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Successful Transcatheter Treatment of Simultaneous Patent Foramen Ovale and Pulmonary Arteriovenous Malformation for Prevention of Recurrent Stroke in a Patient With Cryptogenic Stroke

Jong-Il Park, MD; Jong-Ho Nam, MD; Ung Kim, MD, PhD; Jung-Hee Lee, MD, PhD; Jang-Won Son, MD, PhD

A 51-year-old female without any medical history presented with right hemifield visual defect. Brain magnetic resonance imaging and magnetic resonance angiography showed focal cortical infarction in the left occipital area without significant stenosis in the intracranial arteries. The neurologist suspected cryptogenic stroke and referred the patient to the cardiology department.

Cardiac evaluation, including a 24-h electrocardiogram (ECG) and transthoracic (TTE) and transesophageal (TEE) echocardiography were performed. TTE and the 24-h ECG did not show any abnormalities; however, TEE with the agitated saline test revealed patent foramen ovale (PFO) with microbubbles crossing the slit defect (**Figure A**). The PFO exhibited high-risk features, including large (≥2 mm) size and a large amount of shunt (≥20 microbubbles; **Supplementary Figure 1**). The PFO was suspected as the culprit for stroke and PFO closure was recommended.[1]

However, during careful review of TEE images for planning PFO device closure, microbubbles other than those crossing the PFO were observed in the left atrium (LA) after 5 cardiac cycles of agitated saline infusion (**Figure B**). Suspecting another extracardiac shunt, 3-dimensional computed tomographic pulmonary angiography (3D-CTPA) was performed, revealing a large pulmonary arteriovenous malformation (PAVM; **Figure C**). After discussion with a neurologist, we considered both the PFO and PAVM could be the sources of the cryptogenic stroke and we decided to perform simultaneous transcatheter PFO and PAVM closure. First, transcatheter PFO closure was performed with an Amplatzer PFO occlude device (18 mm; **Supplementary Figure 2A**). However, even after transcatheter PFO closure, an intracardiac echocardiogram with the agitated saline test showed a large amount of microbubbles in the LA after 5 cardiac cycles (**Figure D**). After confirmation of PAVM by angiography, we successfully performed coil embolization (Concerto coils; 10 mm× 30 mm, 9 mm×30 mm) of the PAVM (**Supplementary Figure 2B**,**C**). After the procedure, follow-up 3D-CTPA showed no residual PAVM (**Figure E**) and TTE with the agitated saline test revealed only a few microbubbles in left side cardiac chambers (**Figure F**).

The simultaneous presence of PFO and PAVM responsible for a right-to-left shunt resulting in cryptogenic stroke is rare, and both lesions should be treated to prevent recurrent stroke. Even though it is rare, physicians should keep in mind that PFO and PAVM can coexist and always carefully perform and interpret TEE with the agitated saline test.

Disclosures / IRB Information

None.

Reference

1. Collado FMS, Poulin MF, Murphy JJ, Jneid H, Kavinsky CJ. Patent foramen ovale closure for stroke prevention and other disorders. *J Am Heart Assoc* 2018; **7:** e007146.

Supplementary Files

Please find supplementary file(s);
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Division of Cardiology, Yeungnam University Medical Center, Daegu, Korea
Mailing address: Jang-Won Son, MD, PhD, Division of Cardiology, Yeungnam University Medical Center, 170, Hyeonchung-ro, Nam-gu, Daegu, Korea. E-mail: gubjae@yu.ac.kr

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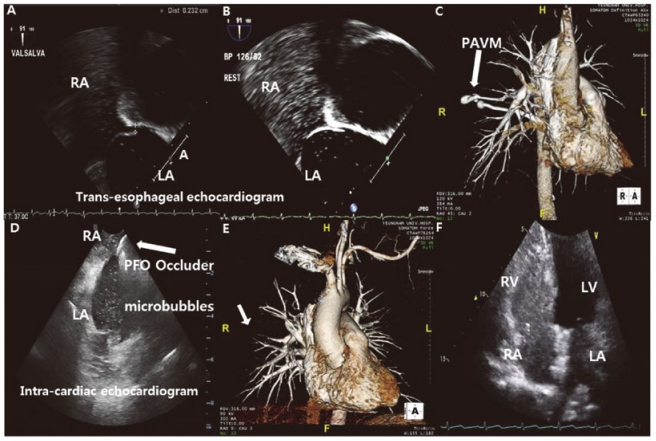

Figure. (**A**) TEE with agitated saline test during Valsalva maneuver. (**B**) TEE after 5 cardiac cycles of agitated saline infusion. (**C**) PAVM on 3D-CTPA (white arrow). (**D**) Intra-cardiac echocardiogram with agitated saline test after PFO closure (white arrow). (**E**) Disconnection of PAVM on 3D-CTPA after coil embolization (white arrow). (**F**) Transthoracic echocardiography with agitated saline test after closure of both PFO and PAVM. PAVM, pulmonary arteriovenous malformation; PFO, patent foramen ovale; TEE, transesophageal echocardiogram; 3D-CTPA, 3D-computed tomographic pulmonary angiography.