In a 77-year-old man with apical hypertrophic cardiomyopathy and nonsustained ventricular tachycardia, a pulmonary nodule in the right middle lobe was incidentally detected on a chest computed tomography (CT), which was performed for screening purposes of the interstitial pneumonia as a side effect of amiodarone. To establish the diagnosis of lung cancer, the patient was admitted to undergo a CT-guided transthoracic needle biopsy of the lung.

The procedure was performed by an experienced pulmonologist using the 18-gauge outer coaxial needle of a disposable core biopsy instrument under CT guidance. The patient was placed in a supine position for the procedure. The biopsy needle was advanced into the lesion, and a specimen was successfully obtained (Figure 1A). Immediately after removing the biopsy needle followed by a postprocedure CT, the patient coughed, discharged a small amount of bloody phlegm, and developed chest pain. Then, he lost consciousness and developed shock with severe hypotension and decreased oxygen saturation. After he was administered 100% oxygen through a mask and received a large quantity of hydration, a chest CT was obtained again for suspected pulmonary hemorrhage or pneumothorax. The CT imaging revealed a small pulmonary hemorrhage and a small pneumothorax in the right lung (Figure 1B). At that time, an electrocardiogram (ECG) showed bradycardia with ST-segment elevation. Therefore, a 12-lead ECG was obtained and showed complete atroventricular block and ST-segment elevation in leads II, III, and aVF (Figure 2). On closer examination, both the first and second CT scans showed a massive air embolism extending from the ostium to the midportion of the right coronary artery (RCA), as well as the existence of air in the ascending aorta and the left ventricular apex (Figure 3).

The patient underwent coronary angiography for the diagnosis of a coronary air embolism with temporary pacing and also received intravenous catecholamine support. Angiography showed that the main RCA vessel had already recanalized with slow flow, but the coronary flow in the right ventricular branch and in the posterior descending branch was still interrupted (Figure 4A; Movie I in the online-only Data Supplement). Coronary aspiration and the selective injection of vasodilators via an aspiration catheter into the occluded branches were performed. After these procedures, angiography demonstrated the recovery of coronary flow (Movie II in the online-only Data Supplement); his ECG recovered to sinus rhythm, and the ST-segment elevation resolved.

Figure 1. A, CT image during the biopsy showed the biopsy needle being introduced into the right lung nodule. B, The repeated CT image showed only a small amount of pulmonary hemorrhage (arrow) and a small pneumothorax (arrowhead) in the right lung.
(Figures 4B and 5). The patient’s symptom also gradually resolved.

After the coronary intervention, a whole-body CT scan was performed and showed no residual air in the aorta, the left ventricle, or the coronary arteries. In addition, no apparent embolism was detected on a brain CT scan, although a brain magnetic resonance image 5 days later showed a small subclinical cerebral infarction in the right parietal lobe. The peak creatine kinase level was 1346 IU/L 10 hours after the event, and an echocardiography showed mild hypokinesis in the inferior wall with preserved left ventricular systolic function. The histological diagnosis of the biopsy specimen was adenocarcinoma. The patient was discharged on day 13 and successfully underwent thoracoscopic right middle lobectomy 5 weeks later.

The CT-guided transthoracic needle biopsy is widely performed to establish a histological diagnosis of lung tumors. The major complications of this procedure are pneumothorax and pulmonary hemorrhage, which are often self-limiting. Systemic air embolism is recognized to be an extremely rare but potentially fatal complication, with an incidence of 0.07%. The possible mechanisms of this fatal complication include direct exposure of pulmonary vein to the atmosphere through the needle, bronchovenous fistula formation attributable to the needle puncture, and air penetration from the pulmonary arterial circulation to the pulmonary vein via the

Figure 2. Twelve-lead ECG demonstrated a complete atrioventricular block and ST-segment elevation in leads II, III, and aVF.

Figure 3. A, The first CT image showed a massive air embolism extending from the ostium to the midportion of the RCA (arrow). B, Sagittal view of the first CT image also showed a massive air embolism of the RCA (arrow). C and D, The repeated CT image showed air embolisms in ascending aorta (arrowhead) (C) as well as in the RCA (arrow) and the left ventricular apex (arrowhead) (D).
pulmonary microvasculature.\textsuperscript{2,3} Previous reports have suggested that possible strategies for preventing the occurrence of systemic air embolism include avoiding coughing and straining during the procedure, positive-pressure ventilation, and biopsy through cystic or cavity lesions.\textsuperscript{2,3} There is no specific established treatment other than supplying 100% oxygen and hyperbaric oxygen therapy, although prompt coronary intervention for air embolism was effective in our case.\textsuperscript{2,3} Close monitoring of the ECG and performing the biopsy procedure with rapidly available angiography and necessary interventions are necessary for the prompt detection and treatment of systemic air embolism.

**Disclosures**

None.

**References**


**Figure 4.** A, Coronary angiography of the RCA showed the coronary flow interruption in the right ventricular branch (arrowhead) and in the posterior descending branch (arrow). B, Final angiography showed recanalized coronary flow in the right ventricular branch (arrowhead) and in the posterior descending branch (arrow).

**Figure 5.** Twelve-lead ECG after percutaneous intervention demonstrated the recovery to sinus rhythm and the ST-segment elevation resolution.
Coronary Air Embolism and Cardiogenic Shock During Computed Tomography-Guided Needle Biopsy of the Lung
Tetsuma Kawaji, Hiroki Shiomi, Yosuke Togashi, Daigo Gunji, Masao Imai, Takahiro Doi and Takeshi Kimura

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