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Case Report

A case of intermittent CT imaging for up to 2 hours following asymptomatic air emboli due to a CT-guided lung biopsy ☆

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ABSTRACT

Air emboli represent rare but severe complications of computed tomography (CT)-guided lung biopsy (CTLB). No reports exist regarding the behavior of air during the early stages of air emboli. We present a case of air emboli following CTLB, evaluated by intermittent CT over a 2-hour period, spanning from onset to resolution.

A man in his 60s underwent CTLB for diagnosis of a slowly enlarging pulmonary nodule in the right lower lobe. Immediately post-biopsy, chest CT revealed air emboli in the right coronary artery and apex of the ascending aorta. The patient was in the head-down position on the CT table, and intermittent CT scans were performed over a 2-hour period until the air emboli resolved. Subsequently, the patient was discharged without any complications.

Introduction

The primary methods for obtaining specimens for pathological examination of lung nodules include transbronchial lung biopsy (TBLB), computed tomography (CT)-guided lung biopsy (CTLB), and surgical procedures [1]. CTLB is a well-established and diagnostically effective technique [2]. Air embolism is a rare but severe complication of CTLB [3–5], with the potential for myocardial or cerebral infarction, and even mortality [6,7]. Notably, early-stage development of air emboli on CT scans remains unreported. Here, we present a case of air emboli caused by CTLB, tracked intermittently over a 2-hour period on CT scans after their occurrence.

☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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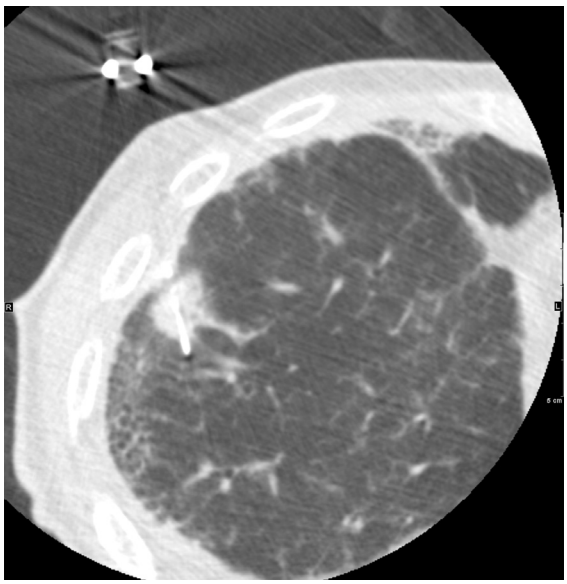

Fig. 1 – Computed tomography (CT) during biopsy. A CT-guided lung biopsy was performed for a pulmonary nodule in the right lower lobe.

Case report

A man in his 60s, with a history of interstitial pneumonia and surgery for bilateral lung cancer, was suspected of having primary lung cancer or metastasis owing to the gradual growth of a nodule in the lower lobe of the right lung, as observed on CT scans. As TBLB did not lead to a diagnosis, CTLB was performed.

In the left half-lateral position, the outer tube of an 18-G core biopsy needle (Bard Mission; Bard Biopsy Systems, Tempe, AZ) was inserted into the nodule under CT fluoroscopy. The biopsy consisted of four 1 cm strokes (Fig. 1). The routine post-procedural whole-chest CT scan immediately after the biopsy revealed a small amount of air in the right coronary artery (Fig. 2A) and at the apex of the ascending aorta (Fig. 2B), which was diagnosed as air emboli. A subsequent head CT did not indicate any intracranial air embolism. Vital signs were within the normal range: pulse rate, 58 beats/min; blood pressure, 135/67 mm Hg; respiratory rate, 19 breaths/min; and oxygen saturation, 99%. No dyspnea or neurological deficits were observed. Electrocardiographic findings were normal.

The patient took a head-down position as far down as possible on the CT table and received 100% oxygen. On the chest

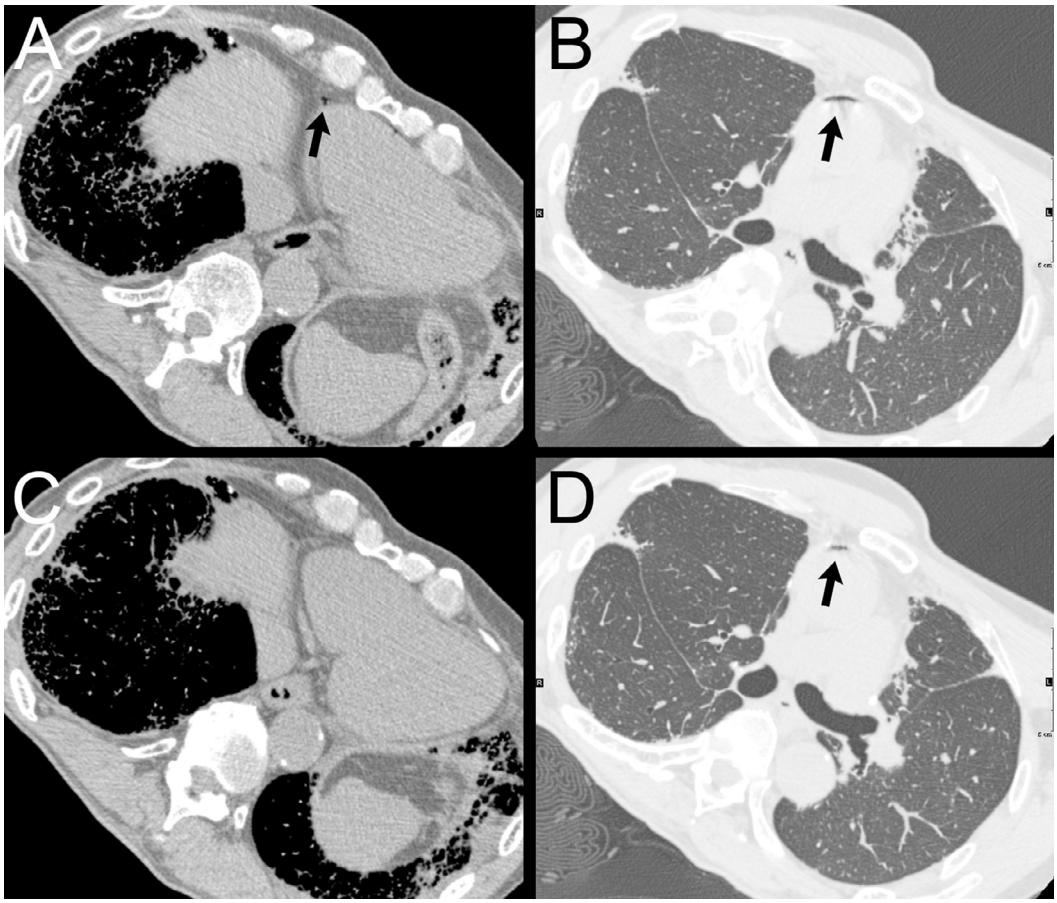

Fig. 2 – Chest Computed tomography (CT) scan immediately after biopsy. Immediately after the lung biopsy, CT images revealed air in the right coronary artery (A, arrow) and at the apex of the ascending aorta (B, arrow). Within 5 minutes, the air in the right coronary artery had dissipated (C), whereas air at the apex of the ascending aorta persisted (D, arrow).

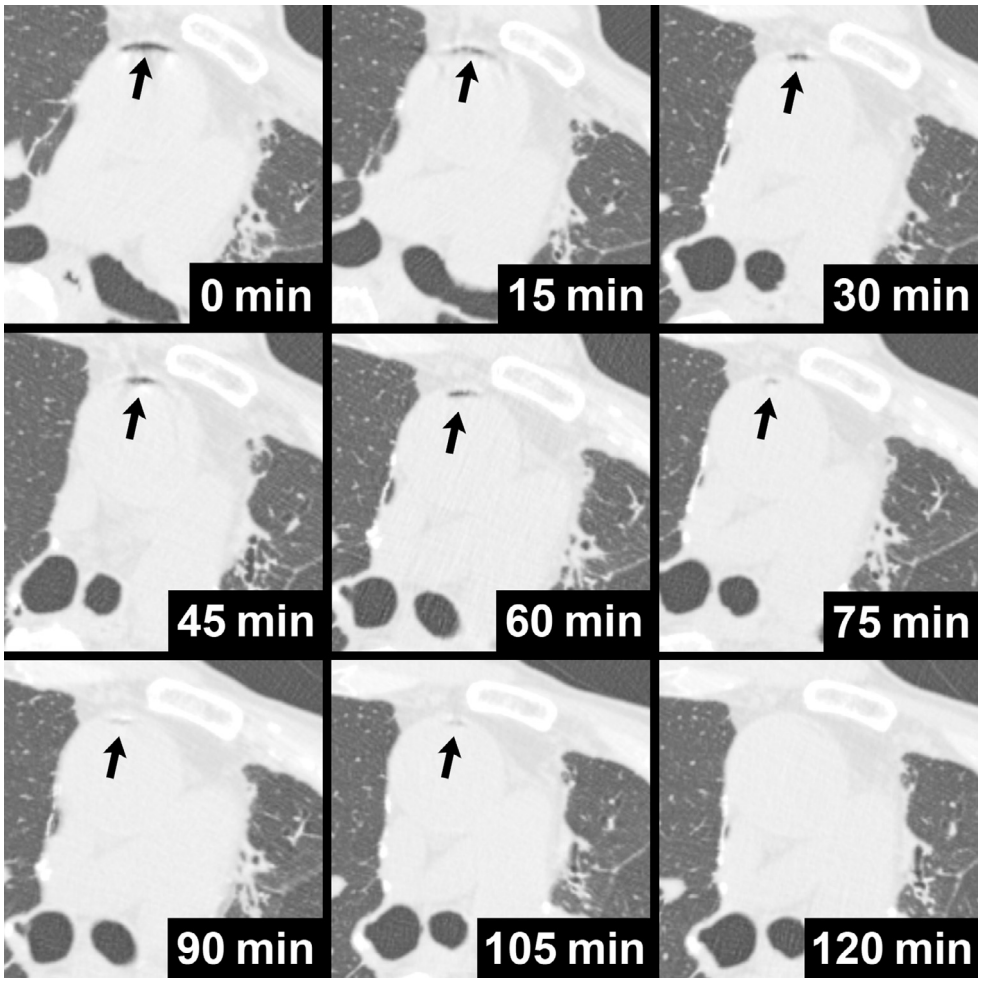

Fig. 3 – Air changes in the ascending aorta up to 2 h after biopsy. Computed tomography (CT) was intermittently performed from the time of air emboli identification, revealing a gradual reduction in the remaining ascending aortic air, which disappeared entirely after 2 hours (arrows).

CT performed 5 minutes later, the air within the right coronary artery disappeared (Fig. 2C), whereas that at the top of the ascending aorta persisted (Fig. 2D). Given the possibility of the air at the top of the ascending aorta migrating towards the brain or entering the circulatory system if the patient moved, the position on the CT table was maintained. Subsequently, another chest CT scan was conducted. Over time, the air at the top of the ascending aorta gradually decreased in the CT images and eventually disappeared in the chest CT conducted 2 hours after the biopsy (Fig. 3). No intracranial air emboli or new strokes were observed on the head CT scan.

After confirming the absence of residual air emboli or new cerebral infarctions on the CT scan the following day, the patient was discharged. The CTLB-diagnosed lung adenocarcinoma was treated with chemotherapy.

Discussion

In our case, we conducted intermittent evaluations of air emboli following CTLB using CT scans, tracking their presence from the moment of occurrence until they disappeared within 2-hours. In this case, air in the right coronary artery and ascending aortic arch were no longer detected in CT scans after 5 minutes and 2 hours, respectively. Although the speed at which air disappears in asymptomatic air emboli remains uncertain, the 2-hours duration observed in this case can serve as a benchmark.

Air embolism is a severe complication of CTLB, with a reported symptomatic air embolism incidence of 0.02%-0.07% [3,8,9]. The incidence of asymptomatic air emboli is even higher, ranging from 0.21% to 0.45% [4,5,10,11]. Recent studies have emphasized the importance of identifying asymptomatic radiological air embolisms before patients develop clinical symptoms, recommending post-biopsy CT scans across the entire thoracic region or aortic-heart area [5,10,12]. In our case, a whole-chest CT scan performed immediately after the procedure revealed asymptomatic air emboli in the ascending aortic apex and right coronary artery, which would have remained undetected by CT scans focused solely on the target area.

In cases of asymptomatic air emboli, preventing them from becoming symptomatic air emboli is crucial, particularly to

prevent air migration into the cerebral arteries. The Trendelenburg position or avoiding positional changes is recommended to prevent air migration into the cerebral circulation [13,14]. In our case, the patient was positioned in a head-down posture immediately after the event and remained in that position for the subsequent 2 hours, successfully preventing air from migrating to the cerebral circulation.

The only treatment method proven to be effective for air embolism is hyperbaric oxygen therapy (HBOT), which not only dissolves air in embolized bubbles by promoting nitrogen absorption but also improves oxygenation of ischemic tissue by supplying 100% oxygen under high pressure [15]. However, HBOT can only be performed in a limited number of facilities. Administering 100% oxygen also has potential benefits [6]. As HBOT was not available at our institution, 100% oxygen was administered in our case. Notably, the air in the ascending aortic arch slowly decreased at the same location without movement, and no other air emboli were observed on CT at any point. This suggests that the air was gradually absorbed into the bloodstream.

In our case, CT scans immediately after their occurrence of asymptomatic air emboli were conducted, and it is noteworthy that these changes did not progress into symptomatic air embolism. Further research is required to reveal the precise duration it takes for the air emboli to disappear and to understand how the size and location of the air emboli may influence this duration.

Patient consent

The informed consent was obtained from the patient.

REFERENCES

[1] Rivera MP, Mehta AC, Wahidi MM. Establishing the diagnosis of lung cancer: diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. Chest 2013;143:e142S–e165S.

[2] Zhan P, Zhu Q-Q, Miu Y-Y, Liu Y-F, Wang X-X, Zhou Z-J, et al. Comparison between endobronchial ultrasound-guided transbronchial biopsy and CT-guided transthoracic lung biopsy for the diagnosis of peripheral lung cancer: a systematic review and meta-analysis. Transl Lung Cancer Res 2017;6:23–34.

[3] Tomiyama N, Yasuhara Y, Nakajima Y, Adachi S, Arai Y, Kusumoto M, et al. CT-guided needle biopsy of lung lesions: a survey of severe complication based on 9783 biopsies in Japan. Eur J Radiol 2006;59:60–4.

[4] Ibukuro K, Tanaka R, Takeguchi T, Fukuda H, Abe S, Tobe K. Air embolism and needle track implantation complicating CT-guided percutaneous thoracic biopsy: single-institution experience. AJR Am J Roentgenol 2009;193:W430–6.

[5] Hiraki T, Fujiwara H, Sakurai J, Iguchi T, Gobara H, Tajiri N, et al. Nonfatal systemic air embolism complicating percutaneous CT-guided transthoracic needle biopsy: four cases from a single institution. Chest 2007;132:684–90.

[6] Cheng H-M, Chiang K-H, Chang P-Y, Chou Y-F, Huang H-W, Chou AS-B, et al. Coronary artery air embolism: a potentially fatal complication of CT-guided percutaneous lung biopsy. Br J Radiol 2010;83:e83–5.

[7] Kodama F, Ogawa T, Hashimoto M, Tanabe Y, Suto Y, Kato T. Fatal air embolism as a complication of CT-guided needle biopsy of the lung. J Comput Assist Tomogr 1999;23:949–51.

[8] Sinner WN. Complications of percutaneous transthoracic needle aspiration biopsy. Acta Radiol Diagn 1976;17:813–28.

[9] Richardson CM, Pointon KS, Manhire AR, Macfarlane JT. Percutaneous lung biopsies: a survey of UK practice based on 5444 biopsies. Br J Radiol 2002;75:731–5.

[10] Kuo H-L, Cheng L, Chung T-J. Systemic air embolism detected during percutaneous transthoracic needle biopsy: report of two cases and a proposal for a routine postprocedure computed tomography scan of the aorto-cardiac region. Clin Imaging 2010;34:53–6.

[11] Ishii H, Hiraki T, Gobara H, Fujiwara H, Mimura H, Yasui K, et al. Risk factors for systemic air embolism as a complication of percutaneous CT-guided lung biopsy: multicenter case-control study. Cardiovasc Intervent Radiol 2014;37:1312–20.

[12] Freund MC, Petersen J, Goder KC, Bunse T, Wiedermann F, Glodny B. Systemic air embolism during percutaneous core needle biopsy of the lung: frequency and risk factors. BMC Pulm Med 2012;12:2.

[13] Ashizawa K, Watanabe H, Morooka H, Hayashi K. Hyperbaric oxygen therapy for air embolism complicating CT-guided needle biopsy of the lung. AJR Am J Roentgenol 2004;182:1606–7.

[14] Jang H, Rho JY, Suh YJ, Jeong YJ. Asymptomatic systemic air embolism after CT-guided percutaneous transthoracic needle biopsy. Clin Imaging 2019;53:49–57.

[15] Muth CM, Shank ES. Gas embolism. N Engl J Med 2000;342:476–82.