

Emergent Surgical Intervention for Embolization of Atrial Septal Defect Closure Device

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The percutaneous transcatheter closure of secundum atrial septal defect has recently become an increasingly widespread alternative to surgical closure in many centers. Although immediate, short, and intermediate term results of percutaneous transcatheter septal closure are promising, the procedure is not free from inherent complications that could be lethal. We report a case of device embolization necessitating emergent surgical retrieval.

Key words: 1. Heart septal defects, atrial
2. Transcatheter closure
3. Device embolization

CASE REPORT

Fifty-year-old woman was admitted with known atrial septal defect (ASD) that was diagnosed 1 year ago. She complained of dyspnea on exertion and mild general weakness. Transthoracic echocardiography demonstrated a 1.8 cm-sized secundum ASD with a large left-to-right shunt ($Q_p/Q_s=2.0$) seen by color flow Doppler. Retrospectively, it appeared that the anterosuperior rim of the defect was not well developed (Fig. 1). Percutaneous transcatheter septal closure (PTSC) was then scheduled. In the cardiac catheterization laboratory, the ASD was measured to be 18 mm in diameter with a balloon under fluoroscopic guidance using a 6-French (6F) sheath through the right femoral vein after induction of general anesthesia. An Amplatzer septal occluder (18 mm) was delivered through delivery sheath (10F) to the left atrium, and deployed successfully. The position of the device was confirmed by transesophageal echocardiography (TEE) and fluo-

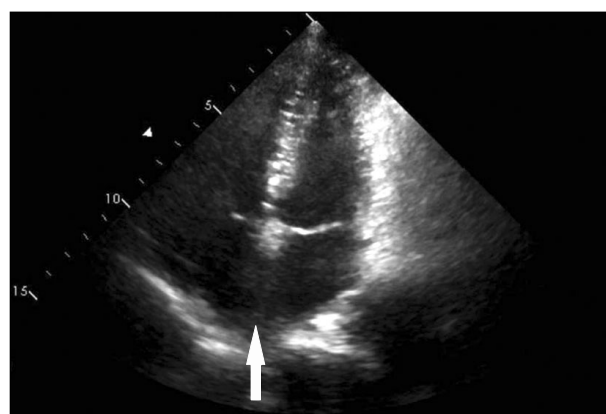


Fig. 1. Transthoracic echocardiography shows secundum atrial septal defect (arrow).

roscopic Imaging (Fig. 2). The patient was hemodynamically stable.

The follow-up echocardiogram on the next day after PTSC revealed disappearance of the device at the atrial septal re-

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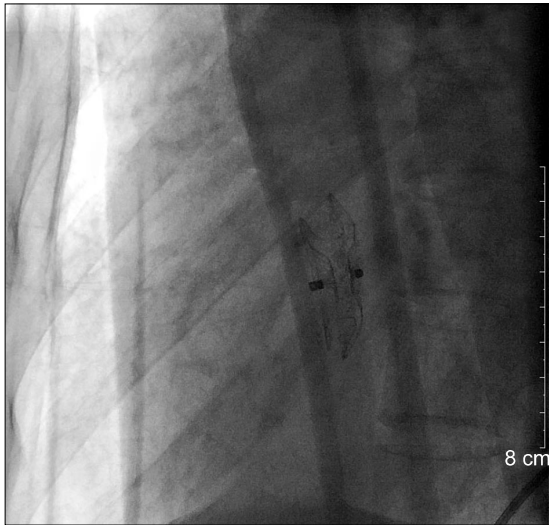


Fig. 2. Fluoroscopic image after percutaneous transcatheter septal closure.

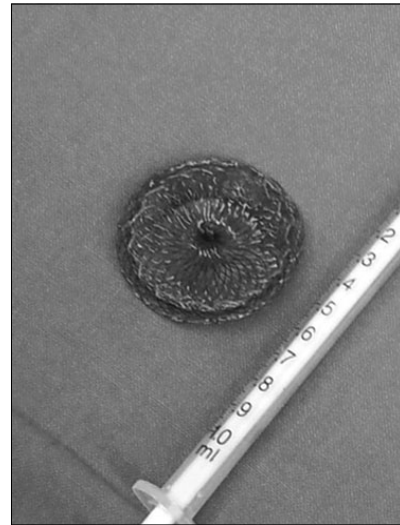


Fig. 4. Retrieved Amplatzer septal occluder device.

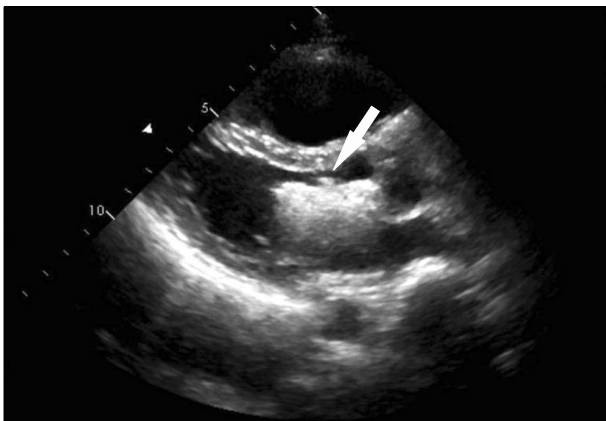


Fig. 3. Follow-up echocardiography performed the day after percutaneous transcatheter septal closure. The device was observed in left ventricular outflow tract (arrow).

gion and the shunt flow through ASD was noted again. The device was observed at the left ventricular outflow tract (LVOT), but luckily there was no significant disturbance of blood flow (Fig. 3). The patient was emergently taken to the operating room. Cardiopulmonary bypass was initiated with aortic and bi-caval cannulation. Aorta was clamped and the heart was arrested with antegrade cardioplegia. Right atriotomy was performed and the secundum ASD was found to be 2×1.5 cm in size. The anterosuperior rim of the ASD was absent. Some bruising was identified at the aortic root. The

Amplatzer septal occluder device was located in LVOT, beneath the anterior leaflet of the mitral valve. The device was successfully retrieved through the mitral opening without damage to the valvular apparatus. Close examination of the retrieved specimen showed structural integrity of the device (Fig. 4). The ASD was closed with bovine pericardial patch. The patient was weaned from cardiopulmonary bypass without difficulty. Intraoperative TEE demonstrated normal function of both mitral and aortic valves. The patient was then discharged in good condition.

DISCUSSION

Although morbidity and mortality are extremely low in surgical repair of ASD, the advantages of the PTSC (including avoidance of cardiopulmonary bypass, reducing blood transfusion, shortening hospital stay, and early return to daily life) have led PTSC to become the primary treatment option for most patent foramen ovale (PFO) and secundum ASD in many centers [1].

Since the first implantation of Amplatzer septal occluder in 1997, this device is currently the most commonly used device for percutaneous closure of ASD [2]. In spite of progressive evolution of techniques and devices, this procedure has attendant failure and complications. And not all secundum ASDs are amenable to device closure.

The reported complications of the ASD device include residual shunt, device malposition, caval thrombosis, systemic or pulmonary embolization, erosion and perforation of the heart, thromboembolism, and atrial arrhythmia [3,4]. And the most important mechanism is poor patient selection or device selection. Device dislodgement can occur if the size of the defect greatly exceeds the waist diameter of the device. On the other hand, implantation of overly large device may cause erosion and perforation, especially when there is a deficient anterosuperior rim of the defect. The incidence of major complication is not well defined. One of the largest series of 2,800 secundum ASD closures using the Amplatzer septal occluder reported 5 cases of cardiac erosion and 7 cases of device embolization [5]. In a meta-analysis of PFO closure, major complications occurred in 1.5% of patients [6]. The risk factors for device embolization are large defect, large device, undersizing of device relative to the defect, inadequate defect rim to hold the device and mobility of device or atrial rim of tissue after device implantation. Moreover, inaccurate deployment and failure to button the ASD or unbuttoning of the occluder can also result in device embolization [4]. Most commonly reported causes of device embolization are inadequate rim of the defect and undersized device. The PTSC criteria by Amin et al. [7] include a defect size less than 32 mm and the presence of at least 4 mm rim of atrial septal tissue surrounding the defect. In this case the cause of the device embolization was likely due to the fact that the device was less than securely positioned because of the deficient anterosuperior septal rim. The time of the occurrence of device embolization may vary. Mashman et al. [2] reported late embolization of the device that occurred 7 weeks after implantation and recommended avoidance of strenuous exercise for 6 months and close echocardiographic surveillance. Application of the device to secundum ASD with deficient anterosuperior rim can be associated with other serious complications such as erosion and cardiac perforation. The bruises

on the aortic root found during surgical procedure were regarded to be caused by device abrasion. If the device had been left at the atrial septum for longer periods of time without embolization it could have resulted in aorta to atrial fistula or free wall perforation of the atria resulting in tamponade. A short or deficient anterosuperior rim should be considered as a risk factor for device embolization as well as aortic perforation in PTSC.

In order to prevent these complications associated with PTSC, proper selection of patient and device is mandatory and surgical repair should remain the standard management for this variant of secundum ASD.

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