

# Coronary artery air embolism complicating a CT-guided percutaneous lung biopsy

Ashwin Deshmukh, Nirav Kadavani, Ritu Kakkar, Shrinivas Desai, Ganapathi M Bhat<sup>1</sup>

Department of Radiology, Jaslok Hospital and Research Centre, <sup>1</sup>Department of Medical Oncology and Stem Cell Transplantation, Jaslok Hospital and Research Centre, Mumbai, Maharashtra, India

**Correspondence:** Dr. Ashwin Deshmukh, Department of Radiodiagnosis, All India Institute of Medical Sciences (AIIMS), Ansari Nagar, New Delhi - 110 029, India, Residential Address: 37, Vikas Nagar, Hotgi Road, Solapur - 413 003, India.  
E-mail: ashwinpdeshmukh@gmail.com

## Abstract

Coronary arterial air embolism is an extremely rare but readily recognizable condition on computed tomography (CT) that may complicate a lung biopsy. We present an incidence of symptomatic air embolism into the right coronary artery during a percutaneous CT-guided lung biopsy that was successfully recognized during the procedure and managed accordingly. An active search for this complication should be made when the patient deteriorates on table and the usual complications (pneumothorax, vasovagal shock, etc.) are ruled out, as immediate resuscitative measures could be life-saving.

**Key words:** Air embolism; coronary artery; interventional radiology; lung biopsy; thoracic imaging

## Introduction

Coronary artery air embolism is a potentially fatal condition. In most of the cases, it is caused by iatrogenic introduction of air bubbles in the aorta or coronary arteries. Thus, majority of the cases have been reported to occur during cardiac catheterization and interventional radiology procedures.<sup>[1]</sup> Very rarely, arterial air embolism occurs during percutaneous lung biopsy. We report a case of aortic and right coronary arterial air embolism occurring during a computed tomography (CT)-guided percutaneous lung biopsy.

## Case Report

A 52-year-old male patient presented with subacute symptoms of cough and hemoptysis. Chest radiograph

revealed multiple lung nodules. CT chest revealed three cavitating lung nodules in the right lung without significant lymphadenopathy or pleural effusion [Figure 1A]. Positron emission tomography scan did not reveal any active disease or a primary malignancy elsewhere in the body. CT-guided lung biopsy was requested for diagnosis of these pulmonary lesions. The patient was placed in supine position, and the anterior lung lesion was targeted for biopsy. A 20-gauge coaxial needle (Cook Medical LLC, Bloomington, USA) was inserted. Before removing the stylet, the patient started experiencing breathlessness and discomfort. He developed bradycardia (heart rate 35–40 bpm) and hypotension (systolic noninvasive blood pressure 60–70 mmHg). A check scan revealed very minimal pneumothorax. However, air density was seen

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in the ascending and descending aorta, and in the right coronary artery [Figure 1B-D]. ECG revealed ST segment elevation in the inferior leads with reciprocal changes in the lateral leads and complete heart block [Figure 2]. He was immediately given 100% oxygen via mask, three ampoules of 0.6 mg atropine intravenously, dopamine infusion, and rapid normal saline infusion but the heart block persisted. The patient underwent immediate cardiac catheterization angiography (with a time gap of 50 min between the onset of symptoms and first angiographic shoot) [Figure 3]. The angiography was normal and did not reveal any filling defects or stenoses. The patient's symptoms started improving while in the angiography suite; the heart rate and blood pressure rapidly normalized. His symptoms resolved soon after the angiography. The patient did not develop any signs or symptoms indicative of air embolism to the central nervous system. The patient was kept under observation in an intensive care unit and discharged after 2 days, after he

refused video-assisted thoracoscopic surgery lung biopsy. Subsequently, he was lost to follow-up.

## Discussion

The most common complication resulting from percutaneous lung biopsy is pneumothorax, which has been reported to occur in 20.5–35% of patients.<sup>[2,3]</sup> However, the incidence of serious complications is quite low, and reported to be 0.75%.<sup>[3]</sup> Air embolism is a very rare event with reported prevalence up to 0.21%.<sup>[4]</sup> One study reported only four cases among 13,206 lung biopsies performed over an 11-year period.<sup>[5]</sup> Coronary arterial air embolism is even rarer. An experimental study showed that as little as 2–3 ml of air injected in the pulmonary vein could be fatal.<sup>[6]</sup>

Certain factors increase the risk of air embolism including cavitating lung masses,<sup>[5]</sup> which was present in our

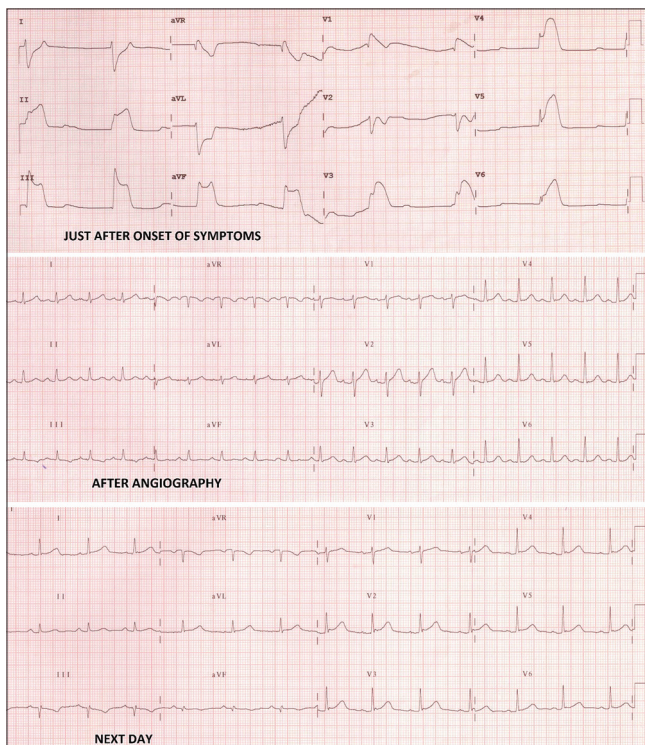


**Figure 1 (A-D):** (A) Baseline CT scan shows multiple cavitary nodules (*white arrowheads*). (B) Air density is seen in the ascending aorta (*black arrow*) and at the right coronary ostium (*black arrowhead*). There is minimal pneumothorax (*star*). (C) Air density is seen along the course of the right coronary artery (*black arrowhead*). (D) The tip of the lung biopsy needle is seen within the lung but away from the nodule. Air density is seen in the ascending aorta (*black arrow*) and along the course of the right coronary artery (*black arrowhead*)

patient. Theoretically, larger bore needles pose a higher risk. However, it occurred in this case despite using a somewhat thinner, 20-gauge needle. Coughing causes sudden increase in bronchial pressure.<sup>[7]</sup> This probably causes a higher risk of air from the bronchi entering the pulmonary veins via a bronchopulmonary fistula.<sup>[8,9]</sup> Our patient did not cough during the procedure. Vasculitis and positive pressure ventilation during the procedure have been proposed to be additional risk factors.<sup>[10]</sup> A few cases have also been reported to occur during wire localization and radiofrequency ablation of lung lesions.<sup>[11,12]</sup>

The two main proposed mechanisms for arterial air embolism include communication between the atmosphere and pulmonary vein, or creation of a pulmonary bronchovenous fistula.<sup>[8]</sup> We propose that the latter occurred in our case, since the air embolism occurred before the removal of stylet and subsequent exposure to atmospheric air.

Few measures have been proposed to reduce the chances of air embolism during percutaneous lung biopsy. "Ipsilateral-dependent position" involves positioning the patient in an oblique lateral position, so that the lung containing the lesion is in a lower, dependent position, and the lesion and the needle track are below the level of the left atrium. This technique along with avoiding intubation anesthesia whenever possible and avoiding needle path through ventilated lung have been shown to reduce the risk of air embolism.<sup>[10]</sup>



**Figure 2:** Serial ECGs reveal complete heart block and S-T segment elevation in inferior leads just after the onset of symptoms followed by gradual normalization

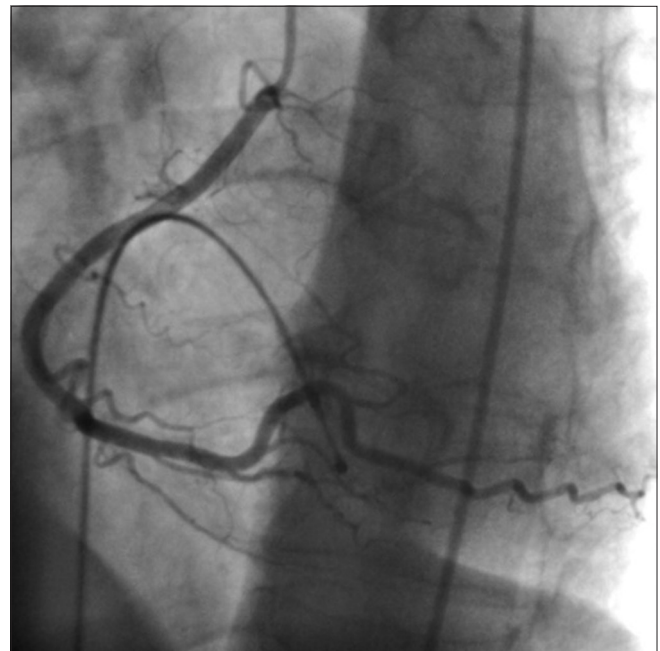
100% oxygen therapy and hyperbaric oxygen therapy (HBOT) have been recommended as immediate measures in cases of air embolism.<sup>[13]</sup> Our patient did not receive HBOT as his symptoms spontaneously improved within a short while and the coronary angiogram was normal. The recommendations for optimum patient positioning for arterial air embolism are not clearly defined. Right lateral position has been recommended in arterial embolism to get the left ventricle in a nondependent position (*cf.* left lateral decubitus for venous air embolism).<sup>[5]</sup> Coronary aspiration and selective injection of vasodilators has been reported to be useful when air embolism occurred into the coronary circulation.<sup>[14]</sup>

## Conclusion

Coronary arterial air embolism is an extremely rare, yet potentially fatal complication of percutaneous lung biopsy. It should be suspected when the patient's clinical deterioration remains unexplained after ruling out the usual complications (tension pneumothorax, vasovagal shock, etc.). It can be easily diagnosed on CT provided an active effort is made to look for it, so that immediate resuscitative measures can be instituted.

## Ethical approval and consents

This case report describes a rare complication of a routine diagnostic procedure. Hence approval from the Institutional Review Board was not obtained. Written informed consent for the procedure was obtained before the patient underwent lung biopsy. For this type of study, consent for publication is not required as the data to be published is sufficiently anonymized.



**Figure 3:** Right coronary angiogram reveals normal opacification of the right coronary artery and its branches without any filling defect



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### Conflicts of interest

There are no conflicts of interest.

### References

1. Khan M, Schmidt DH, Bajwa T, Shalev Y. Coronary air embolism: incidence, severity, and suggested approaches to treatment. *Cathet Cardiovasc Diagn* 1995;36:313-8.
2. 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.
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. *Am J Roentgenol* 2009;193:W430-6.
5. Hare SS, Gupta A, Goncalves ATC, Souza CA, Matzinger F, Seely JM. Systemic arterial air embolism after percutaneous lung biopsy. *Clin Radiol* 2011;66:589-96.
6. Goldfarb D, Bahnson HT. Early and late effects on the heart of small amounts of air in the coronary circulation. *J Thorac Cardiovasc Surg* 1963;46:368-78.
7. Kau T, Rabitsch E, Celedin S, Habernig SM, Weber JR, Hausegger KA. When coughing can cause stroke – A case-based update on cerebral air embolism complicating biopsy of the lung. *Cardiovasc Intervent Radiol* 2008;31:848-53.
8. Arnold BW, Zwiebel WJ. Percutaneous transthoracic needle biopsy complicated by air embolism. *Am J Roentgenol* 2002;178:1400-2.
9. Muth CM, Shank ES. Gas embolism. *N Engl J Med* 2000;342:476-82.
10. Glodny B, Schönherr E, Freund MC, Haslauer M, Petersen J, Loizides A, *et al.* Measures to prevent air embolism in transthoracic biopsy of the lung. *Am J Roentgenol* 2017;208:W184-91.
11. Sakiyama S, Kondo K, Matsuoka H, Yoshida M, Miyoshi T, Yoshida S, *et al.* Fatal air embolism during computed tomography-guided pulmonary marking with a hook-type marker. *J Thorac Cardiovasc Surg* 2003;126:1207-9.
12. Jeannin A, Saignac P, Palussière J, Gékière JP, Descat E, Lakdja F. Massive systemic air embolism during percutaneous radiofrequency ablation of a primary lung tumor. *Anesth Analg* 2009;109:484-6.
13. Balsara ZN, Burks DD. Hyperbaric oxygen therapy for arterial air embolism. *AJR Am J Roentgenol* 2007;188:W98; author reply W99.
14. Kawaji T, Shiomi H, Togashi Y, Gunji D, Imai M, Doi T, *et al.* Coronary air embolism and cardiogenic shock during computed tomography-guided needle biopsy of the lung. *Circulation* 2012;126:195-8.