Air bubble in the heart: An unrecognized complication of IV contrast injector

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ABSTRACT

Introduction: Venous air embolism is a predominantly iatrogenic complication that occurs when atmospheric gas is introduced into the systemic venous system. The incidence of venous air embolism associated with the injection of contrast for computed tomography scan reportedly is 11–23%. Yet, most patients are asymptomatic, it can be fatal if the amount of air is enough to cause hemodynamic instability. Case report: We report a case of a 20-year-old female patient who presented with air bubbles in the right ventricle after an IV contrast computed tomography of the abdomen. Venous air embolism is a potential complication after an IV contrast injection. Conclusion: We conclude that is imperative that clinicians pay special attention to the prevention, association, and early recognition of venous air embolism when performing imagines studies with IV contrast.

Keywords: Venous air embolism, Intravenous contrast injector

INTRODUCTION

Venous air embolism (VAE) is predominantly an iatrogenic complication that occurs when atmospheric gas is introduced into the systemic venous system [1]. Venous air embolism has been described as a complication of neurosurgical procedures performed in a seated position, central venous catheterization, penetrating and blunt chest trauma, high-pressure mechanical ventilation, thoracentesis, hemodialysis, and several other invasive procedures [1]. However, since the advent of relatively newer radiological technologies with power intravenous (IV) contrast injectors, it has become an important contributor to the incidence of VAE [1–3]. The incidence of venous air embolism associated with the injection of contrast for computed tomography (CT) scan reportedly is 11–23% [1]. Venous air embolism associated with IV contrast injection is now widely recognized as a cause of VAE, yet a few cases have been reported in literature. Clinicians should be aware of the association between VAE and radiologic exams with IV contrast. We report a case of a 20-year-old female patient presented with air bubbles in the right ventricle after an IV contrast CT scan of the abdomen.

CASE REPORT

A previously healthy 20-year-old female patient presented to the emergency department with an
accidental stab wound in the left buttock. She denied any other complaint at the time of the initial assessment in the emergency department and only mild bleeding associated with the wound was noted. She was hemodynamically stable, with normal vital signs and physical examination was only remarkable for 3 cm wound in the left gluteal area that compromised skin, fascia, and muscle with no active bleeding. The wound was successfully closed with five sutures by the emergency medicine team without any complication.

While the patient was in the emergency department, she started to complaint of abdominal pain and the patient was sent for an abdominal and pelvis CT scan with contrast. Computed tomography scan showed no intra-abdominal or pelvic injury, but it was positive for air bubbles in the right ventricle without obstruction of right ventricle outflow tract (Figure 1A–B). Based on the CT scan, a diagnosis of right ventricular air embolism as a complication of IV contrast injection was made. The patient did not report any symptoms at that time. She was immediately placed in supine Trendelenburg position, and 100% oxygen was given. The patient was admitted to telemetry unit for close observation. The patient remained asymptomatic, telemetry monitoring was significant only for asymptomatic sinus bradycardia, and a new CT scan showed resolution of the air embolism (Figure 2). The patient was discharged home without further complication the next day.

**DISCUSSION**

Power contrast injectors have the ability to deliver 400 mL of air in 5 seconds if inappropriately timed [4]. Although the volume of air required to cause death is believed to be approximately 200 to 300 mL [2, 5, 6], the amount required to induce hemodynamic instability is unclear. Most cases of VAE associated with contrast injection are clinical asymptomatic and often go undiagnosed [7]. Yet, when the amount of air is large enough to cause symptoms these may include, but are not limited to: cardiopulmonary and central nervous symptoms such as cardiac arrhythmias, chest pain, electrocardiography changes, dyspnea, altered mental status, focal deficit, coma, and death; if it is not detected and treated in time [8]. Other factors associated with the severity of VAE include the rate of infusion, position of the patient and the patient baseline health [2, 3, 8].

When acute right ventricular failure secondary to venous air embolism occurs, it is due to an increase in the pressure of the pulmonary circulation as a result of mechanical blood flow obstruction by an air bubble. Once the right ventricle fails, there may be a secondary decrease of the venous return to the left ventricle, leading to decreased cardiac output and systemic cardiovascular collapse [1].

The management of VAE consists of stopping and preventing any ongoing air entry, hemodynamic support with fluid, pressors or inotropes if needed, and increasing the patient’s oxygenation. To achieve this, the patient should be started on 100% oxygen to decrease air bubble size and placed in a Trendelenburg position that displaces the air bubbles in the right ventricle to a more buoyant position [1, 3, 4, 8]. Direct right heart air aspiration and hyperbaric oxygen also has been described with a good success rate and should be used when available and indicated [8–12].

**CONCLUSION**

Even though most cases of venous air embolism are asymptomatic, mortality rate in symptomatic cases can vary from 30% in cases related to catheter placement up to 80% in trauma patients. Unfortunately, there is not enough data about mortality related to IV contrast injections in literature but the high mortality rates illustrated above gives us an idea of how dangerous this silent but potentially life threatening entity can be. Therefore, it is imperative that clinicians pay special attention to the prevention and early recognition of venous air embolism when performing procedures that pose a risk for this condition.
Author Contributions
Carlos Gonzalez – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Dioben Aquino – Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Balavenkatesh Kanna – Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor
The corresponding author is the guarantor of submission.

Conflict of Interest
Authors declare no conflict of interest.

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REFERENCES