CASE REPORT

The migration of atrial septal occluder device, is it fatal?

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SUMMARY

Atrial septal defect (ASD) is a defect between right and left atrium. Nowadays, percutaneous closure using an atrial septal occluder (ASO) device is the preferred treatment for secundum ASDs due to its minimal invasiveness and high success rates. Although rare, device dislodgement can occur and may require surgical retrieval. This retrospective case series from RSUP Dr. Sardjito Hospital (January 2022–July 2024) reports three paediatric cases of failed ASD closure due to ASO dislodgement. The patients were aged 9, 12, and 13 years. Dislodgement occurred three years post-implantation in one patient, two months post-implantation in another, and intraoperatively in the third. Migration sites included the left atrium and right ventricle. Surgical removal and patch closure were performed in all cases. Cross-clamp times ranged from 20–24 minutes and cardiopulmonary bypass times from 34–46 minutes. All patients successfully recovered and were discharged without residual defects or further complications. Possible causes of ASO dislodgement include undersized devices, large defects, poor rim support, and procedural factors. Despite the children's relatively normal body weights, improper anchoring or anatomical limitations may have contributed to the device failure. While percutaneous retrieval is possible, chronic dislodgements are best managed surgically. No major complications, such as rupture or embolism, occurred postoperatively. In conclusion, although ASO dislodgement is rare, timely surgical intervention is essential. Since asymptomatic cases may remain undiagnosed, regular follow-up is crucial to detect delayed dislodgement.

KEYWORDS:
Atrial septal defect, dislodgement, embolism

INTRODUCTION

Continuing previous research by Ambarsari et al., titled 'Atrial Septal Defect Occluder Devices and Embolization – A Case Series,' published in the Bali Medical Journal in 2023. The atrial septal defect (ASD) is one of the most prevalent congenital heart diseases (CHDs).[1] ASD allows for the shunting of oxygenated blood from the left atrium to the right atrium, which can lead to significant consequences, including embolism, pulmonary stenosis, cardiomyopathy and heart failure if not treated properly and promptly. It may be divided into several types: ASD primum (ASD I), ASD Secundum (ASD II), sinus venosus, and coronary sinus ASD.[2] A small defect less than 3 mm will usually close naturally. While ASD with diameter 3 to 8 mm frequently can be closed in childhood, the large defects frequently fail to close spontaneously.[3] Furthermore, because an ASD is typically asymptomatic and has quiet murmurs, these CHD problems frequently fail to result in an early diagnosis or referral.[1] Over the last few decades, the paradigm for treating ASD has shifted toward less invasive interventions. Techniques and equipment for transcatheter treatment have been improved and refined. ASD closure using a percutaneous device has become a popular choice because it reduces the risk of surgery and decrease length of stay in hospital.[4]

The use of transcatheter percutaneous device closure in ASD is now acknowledged as the main choice for majority of patients with secundum ASD, demonstrating great efficacy and lower complication rates than open surgery. A recent study in 2023 showed a 98% success rate in 1,395 patients and a 97.3% complete closure rate at 1 year. For 2.7 years, only 8 patients who complained of problems had significant complications.[5] Dislodgement and embolism frequently occur during the first several hours following an occluder device insertion, with reported rates ranging from 0.5 to 1.1%. Only a few studies have been conducted to determine the late incidence dislodgement of these closure devices. Retrieval of the dislodged device is necessary in order to prevent further complications such as arterial and valvular obstruction or damage and usually requires surgery.[2]

More problematic complications are associated with small children, technique, fluoroscopy time, and large defects. Many devices can only be utilized for defects up to 20 mm in diameter. Larger defects with a diameter of 20 or 25 mm necessitate a stable device position and in certain cases "oversizing" for proper placement, which may necessitate lengthy procedures including an invasive thoracotomy, full or median sternotomy and an open-heart surgical approach. Additionally, the fluoroscopy time is linked with the ASD complexity.[5]

Residual shunts, stenosis, embolism, device-related thrombosis, cardiac erosion and perforation, infective endocarditis, and sudden death are the most prevalent complications linked with ASD closure devices. Adding to these potentially fatal sequelae, as mentioned before, while patients with smaller ASD rarely show any symptoms, several patients with a dislodged Atrial Septal Occluder (ASO) were

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Table I: Comparison of the Patient Characteristics

Name	Patient 1	Patient 2	Patient 3
Age (years)	9	12	13
Body Weight (kg)	33.2	34.7	36.5
Height (cm)	129	147	149
Sex	female	Male	Female
Type of Defect	ASD II	ASD II	ASD II
Onset	3 years post-intervention	2 months post-intervention	During the intervention
Symptoms	Shortness of breath	Asymptomatic	Palpitations
Echocardiography finding	ASD II, L to R, mild PH	ASD II, TR mild	ASD II
Defect area (cm2)	6	2	3
Site of Dislodgment	Left atrium	Right ventricle	Right ventricle
Cross Clamp time (minute)	23	20	24
Cardiopulmonary bypass time (minute)	46	38	34
LOS (days)	7	6	5

ASD: atrial septal defect, cm: centimetres, LOS: length of stay, L to R: left-to-right shunt, kg: kilogram, min: minutes, PH: pulmonary hypertension, TR: tricuspid regurgitation, ASD II: Atrial Septal Defect type secundum.

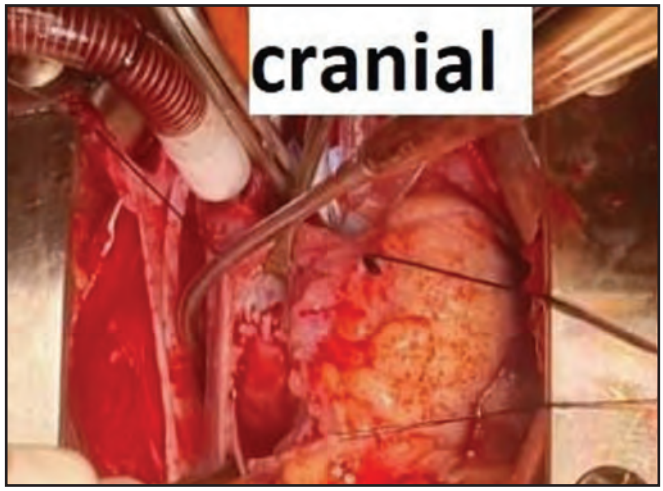

Fig. 1: Atrial septal defect (ASD) closure using an autologous pericardial patch from the first patient

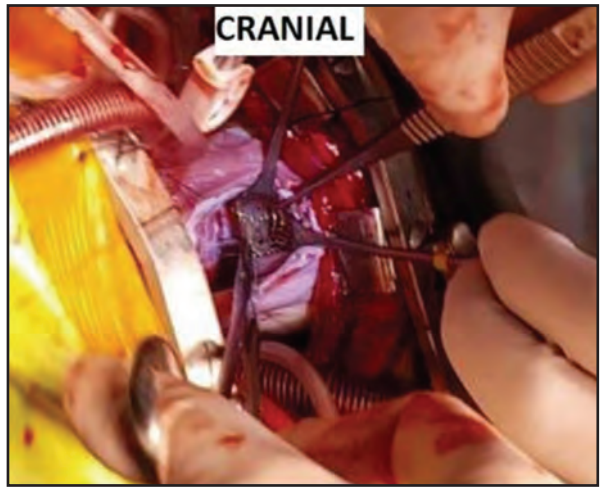

Fig. 2: The dislodgment of the occluder from the second patient

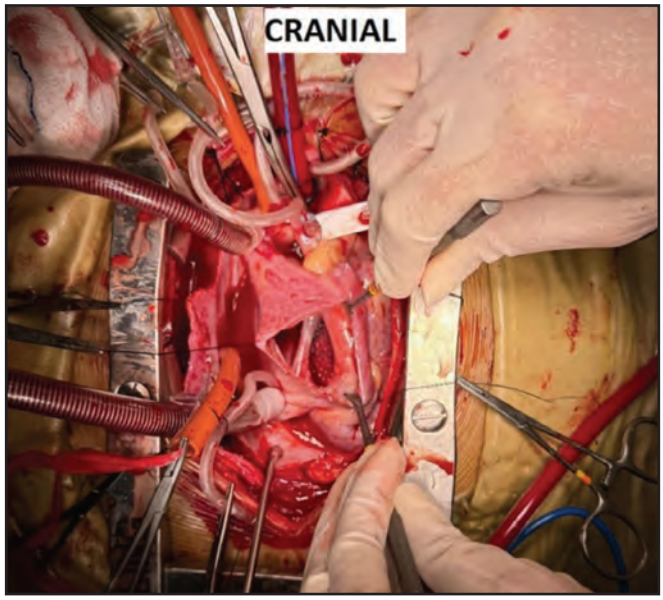

Fig. 3: The dislodgment of the occluder near tricuspid valve from the third patient

also asymptomatic and as a result, they were not recognized to have a potentially life-threatening complication before coming to a hospital with a serious condition.[5] Accordingly, heart failures directly related to complications from an ASD closure using occluder devices have been seldom reported. Hence, in this case series, we report several unsuccessful closure cases using ASO devices which could have been potentially fatal without invasive surgical interventions.

CASE PRESENTATION

This study is a retrospective case series that involved a thorough examination of medical records for patients with ASD who were unsuccessfully closed using an ASO device between January 2022 until July 2024 in RSUP Dr. Sardjito Hospital. This case series reports three patients who were diagnosed with ASD and experienced unsuccessful ASD closure using ASO devices.

Three patients came to our hospital. The first patient complained of difficulty to breath (dyspnea), the second patient had no symptoms (asymptomatic), while the third

patient planned to undergo ASD closure using an ASO device.

Case 1

The first case, female 9-year-old girl had an ASO placement. Three years after the placement, she complained difficulty of breathing. Physical examination revealed that the patient had an increasing respiratory rate and heart beat with normal oxygen saturation. First heart sound and second heart sound were in normal limit with an intermittent split. The radiography examination revealed the migration of an occluder still in atrium. The echocardiography findings are summarized in table I. The operation finding was an ASD II with an area 6 cm2 with a device migration and moving to the right lower Pulmonary Vein (PV). We evacuated the device and followed by ASD closure using an autologous pericardial patch (Figure 1). Follow-up echocardiographic examination revealed no ASD, and the patient had no complaints of dyspnea.

Case 2

The second case, male 12-year-old had an ASO intervention. Two months later, during a routine follow-up visit, transthoracic echocardiography revealed that the occluder device had dislodged and migrated into the right ventricle. The patient remained hemodynamically stable and asymptomatic at the time of discovery. Heart sound demonstrated an intermittent split and pansystolic murmur. The radiology examination revealed the occluder misplaced at the level of Right Ventricle (RV). The echocardiography findings are summarized in table I. Given the risk of further complications, surgical intervention which is ASD closure using autologous patch was planned to retrieve the device and reassess the atrial septal defect for definitive closure. Intraoperative findings revealed an ASD II with an area 2 cm2 and dislodged device in the right ventricle (Figure 2). There was some minimal injury of the Tricuspid Valve (TV) with no rupture was found. Following the operation, the patient remained asymptomatic during the postoperative evaluation with no residual ASD was found in echocardiography evaluation. No health concerns were noted at subsequent follow-up visits.

Case 3

The third case, Female 13-year-old girl complained heart palpitation who was planned to have ASD closure using a percutaneous device. Physical examination revealed that the patient was stable with normal vital sign. We found normal first heart sound, while the second heart sound was accompanied by a systolic ejection murmur. During the procedure, the right and left heart catheterization showed an unsuccessful ASO device replacement, we found an ASD II and the device had escaped into the RV. Thus, the decision was made to perform open surgery on the patient because the operator had failed to replace it correctly. The operation finding was a secundum ASD with an area 3 cm2 and an occluder near the TV of the right ventricle (Figure 3). The evacuated occluder device looked to be undamaged and followed ASD closure using autologous patch. There was no rupture nor heart injury found. Postoperatively, the patient had no complained and echocardiographic evaluation showed no evidence of a residual ASD. Table I presents a comparison of the patient characteristics of the cases.

DISCUSSION

The complications associated with percutaneous ASD closure are diverse and may include vascular trauma, air embolism, device embolization, thromboembolism, venous return blockage, atrial septal damage, aortic perforation, and infective endocarditis. Among these potentially life-threatening outcomes, perforation is considered the most serious and feared complication.[5]

Dislodge of ASO is a rare complication. We only reported three patients with ASO migration in our centre during January 2022 - July 2024. The most common causes for ASO closure complications are undersized devices, small children, large defect sizes, small left atrial, and an inadequate rim.6 In our study we report all the patients were children under 14 years old with the body weight range from 33.2 kg – 36.5 kg. Even though this weight is not defined as small children (BW <15kg)[5], there were several factors such as the operator skill and device patency, which could lead to the unsuccessful ASO placement.

The removal of a dislodged ASO may be achieved via either invasive surgical intervention or percutaneous intervention. Surgical extraction is generally preferred in cases of chronic device dislodgement, particularly when identified several years post-implantation or when associated with right-sided heart failure.[6] In our study we reported two patients with chronic dislodgement but without involving any right heart failure because all of the occluders removed did not create significant blockage of the arterial blood flow. The displacement of ASO may cause mispositioning in several places. The most frequent location is in the RV and PA. As mentioned before, we reported 2 of our 3 patients had mispositioning in the RV near the TV.

Most of these situations need surgical interventions to prevent serious complications.7 Occluder migration into the RV does not always produce clinical symptoms, particularly when pulmonary artery flow remains unobstructed. However, if blood flow to the pulmonary circulation is compromised, the resulting volume overload may precipitate right ventricular failure or trigger arrhythmias.[7-8] In our cases, device migration produced differing outcomes: the first patient experienced dyspnea due to left-sided device displacement, while the second patient remained clinically stable, likely due to the absence of hemodynamic compromise and preserved RV function. Considering the chronicity of the device embolization, we opted against percutaneous retrieval and favoured surgical management. Early intervention in the management of atrial septal defect device dislodgement plays a critical role in ensuring optimal outcomes and preventing complicated sequelae.

CONCLUSIONS

The incidence of ASO migration is considered infrequent because there were only three patients reported between January 2022-July 2024 in our centre. In this study, the three patients did not have any immediate life-threatening conditions such as unstable vital signs due to ASO device displacement. But once found, the patients needed to undergo surgery to remove the device and close the residual defect, to prevent heart deterioration, rupture, or

embolization. Furthermore, surgery to retrieve the devices as soon as possible has a low risk of morbidity and mortality. Complications of ASO device migration in this study did not show any significant results because there was no rupture during open heart surgery due to the device. All the patients were discharged without any health complaints. In our study, we did not follow-up all of the patients with percutaneous placed ASO devices. It is still possible that some patients were having dislodgment of their installed occluder but their condition was underdiagnosed.

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CONSENT STATEMENT

All patients involved in this study provided informed written consent. Their identities have been kept confidential throughout the study.

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