

# Air Embolism Causing Acute Stroke and Myocardial Infarction during Cardiac Catheter Procedures

Lu Geng<sup>1</sup>, Chunhong Chen<sup>2\*</sup>

<sup>1</sup>Department of Cardiology, The Second Hospital of Hebei Medical University, Shijiazhuang, China; <sup>2</sup>Department of Cardiology, The Affiliated Hospital of Hebei University, Baoding, China

## INTRODUCTION

We report a 45-year-old female underwent radiofrequency catheter ablation and suddenly experienced a disturbance of consciousness and bradycardia. Given the timing of the patient's sudden deterioration, air embolism was clearly the cause. Air embolism was diagnosed immediately and the rescue was successful.

Air embolism is an uncommon, but potentially life-threatening event for which prompt diagnosis and management can result in significantly improved patient outcomes. Vascular air embolism mainly manifests with cardiovascular, pulmonary and neurological sequelae [1]. While mortality and morbidity of cerebral air embolism were reported in 80% to 90% of patients in the past, recent case series demonstrated significantly lower rates with early recognition and availability of treatment options [2].

## DESCRIPTION

Cerebral air embolism should be suspected when a patient acutely develops neurological deficits following an event that could allow air into the circulatory system as mentioned above. When air bubbles enter the arterial system, they can cause injury either by occlusion of arterial vessels causing an ischemic infarction or *via* direct endothelial injury leading to the release of inflammatory mediators, activation of the complement cascade and *in situ* thrombus formation, thereby exacerbating ischemia. Common neurological symptoms due to cerebral air embolism include altered mental status, coma, as well as stroke-like focal deficits and seizure. This can occur secondary to cerebral hypoperfusion due to cardiovascular collapse or direct occlusion of cerebral artery by the air bubbles. Micro air emboli are often presumed clinically as CT scanning may not directly demonstrate air and may not show any ischemic lesions [3], as occurred in this case.

Immediate identifying air embolism and source of air entry is very important, which should be removed immediately. The

patient should be positioned in a head down and right lateral decubitus position. This aims to trap air in the left ventricle, thus minimizing entry of air emboli into the left ventricular outflow tract and aortic. This maneuver not only prevents cephalic flow of emboli but also keeps blood in the left ventricle away from the coronary ostia, thereby preventing myocardial infarction. High flow oxygen should be initiated to help minimize ischemia and accelerate reduction of air bubble size. When available, hyperbaric oxygenation should be offered. The higher pressure provided by hyperbaric chamber further increases gas solubility in the plasma.

Cardiopulmonary resuscitation may be carried out based on the patient's symptom severity and hemodynamic state. If fluoroscopy showed area of radiolucency caused by air in left heart, it is applicable to directly aspirate and remove air bubbles through pigtail or angiographic catheter [4].

Coronary artery air embolism should be presumed as the patient suddenly became hypotensive and bradycardic during interventional therapy, but fluoroscopy showed no pericardial effusion. Dopamine and atropine were administered, as well as pressurized venous infusions and the use of intra-aortic balloon pump, may aid in maintaining coronary artery perfusion.

Air embolism is often iatrogenic, accurate operation to avoid air embolism is crucial, especially in all left-sided cardiac catheterization procedures, because air can enter the systemic circulation directly. For avoiding such disastrous complications, prevention is more important than treatment. First, operator need to recognize it and identify the potential risk. Secondly, protocols requiring multiple laboratory staff to confirm correct procedure. Finally, with rapid recognition and prompt treatment, air embolisms can be managed successfully with no permanent sequelae.

## Learning objectives

- Acute onset of neurological symptoms during an invasive procedure should raise the suspicion for cerebral air embolism.

**Correspondence to:** Chunhong Chen, Department of Cardiology, The Affiliated Hospital of Hebei University, Baoding, China; E-mail: chunhongchen163@163.com

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- Optimal patient outcome after air embolism hinges on rapid diagnosis and timely management.
- Treatment for air embolism consists of proper positioning and aspirate, as well as use of intubation and hyperbaric oxygen.
- For air embolism, prevention is more important than treatment.

## CONCLUSION

Improving protocols to avoid air embolism during percutaneous procedures are necessary to avoid this potentially catastrophic complication. The operators of these procedures should be aware of the signs and symptoms of air emboli and be prepared to initiate prompt management.

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