

Systemic Air Embolism Following Diagnostic Bronchoscopy

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Abstract

A 51-year-old man was admitted to have a nodule evaluated using chest computed tomography (CT). Shortly after curetting and transbronchial biopsies via bronchoscopy, hypotension, bradycardia, unconsciousness, and left hemiplegia appeared and resolved within one hour. Head CT showed cerebral air embolism. The following day, lower left quadrant pain developed. Pneumatosis intestinalis on abdominal CT and elevation of creatine kinase and troponin T levels indicated air embolism in the mesenteric and coronary arteries. Some reports have documented cerebral air embolism alone after bronchoscopy; however, we should consider systemic air embolism, even when encountering a patient without specific symptoms related to any organ.

Key words: diagnostic bronchoscopy, systemic air embolism, cerebral air embolism

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Introduction

Diagnostic flexible bronchoscopy is a widely used and safe procedure. Asano et al. reported that the Japanese survey for complications associated with respiratory endoscopy showed a mortality rate of 0.004% and a complication rate with forceps biopsy of 1.93% (1). Major complications included pneumothorax, hemorrhage, pulmonary infections, deterioration of bronchial asthma, respiratory failure, lidocaine intoxication, arrhythmia, and cardiac arrest.

Cerebral air embolism is another complication that may occur during interventional bronchoscopy such as laser operations (2); however, the frequency of this complication in diagnostic bronchoscopy is unknown. Azzola et al. reported a <0.02% incidence of cerebral air embolism following diagnostic bronchoscopy at their institution (3).

The prognosis of patients experiencing air embolism is extremely poor (3). If air enters the vessel, air embolus can occur in multiple organs, but there are no reports of air embolism occurring in regions other than the brain.

We herein report a case of air embolism in multiple organs associated with diagnostic bronchoscopy.

Case Report

A 51-year-old man suffering from diabetes mellitus with insulin therapy and diabetic nephropathy was referred to our institution for the investigation of abnormal findings on a chest radiograph. He was a current smoker (30 packs/year).

An apical segment right upper lobe cavitory nodule was detected on thoracic computed tomography (CT). We could not detect any large vessels, including the pulmonary veins that penetrated the nodule (Fig. 1).

Although the patient was suspected of having pulmonary tuberculosis, a sputum smear for acid-fast bacilli was negative on three examinations. Therefore, we performed flexible bronchoscopy in a supine position without intravenous sedation.

No endobronchial abnormalities were detected, and curettage was performed twice and transbronchial lung biopsy (TBLB) four times under fluoroscopic guidance. During bronchoscopy, he had no coughing or major bleeding events, and no pneumothorax on a radiography fluoroscopic examination immediately after bronchoscopy. Rapid on-site evaluation of cytology revealed many inflammatory cells and no malignant cells. The total duration of bronchoscopy was about 30 minutes. During bronchoscopy, the patient remained in the supine position.



Figure 1. Chest CT from a previous institution. A cavitary nodule was detected in the right upper lobe.



Figure 2. Head CT after bronchoscopy. Air embolized in the left occipital lobe.



Figure 3. Abdominal CT revealed pneumatosis intestinalis (arrow) of the descending colon.

Immediately after completion of bronchoscopy, his blood pressure decreased to 60/40 mmHg, heart rate decreased to 30 bpm, and oxygen saturation dropped to 70%. A neurological examination revealed a Glasgow Coma Scale (GCS) score of 3/15 points. Hypotension and bradycardia quickly recovered after fluid resuscitation. His level of consciousness improved to GCS 9/15 points; however, left hemiplegia appeared. We suspected an intracranial lesion, and indeed, head CT taken 15 minutes after TBLB showed cerebral air embolism (Fig. 2). Fifteen minutes after head CT, brain magnetic resonance imaging (MRI) on sequences of diffusion-weighted images (DWI) showed hyperintense lesions predominantly located around the air density on CT, which was compatible with air embolism. The patient's level of consciousness improved to GCS 15/15, and the left hemiplegia completely recovered within 1 hour after bronchoscopy. He had no other symptoms. After bronchoscopy, chest radiography revealed that the target lesion had enlarged.

The following day, lower left quadrant pain developed. Abdominal CT revealed pneumatosis intestinalis of the descending colon (Fig. 3). In addition, serum creatine kinase and troponin T levels were elevated. Electrocardiogram demonstrated inverted T waves (Fig. 4). Echocardiography revealed no abnormal cardiac wall motion. We considered air embolism in the inferior mesenteric artery and the right

coronary artery. The next day, his abdominal pain and laboratory abnormalities improved with maintenance transfusion and fasting.

A few days later, *Mycobacterium tuberculosis* was cultured on bronchoscopy specimens. He was therefore administered anti-tuberculosis drugs, and thereafter the nodule shrank.

Discussion

We herein report a patient who was diagnosed with pulmonary tuberculosis and developed systemic air embolism following uneventful bronchoscopy with curettage and TBLB.

At our institution, 10,702 flexible bronchoscopies were performed from April 2005 to December 2015. We have observed 2 cases of cerebral air embolism during this period, an overall incidence of 0.019% (Tsuji et al. unpublished results). This rate is similar to that mentioned in Azzola's report (3).

We performed curettage and TBLB, which are the most common methods for performing a biopsy of peripheral lung lesions. Because air embolism developed immediately after TBLB, we believe that TBLB rather than curettage was the most likely cause. Air embolization requires the presence of two factors: a portal for entry into a blood vessel and a pressure gradient to drive gas into the blood vessel (4). In the present case, the number of biopsies performed and the amount of biopsied tissue was the same as that performed usually. In addition, we performed diagnostic bronchoscopy without sedation and used anesthesia only at the mucus membrane, and the patient did not have any significant coughing or bleeding events during bronchoscopy, even without sedation. We were unable to accurately determine the source of the two factors of air embolism, and there may be other unknown factors.

In the present case, we found pneumatosis intestinalis of

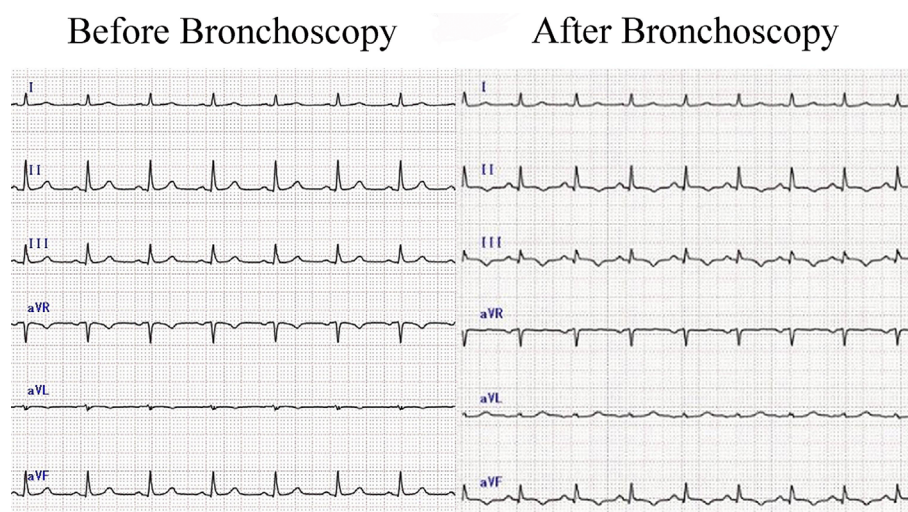


Figure 4. The left panel shows electrocardiogram before bronchoscopy, and the right panel shows electrocardiogram the day after bronchoscopy. Electrocardiogram after bronchoscopy showed inverted T waves in II, III, and aVf.

the descending colon and elevated levels of serum creatine kinase (CPK) and troponin T. Electrocardiogram demonstrated inverted T waves. We considered air embolism in the inferior mesenteric artery and the right coronary artery. One might argue that these findings were not specific to arterial air embolism. Indeed, in acute cerebrovascular accidents, non-specific electrocardiographic changes and elevation of the levels of these serum enzymes have been reported (5-8). However, in previous reports, about 90% of arrhythmia cases associated with cerebral infarction included tachycardiac arrhythmia (5). In contrast, in the present case, the patient had bradycardia. Therefore, we believe that air embolism occurred in the inferior mesenteric artery and the right coronary artery.

Accumulating evidence has shown that the prognosis of patients experiencing air embolism after bronchoscopy is poor (3, 9). Fortunately, our case did not have any permanent damage, because only a small volume of air entered into the pulmonary vein. In general, the definitive therapy of air embolism is hyperbaric oxygen. We considered hyperbaric oxygen; however, the patient improved quickly, and therefore no definitive therapy was needed.

In conclusion, we herein presented a case of air embolism in multiple organs during diagnostic bronchoscopy. When an air embolism is detected in an organ, other organs should be examined as well.

The authors state that they have no Conflict of Interest (COI).

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