plug II placement.

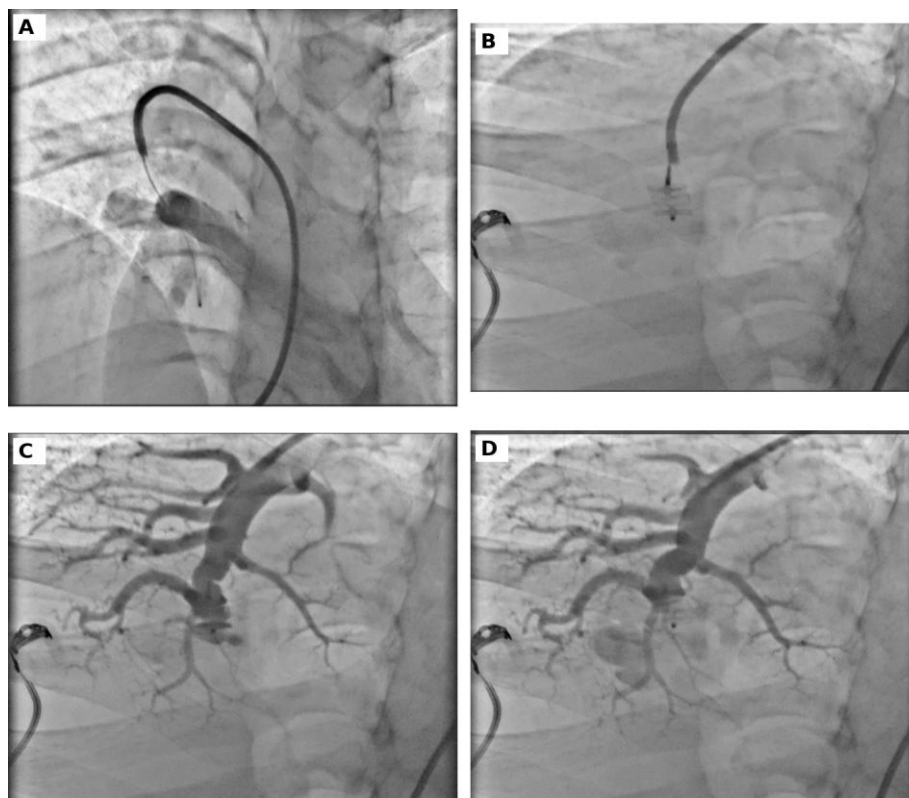


Figure 2. Left lingular pulmonary arteriovenous fistula. Panels A and B demonstrate selective angiographic identification; panels C and D show progressive coil embolization with angiographic control.

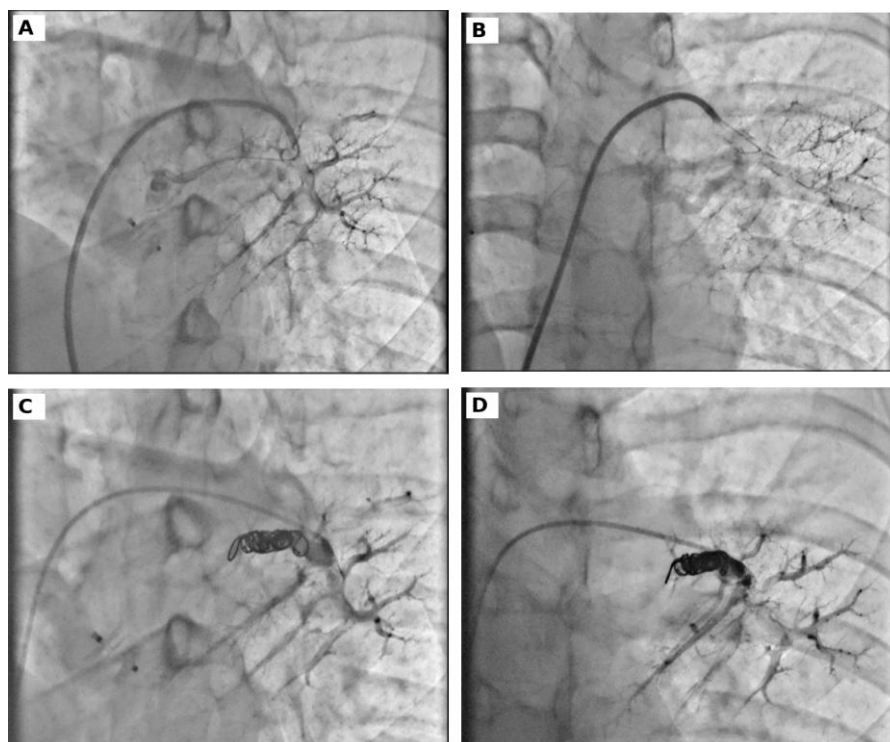


Figure 3. Additional left lower-lobe pulmonary arteriovenous fistula. Panels A and B show selective angiography; panels C and D show coil embolization and post-treatment control.

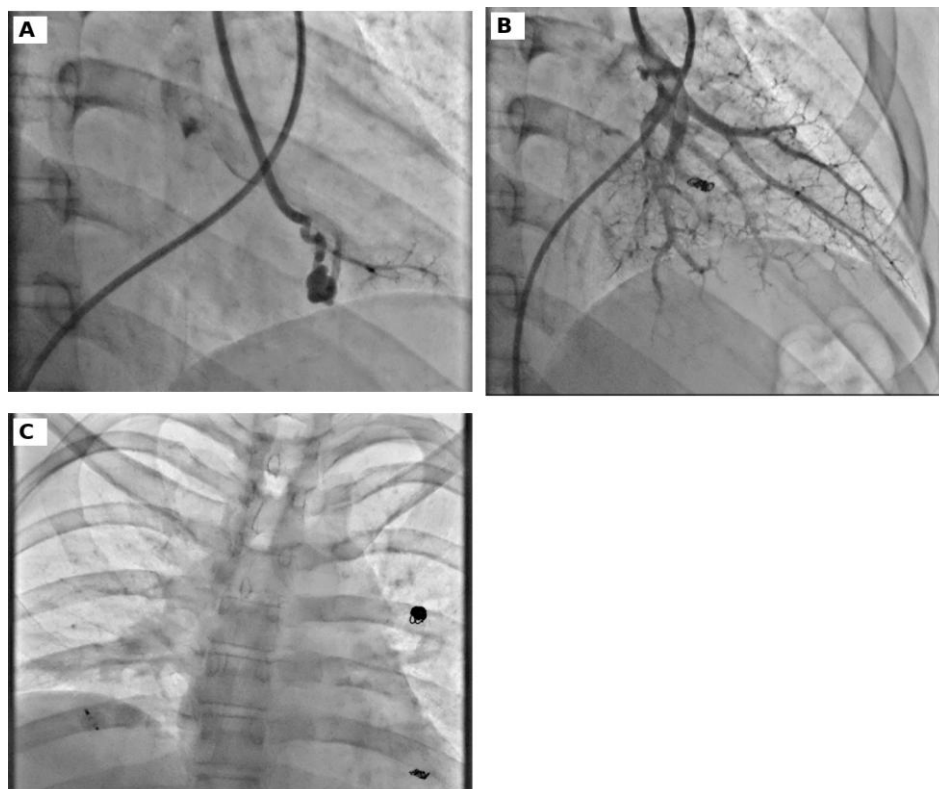


Figure 4. Final angiographic assessment after bilateral embolization, showing occlusive devices in situ and satisfactory angiographic result.

IV. DISCUSSION

This case illustrates a clinically important diagnostic sequence in a young patient with previous ischemic stroke. The initial suspicion of patent foramen ovale or atrial septal defect was not confirmed by intracardiac echocardiography; instead, selective pulmonary angiography revealed bilateral pulmonary arteriovenous fistulas. This finding is consistent with evidence indicating that extracardiac right-to-left shunts can produce paradoxical embolic events and may be underrecognized in patients initially evaluated for intracardiac septal defects [1,2].

The coexistence of antiphospholipid syndrome adds clinical complexity because it represents an independent prothrombotic condition. However, the presence of pulmonary arteriovenous fistulas provides an additional plausible embolic pathway by allowing venous embolic material to bypass the pulmonary capillary filter and enter the systemic circulation. For this reason, the case supports a comprehensive diagnostic approach in young patients with ischemic stroke, especially when intracardiac shunt is not demonstrated or when the clinical history suggests paradoxical embolism [2,3].

Percutaneous transcatheter embolization has become the preferred therapeutic strategy for anatomically suitable pulmonary arteriovenous malformations. In a cohort study of 43 patients with 72 untreated lesions, Wu et al. reported 100% technical success and significant improvement in oxygenation and functional class, although reperfusion varied according to the embolic strategy [4]. Similarly,

recent reviews emphasize that device selection should be individualized according to feeding artery size, venous sac anatomy, multiplicity of lesions, and risk of recanalization [5].

The plug-and-coil strategy used in this patient is aligned with current endovascular practice. Combined embolization may be useful when multiple lesions are present or when different vascular anatomies require different occlusive materials. Published data suggest that approaches involving coils, plugs, or combined devices can achieve high rates of technical success, although follow-up imaging remains necessary because recanalization and persistence may occur [4-7]. Therefore, long-term surveillance should be planned after discharge, preferably with computed tomography angiography or contrast echocardiographic assessment according to institutional protocols and patient-specific risk.

V. CONCLUSION

Bilateral pulmonary arteriovenous fistulas should be considered in the evaluation of young patients with ischemic stroke when intracardiac right-to-left shunt is suspected but not confirmed. In the present case, intracardiac echocardiography ruled out patent foramen ovale and atrial septal defect, while selective pulmonary angiography identified bilateral pulmonary arteriovenous fistulas with drainage to the left atrium. Percutaneous embolization with Amplatzer Vascular Plug II and Interlock coils achieved satisfactory angiographic occlusion without major procedural events. This case supports multidisciplinary

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evaluation and individualized endovascular management in selected patients.

DECLARATIONS

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