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CASE REPORT

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Air embolism after transbronchial lung cryobiopsy: A case report

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Abstract

A 76-year-old woman underwent transbronchial lung cryobiopsy (TBLC) and transbronchial lung biopsy (TBLB) for examination of interstitial infiltrates. After the examination, the patient's consciousness became clouded, and head computed tomography showed an air embolus. She was started on 100% oxygen, and her consciousness improved, but she remained hemiplegic on the left side and dysphagic. Vascular air embolism (VAE) is a rare but serious complication. Although cases of VAE have been reported with conventional transbronchial forceps biopsy, cases of VAE after TBLC are quite rare, and thus this case is reported.

KEYWORDS
air embolism, CT-guided lung biopsy, transbronchial forceps biopsy, transbronchial lung cryobiopsy (TBLC)

INTRODUCTION

Transbronchial lung cryobiopsy (TBLC) is a relatively new bronchoscopic technique that allows for larger tissue samples and fewer crush artefacts to the tissue samples compared to transbronchial forceps biopsy. Recent reports showed that the diagnostic yield of TBLC is 91%, which is useful in the diagnosing of diffuse parenchymal lung disease (DPLD).[1] However, bleeding and pneumothorax requiring drainage are complications of cryobiopsy in 3.8%–16% and 6.3%–9.5% of cases, respectively,[1–3] with a slightly higher rate of bleeding than conventional transbronchial forceps biopsy. Therefore, prophylactic procedures for haemorrhage control are recommended when performing TBLC for DPLD.[4]

Another complication of conventional transbronchial forceps biopsy is vascular air embolism (VAE). In particular, coronary VAE and cerebral VAE are severe complications with high mortality rates, although they are relatively rare, and reports of air embolism after TBLC are minimal, with some reporting a 0.4% incidence.[5] A case of VAE after TBLC for DPLD is presented.

Case report

A 76-year-old woman with no smoking history presented to our hospital with a chief complaint of dyspnoea. Thoracic computed tomography (CT) showed reticular shadows in the bilateral lower lobes and consolidations in the lingula of the left lung. Bronchoscopy was performed under conscious sedation with midazolam (total 5.0 mg) and fentanyl (total 0.08 mg). The procedure was done under oral 8.0-mm diameter uncuffed endotracheal intubation. Bronchoscopes was 1TQ290®; OLYMPUS and cryoprobe was 1.9-mm diameter ERBECRYO®2; Erbe Elektromedizin Gmb. The biopsy site was decided by views of anterior–posterior and about a 45° oblique X-ray. TBLC was performed in the left lower lobe for a freezing time of 7 s with a bronchial balloon blocker for bleeding prophylaxis. The balloon was four french Fogarty Catheter® (E-080-4F); Edwards Lifesciences. TBLB was performed four times in the lingula of the left lung. Neither severe bleeding nor coughing occurred during the procedure, and prophylactic balloon for less than 30 s. Blood pressure did not change during and after the procedure. The patient had an oxygen demand of 2 L/min before the procedure, increasing to 7 L/min during the procedure for a temporary decrease, but managed to return to 2 L/min after the procedure. An X-ray immediately after biopsy showed no pneumothorax. After the procedure, flumazenil was administered, but the patient remained somnolent. Three hours after the examination, the patient's state of consciousness was slowly improving, but 1 h later, just after walking to the toilet, the patient's state of consciousness deteriorated to Glasgow Coma Scale: E1V2M4 and spasms

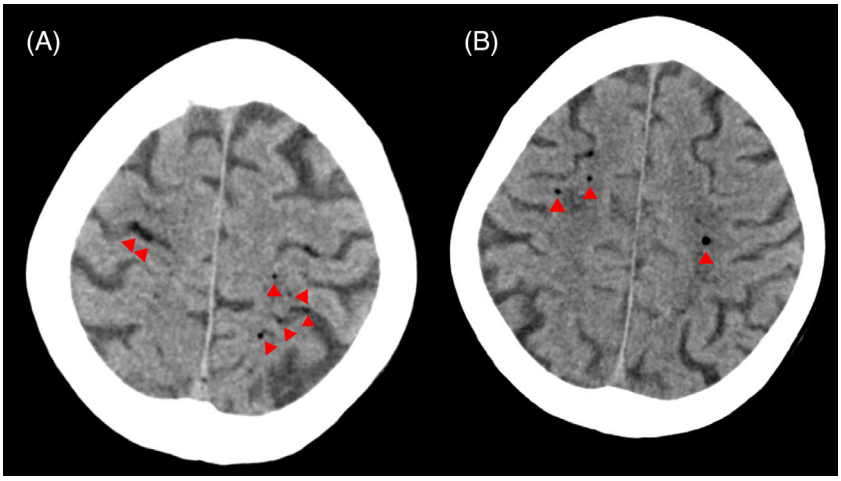

FIGURE 1 (A, B) Computed tomography imaging shows dots and lines of air (arrowheads) around the parietal lobe and precentral gyrus

of the upper and lower extremities appeared. CT and MRI of the brain showed findings suggestive of air embolism (Figure 1). She was started on 100% oxygen and levetiracetam. The next day, the patient's consciousness remained unchanged. The air was no longer seen on MRI, but cerebral edema was seen in the parietal lobes (Figure 2). The patient was started on steroid and glycerol therapy. Her consciousness slowly improved, and 7 days after onset, her disorientation improved to Glasgow Coma Scale: E4V5M6. However, the patient still had left upper limb paralysis and dysphagia, and was transferred to a rehabilitation hospital.

DISCUSSION

VAE after bronchoscopy is an uncommon but serious complication. TBLC has a higher rate of hemorrhagic complications than conventional transbronchial forceps biopsy because of its larger tissue size, so one should be careful about VAE, as well as haemorrhage and pneumothorax. This is the first case of VAE after TBLC at our institution. Since the number of cases of TBLC is smaller than that of conventional biopsy, it is important to accumulate more cases in the future.

VAE causes serious symptoms due to occlusion of cerebral arteries, coronary arteries, and other cardiovascular arteries. The entry of air into the cardiovascular system is required for direct traffic between the pulmonary veins and lumina, such as alveoli and bronchioles, as well as a pressure gradient that allows gas to flow into the venous annulus.[6] However, pathology does not always show the pulmonary veins, and the cause is unknown in some cases.[7] In this case, the collected tissue showed fine venules, but no large veins.

The risk of developing VAE has been reported in CT-guided lung biopsies, severe bleeding, biopsies from the lower lobes, larger biopsy needles, and procedures for local airway wall lesions, such as laser, argon plasma coagulation therapies, and thermal ablation are associated with a higher risk of developing VAE.[6,8,9] As with CT-guided biopsy, TBLC can result in a higher risk of VAE because of the large size of the tissue, which can result in a fistula with the pulmonary vein and possible fistula with the air space.

Symptomatic VAE with cerebrovascular or cardiovascular air has a poor prognosis, with a mortality rate of 26.4%–28%.[67] However, many cases of asymptomatic VAE have been reported in CT-guided lung biopsies, and the prognosis is very good.[10] When a lung biopsy is performed, CT imaging is not routinely performed in asymptomatic cases. Thus, it is suggested that asymptomatic cases with air entering the vessels may be more common.

Systemic VAE is often present with neurological and cardiovascular symptoms. In particular, neurological symptoms were seen in 97% of patients, and cardiovascular symptoms such as arrhythmia, chest pain associated with myocardial infarction, hypotension, and cardiac arrest were reported in 28% of patients. The onset of symptoms is usually within 30 minutes of biopsy, although in 28% of cases, there is delayed loss of consciousness or hemiparesis after sedation is withdrawn.[6] In the present case, the onset of the infarction occurred after the patient started walking, and it is thought that intracardiac air caused the infarction to the cerebral artery during positional change from supine to upright.

Administration of 100% oxygen is the recommended treatment for VAE, but positive pressure should be limited when tracheal intubation is used. Although there are physiological mechanisms supporting the use of hyperbaric oxygen therapy, which is thought to reduce the influx of gas into the vessels, the therapeutic effect is controversial.[6] Patient positioning is also a factor in air embolization. For example, if the right ventricular outflow tract is obstructed by air, cardiac collapse can lead to hypotension. In this situation, the left lateral decubitus and Trendelenberg's position (Durant's manoeuvre) helps to relieve cardiopulmonary collapse by allowing airflow from the right ventricular outflow tract to the right atrium.[11] The patient was treated with 100%

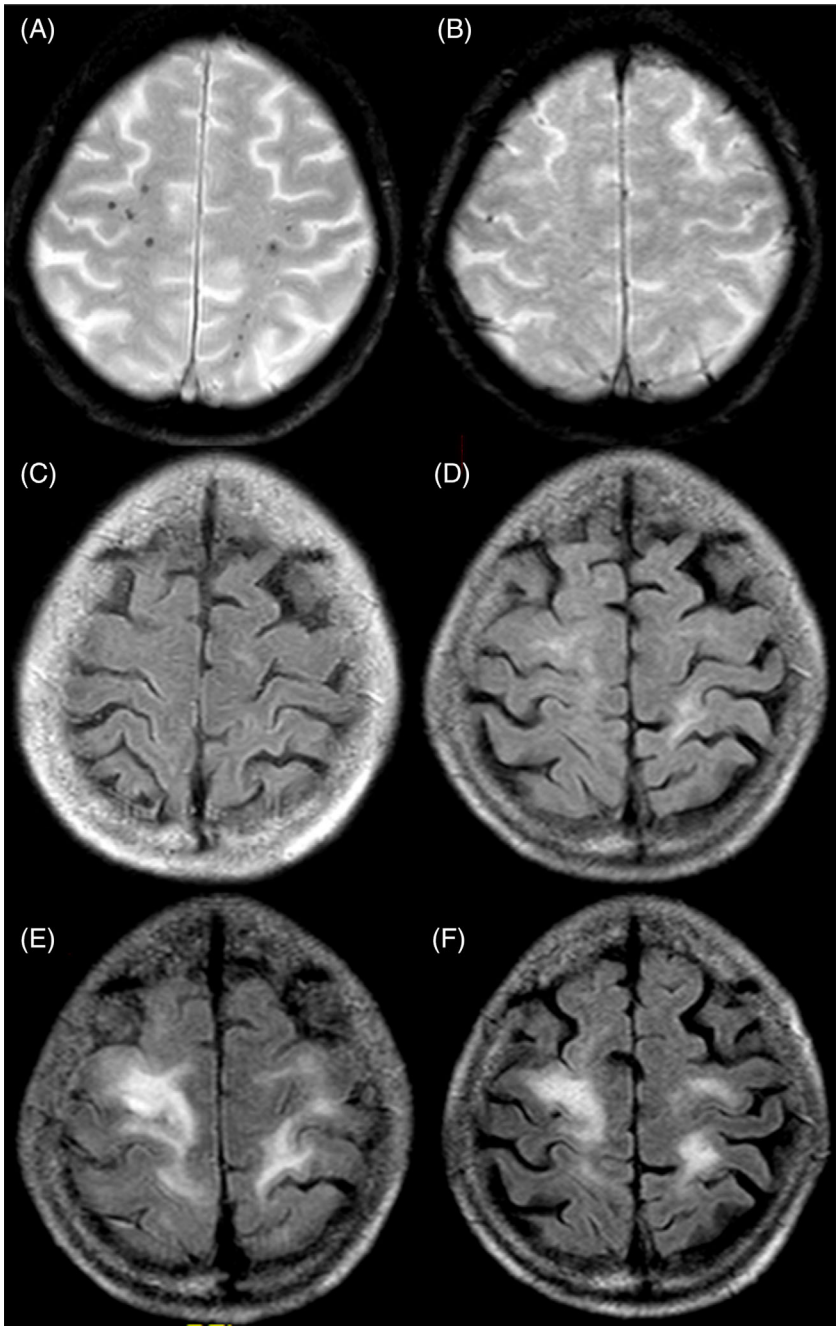

FIGURE 2 (A, B) MRI(T2*WI). Panel A is MRI just after onset. Sporadic low-signal intensity areas are seen on T2*WI, mainly in the bilateral deep watershed and boundary regions. Panel B is MRI 14 h after onset. A DWI high-signal intensity area emerges along the right parietal and precentral dorsal cortex. Air has disappeared. (C–F) MRI (FLAIR). Panels C–F show MRI just after onset, 14 h later, 6 days later, and 14 days later, respectively. Panel C does not show infarction. Panel D shows high signal intensity in the right parietal region and dorsal cortex of the precentral region, which is swollen. Panel E shows FLAIR high-signal intensity in areas consistent with grey matter, where air was seen on CT. Panel F shows the remaining FLAIR high-signal intensity area, but it has partially diminished

oxygen and showed gradual improvement in consciousness, but mild hemiplegia remained.

In conclusion, a relatively uncommon case of VAE that developed after TBLC was described. VAE with systemic symptoms is an uncommon complication, but it is critical and can occur in TBLC, so physicians should pay attention to the appearance of symptoms. In addition, it is essential to provide adequate informed consent before the procedure and prepare emergency protocols in case of suspected VAE.

AUTHOR CONTRIBUTIONS

Masanori Kawataki: conception and design, acquisition of data, drafting of the manuscript. **Yosuke Nakanishi**: conceptualization. **Takashi Niwa**: supervision and conceptualization. **Tadashi Ishida**: writing-review and editing.

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CONFLICT OF INTEREST

None declared.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

The authors declare that appropriate written informed consent was obtained for the publication of this manuscript and accompanying images.

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