



Transcatheter closure for decompression sickness with a patent foramen ovale: A case report

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ABSTRACT

A patent foramen ovale is one of the predisposing factors of neurotic decompression sickness. Transcatheter closure of a patent foramen ovale is effective in the secondary prevention of decompression sickness associated with intracardiac shunt. The size of the umbrella should not be limited to the diagnosis of a patent foramen ovale or an atrial septal defect but should be determined by the supporting force of the soft margin of the atrial septum. The surgical method of patent foramen ovale closure is the same as that of the closure of an atrial septal defect, but the closure umbrella of a patent foramen ovale is different from that of the closure umbrella of an atrial septal defect. The size of the umbrella of the right atrium is larger than that of the left atrium, and it is better to close the atrial septum.

1. Case presentation

A 49-year-old Chinese man was admitted to our hospital on account of nausea and vomiting of one day's duration. The patient did not have a history of hypertension, diabetes, hepatitis, or tuberculosis. The patient had experienced nausea and vomiting accompanied by fatigue on the previous day and had vomited several times; the vomitus included bilious gastric contents. Therefore, the patient visited the outpatient department of our hospital, where he was prescribed medication for antiemesis, acid suppression, and poor urine volume. Physical examination revealed a flat soft abdomen with no tenderness or rebound pain. Ancillary examinations—routine blood, urine, liver function, potassium, sodium, and chlorine, blood amylase, and coagulation time—were normal. There were no abnormalities with AFP, CEA, and CA19-9. RVST and VDRL were non-reactive. No obvious abnormality was noted on a posteroanterior plain chest radiograph. Upon symptomatic treatment, the vomiting reduced, but there was still obvious nausea; therefore, the patient was admitted to our hospital for further systematic diagnosis and treatment. No fever, night sweats, abdominal distension, abdominal pain, cough, expectoration, or intermittent headache was noted. The gallbladder wall was thicker in diet and sleep. Gastroscopy revealed chronic non-atrophic gastritis. Although the patient was administered symptomatic treatment for acid suppression and for relief from nausea and vomiting, he still

complained of a headache and dizziness. Head CT and MRI showed no obvious abnormalities. A TCD foaming test was positive, supporting right to left shunt (potential type, large amount) (Fig. 1), but there was no obvious abnormality on cerebral artery ultrasound. Further clinical history, elicited at the cardiovascular surgery consultation, revealed that the patient had travelled by flight one day before admission; he also had a history of flying accompanied by the above-mentioned symptoms. However, those symptoms were mild and had not been considered cause for concern. After the cardiovascular surgery consultation, a diagnosis of “patent foramen ovale, neurotic decompression sickness” was made. The patient was treated with oxygen, and transcatheter closure was performed under transthoracic echocardiography. A Siemens sc2000 color Doppler ultrasonic diagnostic instrument is used for echocardiography, with a 4p1 probe and 3.5 MHz frequency. In the apical four chamber view, the size of the left atrium was 38.7×40.1 mm. The central part of the atrial septum was a hyperechoic light band, with a soft edge. No septal blood flow was observed. The length of the soft edge was 23.2 mm, that of the hard end of the upper edge of the adjacent atrial septum was 4.7 mm, while that of the lower edge was 9 mm. The length of the hyperechoic light band of the central part of the atrial septum under the xiphoid process was 21.1 mm. A 25-mm foramen ovale occluder umbrella was implanted under local anesthesia and ultrasound guidance. No abnormality was observed upon echocardiography (Fig. 2) after the

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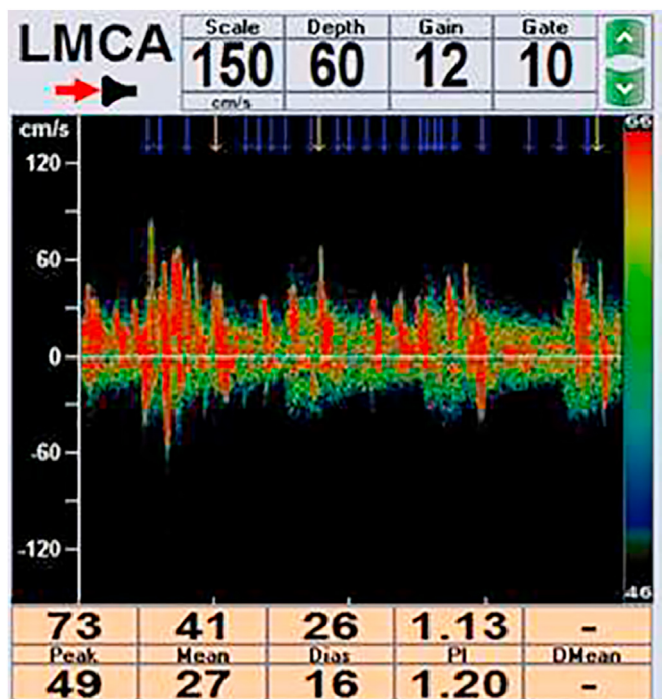


Fig. 1. Transcranial Doppler foaming test showed waterfall like changes, Contrast-enhanced transcranial Doppler (+).

operation, and the above symptoms did not occur in the follow-up flight history of the patient.

2. Discussion

The foramen ovale is a normal communication channel in the heart of a fetus. It usually closes in the first year of life. In children over 3 years of age, in whom it fails to close, it is termed patent foramen ovale; 20-25% of adults have a patent foramen ovale.

Decompression sickness is a systemic disease caused by improper decompression. After working in a high-pressure environment, the dissolved gas in the body exceeds the supersaturation limit, and bubbles are formed inside and outside the blood vessels and tissues.¹ Transcatheter closure of a patent foramen ovale is effective in the secondary prevention of decompression sickness associated with intracardiac shunt.² Acute decompression sickness (the clinical manifestations of skin, bone and joint, and nervous, circulatory, and respiratory systems), caused by free air bubbles in the body, appeared within 36 hours of decompression. The patient experienced decompression sickness related to a history of flying. A patent foramen ovale and abnormal gas embolism caused neurotic decompression sickness. Nausea, vomiting, headache, and dizziness were found and appeared to have been aggravated. After transcatheter closure of the patent foramen ovale, the symptoms disappeared. A patent foramen ovale is one of the predisposing factors of neurotic decompression sickness. The size of the umbrella should not be limited to the diagnosis of a patent foramen ovale or an atrial septal defect but should be determined by the supporting force of the soft margin of the atrial septum. The surgical method of patent foramen ovale closure is the same as that of the closure of an atrial septal defect, but the closure umbrella of a patent

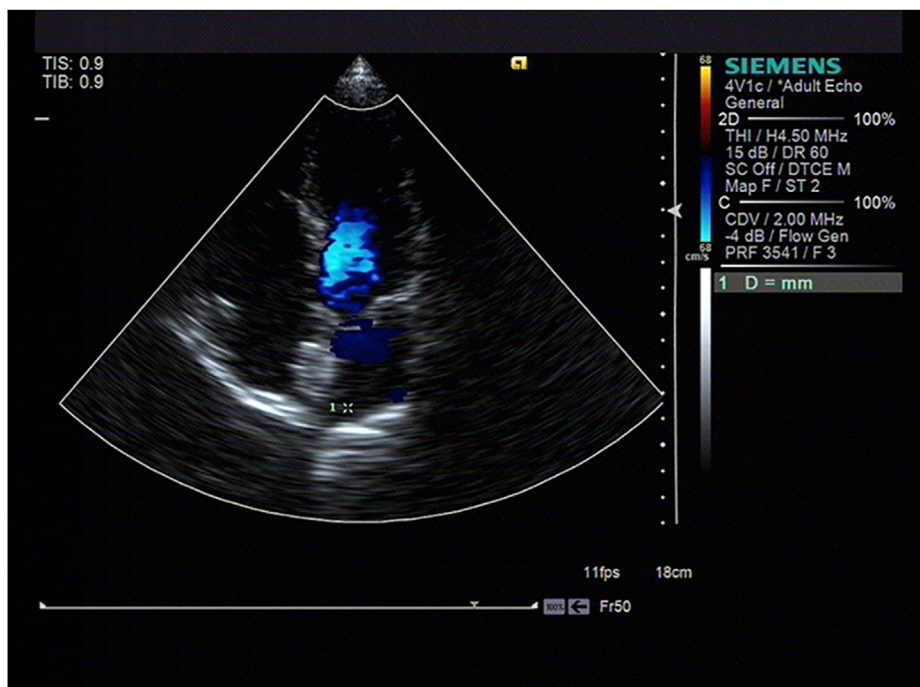


Fig. 2. Echocardiography showed that the occlusion umbrella was in good position.

foramen ovale is different from that of the closure umbrella of an atrial septal defect. The size of the umbrella of the right atrium is larger than that of the left atrium, and it is better to close the atrial septum. At present, the material of the occluder umbrella has been developed to be biodegradable, which tends to make the operation perfect.

Ethical approval

The study was approved by the ethics committee of Yanbian University Hospital. All clinical practices and observations were conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from each patient before the study was conducted.

Patient consent

Written informed consent was obtained from patients for publication

of these case reports and any accompanying images.

Declaration of competing interest

No potential conflict of interest was reported by the author.

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