Migration of an Atrial Septal Defect Occluder in a Pregnant Patient

Alan Mendez-Ruiz, MD, Michael Dangl, MD, Jorge Peñalver, MD, and Rosario Colombo, MD,
Miami, Florida

INTRODUCTION

Atrial septal defect (ASD) accounts for 10% of all congenital heart disease.[1] The most common type is the ostium secundum defect, which accounts for 80% of ASD cases.[2] Currently, surgical and transcatheter closure (TC) are the available therapeutic options for secundum ASD, and TC has become the mainstay of treatment and is associated with lower mortality, periprocedural complications, and length of hospital stay. Among the most common complications associated with TC are arrhythmias, atrioventricular block, cardiac erosion, and occluder migration.[1]

Migration of ASD occluder (ASDO) has been reported in as many as 1.6% of cases.[1] The most common sites for migration are to the right heart and pulmonary artery. Serious complications such as ventricular outflow tract obstruction and limb ischemia have been associated with ASDO migration.[3] The majority of occluder migrations occur within the first 24 hours following implantation, although delayed migration has been reported.[1] Transthoracic echocardiography (TTE) has been shown to accurately identify early and delayed ASDO migration; however, its use becomes limited in the case of extracardiac migration.[4,5] Percutaneous catheter retrieval has been shown to be safe and efficacious;[6] however, surgery may be required when percutaneous retrieval is not feasible. We present the delayed migration of an ASDO in a pregnant patient seen on TTE.

CASE PRESENTATION

The patient is a 24-year-old woman at 28 weeks' gestation with a medical history of mitral valve prolapse and ASDO placed in the patient's home country 5 years prior to presentation. Despite ASD closure, the patient had persistent dyspnea with exertion. The patient established care with an obstetrician and was referred for an outpatient TTE due to their symptoms. The TTE revealed a large ostium secundum ASD and absence of ASDO in the interatrial septum. The measured defect was of 26.8 mm in a modified right ventricle- (RV-) focused apical 4-chamber view with left-to-right shunt (Figure 1A, Video 1). The posterior rim measured 3.1 mm, and the aortic rim was absent in a short-axis view (Figure 1B, Video 2). A circular hyperechoic object was seen in the parasternal and modified parasternal short-axis views and was felt to be located within either the left atrium or the pulmonary artery, which raised concern for a dislodged ASDO (Figure 1B and C, Videos 2 and 3). The object was not seen in the left atrium in other echo views, further suggesting it was located within the pulmonary artery. Left ventricular systolic function was normal, with an ejection fraction of 55% to 60%. The RV was mildly dilated (right ventricular outflow tract [RVOT] diameter 38 mm) with qualitatively mild systolic dysfunction. The calculated Qp/Qs was 2.3/1.0. The right ventricular systolic pressure was normal at 25 mm Hg. A report of a TTE done 2 years earlier described the ASDO as well seated with residual color-flow interatrial shunting.

The patient was subsequently referred to the emergency room for further evaluation. On presentation, their pulse was 81 bpm and regular, blood pressure was 114/68 mm Hg, and oxygen saturation was 97% on room air. On examination no jugular venous distention was noted. Their lungs were clear to auscultation. A fixed S2 splitting was heard, and no murmurs were present. Trace pedal edema was noted. An electrocardiogram showed normal sinus rhythm. Their laboratory results, including a complete metabolic panel and complete blood count, were all within normal limits. Obstetric ultrasound revealed an underweight fetus at 28 weeks of gestation. A 2-view chest x-ray revealed migration of the ASDO (diameter 46 mm) possibly into the pulmonary artery (Figure 2). A multidisciplinary heart team met to discuss management. Given the length of time since initial ASD implantation, the ASDO was felt to be likely endothelialized and therefore percutaneous retrieval was not a viable option. Surgery was considered elective, not urgent nor emergent, with surgical follow-up arranged for after delivery of the child. The patient was started on aspirin 81 mg daily as an antithrombotic measure. Planned c-section delivery occurred at 33 weeks due to fetal growth restriction without complications. Chest computed tomography (CT) confirmed migration of the ASDO within the pulmonary artery (Figure 3). The patient was lost to follow-up prior to the planned surgery for ASDO retrieval.

DISCUSSION

Migration of ASDO most often occurs within 24 hours of implantation, yet delayed migration (>24 hours) has been described in previous case reports.[4,6,7] Engin *et al.*[4] reported the case of a migration of an Amplatzer occluder 7 years after implantation and approximately 1 year after the last TTE follow-up. The device migrated into the main pulmonary artery. It was surgically removed, and the ASD was closed. We believe that migration likely occurred at least 5 years after occluder implantation based on a previous TTE report that documented the ASDO was in place but cannot exclude the possibility

From the Department of Internal Medicine, University of Miami Miller School of Medicine/Jackson Memorial Hospital, Miami, Florida (A.M.R., M.D.); and Department of Medicine, Cardiovascular Disease Division, Jackson Memorial Hospital, Miami, Florida (J.P., R.C.).

Keywords: Atrial septal defect, Occluder, Migration, Pregnancy, Transthoracic echocardiogram

Conflicts of interest: The authors reported no actual or potential conflicts of interest relative to this document.

Correspondence: Rosario Colombo, MD, Department of Cardiology, Jackson Memorial Hospital, 1611 NW 12th Avenue, Miami, Florida 33136. (E-mail: *rosario.colombo@jhsmiami.org*).

2468-6441

https://doi.org/10.1016/j.case.2023.08.002

VIDEO HIGHLIGHTS

Video 1: Two-dimensional TTE, basal parasternal short-axis RV-focused view with color-flow Doppler, demonstrates the dilated right heart, a large secundum ASD with a left-to-right shunt, and mild tricuspid regurgitation.

Video 2: Two-dimensional TTE, basal parasternal short-axis view, demonstrates the dilated RVOT and right atrium, the large secundum ASD with the deficient posterior, and absent aortic rims. A circular echodense object concerning for the suspected dislodged ASDO in the left atrium or main pulmonary artery is seen.

Video 3: Two-dimensional TTE, basal parasternal short-axis RVOT-focused view with color-flow Doppler, demonstrates the dislodged ASDO device within the pulmonary artery. Mild pulmonary regurgitation without color-flow evidence for flow obstruction is also noted.

View the video content online at www.cvcasejournal.com.

of TTE misinterpretation and a more remote migration soon after placement.

Risk factors associated with occluder migration are known to be large ASD diameter, rim deficiency (length <5 mm), and device under- or oversizing.[3] We measured the maximum ASD diameter by TTE, and it was 26.8 mm in a modified RV- focused apical 4-chamber view. The posterior rim was deficient, and the aortic rim was absent, which likely contributed to dislodgement of the occluder from the ASD, as residual interatrial shunt was noted in the TTE performed 2 years before the presentation.

The utility of TTE for accurate cardiac localization of early and delayed ASDO migration has been previously reported.[4,5] It was challenging to determine the precise location of the ASDO device with chest x-ray and TTE alone, but it was thought to be located within the left atrium or the pulmonary artery (Figure 1B and C). Color-flow and conventional Doppler did not suggest obstruction to flow, and the right ventricular systolic pressure was normal. No further imaging was obtained during intrauterine pregnancy, but a noncontrast CT scan performed after delivery confirmed that the ASDO device was within the pulmonary artery.

There are no previously reported cases of ASDO migration in pregnancy. In a multicenter retrospective study by Yap *et al.*[8] comparing pregnancy outcomes in patients with repaired versus unrepaired ASD, 188 patients were evaluated. Although the technique used for ASD repair was not described, no events related to device migration during pregnancy and the postpartum period were reported. In terms of obstetric complications, no differences were observed between women with unrepaired and repaired ASD; however, women with an unrepaired ASD had a higher risk of fetal mortality (adjusted odds ratio = 5.55; 95% CI, 1.77-17.4) and offspring small for gestational age (adjusted odds ratio = 1.95; 95% CI, 1.15-3.30) as seen in the case presented above with an underweight fetus at 28 weeks of gestation.[8]

There are currently no guidelines for the management of migrated ASDO. Treatment strategies have been limited to case reports and case series that include surgery, TC retrieval, and conservative management.[3,6,7] Immediate TC retrieval was not considered due to the low likelihood of success given the concern for device endothelialization.[6] Immediate surgical retrieval was also not attempted due to the clinical stability of the mother and the child and the risks that cardiopulmonary surgery carries during pregnancy.[9] A conservative approach was decided with a plan for surgical retrieval following delivery.

Although it is well known that pregnancy is associated with a 4 to 6 times increased risk of venous thromboembolism, and the risk of paradoxical embolism in ASD has been reported in up to 14% of patients, current guideline recommendations on anticoagulation are limited to patients with ASD and atrial fibrillation.[2,10,11] Additionally, the use of anticoagulation during pregnancy is associated with increased risk of maternal bleeding and thrombotic events as well as a higher risk of fetal loss.[12] Furthermore, the thrombogenicity of ASDO, particularly the Amplatzer device, has been shown to be low.[13]

CONCLUSION

Delayed ASDO migration is an infrequent and previously unreported complication in a pregnant patient. Transthoracic echocardiogram is a safe, rapid, and noninvasive study during pregnancy that allows

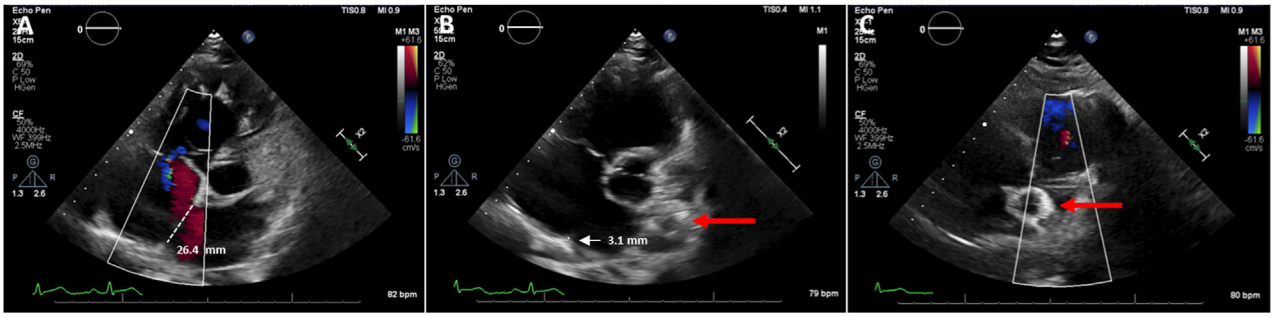

Figure 1 Two-dimensional TTE, basal parasternal short-axis views. **(A)** Right ventricle- (RV-) focused view with color-flow Doppler, systolic phase, demonstrates the dilated RV and right atrium with a large secundum ASD with left-to-right shunt and mild tricuspid regurgitation. **(B)** Without color-flow Doppler, the deficient posterior rim *(white arrow)* and absence of an aortic rim are demonstrated. A circular echodense object *(red arrow)* concerning for the suspected dislodged ASDO in the left atrium or main pulmonary artery is seen. **(C)** Right ventricular outflow tract–focused view, diastolic phase with color-flow Doppler, demonstrates the dislodged ASDO device *(red arrow)* within the pulmonary artery.

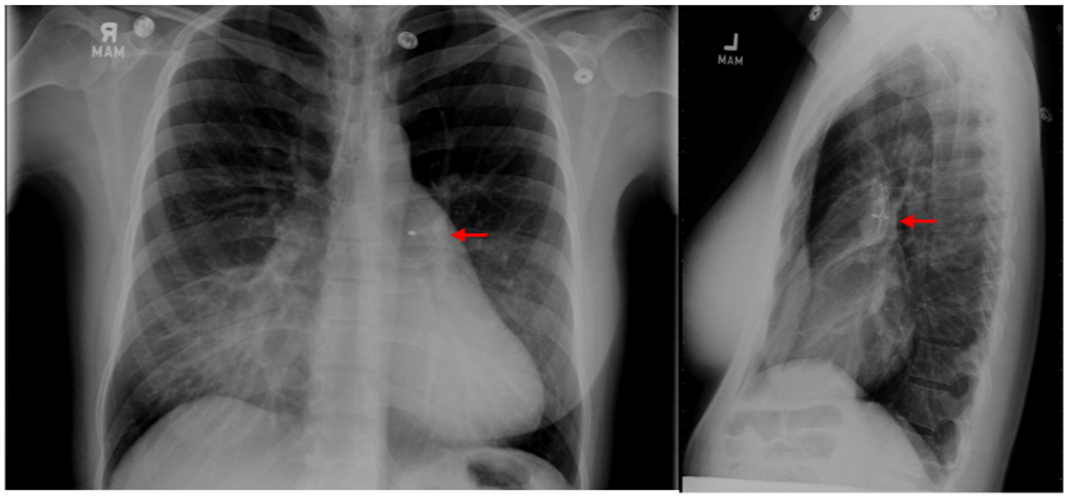

Figure 2 Chest x-ray posteroanterior and lateral views demonstrate the migrated ASDO *(arrows)* near the left atrial appendage or main pulmonary artery.

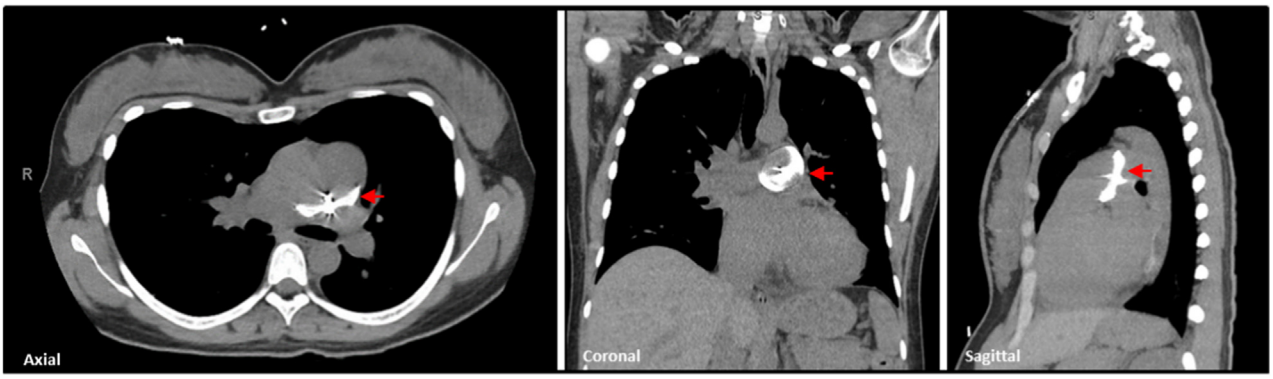

Figure 3 Chest CT scan without contrast and axial, coronal, and sagittal displays demonstrate the migrated ASDO *(arrows)* within the main pulmonary artery.

ASDO localization and hemodynamic evaluation that can help guide decision-making. We reported a conservative approach to an embolized ASDO discovered within the pulmonary artery in a hemodynamically stable patient who subsequently underwent uncomplicated delivery.

ETHICS STATEMENT

The authors declare that the work described has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans.

CONSENT STATEMENT

Complete written informed consent was obtained from the patient (or appropriate parent, guardian, or power of attorney) for the publication of this study and accompanying images.

FUNDING STATEMENT

The authors declare that this report did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

DISCLOSURE STATEMENT

The authors report no conflict of interest.

DATA SHARING

All data relevant to the article are included in the article.

ACKNOWLEDGMENTS

We thank sonographer Maria Quiroz for her acquisition of echocardiography images and Dr. Marian Calfa for his clinical assistance with this case.

SUPPLEMENTARY DATA

Supplementary data to this article can be found online at https://doi.org/10.1016/j.case.2023.08.002.

REFERENCES

1. Alnasser S, Lee D, Austin PC, Labos C, Osten M, Lightfoot DT, et al. Long term outcomes among adults post transcatheter atrial septal defect closure: systematic review and meta-analysis. Int J Cardiol 2018;270:126-32.
2. Baumgartner H, Bonhoeffer P, De Groot NM, de Haan F, Deanfield JE, Galie N, et al. ESC guidelines for the management of grown-up congenital heart disease (new version 2010). Eur Heart J 2010;31:2915-57.
3. Martínez-Quintana E, Rodríguez-González F. Risks factors for atrial septal defect occlusion device migration. Int J Angiol 2016;25:e63-5.
4. Engin B, Ç Canbay, Nişli K, Bilge AK, Umman B. Late embolization of an atrial septal defect closure device into the main pulmonary artery. Anatol J Cardiol 2020;24:113-5.
5. Yared K, Baggish AL, Solis J, Durst R, Passeri JJ, Palacios IF, et al. Echocardiographic assessment of percutaneous patent foramen ovale and atrial septal defect closure complications. Circ Cardiovasc Imaging 2009;2:141-9.
6. Wagdi P, Kunz M. Percutaneous, minimally invasive retrieval of a dislodged and impacted device from the abdominal aorta, four months after closure of an atrial septal defect. Am J Cardiol 2008;102:1111-2.
7. Koussayer S, Mousa A, Elkalla MA, Alaujan R, Khalil B. Conservative management of asymptomatic lately embolized amplatzer atrial septal occluder device to the supraceliac abdominal aorta: case report and the literature review. Radiol Case Rep 2021;16:1912-8.
8. Yap SC, Drenthen W, Meijboom FJ, Moons P, Mulder BJM, Vliegen HW, et al. Comparison of pregnancy outcomes in women with repaired versus unrepaired atrial septal defect. BJOG 2009;116:1593-601.
9. Shook LL, Barth WHJ. Cardiac surgery during pregnancy. Clin Obstet Gynecol 2020;63:429-46.
10. Rybstein MD, DeSancho MT. Risk factors for and clinical management of venous thromboembolism during pregnancy. Clin Adv Hematol Oncol 2019;17:396-404.
11. Bannan A, Shen R, Silvestry FE, Herrmann HC. Characteristics of adult patients with atrial septal defects presenting with paradoxical embolism. Catheter Cardiovasc Interv 2009;74:1066-9.
12. Stout KK, Daniels CJ, Aboulhosn JA, Bozkurt B, Broberg CS, Colman JM, et al. 2018 AHA/ACC guideline for the management of adults with congenital heart disease: a report of the American College of Cardiology/American Heart Association task force on clinical practice guidelines. Circulation 2019;139:e698-800.
13. Hornung M, Bertog SC, Franke J, Id D, Taaffe M, Wunderlich N, et al. Long-term results of a randomized trial comparing three different devices for percutaneous closure of a patent foramen ovale. Eur Heart J 2013;34:3362-9.