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Case Report

An unexpected complication: Air embolism during contrast-enhanced computed tomography☆

*Khadija Laasri**, *Amine Naggar, Salma Marrakchi, Omar El-aoufir, Fatima Zahra Laamrani, Laila Jroundi*

Department of Emergency Radiology, Ibn Sina University Hospital, Mohammed V University, Rabat, Morocco

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ABSTRACT

Air embolism is often an iatrogenic complication that may occur in venous or arterial circulation depending on the port of entry. We present a case of a 40-year-old female who had a venous air embolism in the pulmonary artery as a consequence of the injection of a contrast agent. She experienced dyspnea and chest pain following a contrast-enhanced chest computed tomography imaging. She was successfully treated and discharged from our hospital. Early detection of this clinical condition is essential to prevent morbidity and mortality.

Introduction

In addition to occurring in the radiology suite during angiography, needle biopsy, or pneumoradiographic operations, venous air embolism (VAE) can also happen in many medical settings, such as during the implantation, usage, and removal of intravenous catheters and devices, trauma, surgery, and gynecological interventions [1]. Power injectors for contrast-enhanced computerized tomography (CT) provide a particularly high-risk scenario for the unintentional rapid injection of air into the venous circulation; a single fatal event has been reported in the past [2]. Nevertheless, CT with power injectors is an essential diagnostic tool for physicians [1]. We present a case of a 40-year-old female who had an air embolism in the pulmonary artery as a consequence of the injection of a contrast agent. She experienced dyspnea and chest pain following a contrast-enhanced chest computed tomography imaging. She was successfully treated and discharged from our hospital. Early detection of this clinical condition is essential to prevent morbidity and mortality.

Case report

We report the case of a 40-year-old female with no past medical/surgical history who presented to the Emergency Department complaining of progressively worsening epigastric pain of three days duration. On physical examination, she had no dyspnea; arterial oxygen saturation (SpO2) was 98%, on room air; there was moderate diffuse abdominal tenderness to pal-

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* Corresponding author.
E-mail address: Kadijalaasri93@gmail.com (K. Laasri).

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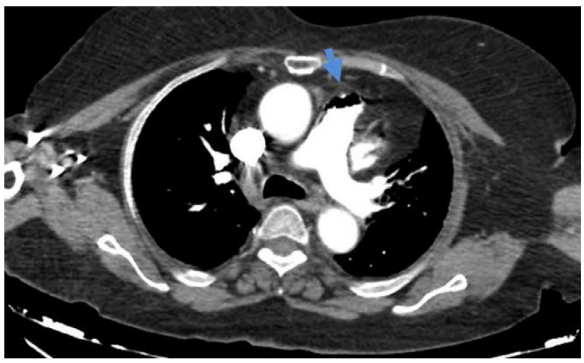

Fig. 1 – Axial chest computed tomography angiography image at the level of the pulmonary trunk, identifying the air-fluid level in the lumen of the pulmonary trunk (arrow), compatible with gas embolism.

pation. A contrast-enhanced computed tomography (CECT) of the chest, abdomen, and pelvis was ordered to rule out acute aortic dissection and abdominal aortic aneurysm. Immediately following the completion of the CECT, the patient became acutely dyspneic and tachypneic and appeared ashen and diaphoretic. CECT showed no acute aortic dissection or abdominal aortic aneurysm, but a venous air embolism was seen in the main pulmonary artery, just above the pulmonic valve (Fig. 1).

Supplemental 100% oxygen via a nonrebreather mask was initiated. The CT technician reported leakage of the contrast agent from one of the hubs on the venous cannula at the time of contrast injection which likely led to the introduction of air in the venous circulation. The hemodynamic stability of the patient was maintained with Trendelenburg and left lateral decubitus positioning (Durant's maneuver). The patient was immediately transferred to the intensive care unit for close monitoring of her vital signs. Her arterial blood gases on room air showed normal values. Her electrocardiogram showed sinus tachycardia. Laboratory tests yielded; a Troponin T value of 0.011 ng/mL (N:0–0.014), CK-MB value 71 U/L (N:20–170), and results of other laboratory tests were normal.

The patient maintained hemodynamic stability with Trendelenburg and left lateral decubitus positioning (Durant's maneuver), and supportive care alone and she was transferred to the intensive care unit (ICU) for observation. Echocardiography did not show any evidence of right or left ventricular failure. During the next 48 hours, she remained hemodynamically stable with no requirements for vasoactive agents. She was later discharged home on warfarin with subsequent outpatient follow-up.

Discussion

Venous air embolism (VAE) is a condition resulting from the presence of gas bubbles inside the systemic venous system. Generally, this is an iatrogenic complication that can occur during venous access procedures, caused by the incidental introduction of atmospheric gas into the venous blood flow [3,4]. During contrast media injection for computed tomography (CECT) small amounts of air can be discovered in about 23% of patients [5]. This gas can arise from the inadequate removal of the air from the syringe, from the pressure tubing, or microbubbles present within the contrast medium.

The afflicted end organs and the degree of embolism severity determine the clinical presentation. Smaller instances typically show no symptoms at all or vague symptoms such as dyspnea, disorientation, chest pain, and a cough or gasp when the air bolus reaches the pulmonary circulation. Monitoring in the operating room may occasionally reveal a quick drop in end-tidal CO2 or a systolic murmur on cardiac auscultation [1,6,7]. Until neurological repercussions become apparent, the diagnosis is frequently completely ignored, or it may be determined based only on a retrospective reconstruction of the embolic event [1].

The risk of morbidity or mortality not only is affected to the amount of air but also to the speed of introduction; for this reason, the most serious accidents are linked to the use of injector pumps [8,9].

VAE is radiologically seen on CT as gas bubbles within contrast-enhanced veins that vary in size from less than 1 cm to 1-3 cm in diameter. These gas bubbles are typically found in the main pulmonary artery, superior vena cava, right side of the heart, subclavian, or brachiocephalic vein. Several patients can have multiple emboli at different sites [3]. Due to motion artifact, gas bubbles typically display a triradiate appearance (dynamic Mercedes-Benz sign). Gas from the venous system may occasionally enter the arterial system due to the preexistence of anatomical abnormalities like pulmonary shunts or patent foramen ovale, increasing the risk of an arterial air embolism [1]. To prevent or minimize the risk of VAE, before initiating the injection, it is important to remove the air from the syringe and the pressure tubing and orientate the syringe downward [10].

At the onset of the slightest symptoms, because of this potentially life-threatening condition, the emergent treatment includes Durant's maneuver, which consists of putting the patient on the left-lateral decubitus, head-down positioning, to decrease air entry into the right ventricle outflow tract [1,3,5]. Aspiration of air from the right atrium/ventricle through a multiport central catheter or pulmonary artery catheter (Swan Ganz) may be attempted but is often of limited value. Alternatively, external cardiac compression may facilitate fragmentation and dispersion of a large right ventricular air embolus. Supportive care includes volume resuscitation for shock, vasopressors or inotropes as needed, and 100% O2 to enhance re-absorption or hyperbaric therapy to force a dissolution of nitrogen [1].

Conclusions

Despite being an uncommon complication, air embolism can be fatal, thus early detection and prevention are crucial. When patients have a neurological episode in the presence of a recognized risk factor or experience sudden onset respiratory distress, this condition should be suspected. In order to reduce air entrance into the right ventricular outflow tract, treatment op-

tions include Durant's maneuver, left-lateral decubitus, head-down positioning, hyperbaric therapy, 100% O2, and supportive care.

Author's contributions

All authors contributed to this work. All authors have read and approved the final version of the manuscript.

Patient consent

Written informed consent for publication was obtained from the patient.

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