CASE REPORT

Air Embolism Detected During Computed Tomography Fluoroscopically Guided Transthoracic Needle Biopsy

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Abstract

Air embolism is a rare but potentially fatal complication of percutaneous needle biopsy of the lung. We report a case of cerebral air embolism which occurred during computed tomography (CT)guided needle biopsy. Air entering the aorta is depicted on CTfluoroscopy images of the procedure.

Key words: Air embolism—Computed tomography (CT)—CTguided biopsy—Lung biopsy—Needle biopsy—Complications

Computed tomography (CT)-guided lung needle biopsy is a common diagnostic procedure for evaluating pulmonary lesions. The most frequent complication is pneumothorax, followed by pulmonary hemorrhage and hemoptysis [1]. Air embolism is an extremely rare but potentially fatal complication [2]. We present a case of cerebral air embolism in a 69-year-old woman which occurred during CT-guided lung biopsy. Air entering the aorta is depicted on CT-fluoroscopy images of the procedure.

Case Report

A 69-year-old woman was admitted to our hospital for evaluation of an abnormal opacity on a conventional chest radiograph taken as part of an annual health check-up. A chest CT scan (5 mm thickness; Hispeed CT/i, GE Yokogawa Medical System, Tokyo, Japan) showed a well-marginated nodule 0.8 cm in diameter in the upper lobe of the right lung. The patient was a nonsmoker and serum tumor markers such as squamous cell carcinoma related antigen (SCC), neuron specific enolase (NSE), carcinoembryonic antigen (CEA), and cytokeratin 19 fragment (CYFRA) were not elevated. Although findings were not suggestive of malignancy, CT-guided biopsy was requested to establish the diagnosis (Fig. 1A).

The patient was placed in the supine position and the pulmonary nodule was localized using CT. Under CT-fluoroscopy guidance (1 sec per rotation, 5 mm thickness; Hispeed CT/i, GE Yokogawa Medical System) with a step-and-shoot approach, a 15 cm, 18G automated cutting needle (TEMNO II, Allegiance Healthcare, Tokyo, Japan) was inserted into the lesion using a single-needle technique. At first, the needle was situated medial to the nodule and we did not sample the lesion here (Fig. 1B). The needle was repositioned as shown in Fig. 2, the inner stylet extended into the lesion,

and a specimen acquired (Fig. 2). The patient did not cough during the procedure. Immediately after the procedure was completed, she became unresponsive and hypotensive. Resuscitation was begun in the supine position. Her heart rate and blood pressure returned to normal, but she did not regain consciousness. A chest CT scan showed pulmonary hemorrhage along the needle pathway and a small amount of pleural fluid or hematoma, but no air bubble in the vessels. A cranial CT scan showed small air bubbles in the right cerebral arteries (Fig. 3).

The patient was transferred to a hyperbaric-oxygen chamber within 60 min of the event. After the treatment she became gradually alert, but left hemiplegia became apparent. Cranial magnetic resonance (MR) images, including diffusion-weighted images, obtained 3 hr and 6 hr after the event, did not show any evidence of acute infarction. One week after the event, cranial MR images were repeated and cerebral infarction was observed in the right frontal lobe (Fig. 4). After rehabilitation therapy, hemiplegia improved markedly.

The pathologic examination of the pulmonary specimen revealed cryptococcosis.

Discussion

CT-guided needle biopsy is a common procedure for evaluating pulmonary lesions. We usually perform procedures according to the clinicians' requests, though we have to remember critical complications, as in this case, may occur on occasion. Radiologists and clinicians should give careful consideration to the indication of needle biopsy based on clinical information, including imaging characteristics of lesions and the clinical risk factors for malignancy, and should consider other methods of evaluation such as short-term follow-up or utilization of other modalities.

There have been many reports concerning various complication of this procedure. The most frequent complication is pneumothorax, reported in about 27% of cases, followed by intrapulmonary hemorrhage (11%) and hemoptysis (7%) [1]. Systemic air embolism is a rare complication, reported in 0.07% of cases, and is potentially fatal [1, 2]. The complication rates associated with an automated cutting needle and fine needle aspiration are similar [3, 4]. In addition, when an on-site cytopathologist is not available, automated biopsy devices provide a lower false negative rate [3].

The mechanism of air embolism in this case was thought to be communication between the airway and a pulmonary vein during a needle biopsy. We suspected there were two possible ways in which air embolism could have occurred: (a) when the needle tip was positioned within a pulmonary vein, communication between

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Fig. 1. A Chest CT scan shows a small opacity in the upper lobe of the right lung. A pulmonary vein is adjacent to the lesion (arrow). B CT-fluoroscopy image shows the biopsy needle might have penetrated the pulmonary vein. A specimen was not taken here.



Fig. 2. CT-fluoroscopy image shows the biopsy needle in the lesion and nondependent air in the ascending aorta (arrow).

the atmosphere and pulmonary vein was created; (b) when the needle penetrated a pulmonary vein and a bronchus or the air-filled portion of a cavitary lesion or a cyst, communication between an airway and a pulmonary vein may have been created. Coughing or a Valsalva maneuver may increase airway pressure, facilitating aspiration of air into the pulmonary vein [2, 5].

After this event, we reviewed the CT-fluoroscopy images carefully and identified nondependent air in the ascending aorta (Fig. 2). During the procedure we were not aware of air entering the aorta. The needle pathway was adjacent to a pulmonary vein (Fig. 1B). The needle we used was airtight, so we believe that the air passage route was a bronchiolar–pulmonary venous communication.

Although air embolism as a complication associated with percutaneous lung needle biopsy has been reported previously [2, 5– 11], this is the first report in which the CT-fluoroscopy images have shown the appearance of air entry during the procedure. This case suggests that air aspiration can be readily detected on CTfluoroscopy, and this possibility is very important because the patient's recovery depends on the early recognition of complications [6, 11, 12].



Fig. 3. Cranial CT scan shows air densities in the branches of the right middle cerebral artery (arrows).

Immediate treatment should include the following: (a) removal of the biopsy needle without tissue sampling, (b) placement of the patient in the flat spine position [12], (c) administration of 100% oxygen, (d) routine supportive measures such as steroid and anticonvulsant therapy, (e) immediate transfer to a hyperbaric oxygen chamber [12].

In conclusion, during CT-guided lung biopsy operators should review images carefully not only for needle tip position but also for possible air entry into the aorta.

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Fig. 4. Diffusion-weighted MR image obtained 1 week after the event shows a high-intensity lesion in the right frontal lobe.

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