

Cerebral air embolism during endoscopic band ligation with liver cirrhosis

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Abstract

Cerebral air embolism is an uncommon disorder, but it can result in significant morbidity and even mortality. Cerebral air embolism during esophago-gastro-duodenoscopy is also rare, but has in recent years been repeatedly reported. We report here a patient with cerebral infarction due to air embolism during endoscopic variceal ligation in liver cirrhosis. The patient was later confirmed to have patent foramen ovale. To our knowledge, this is the first report of such a complication with underlying patent foramen ovale and portal hypertension, who did not have underlying malignancy.

INTRODUCTION

Cerebral air embolism (CAE) is an uncommon disorder but can result in significant morbidity and even mortality. It is a well documented complication of various procedures, such as venous access surgery, neurologic or otolaryngologic surgeries, and barotraumas.¹ CAE occurring during esophago-gastro-duodenoscopy is also a rare complication; only 15 cases have been reported in the literature, and most of the cases were cancer related. We report here the first case of cerebral infarction due to air embolism during endoscopic variceal ligation in liver cirrhosis, who later was confirmed to have patent foramen ovale. Our patient did not have underlying malignancy. We also review all previous reported cases of CAE complicating esophago-gastro-duodenoscopy.

CASE REPORT

A 61-year-old woman was admitted due to an episode of hematemesis. Esophago-gastro-duodenoscopy was performed and esophageal varices were detected at gastro-esophageal junction with sign of recent bleeding. Endoscopic variceal ligation was performed and bleeding was controlled. Three hours after the procedure, the patient deteriorated and became drowsy. Neurological examination revealed a right-sided conjugate eye deviation with left-sided hemiparesis and extensor plantar reflex. An emergency unenhanced CT scan of the head

revealed multiple foci of air within the sulci of the right hemisphere, which was supportive of CAE. (Figure 1 A,B) Subsequent magnetic resonance imaging (MRI) diffusion-weighted images showed an acute right cerebral infarct (Figure 1 C,D). She was given hyperbaric oxygen therapy which was started at the emergency department. Two days

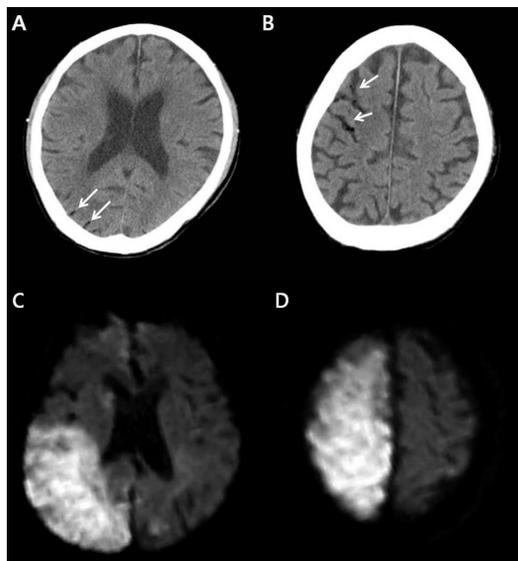


Figure 1. A, B An emergency CT scan of the head showing multiple foci of air within the sulci of the right hemisphere (arrows). C, D. Subsequent brain magnetic resonance imaging (MRI), diffusion weighted images showing recent right cerebral infarct.

after completion of the hyperbaric oxygen therapy, she was able to obey commands. On further investigations, a right-to-left shunt and patent foramen ovale was detected by the transcranial Doppler ultrasonography. Abdominal CT revealed advanced liver cirrhosis with splenomegaly, esophageal and paraesophageal varices, likely with portal hypertension. Two weeks after symptom onset, there was modest neurological improvement. The right-sided conjugated eye deviation had resolved and she could move her left arm and leg. She was transferred to a rehabilitation unit 4 weeks later with residual left upper extremity weakness.

DISCUSSION

CAE during esophago-gastro-duodenoscopy has been uncommon, but there were repeated reports in the recent years. (Table 1) CAE should be considered when patients show clinical features of hemiparesis and impaired consciousness after an endoscopic procedure.² Air embolism may occur when there is a communication between the vasculature and an air source, such as disruption of the mucosa from ulceration, biopsy, sphincterotomy or dilatation.³ Because of unique hepatic venous drainage, systemic air embolism is uncommon with esophago-gastro-duodenoscopy procedures. CAE is even more rare because of capillary filtration in the lungs. For the air to travel from disrupted mucosa to the cerebral artery system, portosystemic shunts

in the liver and right-to-left shunt in the heart or lung is necessary. We conducted a PubMed search for cases of CAE associated with esophago-gastro-duodenoscopy between January 2010 and September 2014, and identified 6 cases of CAE.^{2,4-8} (Table 1) All cases were associated with cancer, but the presence of patent foramen ovale and portal hypertension were uncertain in some of the reports. There was only one report of a patient with patent foramen ovale detected by echocardiogram with portal hypertension, but the patient had underlying hepatic malignancy.⁷ When a patient with cancer is suspected to have CAE, though paradoxical embolism via an intracardiac shunt or pulmonary shunts cannot be excluded, the atrial-esophageal fistula tract is also possible⁹, as the esophagus is directly in contact with the posterior wall of the left atrium between the mid-posterior part of the atrium and the distal border of the inferior pulmonary veins. In the 9 cases that were previously reported before 2010², most of cases were associated with balloon dilation; whether right-to-left shunt and portal hypertension were present were not mentioned. Our patient had no history of cancer, and the right-to-left shunt was confirmed by transcranial Doppler ultrasonography with bubble test. The abdominal CT showed advanced liver cirrhosis with splenomegaly, likely with portal hypertension.

Because of its rare occurrence, there is no evidence-based treatment for CAE. However, there is some patho-physiological rationale to

Table 1: Previously reported cases of cerebral air embolism in esophagogastroduodenography

Authors	Age/sex	Underline disease	Procedure	Portosystemic shunt	Right-to-left shunt	Treatment and outcome
Zampeli, 2013 ⁴	72/M	cardiac adenocarcinoma metastatic esophageal stricture	Ballooning dilation	Unknown	Unknown	Oxygen therapy, death
Niehaus, 2013 ⁵	64/W	gastric adenocarcinoma and esophageal stricture	Ballooning dilation	Unknown	PFO (-)	HBO therapy, death
Pee, 2013 ⁶	84/W	esophagitis and stricture	ballooning dilation	Unknown	Unknown	HBO therapy, death
Truyols, 2012 ⁷	48/M	chronic liver disease, esophageal varices, and hepatocellular cancer	Variceal ligation	LC (+)	PFO (+)	Oxygen therapy, death
Koster, 2012 ⁸	76/W	Esophageal cancer, postradiation esophageal stricture	ballooning dilation	Unknown	Not performed	Oxygen therapy, walk with a cane
Kolluru, 2010 ²	71/M	Squamous cell cancer, esophageal ulcer	Diagnostic procedure	Unknown	PFO (+)	Oxygen therapy, discharged with left hemiparesis

PFO: patent foramen ovale, HBO: hyperbaricoxygen

use hyperbaric therapy with 100% oxygen.¹⁰ It has been reported that the mortality rate for untreated patients with CAE was greater than 90%, but hyperbaric oxygen therapy has reduced the mortality rate to as low as 7%.¹¹ In our patient, the hyperbaric oxygen therapy was given within 12 hours. Although the patient had residual left hemiparesis, her mental has improved. Thus, if air CAE is suspected, treatment with hyperbaric oxygen therapy should be considered as soon as possible.

In conclusion, to our knowledge, this is the first report of CAE during esophago-gastro-duodenoscopy in a patient who had a patent foramen ovale and portal hypertension, but no underlying malignancy.

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