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Case Report

Right Ventricular Failure During Transcatheter Closure of Atrial Septal Defect Diagnosed by Transesophageal Echocardiography

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Abstract

Transcatheter closure of atrial septal defect (ASD) with Amplatzer Septal Occluder is considered as a safe and effective alternative to surgical repair. The incidence of transient ST segment elevation of inferior lead during transcatheter closure of ASD is reported to be 5 %. This is thought to be caused by embolization of air bubbles from the catheters to the right coronary artery. ST segment elevation combined with right ventricular failure during transcatheter closure of ASD is not previously reported.

Keywords: *Atrial Septal Defect; Amplatzer Septal Occlude; Right Ventricular Failure*

Introduction

Transcatheter closure of atrial septal defect (ASD) with Amplatzer Septal Occluder is considered as a safe and effective alternative to surgical repair [1]. Although device closure is preferred for the patients and doctors because of shorter hospitalization and less pain, the incidence of complications is 7.2 to 8.6% [1,2]. The incidence of transient ST segment elevation of inferior lead during transcatheter closure of ASD is reported to be 5 % [3]. This is thought to be caused by embolization of air bubbles from the catheters to the right coronary artery [4]. Here we report the ST segment elevation combined with right ventricular failure during transcatheter closure of ASD.

Case

A 46-year-old female with secumdum atrial septal defect (ASD) was referred to the hospital for transcatheter device closure. She was hemodynamically stable and asymptomatic. Electrocardiogram showed normal sinus rhythm with incomplete right bundle branch block. Transthoracic echocardiogram showed mildly enlarged right ventricle and 20 mm-sized interatrial septal defect on the mid portion of septum. Color Doppler showed left-to-right shunt flow. Continuous wave Doppler revealed mild tricuspid regurgitation with the maximal velocity (V_{max}) of 2.7 m/sec and the pressure gradient of 29 mmHg between right atrium and right ventricle, suggesting borderline resting pulmonary hypertension. Transesophageal echocardiography demonstrated that the size of ASD was 14 mm at 0°, 29 mm at 63°, and 17 mm at 127°. We performed the transcatheter closure under general anesthesia. The size of ASD was estimated using 34 mm sizing balloon. ASD was closed by Amplatzer Septal Occluder with 30 mm size (Figure 1A). At the time of device closure, the electrocardiogram showed ST segment elevation at lead II and III. Blood pressure was 77/52 mmHg and heart rate was 63/min. Isotonic saline, dopamine, and heparin was infused immediately. Coronary angiography showed normal coronary arteries (Figure 2). Transesophageal echocardiography demonstrated that Amplatzer Septal Occluder was in place, left ventricular function was normal but right ventricular wall motion was decreased, suggesting right ventricular failure (Figure 1B, C). ST segment was normalized after 5 minutes and transesophageal echocardiography showed partial recovery of right ventricular wall motion (Figure 1D). The patient was closely monitored in the coronary care unit. Follow-up transthoracic echocardiogram on the next day showed preserved right ventricular contraction. The patient discharged without any cardiologic or neurologic event.

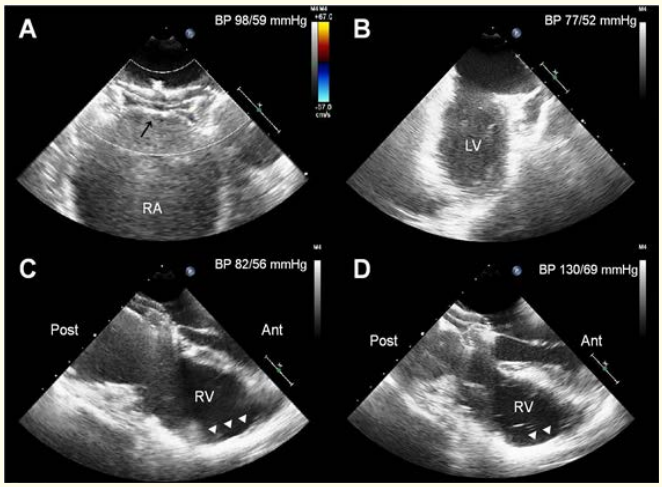

Figure 1: *Transesophageal echocardiography during transcatheter closure of atrial septal defect using Amplatzer Septal Occluder. (A) Successful deployment of Amplatzer Septal Occluder (black arrow) without remnant shunt flow. (B) Normal left ventricular function with ST segment elevation. (C) Enlarged right ventricle with decreased wall motion (white arrowhead). (D) Partially recovered but still decreased right ventricular wall motion after 5 minutes (white arrowhead). Ant indicates anterior; Post, posterior, RA, right atrium; LV, left ventricle; RV, right ventricle.*

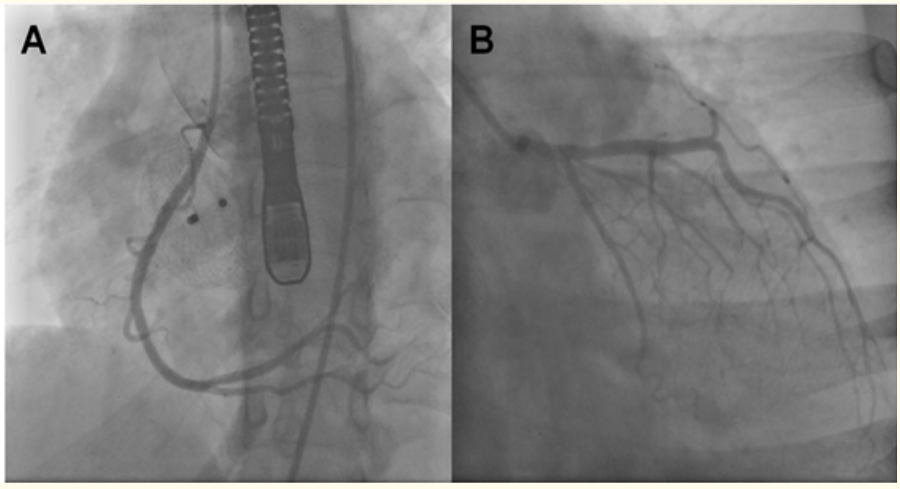

Figure 2: *Coronary angiography taken 5 minutes after device closure of atrial septal defect showing normal coronary arteries without proven air bubbles inside vessels. (A) Right coronary artery in left anterior oblique view. (B) Left coronary artery in anteroposterior caudal view.*

Discussion

Transcatheter closure of atrial septal defect (ASD) with Amplatzer Septal Occluder is considered as a safe and effective alternative to surgical repair [1]. Although device closure is preferred for the patients and doctors because of shorter hospitalization and less pain, the incidence of complications is 7.2 to 8.6% [1,2] The incidence of transient ST segment elevation of inferior lead during transcatheter closure of ASD is reported to be 5 % [3]. This is thought to be caused by embolization of air bubbles from the catheters to the right coronary

artery [4]. ST segment elevation combined with right ventricular failure during transcatheter closure of ASD is not previously reported. In this patient, it is thought that air embolism would cause the right ventricular failure. Although we tried to remove every air bubble inside the Amplatzer Septal Occluder by soaking and flushing with water, some bubbles were inevitably released during the device deployment. Air bubbles might enter into the os of right coronary artery and cause transient flow limitation of right coronary artery, developing wall motion abnormality. But when we performed coronary angiogram, we could not find any air embolism inside coronary arteries. It is also possible that air bubbles would result in pulmonary artery air embolism and consequent right ventricular failure if large amount of air was embolized. But just a small amount of air was embolized in this case.

Although our patient recovered in 8 minutes, air embolism can bring about irreversible consequences such as inferior wall myocardial infarction or right ventricular infarction. It is important to remove all possible air bubbles of the device to prevent air embolism during transcatheter closure of ASD.

Conclusion

Although air embolism is usually transient event during procedure, it can bring about irreversible consequences such as inferior wall myocardial infarction or right ventricular infarction. It is important to remove all possible air bubbles of the device to prevent air embolism during transcatheter closure of ASD.

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