Systemic air embolism as a complication of percutaneous computed tomography guided transthoracic lung biopsy

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ABSTRACT

A 57-year-old man underwent prone position computed tomography (CT) guided percutaneous transthoracic lung biopsy. After removal of the 18-gauge biopsy needle, the patient lost consciousness and developed shock. CT showed signs of air embolism in descending aorta and left atrium. Cardiopulmonary resuscitation was unsuccessful. A postmortem CT scan confirmed a massive air embolism in the descending aorta, left ventricle and brain. Systemic air embolism occurs in around 0.001–0.003% of lung biopsy procedures. Recommendations to reduce the risk include requesting the patient to stop breathing during the procedure and preventing the exposure of the outer cannula of a coaxial biopsy needle to the atmosphere.

KEYWORDS

Lung biopsy – Embolism

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Case report

A 57-year-old man with a poorly differentiated Gleason 4 pattern adenocarcinoma of the prostate and absence of any detectable osseous lesion or major comorbidities underwent right-sided computed tomography (CT) guided percutaneous transthoracic lung biopsy for diagnosis of multiple bilateral pulmonary nodules under local anaesthesia. The patient was placed in a prone position (Fig 1). Biopsy technique followed 2003 British Thoracic Society guidelines: a 21-gauge biopsy needle was advanced only during suspended respiration (at end expiration); after removal of the central stylet, a 10-ml syringe was attached. Suction was applied while rotating, advancing and retracting the needle during suspended respiration. No cough occurred during the procedure. Immediately after the procedure, the patient became unresponsive and hypotensive. CT showed air embolism in the descending aorta and left atrium associated with a minimal pneumothorax (Fig 2). Following cardiac arrest, cardiopulmonary resuscitation was undertaken according to the adult advanced life support protocol but was unsuccessful and the patient died. Postmortem CT confirmed a massive air embolism in the descending aorta, left ventricle and brain (Figs 3 and 4). Histology showed metastatic prostate adenocarcinoma to the lung positive for prostate-specific antigen stain.

Discussion

Systemic air embolism is a feared and potentially fatal complication which occurs in around 0.001–0.003% of CT-guided transthoracic lung biopsies.^{1,2} Air embolism may be venous or arterial; systemic venous embolism of small amount of air is usually tolerated and causes no adverse effects, while systemic arterial air embolism from the pulmonary veins into the systemic arterial circulation may be fatal, even for a small quantity of air. Possible mechanisms include the creation of a fistula between the air-containing space and a pulmonary blood vessel; a second mechanism is opening the outer cannula of a coaxial biopsy needle to the atmosphere.

As pulmonary vein pressure is low, and may be even negative in case of biopsied lesions located above the level of the left atrium, it is easy to suppose that patient position may increase the risk of air embolism in cases of accidental pulmonary vein injury, although this supposition is not confirmed in the literature.³ Similarly, other conditions prolonging the exposure of the vessel lumen to the airway can increase the risk of embolism, such as chronic obstructive pulmonary disease and air trapping, cavitary or cystic lesions, pathological states that interfere with the normal haemostatic mechanism or circumstances decreasing pulmonary vein pressure, such as cough and inspiration.

Figure 1 percutaneous computed tomography guided lung biopsy in a patient with multiple pulmonary nodules; the patient is in the prone position.

Figure 3 Post-mortem computed tomography showing a massive air embolism in the left ventricle (supine position).

Figure 2 Radiological evidence of air embolism associated with a minimal pneumothorax.

Figure 4 Post-mortem computed tomography showing a massive air embolism in the descending aorta.

Recommendations to reduce the risk include requesting the patient to suspend breathing during the procedure and the use of a haemostatic valve.

Clinical manifestations of systemic arterial air embolism depend on organ involvement, typically with cardiovascular and neurological symptoms reflecting artery obstruction. CT is the diagnostic tool of choice for any clinical problem during the procedure because the patient is already lying on the scanning bed.

Although prompt recognition and immediate management (such as administration of 100% oxygen, placing the patient in the left lateral decubitus and hyperbaric oxygen therapy) may exclude long-term complications, in some cases systemic air embolism is still fatal, as in the present case. The massive air embolism involving the left ventricle and descending aorta that we describe is extremely rare. Most cases reported are limited to cerebral, spinal or coronary embolism, resulting in stroke or infarction.⁴⁻⁶ In most cases, a minimal air embolism was asymptomatic.⁷ To our knowledge, this is the only case of a sudden death from a massive air embolism of the aorta and left ventricle following a CT-guided transthoracic lung biopsy.

In conclusion, systemic fatal air embolism following CT guided transthoracic lung biopsy is extremely rare. Nevertheless, it can occur despite follows the recommendations of

British Thoracic Society guidelines. Care should be taken in case of air trapping, cavitory or cystic lesions.

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