Radiology Case Reports 18 (2023) 1261–1263

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Acute decompensation of patient following an outpatient CT-guided needle biopsy: A case report ☆,☆☆

Danielle Fall, PA-C[a], *Tyler Smith, MD*[b,*], *Ann Marie Prazak, PharmD*[c], *Ziga Cizman, MD*[b], *Aidin Iravani, MD*[a]

[a] *Department of Internal Medicine, Devision of Pulmonology and Critical Care Medicine, University of Utah School of Medicine, 50 N Medical Dr, Salt Lake City, UT 84132, USA*

[b] *Department of Interventional Radiology, University of Utah School of Medicine, 50 N Medical Dr, Salt Lake City, UT 84132, USA*

[c] *Department of Pharmacy Services, University of Utah Health, University of Utah School of Medicine, 50 N Medical Dr, Salt Lake City, UT 84132, USA*

ARTICLE INFO

Article history:
Received 11 December 2022
Accepted 21 December 2022

Keywords:
Arterial air embolism
Pneumothorax
Hyperbaric oxygen therapy
Lung biopsy

ABSTRACT

A 74-year-old female with history of type 2 diabetes, hypertension, and uterine adenocarcinoma presented for CT-guided lung biopsy that was ultimately complicated by an arterial air embolus requiring intensive care. Systemic air embolism is a very rare event but can be devastating. Prompt recognition can be difficult due to an often-vague presentation but is essential and should be considered upon rapid deterioration of a patient's status following high risk procedures. Hyperbaric oxygen therapy is preferred; however, if this is unavailable, additional treatments are predominately supportive care with 100% supplemental oxygen, rapid volume expansion, and ionotropic medications as needed.

Introduction

Air embolism is a rare potentially life-threatening complication of endovascular procedures including central venous catheter placement, surgical, and interventional radiology procedures. Air embolisms can be difficult to detect and should always be considered upon rapid neurologic or cardiovascular decompensation following high risk procedures. Due to the high chance of mortality and morbidity, clinicians should be able to recognize and manage complications related to systemic air embolism. We present

Abbreviations: RRT, Rapid Response Team; TTE, Transthoracic echocardiogram.

☆ Funding: No funding was received for this case study.
☆☆ Competing Interests: The authors have no competing interests.

* Corresponding author.
E-mail address: tyler.a.smith@hsc.utah.edu (T. Smith).

https://doi.org/10.1016/j.radcr.2022.12.052

a case of an arterial air embolism after CT guided lung biopsy.

Case report

The patient consented for publication of this case. A 74-year-old female with history of type 2 diabetes, hypertension, gout, and uterine adenocarcinoma status post hysterectomy was found to have enlarging pulmonary nodules over a 4-month period and a new right middle lobe pulmonary nodule measuring 7 mm. Patient presented for outpatient CT-guided needle biopsy. The patient reported no symptoms prior to procedure and was in her usual state of health. Two successful core needle samples were obtained using a coaxial biopsy system (17-gauge coaxial, 18-gauge biopsy device) of a right middle lobe nodule. During withdrawal of the coaxial needle, the patient coughed several times and acutely decompensated during the completion CT scan. The completion non-contrast CT revealed an acute air embolus (Figs. 1A-C), and the rapid response team (RRT) was activated. At time of RRT activation, blood pressure was 60/18 mmHg (mean 22 mmHg), heart rate 40 beats per minute and SpO2 was 70%. Upon the immediate recognition of the air embolus, the patient was transferred to a stretcher in the Trendelenburg position and placed on 100% supplemental oxygen. A left groin arterial line and central venous catheter were placed. The patient received 1L IV fluid and epinephrine 100 mcg IV push followed by an epinephrine infusion at 0.08 mcg/kg/min. After the patient was stabilized, a non-contrast CT scan of head, neck, chest, abdomen and pelvis were obtained (Fig. 2).

The patient remained alert and oriented with no gross neurological deficits. A right sided chest tube was placed due to a persistent right pneumothorax, and the patient was admitted to the oncology intensive care unit. Admission labs were notable for elevated troponin of 1.39 mg/mL, and EKG showed normal sinus rhythm, heart rate 72, and QRS duration of 116 ms. The patient required epinephrine infusion for 5 hours. The next day troponin peaked at 26.43 mg/mL and EKG progressed to accelerated junctional rhythm with non-specific T-wave inversion. Transthoracic echocardiogram (TTE) revealed hypokinetic apical septal segment, apical inferior segment and the apex. The patient required nasal cannula 1-2 L for 36 hours. At 48 hours, the patient was discharged home. Repeat TTE 1 month after discharge showed resolution of wall motion abnormalities.

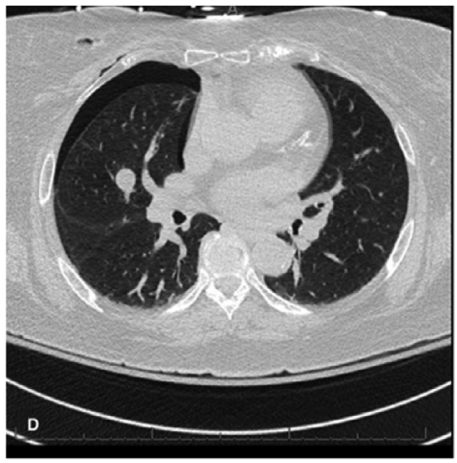

Fig. 2 – CT chest with resolution of air embolism and a small right pneumothorax.

Discussion

The most common complications following CT-guided transthoracic needle biopsy are pulmonary pneumothorax (22.2%-28.6%), and pulmonary parenchymal hemorrhage (13.4%-23.8%) [1,2]. Systemic air embolism is a very rare event with a reported incidence of 0.02%-0.07% [3–6]. Air embolus may be asymptomatic; however, arterial air embolism can be devastating. As little as 2 mL of air in the cerebral circulation can be fatal, and 0.5-1 mL of air in a coronary artery can lead to cardiac arrest [3–6]. Proposed risk factors for systemic air embolism during percutaneous lung biopsy include positive end-expiratory pressure, coughing during biopsy, obstructive pulmonary disease, prone positioning during biopsy, and

Fig. 1 – Chest CT. (A) Aortic air embolism. (B, C) Right coronary artery air embolism.

larger needle size [6]. One recent retrospective study which included 19 patients who underwent percutaneous lung biopsy complicated by systemic air embolism found that the only statistically significant ($P < .05$) risk factors included location of the nodule above the left atrium and the patient coughing during the procedure [4].

Air embolism can be a difficult complication to predict and detect [5,6]. Arterial air embolism should be considered upon rapid deterioration of a patient's neurologic or cardiovascular status during a procedure that carries a high risk for arterial air embolization [5–7]. Procedures that carry the highest risk of air embolism (arterial or venous) are those with the presence of a pressure gradient, including introduction of central venous catheters above the level of the heart, percutaneous lung biopsies, and neurosurgical or otolaryngological procedures done in fowler's position [6,8]. Acute symptoms are often vague or can mimic those of stroke or cardiovascular event making rapid and accurate diagnosis difficult [7]. CT scan can quickly detect air embolism with a high sensitivity and specificity. Other imaging modalities to consider include radiography, transthoracic echocardiography, and transesophageal echocardiography [7].

If arterial air embolism is detected during the course of a procedure it should be stopped immediately [6]. If air is detected in the left heart the patient should be placed in the right lateral decubitus position to trap the air in the left ventricle [5]. Patients should be supported with 100% supplemental oxygen, intravenous fluids, and ionotropic medications in cases of persistent hypotension [5,6,8]. If possible the patient should be placed in a hyperbaric oxygen chamber within 4-6 hours, which will promote the diffusion of nitrogen from intravascular gas into blood, thus reducing air bubble size and lessening ischemic injury [5–7]. If arterial gas is visualized beyond the heart the patient can be placed in Trendelenburg position to avoid entry of gas into the cerebral circulation, however this may be inadequate to overcome the rate of arterial flow needed to stop an air embolism from traveling cranially and could exacerbate development of cerebral edema [9].

If hyperbaric oxygen is unavailable, additional treatments are predominantly supportive care, paying special attention to the protection of vital organs, including the brain and heart, from further ischemic damages.

Patient consent

The patient discussed in this case report provided written informed consent for publication of their case.

REFERENCES

[1] Heerink WJ, de Bock GH, de Jonge GJ, Groen HJM, Vliegenthart R, Oudkerk M. Complication rates of CT-guided transthoracic lung biopsy: meta-analysis. Eur Radiol 2017;27(1):138–48. doi:10.1007/s00330-016-4357-8.
[2] Elshafee AS, Karch A, Ringe KI, Shin HO, Raatschen HJ, Soliman NY, et al. Complications of CT-guided lung biopsy with a non-coaxial semi-automated 18 gauge biopsy system: frequency, severity and risk factors. PLoS One 2019;14(3):e0213990. doi:10.1371/journal.pone.0213990.
[3] 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. doi:10.1186/1471-2466-12-2.
[4] Liu SH, Fu Q, Yu HL, Yang Q, Hu YB, Zhang ZX, et al. A retrospective analysis of the risk factors associated with systemic air embolism following percutaneous lung biopsy. Exp Ther Med 2020;19(1):347–52. doi:10.3892/etm.2019.8208.
[5] Ramaswamy R, Narsinh K, Tuan A, Kinney T. Systemic air embolism following percutaneous lung biopsy. Semin Interv Radiol 2014;31(04):375–7. doi:10.1055/s-0034-1393975.
[6] Fiore L, Frenk NE, Martins GLP, Viana PCC, de Menezes MR. Systemic air embolism after percutaneous lung biopsy: a manageable complication. J Radiol Case Rep 2017;11(6):6–14. doi:10.3941/jrcr.v11i6.2990.
[7] Muth CM, Shank ES. Gas embolism. N Engl J Med 2000;342(7):476–82. doi:10.1056/NEJM200002173420706.
[8] Wong AYC, Irwin MG. Large venous air embolism in the sitting position despite monitoring with transoesophageal echocardiography. Anaesthesia 2005;60(8):811–13. doi:10.1111/j.1365-2044.2005.04237.x.
[9] Moon RE, de Lisle Dear G, Stolp BW. Treatment of decompression illness and latrogenic gas embolism. Respir Care Clin N Am 1999;5(1):93–135.