A 78-year-old woman with a history of paroxysmal atrial fibrillation and hypertension presented with sudden chest pain, dyspnea, and severe hypoxia ($O_2$ saturation=79%; arterial blood gas test results: $P_{\text{aco}_2}$ level=37.4 mmHg and $P_{\text{ao}_2}$ level=46.1 mmHg under high-flow oxygen administration). Electrocardiography showed ST elevation in the inferior leads. Transthoracic echocardiography showed hypokinesis of the right ventricular free wall and enlargement of the right ventricle with flattening of the interventricular septum during diastole (online-only Data Supplement Movie I). As clinical suspicion for pulmonary embolism associated with inferior myocardial infarction was high, emergent multidetector computed tomography (MDCT) was performed: no thrombi were found in the pulmonary artery, but a thrombus was observed in the right coronary sinus of Valsalva (Figure 1A and 1B). After MDCT, repeat echocardiography confirmed a thrombus attached to the ostium of the right coronary artery (RCA) (Figure 2A and 2B and online-only Data Supplement Movie II). As severe hypoxemia persisted even after tracheal intubation and mechanical ventilation, an extracorporeal membrane oxygenator was introduced. Aortography with manual dye injection above the noncoronary cusp showed thrombi in the mid-RCA but not the right coronary sinus of Valsalva. Complete perfusion was successfully achieved after thrombus aspiration (online-only Data Supplement Movie III). Warfarin and heparin therapies were started for the prevention of further thrombosis. Transesophageal echocardiography (TEE) showed a patent foramen ovale (PFO) with left-to-right shunting (online-only Data Supplement Movie IV). However, the right-to-left shunting of flow through the PFO could not be demonstrated using an agitated saline bubble study during isometric tension (online-only Data Supplement Movie V). Smoke-like echoes were observed in the left atrial appendage, but thrombi were absent (online-only Data Supplement Movie VI). The patient exhibited no neurological deficits in the following days.

**Discussion**

In the present case, although the cause of thrombus formation in the aortic root remains unknown and MDCT did not show any thrombus in the left atrial appendage (Figure 1C), the thrombus probably formed in the left atrial appendage and moved to the aortic root, because (1) the patient had a history of paroxysmal atrial fibrillation, however, only as an isolated...
event 2 years ago, and she was not on medication, and smoke-like echoes were observed in the left atrial appendage; (2) paradoxical embolism was unlikely because right-to-left shunting of flow through the PFO could not be demonstrated using an agitated saline bubble study during isometric tension; (3) vessel wall disorders such as erosive lesions, atheromatous plaques, or dissection were not detected with TEE or MDCT; and (4) deep venous thrombus was not detected by lower extremity venous Doppler. The presence of coagulation disorder cannot be ruled out because both activity of protein C and amount of protein S were low (25% and 51%, respectively).

Although the definitive cause of the hypoxemia remains uncertain, acute right-to-left shunt via the PFO, caused by decompensated right ventricular function, is most likely.1 This is further supported by the improvement of the severe hypoxemia and enlargement of the right ventricle after reperfusion of the obstructed RCA (online-only Data Supplement Movie VII). Percutaneous cardiovascular intervention in the early phase of acute myocardial infarction may allow recovery of right ventricular function and decreased right atrial pressure, causing a subsequent reduction and disappearance of the right-to-left shunt flow through the PFO.

Disclosures

None.

Reference


Key Words: acute myocardial infarction ■ multidetector computed tomography ■ thrombosis ■ hypoxia ■ patent foramen ovale
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SUPPLEMENTAL MATERIAL

Movie 1. Transthoracic echocardiography showed hypokinesis of the right ventricular free wall and enlargement of the right ventricle with flattening of the interventricular septum during diastole.

Movie 2. Transthoracic echocardiography showed a thrombus attached to the ostium of the right coronary artery.

Movie 3. Aortography with manual dye injection above the non-coronary cusp showed thrombi in the mid-RCA but not the right coronary sinus of Valsalva. Complete perfusion was successfully achieved after thrombus aspiration.

Movie 4. Transesophageal echocardiography showed a patent foramen ovale with left-to-right shunting.

Movie 5. Transesophageal echocardiography did not show the right-to-left shunting of flow through the PFO using an agitated saline bubble study during isometric tension, such as coughing, lifting or a forceful Valsalva maneuvers.

Movie 6. Smoke-like echoes were observed in the left atrial appendage using transesophageal echocardiography, but thrombi were absent.
Movie 7. Transthoracic echocardiography revealed the improvement of the right ventricular free wall motion and enlargement of the right ventricle after reperfusion of the obstructed RCA.