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CASE REPORT

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Successful occluder removal and reocclusion of an atrial septal defect after occluder immigration to aortic arch: a case report

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Abstract

Background Atrial septal defect (ASD) is a common congenital heart disease, and currently, transcatheter intervention is the most common clinical treatment method. However, certain complications still occur during the percutaneous process, among which occluder loss and displacement are rare but serious complication. Although the probability of occluder loss and displacement is low, severe cases can endanger life.

Case presentation Here, we report the case of a patient who underwent ASD closure in which the occluder fell off into the aortic arch, the detached occluder was recovered through catheter intervention, and the patient underwent ASD closure again.

Conclusions In this case report, we highlight that although percutaneous closure of an ASD is regarded as a routine procedure, clinicians should remember the possibility of complications, especially occluder loss and displacement. Therefore, interventionist should carefully evaluate the situation before intervention closure, establish standardized interventional treatment procedures, and provide timely treatment follow-up.

Keywords Atrial septal defect (ASD), Displacement of occluder, ASD closure

Background

With the continuous development of minimally invasive intervention technology, transcatheter closure has become the preferred treatment method for Atrial septal defect (ASD). Although interventional therapy is gradually being accepted by an increasing number of people because of its minimal trauma, simple nature, and good results, approximately 0.55% of patients still experience complications [1]. Occluder immigration usually occurs during or within 12 h after ASD closure, with very few cases occurring several months after closure [2]. After ASD occluder immigration, the occluder is most commonly found in the pulmonary circulation, followed by immigration to the left and right atria and ventricles and, rarely, to the aorta or its branches. After the occluder dislodges, it is usually removed through catheter intervention or surgical thoracotomy. However, the consequences of occluder displacement are serious, and if not handled in a timely manner, occluder displacement may even endanger life. Here, we report a case of ASD closure in which the occluder fell off into the thoracic aorta. Subsequently, transcatheter intervention was used to recover

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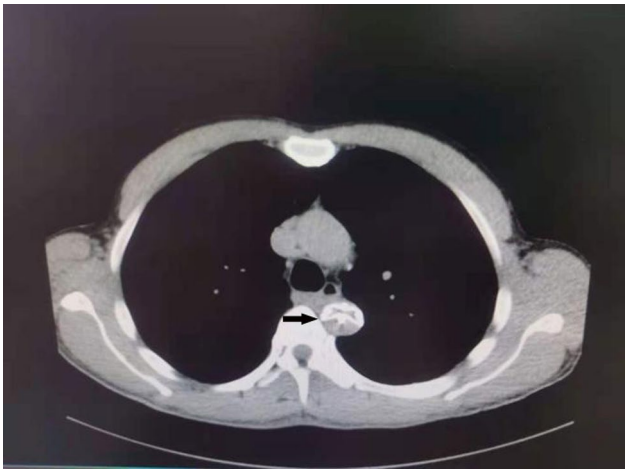

Fig. 1 Chest CT revealed a dense shadow within the aortic arch, indicating the possibility of occluder immigration

the detached occluder, and ASD intervention closure was performed again.

Case presentation

A 43-year-old male underwent ASD closure through catheterization at another hospital. Unfortunately, the occluder fell off after being released during the closure. The patient was rushed to our hospital for emergency treatment. Chest computed tomography (CT) revealed a dense shadow within the aortic arch, indicating the possibility of occluder immigration(Fig. 1). The electrocardiogram was normal. Routine blood tests, liver and kidney function tests, coagulation function tests, and D-dimer measurements showed no significant abnormalities. The patient's vital signs were stable, and 2/6-grade systolic murmurs could be heard in the second intercostal space of the left sternum. The occluder may have fallen into the left atrium and then circulated through the mitral valve to the left ventricle and finally through the aortic circulation to the thoracic aorta. Considering the high risk of surgical removal of the occluder, we attempted to use a mesh capture device to remove the occluder through the femoral artery. Under digital subtraction angiography (DSA) fluoroscopy, it was observed that the atrial septal occluder was located in the descending aorta(Fig. 2), and a guide wire was used to retrieve the occluder. Considering the patient's choice of an 18 mm ASD occluder in the external hospital, a 14 F atrial septal transport sheath was sent along the guide wire, and an end hole catheter(Fig.S1) was sent through the transport sheath to the descending aorta occluder. The right disc rivet of the occluder was successfully grabbed using a mesh capture device(Fig.S2), and the occluder was inserted into the transport sheath and withdrawn from the transport system(Fig. 3)(Video.S1). The occluder was successfully removed. Subsequently, transthoracic echocardiography revealed a 0.9 cm ASD(Fig. 4) and transesophageal echocardiography revealed a 1.0×1.15 cm ASD(Fig. 5). After evaluation, a 20-mm ASD occluder was selected and deployed successfully across the defect via the conventional technique. After confirming the position and stability of the device on DSA and TTE, the device was released(Fig. 6). Postoperative follow-up cardiac ultrasound revealed that the occluder was in place and that there was no significant shunt. One-year follow-up revealed normal cardiac ultrasound, routine blood test and liver and kidney function test results, and no serious complications, such as occluder immigration, right ventricular outflow tract obstruction, or atrioventricular conduction block, were found. No impact of the occluder immigration or damage to the valves caused by the occluder was found.

Fig. 2 Under DSA fluoroscopy, it was observed that the atrial septal occluder was located in the descending aorta

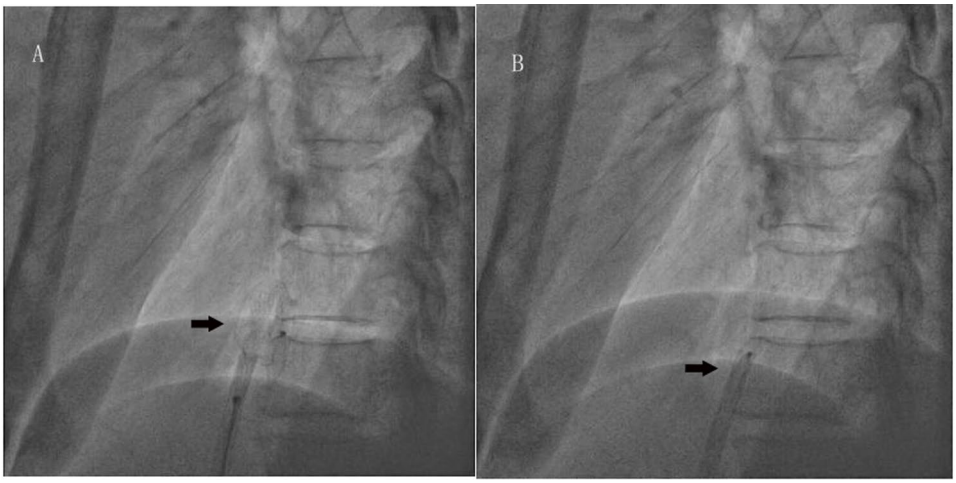

Fig. 3 The right disc rivet of the occluder was successfully grabbed using a mesh capture device, and the occluder was inserted into the transport sheath and withdrawn from the transport system

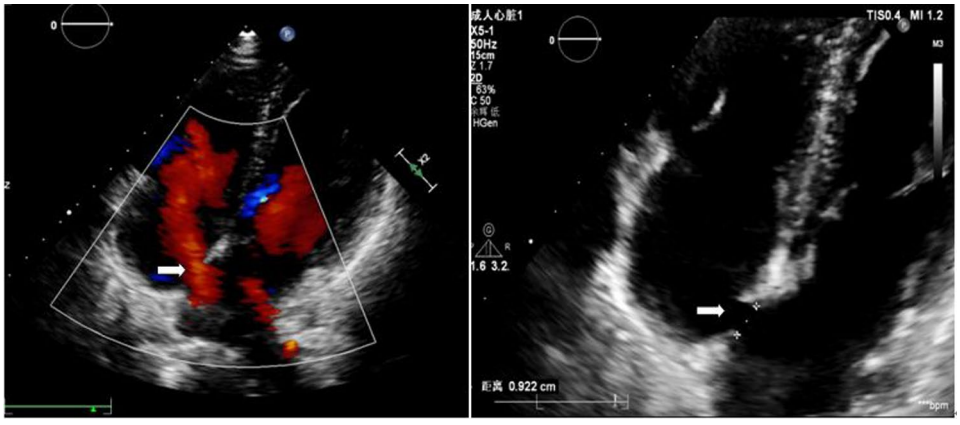

Fig. 4 Transthoracic echocardiography revealed a 0.9 cm ASD

Discussion and conclusions

A review of relevant case reports revealed that interventional closure of atrial septal defects through catheterization rarely results in the immigration and displacement of the occluder. However, when the occluder dislodges, it can cause a series of clinical symptoms, and in severe cases, it can even endanger life [3]. When the occluder falls off the left heart system, larger occluders are usually stuck at the mitral or aortic valve orifice due to haemodynamic effects, thereby affecting valve function and left heart function and causing symptoms of chest tightness and palpitations. Smaller occluders can even flow into the arterial system, affecting the blood supply to the corresponding organs and causing symptoms of organ ischaemia [4, 5]. When detached into the right heart system, larger occluders usually stay in the right atrium or right ventricle, causing symptoms of palpitations and chest tightness. Smaller occluders can reach the pulmonary artery with blood circulation, causing clinical symptoms related to pulmonary embolism [6]. Failure to handle occluder immigration in a timely manner will result in serious consequences. At present, the main reasons for the immigration and displacement of the occluder in relevant reports are as follows [7–9]: (1) the size of the occluder is too small, (2) the anatomical location of the lesion is special (the distance between the residual end of the defect and the surrounding structure is too short or the rim is relatively soft), and (3) improper operation of the equipment or quality issues with the equipment itself. Reviewing the characteristics of this patient, the reason for the immigration of the occluder may be the small size of the selected occluder and the thin and weak atrial septum at the rim of the atrial defect, which could not support the occluder for a long time. Therefore, when we performed interventional occlusion again, we chose a larger occluder, and all postoperative indicators indicated that the occlusion effect was satisfactory. At the same time, when choosing the intervention method for removing the occluder, the following points should be kept in mind: (1) A blind operation should not be carried out,

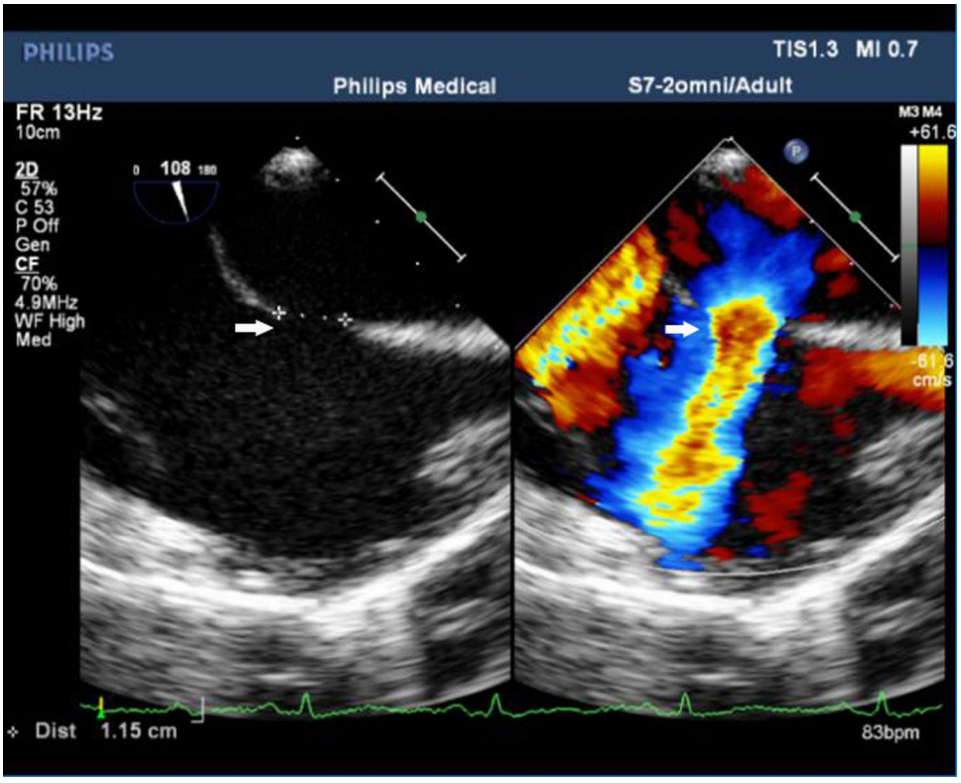

Fig. 5 Transesophageal echocardiography revealed a 1.0 × 1.15 cm ASD

Fig. 6 A 20-mm ASD occluder was selected and deployed successfully across the defect via the conventional technique

and the quality of the imaging evaluation should be fully improved to clarify the specific location of the occluder to formulate the operation route. (2) The transport sheath selected for the recovery of the occluder should be 2 F larger than the transport sheath matched with the occluder model to facilitate recovery. If the occluder is large, a small slope can be cut at the end of the conveying sheath to increase the recovery area of the sheath mouth. (3) After removing the occluder, it is necessary to inspect the occluder to observe whether its structure is intact and whether there is any adhering autologous tissue and if so, to treat the damaged heart cavity and large blood vessel structure.

Although transcatheter closure of atrial septal defects is relatively simple, the following points should be kept in mind during intervention closure: (1) Before intervention closure, echocardiography evaluation of the size of the atrial septum and the condition of each rim should be performed, and the indications for interventional treatment should be clarified. (2) Before and after releasing the occluder, echocardiography should be used to confirm the position and shape of the occluder. The interventionist needs to repeatedly confirm the stability of the occluder before releasing it. (3) Cardiac ultrasound should be regularly performed after surgery to observe changes in the occluder and cardiac structure; therefore, adequate preoperative preparation and standardized intraoperative procedures should be carried out to minimize the occurrence of complications. Close postoperative follow-up should be conducted to promptly identify and address any related complications to maximize the benefits for patients.

In summary, careful preoperative evaluation, standardized intraoperative procedures, and timely postoperative follow-up are important, and catheter intervention closure is a safe and effective treatment method for ASD. When immigration and displacement of the occluder occur, the removal of the occluder via a catheter is simple and minimally invasive, making it the preferred treatment for occluder immigration and displacement.

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Author contributions

Zaiqiang Zhang wrote the main manuscript text. Jiawang Ding and Zaiqiang Zhang reviewed the manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Competing interests

The authors declare no competing interests.

Disclosure of conflict of interest

None.

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