TEHRAN HEART CENTER

Case Report

Device-Induced Perforation of Right Atrium Following Interventional Closure of Atrial Septal Defect (ASD)

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Abstract

This is a case presentation of a 26-year-old woman with a moderate-sized atrial septal secundum defect (17mm) who underwent catheterism, during which an Amplatzer Septal Occluder number 26 was inserted successfully. On the second postoperative day, she deteriorated and a clinical examination showed a typical tamponade. After a percutaneous aspiration of the pericardial cavity and transient improvement in vital signs, a pig-tail catheter was inserted percutaneously emergently, and the patient was transferred to the operating room in a preshock state. During the operation, an active bleeding point in the superoanterior aspect of the right atrium near the aortic root was detected, which was repaired by direct suture and pericardial patch reinforcement. The Amplatzer device was removed and the atrial septal defect was repaired with a pericardial patch.

A lethal complication of the interventional closure of atrial septal defect, properly treated by an emergent intervention and operation, is presented and discussed herein.

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Introduction

Atrial septal defect (ASD) is a prevalent congenital heart disease (3.78 per 10000 live births).[1] Surgical treatment is safe and effective, but there are complications related to thoracotomy, bleeding, arrhythmia, post-pericardectomy syndrome, and residual defects.[1] Over the years, various devices have been utilized for the closure of ASDs by interventional pediatric cardiologists. The concept of the ASD closure device was first introduced by Ring et al. in 1976.[2] The devices usually used for ASD closure are the CardioSEAL Septal Occluder, Amplatzer Septal Occluder (ASO), and Das-AngelWings Septal Occluder.[2] The ASO is a device approved by the FDA for the transcatheter closure of secundum ASDs and fenestrations of the Fontan

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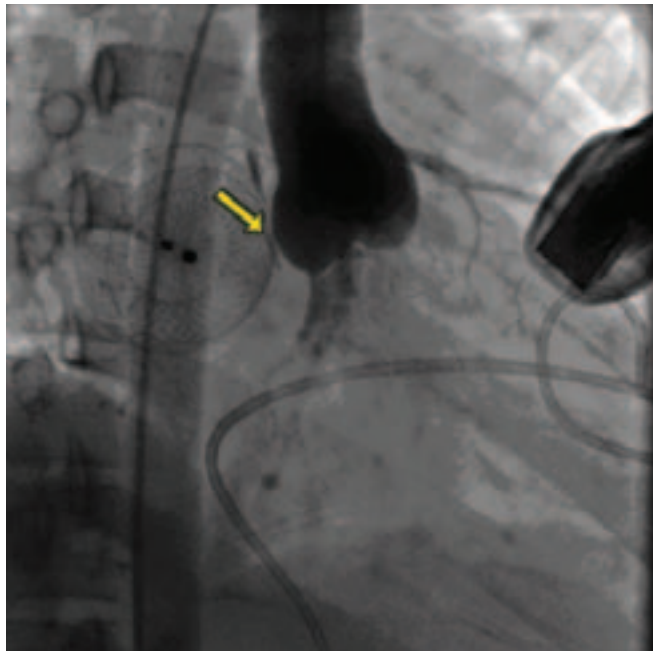
operation.[3,4]

The ASO is a self-expandable, double-disc device made from a Nitinol wire mesh. Nitinol is a metal alloy used in many medical appliances. The two discs are linked together by a short connecting waist corresponding to the size of the ASD. Its closing ability is normally increased by filling the discs and the waist with polyester fabric.[3]

Case report

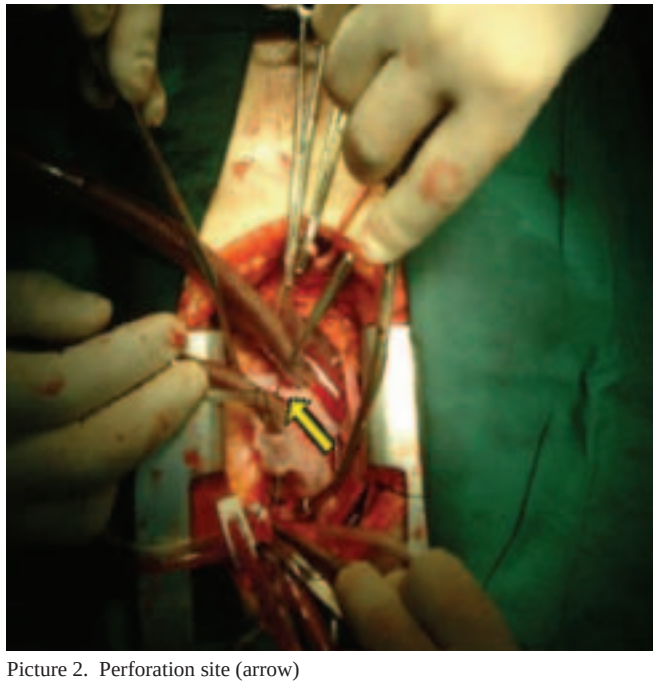
A 26-year-old woman with symptoms of palpitation and dyspnea on exertion was referred for ASD closure with the ASO. She had normal sinus rhythm on her ECG and a normal chest X-ray. Transthoracic and transesophageal echocardiography revealed a moderate-sized ASD (secundum type) 17mm in size as well as left-to-right shunt, Qp/Qs=1.8, anterosuperior rim: 2mm, posteroinferior rim: 16 mm, anteroinferior rim: 7-8mm, posterosuperior rim: 11mm, superior rim: 10mm, inferior rim: 19mm, and ejection fraction: 50%.

The patient underwent catheterism and received heparin (7500 units intravenous). The patient's activated clotting time was not checked. An ASO number 26 was inserted successfully for the closure of the defect, and balloon sizing was performed. Transesophageal echocardiography was not available during the procedure. Aspirin and Plavix were prescribed for the patient after the procedure. She was in good physical condition for 2 days, but then a mild pericardial effusion was detected, which was confirmed by echocardiography. The effusion suddenly deteriorated, and the patient's blood pressure decreased and her pulse rate increased. Echocardiography showed severe pericardial effusion. Before long, she was in shock. The clinical impression being that of cardiac tamponade, percutaneous aspiration of the pericardial cavity was performed, which led to a transient improvement in the patient's vital signs. Emergently, a pig-tail catheter was inserted percutaneously. On account of the fact that the patient was bleeding continuously and was in a preshock state, she was transferred to the operating room, where via a mid-sternotomy incision her pericardial cavity was exposed and copious amounts of blood were aspirated. An active bleeding point in the superoanterior aspect of the right atrium adjacent to the aortic root was detected (Picture 1).



Picture 1. Proximity and probable erosion of posterior side of aortic root (arrow)

Cannulation of the aorta, superior vena cava and inferior vena cava was carried out after cardiopulmonary bypass had been established. The right atrium was opened, and the ASO was pulled back in its sheath and removed by the interventionist (Picture 2).



Picture 2. Perforation site (arrow)

The ASD was repaired using a pericardial patch, and the right atrial perforation was repaired by direct suture and pericardial patch reinforcement. Cardiopulmonary bypass and, subsequently, the operation were terminated

uneventfully. After a normal and uneventful postoperative course, the patient was discharged from hospital in good general condition.

Discussion

Reports from different parts of the world indicate that the ASO-associated cardiac perforation is a rare complication which uniquely involves the anterosuperior atrial walls and the adjacent aorta. Despite a great deal of research, the pathophysiology of this complication has hitherto remained poorly understood.[4,5] It is worthy of note that the fistulisation of different cardiac chambers has also been reported.[6] As reported in the literature, our patient had perforation in the anterosuperior aspect of her right atrium. There are reports of early as well as late perforations by the ASO.[7,8] Patients with deficient aortic rims and/or superior rims may be at higher risk of device erosion.[9,10,11] In our case, however, it seems that the rim was sufficient and a deficient rim cannot be blamed for the erosion. Oversized ASOs may increase the risk of erosion, and a device to the defect ratio of 1:1 or a device 10-20% larger than invasively measured stretched defect diameter should be chosen and implanted on the basis of the intracardiac echocardiographic data. [9,12,13] The defect should not be overstretched during balloon sizing,[9] and the reason for cardiac perforation in our case must have been a mismatch between the size of the defect and that of the device; in other words the insertion of a large device in a small ASD. Morphologic variations of the ASD are common. Transthoracic echocardiography supplemented with transesophageal echocardiography is crucial for the determination of the ASD morphologic features, diameter, and rims, which are crucial for proper patient selection. Transesophageal echocardiography allows precise guiding and positioning of the ASO, which is essential for a safe and effective transcatheter ASD closure.[11,14] In our patient, the catastrophic perforation must have occurred 2 days after the procedure because during the first 2 post-intervention days there were no abnormal findings other than mild pericardial effusion. This is a point to ponder; indeed the fact that such delayed catastrophic events may occur after such procedures renders a close observation of the patients, even those in whom the immediate results are promising, mandatory.

Conclusion

Cardiac perforation following ASD closure with the ASO is a rare complication. Transesophageal echocardiography during the interventional procedure may reduce the incidence of this complication in as much as it affords a better view of the defect rims, thereby avoiding a mismatch between the size of the device and that of the ASD.

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