

# Cerebral air embolism associated with lung cancer invading the pulmonary vein, left atrium, and main bronchus

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## Abstract

Cerebral air embolism caused by lung cancer is extremely rare, especially if not associated with invasive procedures such as needle biopsy. We describe the case of an 86-year-old man with squamous cell lung carcinoma of the left lung. He developed a bad cough and subsequently suffered left hemiplegia. Brain computed tomography (CT) on admission showed no abnormal findings. Diffusion-weighted magnetic resonance (MR) imaging revealed high intensity lesions in the right frontal lobe and right parietal lobes. Repeated brain CT revealed air densities around the high intensity lesions on previous MR imaging, compatible with air embolism causing cerebral infarction. Chest CT confirmed a left pulmonary hilar mass invading the left pulmonary vein, left atrium, and main bronchus. Air densities were found in the left heart ventricle. These radiological findings were attributed to cerebral air embolism associated with advanced lung cancer. Shortly afterwards he died of progressive respiratory failure. Our case reveals two important aspects. First, cerebral air embolism can be caused by lung cancer invading the pulmonary vein, left atrium, and main bronchus without iatrogenic causes. Therefore, we should pay special attention to the etiology when the patients with lung cancer in the advanced stage developed cerebral infarction. Second, repeated CT is recommended if cerebral air embolism is suspected because initial head CT does not always reveal air bubbles.

**Keywords:** Cerebral air embolism, stroke, lung cancer

## INTRODUCTION

We recently experienced a rare case of cerebral infarction caused by cerebral air embolism. Cerebral air embolism is a rare complication of invasive procedures such as percutaneous transthoracic lung biopsy.<sup>1</sup> Cerebral air embolism caused by lung cancer is extremely rare, especially if not associated with invasive procedures such as needle biopsy.<sup>1-4</sup> The pathway introducing the air emboli remains just speculation in most cases. Our patient was diagnosed with lung cancer invading the pulmonary vein, left atrium, and main bronchus, and subsequently developed cerebral air embolism. Radiological and autopsy findings confirmed the pathway of the air emboli in this case.

## CASE REPORT

An 86-year-old man received chemotherapy and radiation therapy for squamous cell lung carcinoma of the left lung in the advanced

stage. Two years after the radiation therapy, he developed a bad cough and subsequently suffered left hemiplegia. He was immediately transferred to our hospital by ambulance. Brain computed tomography (CT) on admission showed no abnormal findings. Diffusion-weighted magnetic resonance (MR) imaging revealed high intensity lesions in the right frontal and parietal lobes. MR angiography showed no evidence of major artery occlusion. He suffered generalized tonic-clonic seizure eight days after admission. Repeated brain CT revealed air densities around the hypodense lesions detected on the previous CT, which were compatible with air embolism causing cerebral infarction (Figure 1A). For further investigation of air embolism, chest CT confirmed a left pulmonary hilar mass invading the left pulmonary vein, left atrium, and main bronchus (Figure 1B). Furthermore, air densities were found in the left ventricle of the heart (Figure 1C). These radiological findings were attributed to cerebral air embolism associated with advanced lung

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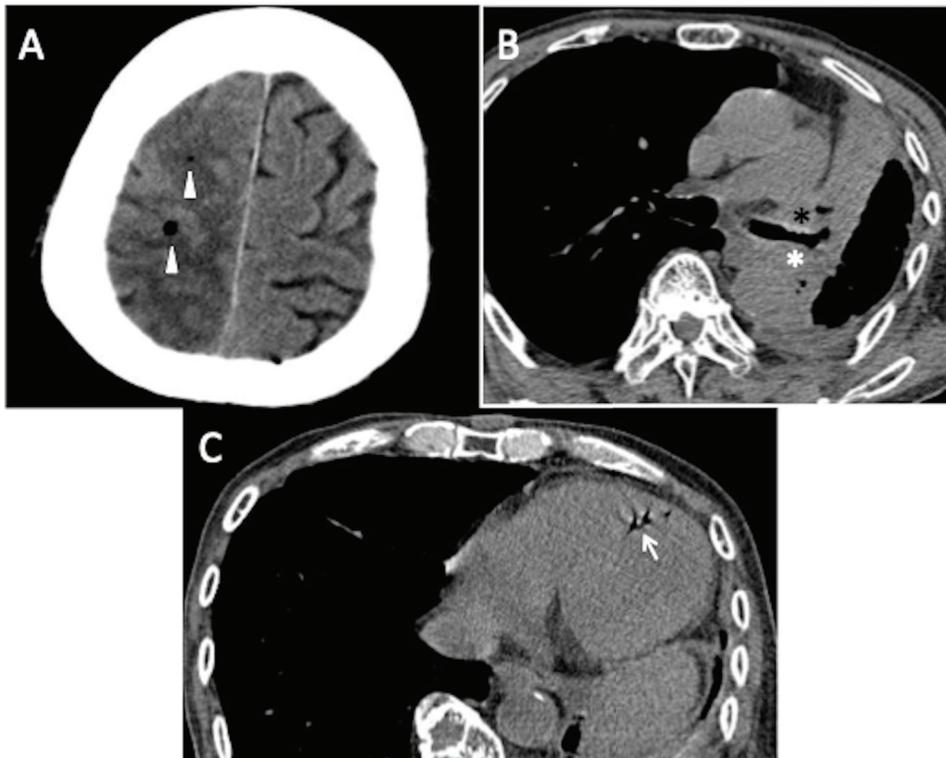


Figure 1. Brain CT scan on hospital day 8 showing air densities (arrowhead) around the infarct areas (A). Chest CT scan showing the left pulmonary hilar mass invading the left pulmonary vein (black asterisk), left atrium (white asterisk), and main bronchus (B). Chest CT scan showing air densities (arrow) in the left heart ventricle (C).

cancer. Based on the grave prognosis, he received supportive treatment. He died of progressive respiratory failure on hospital day 14. Autopsy confirmed the presence of squamous cell lung carcinoma of the left pulmonary hilum invading the left pulmonary vein, left atrium, and main bronchus, confirming the radiological findings.

## DISCUSSION

This case clearly demonstrates the presence of cerebral air embolism from advanced lung cancer invading the pulmonary vein, left atrium, and main bronchus. Only three cerebral air embolism cases caused by lung cancer without invasive procedures have been reported.<sup>2-4</sup> Air embolism requires two conditions: communication between the air and the blood vessel, and pressure gradient favoring the passage of air into the circulation. In this case, radiological and autopsy findings confirmed that the air entered the systemic circulation through a fistula between the main bronchus, tumor cavity, and pulmonary veins during increased intrathoracic pressure caused by coughing.<sup>4,5</sup> The air bubble then passed into the left heart ventricle

and subsequently occluded the cerebral circulation resulting in cerebral infarction. Coughing can increase airway pressure and cause cerebral air embolism in patients with idiopathic pulmonary fibrosis, emphysema, lung cancer, and after biopsy of the lung even if the fistula is very small.<sup>4,5</sup>

Initial head CT showed no obvious air bubbles in the brain, suggesting that the initial embolic source was a small amount of air. Therefore, repeated CT for early diagnosis is recommended if cerebral air embolism is suspected.

In conclusion, our case revealed two important aspects. First, cerebral air embolism can be caused by lung cancer invading the pulmonary vein, left atrium, and main bronchus without iatrogenic causes. Second, repeated CT is recommended if cerebral air embolism is suspected because initial head CT does not always reveal initially small air bubbles.

## DISCLOSURE

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