CASE REPORT

Coronary artery air embolism: a potentially fatal complication of CT-guided percutaneous lung biopsy

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ABSTRACT. CT-guided transthoracic lung biopsy is becoming a widely accepted procedure for the diagnosis of pulmonary lesions. The rate of severe complications following such a procedure has been reported. Of these complications, air embolism is the most likely to be fatal. We report a case of right coronary air embolism resulting in myocardial infarction after a CT-guided percutaneous needle biopsy of the lung. The patient died from underlying malignant disease 4 months later.

Received 2 October 2008
Revised 25 June 2009
Accepted 25 June 2009

DOI: 10.1259/bjr/39096533

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Coronary artery air embolism, a condition with a high mortality rate, mostly results from the iatrogenic introduction of gas bubbles into the bloodstream. Direct injection of air or gas into major arterial vessels during cardiac catheterisation or interventional radiological angiography has been reported; however, it also is a rare complication of CT-guided percutaneous transthoracic biopsy of the lung. In the literature, 19 possible causes for air embolism are listed [1]. Of these, two are generally accepted as the most probable causes: communication of the ambient air with a pulmonary vein via the biopsy needle, or development of a bronchial-venous fistula at the needle tract or site of the core sample. We report a case of air embolism in the aorta and right coronary artery resulting in myocardial infarction after a CT-guided percutaneous needle biopsy of lung.

Case report

A 35-year-old male patient was admitted because of dysphagia and odynophagia; tongue cancer was diagnosed. Neck CT revealed tumour stage: T4N0Mx, at least Stage 4A. A chest X-ray showed multiple cavitary lesions in both lungs and a CT-guided lung biopsy was requested for histopathological diagnosis. The patient was placed in the supine position and a 17-gauge coaxial needle system was chosen for the procedure. Three cutting needle biopsies were performed (Figure 1). After removing the needle there was no obvious pneumothorax or parenchymal haemorrhage; however, air embolism was noted at the proximal

aortic arch and right coronary artery (Figure 2). The patient then experienced syncope and ventricular tachycardia, requiring resuscitation manoeuvres. He was transferred to the intensive care unit for further treatment with positive pressure ventilator and 100% oxygen. A blood biochemistry test 2 h later showed elevated levels of the cardiac enzyme creatine kinase (CK; 43 IU L⁻¹), CK-MB (35 IU L⁻¹), troponin I (0.03 µg L⁻¹), myoglobin (402.7 ng mL⁻¹), blood urea nitrogen (BUN; 56 mg dL⁻¹) and creatinine (2.0 mg dL⁻¹). Troponin I became elevated to 9.35 µg L⁻¹ 18 h after resuscitation. The histopathology revealed fibrosis with focal pigment deposition and pus cells. The patient died 4 months later from tongue cancer.

Discussion

CT-guided transthoracic needle biopsy is becoming a common procedure used mainly to elucidate the nature of pulmonary lesions. The most common complication is pneumothorax, accounting for 20.5% of cases (according to a recent survey from the UK [2]) and 35% from a survey of lung biopsies in Japan [3]. Severe complications, including tumour seeding at the site of the biopsy route, tension pneumothorax, severe pulmonary haemorrhage and air embolism, occur in up to 0.75% of cases [3]. The reported incidence of air embolism ranges from 0.02% to 0.06%, although the real incidence is considered to be higher owing to missed asymptomatic cases [3, 4].

Free gas in the arterial system can cause air embolism in any organ. Embolisation to the cerebral or coronary circulation can result in severe morbidity or death. Embolisation into the coronary arteries induces electrocardiographic changes typical of ischaemia and infarction;

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Figure 1. CT image showing the biopsy needle in the lesion. The patient was lying supine. A 17-gauge coaxial needle system was introduced into the cavitated nodule at the lingula.

dysrhythmias and cardiac arrest can occur [1]. Troponin I is used as the optimal early marker of acute myocardial infarction and elevated levels of troponin I can be detected a few hours after onset [5]. In the case reported here, elevation of troponin I levels were observed 2 h after the diagnosis of coronary artery air embolism, with maximum levels observed 18 h later.

Mansour et al [6] recognise three possible causes for air embolism:

- communication between the pulmonary vein and the atmosphere;
- bronchovenous fistula or other communication between air-containing spaces and pulmonary veins;
- air from the pulmonary arterial system reaching the pulmonary venous circulation by traversing the pulmonary microvasculature.

The presence of cavitation is recognised as a risk factor. Considering that the air was visible in the aorta immediately after the biopsy, we assume that the

mechanism in our case was direct communication between the atmosphere and the vascular system via the biopsy needle with negative intrathoracic pressure pulling atmospheric air into the pulmonary veins.

Trendelenburg's position is suggested when detecting air embolism, although some authors consider that a flat supine position would be sufficient [1, 7]. Hyperbaric therapy is generally suggested to treat systemic air embolism; however, conservative therapy with the administration of 100% oxygen produced significant improvement of the pre-existing systemic air within 4 h in an asymptomatic patient [4]. In our patient, no hyperbaric therapy was applied and he still recovered from the near fatal condition. An unusual observation was that we did not find evidence of cerebral artery air emboli despite his transient left paralysis.

Some authors consider larger needle diameter as a risk factor [8], although others have reported air embolism with both 18-gauge and 22-gauge needles [6]. To prevent inadvertent ingress of air, the biopsy procedure for pulmonary lesions in our institute follows the principle of exchanging the internal stylet of the introducer needle for the biopsy needle immediately, and vice versa. Routine breath-holding during removal of the introducer needle is required for each compliant patient. In fact, there was no arterial air embolism even in uncooperative patients in our hospital; however, we still suggest the present method to prevent possible air-trapping during the procedure.

Air in the aorta or coronary artery is pathognomonic and easy to diagnose on CT images, but can be underdiagnosed in asymptomatic patients.

Conclusion

Coronary artery air embolism is a rare complication of percutaneous transthoracic needle biopsy of the lung; it is potentially fatal even after aggressive and immediate resuscitation manoeuvres. Death due to severe complications of CT-guided biopsy has been reported. We report

(a)

(b)

Figure 2. (a) Air was noted within the aortic root on the non-dependent side with air–fluid level (long arrow). The needle biopsy tract was still visible (short arrow). (b) Transverse cross-section of the right coronary artery. Air was noted within the right coronary artery. There was no pneumothorax.

this case due to the typical radiological findings and compatible clinical conditions, including vital signs and laboratory data with coronary artery air embolism.

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