

Massive Iatrogenic Cerebral Air Embolism: A Fatal Evolution

Mariem Hadj Dahmane¹, Imen Bouassida¹, Amina Abdelkbir¹, Hazem Zribi¹, Chiheb Ben Maaouia², Nizar Fitouhi², Sonia Ouerghi², Adel Marghi¹

¹Thoracic Surgery Department, Abderrahmen Mami University Hospital, Ariana, Tunisia

²Anesthesia reanimation department, Abderrahmen Mami University Hospital, Ariana, Tunisia

Abstract

Cerebral air embolism is a rare clinical entity. The most common cause was iatrogenic. We report a case of a fatal Cerebral air embolism following the placement of a chest tube to relieve pneumothorax. A 71-year-old male with a history of pulmonary emphysema, was admitted for partial bilateral spontaneous pneumothorax. During the placement of the chest tube, the patient suddenly changed consciousness. A massive cerebral air embolism was diagnosed by a brain computed tomography (CT). The pneumothorax was persistent making the management of this air embolism difficult. Despite attempts to stabilize the patient, he died two days after the chest tube insertion.

Introduction

Cerebral air embolism can be caused by the introduction of air into the venous or arterial system. Common causes reported in the literature are iatrogenic. Cerebral air embolism may result from a number of thoracic procedures such as lung biopsy, thoracic surgery, and cardiopulmonary resuscitation [1]. However, massive cerebral air embolism secondary to chest tube insertion for management of a pneumothorax is a very rare entity [1,2].

We report a case of massive cerebral air embolism diagnosed after developing sudden neurologic deficits while undergoing insertion of chest tube to relieve pneumothorax.

Case Report

A 71-year-old male with a history of idiopathic pulmonary fibrosis and emphysema was admitted to the hospital for management of bilateral secondary partial pneumothorax. On admission, the patient was tachypneic, and the oxygen saturation on the pulse oximeter was 88% in ambient air. Chest radiograph and CT showed a bilateral secondary partial pneumothorax predominant on the left side (**Figure 1**). We decided to place a chest tube on the left. Immediately, when the chest tube was putted on, consciousness began to deteriorate. Examination revealed a patient disturbed consciousness and his GLASGOW was 8/15. He was intubated. The chest CT was performed, did not show lung arteriovenous fistula or communication between blood vessels and air spaces, but it revealed severe lung emphysema, and persistence of small partial right pneumothorax. No right-to-left shunt was detected. The brain CT showed massive cerebral air embolism without any evidence of cerebral damage (**Figure 2**). We suspected that air migrated from the pleural cavity to the lung vein or artery and caused massive cerebral air embolism, when the chest tube was



Figure 1: Chest computed tomography showed a bilateral partial pneumothorax (green arrows) predominant on the left side undergoing a severe lung emphysema..

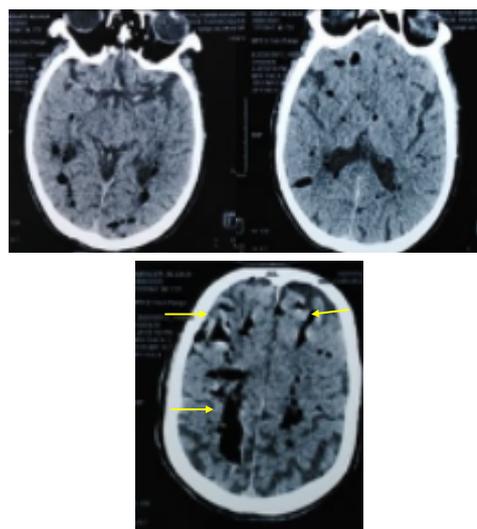


Figure 2: Brain Computed tomography: axial cuts showing bilateral massive cerebral air embolism with multiple foci of gas in cerebral circulation (yellow arrows).

Correspondence: Mariem Hadj Dahmane, Thoracic Surgery Department, Abderrahmen Mami University Hospital, Ariana, Tunisia. Email: mariamhajd@gmail.com

Keywords: air, chest drainage, cerebral, embolism, pneumothorax, management

Received: 9 January 2022; **Accepted:** 16 January 2022; **Published:** 20 January 2022

putted on. Hyperbaric oxygen therapy was largely discussed because the persistent of small right secondary pneumothorax. The thoracotomy drainage was very critical since the small quantity of air in the pleural cavity underling a severe lung emphysema. Unfortunately, the hyperbaric oxygen therapy was not performed because the poor evolution. In fact, the patient developed quickly signs of elevated intracranial pressure. He died the second day of chest tube insertion.

Discussion

Massive cerebral air embolism is a rare clinical entity. This incident can provoke disastrous pulmonary, cardiac, or neurological effects and is associated with high morbidity and mortality. In the literature, the most common causes reported where scuba diving, central venous catheter removal, endoscopic procedures, pulmonary barotrauma, and cerebral aneurysms coiling [3]. A disruption of the mucosal barrier of veins or arteries is commonly associated [4]. Patent oval foramen can provide a right-to-left shunt for venous gas to embolize to the cerebral arteries [5]. Chest tube placement is associated with many complications including chest pain, bleeding, and infection but air embolism is known as a rare complication [1].

In the case of chest tube insertion, like our patient, many mechanisms of the occurrence of cerebral air embolism have been speculated. In fact, air entering the circulation has to come from the atmosphere, airway tracts, or from the pleural space [2]. It can be also explained by, air entering the vein may shunt into the arterial circulation through an intrapulmonary arteriovenous fistula or malformations [2]. Another possibility is that the air entering the blood vessel exceeded the pulmonary's filtration capacity, and cause the migration of air from the venous side to the arterial side.

The symptom of cerebral air embolism is not specific. It is determined by the areas and the quantity of cerebral gas. The symptoms ranging from minor motor weakness to loss of consciousness, seizures, encephalopathy, and coma [6].

The diagnosis is confirmed by the identification of air in the cerebral circulation. Brain CT or brain magnetic resonance imaging can show the presence of gas in the cerebral vasculature, especially if there is a delay in imaging [3].

The management consisted on hyperbaric oxygen therapy, anticonvulsant, high-flow oxygen, and a wait-and-see approach [3]. Hyperbaric oxygen therapy helps by raising ambient pressure around the air bubble and increasing the gradient for nitrogen out of the bubble and for oxygen into the bubble [6]. However, there is only one absolute contraindication to this therapy which is pneumothorax [7]. This is why, in our patient, hyperbaric oxygen therapy was not performed and the patient died two days after chest tube insertion.

Conclusion

As a conclusion, Cerebral air embolism as complication of chest drainage is rare. This diagnosis should be suspected

when the patient starts having neurological symptoms while undergoing chest tube insertion. The management of cerebral air embolism consists on hyperbaric oxygen therapy as a prime therapeutic measure. However, when the chest tube was inserted for a pneumothorax the therapy become discussed and necessitate a complete relieve of the pneumothorax. For that, the management of some cases was critical and the air embolism can be fatal.

Ethics approval and consent to participate: The study was approved by the Ethical Committee of Abderrahmen Mami Hospital.

Conflict of Interest: The authors have no conflicts of interest to declare.

Funding Sources: The authors did not receive any fund for this manuscript.

Author Contributions: Mariem Hadj Dahmane and Imen Bouassida wrote the manuscript. Amina Abdelkbir, Chiheb Ben Maaouia and Nizar Fitouhi were involved in the interpretation of the data. Hazem Zribi, Sonia Ouergui et Adel Marghli provided expertise and feedback.

All authors drafted the article, revised it critically for important intellectual content and approved the final version to be submitted.

Acknowledgements: Not applicable.

References

1. Kim SI, Kwak HJ, Moon JY, Kim SH, Kim TH, et al. (2013) Cerebral air embolism following pigtail catheter insertion for pleural fluid drainage. *Tuberc Respir Dis (Seoul)* 74(6):286-290.
2. Alkhankan E, Nusair A, Mazagri R, Al-Ourani M (2016) Systemic Air Embolism Associated with Pleural Pigtail Chest Tube Insertion. *Case Rep Pulmonol* 2016:4053748.
3. Togo M, Hoshi T, Matsuoka R, Imai Y, Kohara N (2017) Multiple small hemorrhagic infarcts in cerebral air embolism: a case report. *BMC Res Notes* 10(1):599.
4. Betancourt-Torres M, Perez-Torres A, Figueroa-Diaz L, et al. (2020) Iatrogenic Cerebral Air Embolism During Esophago-Gastroduodenoscopy. *Am J Case Rep* 21:925046.
5. Masaya Togo, Taku Hoshi, Ryosuke Matsuoka, et al. (2017) Multiple small hemorrhagic infarcts in cerebral air embolism: a case report. *BMC Res Notes* 10:599.
6. Mishra R, Reddy P, Khaja M (2016) Fatal Cerebral Air Embolism: A Case Series and Literature Review. *Case Rep Crit Care* 2016:3425321.
7. Yan L, Liang T, Cheng O (2015) Hyperbaric oxygen therapy in China. *Med Gas Res* 5:3.

Copyright: © 2022 Dahmane M. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.