Risks Factors for Atrial Septal Defect Occlusion Device Migration

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Abstract

Keywords

- atrial septal defect
- device
- migration

Atrial septal defect (ASD) is one of the most common congenital heart defects requiring procedural intervention. In such cases, transcatheter closure of secundum ASDs has been demonstrated to be safe and effective in both children and adults, with similar success and complication rates to surgery. However, appropriate patient selection and an accurate device selection is mandatory to prevent serious complications such as ventricular arrhythmias, outflow tract obstruction of the left and right ventricle, or ischemic events secondary to the obstruction of blood flow due to device embolization.

Device closure of atrial septal defects (ASDs) has proven to be safe and effective procedure leading to a significant improvement in clinical status and heart cavity dimensions in both adults and children.^{1,2} However, several complications have been reported regarding the percutaneous closure of ASD such as retroperitoneal bleeding, erosion, arrhythmias, endocarditis, air embolism or thromboembolic events.³ Device embolization, with an incidence of 0.4 to 1.1%, occurs mainly in the early postinterventional period due to discrepancies in the size of the defect or inappropriate placement because of the oblique position of the device. In such cases, the most common sites of embolization are the right cardiac chambers or the pulmonary artery. On the contrary, left-sided migration is very rare.⁴

Case Report

A 19-year-old male patient with pulmonary stenosis and a ventricular septal defect operated on in childhood was referred to our adult congenital heart disease unit for evaluation. The patient had a New York Heart Association (NYHA) functional class I/IV with no associated palpitations. Cardiac auscultation showed a protosystolic murmur on the pulmonary focus while the electrocardiogram revealed a sinus rhythm. Transthoracic and transesophageal echocardiography, using a Sonos 5500 echocardiographic device (Philips,

Andover, MA), showed a normal left ventricular function, a dilated right ventricle, a mild-to-moderate pulmonary regurgitation with mild valve stenosis and an ostium secundum type ASD. The ASD had 12 mm of diameter, a left-to-right shunt with a Qp/Qs (pulmonary to systemic flow) ratio of 1.5 and a large superoposterior (superior vena cava) and inferoposterior (inferior vena cava) rims (20 mm) with a small inferior (atrioventricular valve) rim (5 mm) and a deficient anterosuperior (retroaortic) rim of 3.5 mm (►Fig. 1A, B).

The ASD was treated percutaneously with a 13-mm Amplatzer septal occluder (AGA Medical Corporation, Golden Valley, MN) after confirmation of its size with the inflation of a balloon at the ASD (►Fig. 1C). Transesophageal echocardiography performed during device implantation confirmed the correct placement of the device (►Fig. 1D). Also, at hospital discharge transthoracic echocardiography evidenced an adequate anchorage of the device to the ASD.

However, 6 months later, control transthoracic echocardiography demonstrated a persistent ASD. For this reason, a chest X-ray (►Fig. 2A), an abdominal fluoroscopy (►Fig. 2B), and an abdominal angiography (►Fig. 2C) were performed which assessed device embolization into the aorta without obstruction to the blood flow. In an effort to rescue the occluder, a lasso was used to grab the screw mechanism of the right atrial disk and pull the device into sheath (►Fig. 2D). Although we managed to mobilize it up to the aorta

Fig. 1 (A) Aortic valve short axis transesophageal echocardiography view showing the interatrial septum defect (asterisk) (double arrow head shows the anteriosuperior [retroaortic] rim and the arrow head shows the superoposterior [superior vena cava] rim). (B) Lower-middle transoesophageal views corresponding to the four-chamber view (arrow head showing the inferior [atrioventricular valve] rim of the atrial septal defect [ASD] [asterisk]). (C) Stretched ASD balloon diameter of 11 mm (arrow head) measured with an Amplatzer sizing balloon of 20 mm diameter during the percutaneous procedure. (D) Aortic valve short axis transesophageal echocardiography view with the Amplatzer septal occluder device (asterisk) implanted at the ASD. RA, right atrium; LA, left atrium; RV, right ventricle; LV, left ventricle; Ao, aorta.

bifurcation it could not be finally removed. The patient was taken to the operating room by the vascular surgery team to remove the device. The device was removed via a trans-abdominal approach, clamping the aorta from the superior mesenteric artery to below the renal arteries.

Discussion

The Amplatzer septal occluder is the most commonly used ASD closure device worldwide at the present time. The feasibility, safety, and efficacy of device occlusion are based on self-expandable, retrievable, and repositionable design of the device.

Risk factors for device embolization include a large ASD, inadequate and thin atrial rim, inappropriate placement of the device, and under or oversizing of the device⁵ as the ASD is not a perfect circular shape. Also, the presence of a floppy rim may result in a false larger defect when the balloon used to measure the ASD during the cardiac catheterization stretches the atrial rim. As well, deficient rims are intimately related to the success of the procedure and adequate attachment of the device to the septum.⁶ However, many centers do not consider anteriosuperior (retroaortic) rim deficiency to represent an absolute contraindication to device implantation.

In the first 24 hours after placement is when the majority of devices embolize, with the consequent risk of narrowing the main or branched pulmonary artery or harming the mitral and tricuspid valves. However, devices migrate rarely to the peripheral venous system or to the left side of the heart.

Although, ischemic complication are very rare after device embolization⁶ it should be a matter of concern, besides left ventricular outflow tract obstruction and ventricular arrhythmias, when the device goes into the systemic circulation. In such cases, percutaneous foreign body retrieval should be the first technique to remove migrated devices, because it obviates major cardiovascular surgery with high efficacy and few complications.^{7,8} However, several unsuccessful attempts to capture and remove it should raise the surgical option.

In our patient, the size of the ASD was consistent with that obtained by measuring the inflated balloon during the percutaneous procedure and the one calculated by echocardiography. However, the small anteriosuperior (retroaortic) and inferior (atrioventricular valve) rims could favor the device embolization. For this reason, there is a tendency to use larger devices when the retroaortic rims are deficient. Nonetheless, we should take into account that while device embolization is mostly related to undersized devices, erosions are related to

Fig. 2 (A) Lateral chest X-ray showing the Amplatzer septal occluder device at the abdominal aorta (asterisk). (B) Abdominal X-ray evidencing the occluder device at the aortic level (asterisk). (C) Abdominal angiography showing the atrial septal defect occluder device within the abdominal aorta (asterisk), at the junction of the superior mesenteric and renal arteries. (D) Percutaneous foreign body retrieval technique to remove the migrated device (asterisk).

oversized occluders.⁵ Therefore, one of the most important goals is to make an appropriate patient selection and carry out an accurate device choice.

Note

This article has not been submitted for publication nor has it been published in whole or in part elsewhere. We attest to the fact that all authors listed on the title page have contributed significantly to the work, have read the article, attest to the validity and legitimacy of the data and its interpretation. The authors of this article have also certified that they comply with the principles of ethical publishing. No author has any conflict of interest.

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