Cerebral Air Embolism After Central Venous Catheter Removal: A Case Report and Literature Review

Abstract

Objective: To explore the clinical manifestations, management and prognosis of cerebral air embolism after central venous catheter removal.

Methods: A 51-year-old female had thoracic sympathectomy for her Raynaud’s disease under video assisted thoracoscopic surgery. She was confirmed having congenital atrial septal malformation. The surgical procedures were uneventfully. She was suddenly onset of shortness of breathing, consciousness loss and convulsion after the right internal jugular venous catheter removal. The CT scan showed the air embolism on the right frontal lobes of the brain. Her left extremities were paralysis. She walked on her own with her left hand weakness by multidiscipline therapy including hyperbaric oxygen therapy after five weeks. Five relevant case reports (from Jan 2000 to Jun 2013) were found in PubMed, EMBASE and Google Scholar.

Results: All of six cases had CT or MRI signs of cerebral air embolism. The air emboli entered into artery system from venous system through potential right to left shunt in four cases after the central venous catheters pulled out. Those patients who were diagnosed as paradoxical cerebral air embolism manifested hemiplegic. Two cases showed the air emboli in sinus cavernous and the cortical veins which resulted in cerebral venous air embolism and cerebral edema, in which the symptoms disappeared within few hours.

Conclusion: It is important to prevent cerebral air embolism when removing the central venous catheter. The approaches are as follows: asking patient in supine position, instructing patient breath holding, applying Vaseline guzes or antibiotic ointments and covering the exit site with airtight tapes.

Keywords
Cerebral air embolism; Central venous catheter removal; Paradoxical cerebral air embolism; Cerebral venous air embolism; Hemiplegic; Hyperbaric oxygen therapy

Case Report

Volume 1 Issue 2  - 2014

Youming Zong*
Department of Critical Care Medicine, Jiaxing First Hospital, China
*Corresponding author: Youming Zong, Jiaxing First Hospital, Jiaxing Zhonghuan Nanlu 1882, Zhejiang Province, China, Tel: 86-573-8251-9099; Fax: 86-573-8208-3006; E-mail: jxicu@163.com

Received: May 23, 2014 | Published: June 09, 2014

Introduction

Both internal jugular vein or subclavian vein puncture and central venous catheter insertion are commonly used in patients for different purposes, such as hemodynamic monitoring, administration of medications, parenteral nutrition, hemodialysis, transvenous pacing, poor peripheral access and so on. The complications of the central venous catheter can occur at any time when the catheter is inserted, in use, or even at the time of catheter removal. These complications include hemorrhage, pneumothorax, embolism and infection [1,2]. Among them, air embolism is a potentially catastrophic, usually threatens to life. Once cerebral air embolism occurs, it usually takes a long time for rehabilitation and affects the patient daily life because hemiplegia and extremities disability resulted from cerebral ischemia infarction or edema. We describe a case of cerebral air embolism after internal jugular central venous catheter removal and search relevant literatures for review.

Case Presentation

A 51-year-old female was diagnosed as Raynaud’s disease with her hands cold and pain for 7 years. She had undergone thoracic sympathetic nerve radiofrequency thermal ablation 6 months ago but relapsed. She was admitted for thoracic sympathectomy under video assisted thoracoscopic surgery. Physical examinations including oxygen saturations, heart rates, respiration rates and blood pressure were in the normal range. Systolic murmur could be heard on the left of the sternum. Extremities and neurological examinations were normal. The echocardiogram illustrated the atrial septal malformation and pulmonary hypertension. The procedures of right internal jugular vein puncture and catheterization (ARROW single-lumen catheter), anesthesia and surgery were uneventfully. Her hands turned to warm after surgery.

Five days later, the internal jugular venous catheter was planned to remove. She was instructed in supine position and holding breath when the internal jugular vein catheter was
Cerebral Air Embolism after Central Venous Catheter Removal: A Case Report and Literature Review

Discussion

The central venous catheterization is widely used in clinical practice. The complications include hemorrhage, infection, pneumothorax and embolism etc. However, it is limited to the sporadic case reports about cerebral air embolism following the central venous catheter removal. When it occurs, the patient is often life-threatening [8]. First of all, the patient should be in supine or at least half-lying position. The exit site is pressed by gauze immediately for 5 minutes when the catheter pulls out, and then fixed by tapes [9]. It is rare that the cerebral air embolism occurs after the central venous catheter removal. A persistent residual catheter track might be presented which allowing air to enter into the vascular even if the exit site taped [5]. The outside air seems to be more likely entered into if the patient experiences a reduction in the central venous pressure, such as upright position or deep inspiration after removing of the central venous catheter [10]. The patient manifests dyspnea, loss of consciousness, or seizures. Most of them have no circulatory collapse.

Cerebral air embolism followed by central venous catheter removal is characterized by two mechanisms. One is the result of the air emboli passing through the potential right to left shunts. Such shunts include congenital atrial septal malformation, patent foramen ovale, etc. It is reported that the rate of patent foramen ovale is about 35% [11]. Air emboli from the venous system enter into the arterial system directly and result in cerebral arterial air embolism. It is also known as paradoxical cerebral air embolism [12]. Another is the air emboli which retrograde into cerebral venous system from internal jugular vein when the patient is on sitting position. Accordingly, the air emboli could be found in the cavernous sinus or intracranial venous system [13]. Paradoxical cerebral air embolism results in the brain cortex or focal ischemia infarction and central nerve system dysfunction. Cerebral venous air embolism results in cerebral venous drainage barriers that result in cerebral edema. In our case the air emboli enter into the left atrium from the right atrium through congenital atrial septal defect, and flow into the cerebral artery leading to the cerebral ischemia infarction. The hyperbaric oxygen treatment initiates as early as possible. Hyperbaric oxygen can help the patients to be consciousness. In our case, we find hyperbaric oxygen treatment playing an important role in recovery. Besides, it speeds up the dissolution of air emboli by applying 100% oxygen inhalation [14]. The symptoms are improving slowly at first, but the patient shows a significant improvement of neurological dysfunction after one month.

The cerebral air embolism followed by central catheter removal should be concerned. The patient is in supine or head down. The patient is instructed to hold the breath at the end of inspiratory. While the catheter pulling out, the gauze pressing is no less than 5 minutes. The skin exit site which the central venous catheter left would be covered or sealed by Vaseline gauzes or with antibiotic ointments. In order to prevent the outside air entering into the intravenous through the residual track, the airtight adhesive tapes should be used. All potential risks such as laughing, coughing as well as turning to upright position which change the pressure of intrathoracic might be avoided. It is recommended that the patient be in supine position for at least half an hour after central venous catheter removal [9]. The symptoms presenting after the central venous catheter removal, although it is rare, should we consider the complication of cerebral air embolism. Prevention is rather important to decrease morbidity and mortality.

Conclusion

It is important to prevent cerebral air embolism when removing the central venous catheter. The approaches are as
follows: asking patient in supine position, instructing patient breath holding, applying Vaseline gauzes or antibiotic ointments and covering the exit site with airtight tapes.

References


