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CASE REPORT

INTERMEDIATE

CLINICAL CASE

A Very Late Atrial Septal Erosion After an Ostium Secundum Percutaneous Closure

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ABSTRACT

Complications after device closure of ostium secundum defects are rare but possible. We present a very late erosion of the interatrial septum after a percutaneous closure of an ostium secundum defect. Identification of early clinical and imaging clues associated with this condition is fundamental for a timely diagnosis and treatment. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2023;18:101925) © 2023 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

A 37-year-old woman was referred to her cardiologist for a recent history of headache and palpitations. The clinical examination revealed a soft midsystolic murmur and frequent atrial extrasystoles were found on the electrocardiogram.

PAST MEDICAL HISTORY

At the age of 25, she underwent a percutaneous closure of an ostium secundum defect. It was localized in the anterior-superior region of the septum primum with a moderate left-to-right shunt and echocardiographic signs of right ventricular volume overloading.[1] Transesophageal echocardiography (TEE) confirmed the presence of a single ostium secundum defect with surrounding rims >5 mm (**Figure 1**). So, a percutaneous closure was performed using an Amplatzer Septal Occluder,[2] model 9-ASD-015, resulting in complete shunt obliteration. Moreover, a bicuspid aortic valve was detected, without any flow alterations or other associated pathological conditions (including connective tissue diseases).

LEARNING OBJECTIVES

- To pay attention to a very late, rare but potentially relevant complication of a percutaneous atrial septal defect closure.
- To underline the importance of a longer term echocardiographic follow-up.

At the 1-month follow-up the patient was asymptomatic and transthoracic echocardiography showed a well-placed device without any remarkable issues. Her clinical course was uneventful and adequate device positioning was confirmed by transthoracic echocardiographies performed yearly.

Only 2 events need to be reported: a recent pregnancy followed by a very strong, long-lasting cough owing to COVID-19 infection.

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ABBREVIATIONS AND ACRONYMS

ASA = atrial septal aneurysm

ASD = atrial septal defect

TEE = transesophageal echocardiography

DIFFERENTIAL DIAGNOSIS

The differential diagnosis included a long COVID-19 syndrome or a new-onset atrial tachyarrhythmia, related to the atrial septal device.

INVESTIGATIONS

Transthoracic echocardiography was performed in our institution for these symptoms with new findings: the device seemed to be more prominent in the left atrial cavity with a suspected left-to-right color Doppler flow at the lower rim of the device. TEE, performed the following day, shown a paper-thin atrial septal aneurysm (ASA) waving incessantly between the left and the right atrial disks (Videos 1 and 2) with a severe left-to-right shunt at the lower rim of the device (**Figures 2 and 3**, Video 3). The device was well-anchored to the aortic rim but its lower part appeared more mobile and prominent in the left atrium (Videos 4 and 5). In fact, an atrial septal erosion was detected at the lower rim of the device with TEE multiplanar reconstruction (**Figures 4 and 5**).

MANAGEMENT

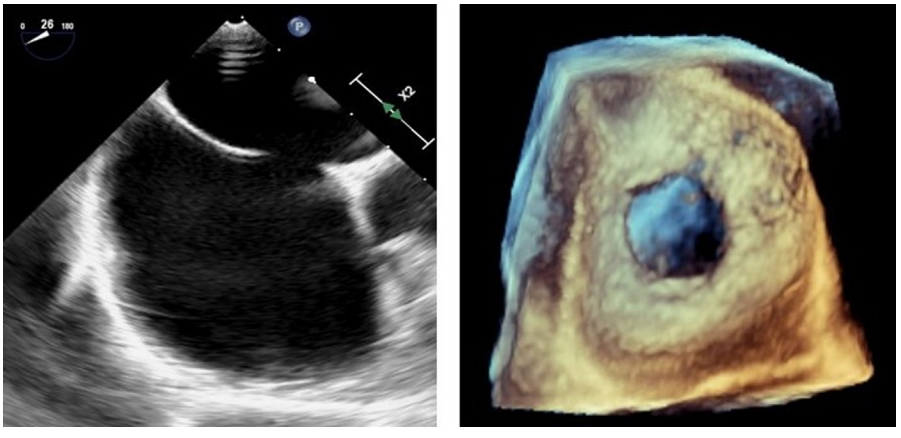
After discussion, considering shunt severity and initial device instability, a surgical approach was chosen (**Figure 6**). At open surgery, performed a few days later, the device appeared well-endothelialized (**Figure 7**), but it was "completely detached and mobile at its lower rim," as the procedural report states. So, the device was removed and closure of the atrial septal defect (ASD) with an autologous pericardial patch (dimension 3 × 4 cm) was then successfully performed. No residual interatrial shunt was evident with TEE at the end of the procedure (**Figure 8**). The patient was discharged on day 6 without any complications.

DISCUSSION

Iatrogenic erosion of the septum primum after percutaneous closure of an ASD is a very rare event.[3] Although it might not be considered immediately life threatening, device instability could be associated with a theoretical risk of device embolization, as well as paradoxical embolism recurrences and long-term hemodynamic impairment owing to the novel defect.[4]

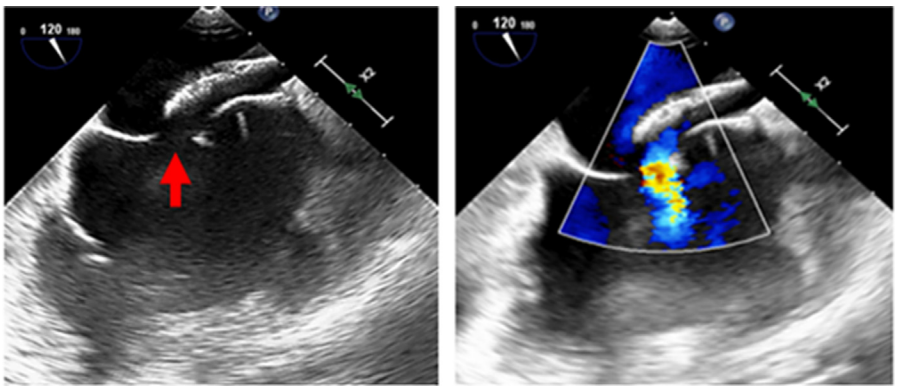
Despite septum primum erosion being mostly unpredictable, in this case we can speculate 3 potential mechanisms contributing to atrial septal erosion. First, the frailty of a paper-thin septum primum and the hypermobility of a huge ASA (Videos 1 and 2), could be considered as risk factors for developing interatrial septum erosion; in fact, a continuous waving movement of a thin septum primum between the left and the right atrial disk could predispose to

FIGURE 1 The Original Ostium Secundum Defect



The original ostium secundum defect seen en face from left atrial side, on the **right**, and from a midesophageal 26° transesophageal echocardiography view, on the **left**.

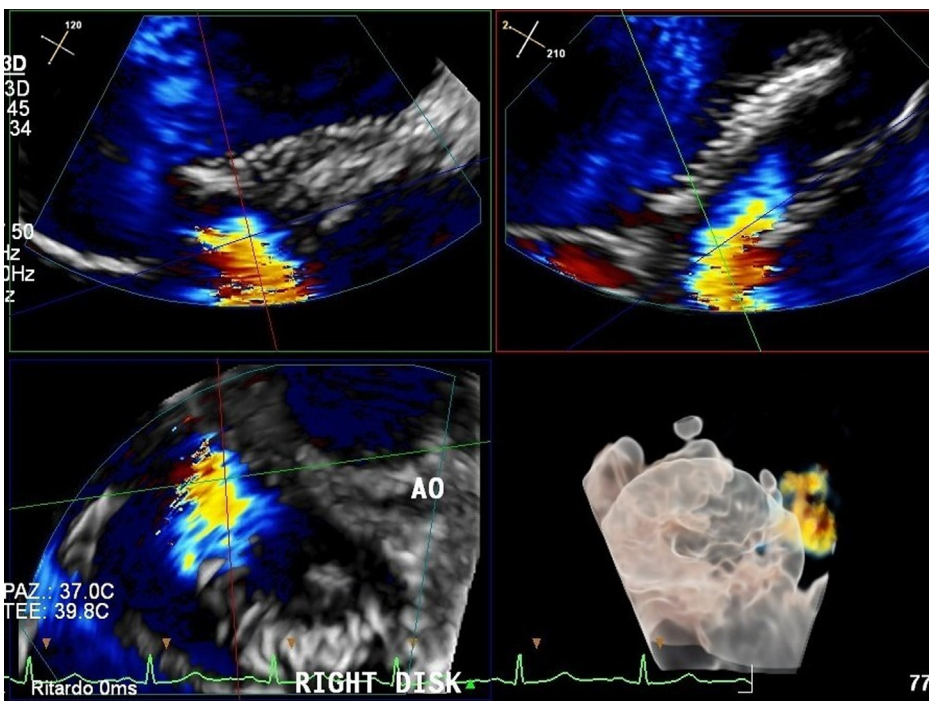
FIGURE 2 **Left-to-Right Interatrial Shunt**



Midesophageal bicaval view showing the erosion site **(red arrow)** at the lower rim of the device **(left)** with a significant left-to-right color Doppler flow **(right)**.

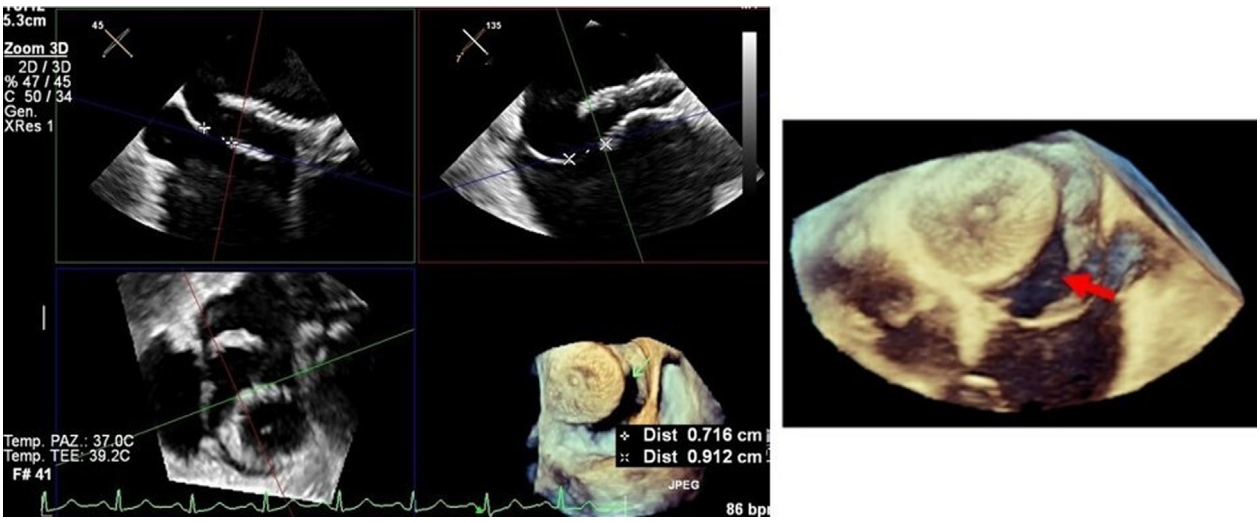
interatrial wear and then erosion.[4,5] Moreover, we must remember the presence of a bicuspid aortic valve, which could suggest greater tissue frailty. Another contributing factor might be the recent pregnancy. The volume overload and the hyperdynamic state typical of pregnancy[6] could have had a negative impact on the thin ASA, owing to an increased shear stress resulting in a higher risk for

FIGURE 3 **Interatrial Shunting: 3D Multiplanar Reconstruction**



A transesophageal echocardiography multiplanar reconstruction demonstrating left-to-right interatrial shunt severity. A 3-dimensional (3D) en face left side view at the **bottom right** (glass technique).

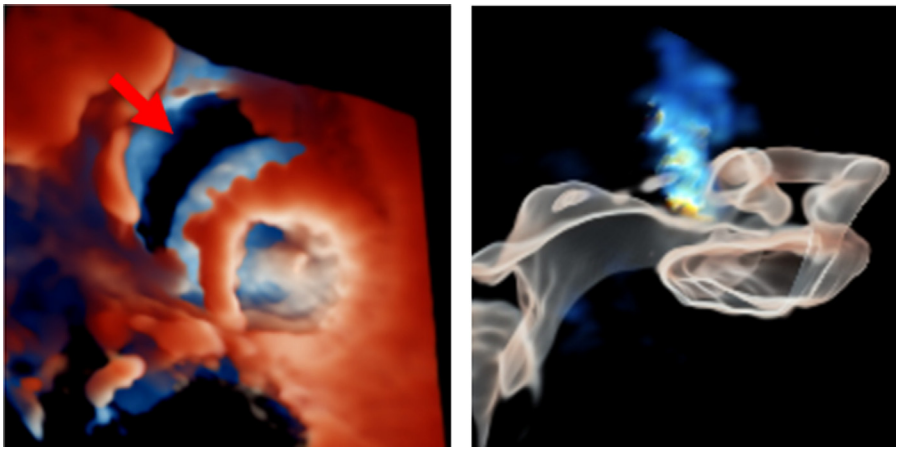
FIGURE 4 Atrial Septal Erosion (Left Atrial Side)



A transesophageal echocardiography multiplanar reconstruction showing atrial septal erosion **(arrows)** seen en face from left atrial side, surrounding almost the entire lower rim of the device (maximum width of 7 mm to the rear septum and 9 mm to the lower septum) **(left)**.

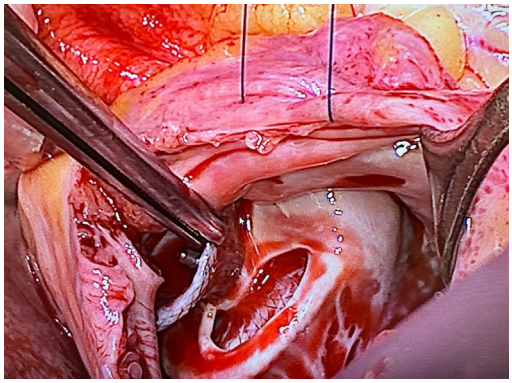
tissue tearing. Last, the strong and long-lasting COVID-19-related cough could have caused a pressure overload on the thin ASA, almost like a Valsalva maneuver, encouraging the waving motion of the ASA between the 2 device disks. So, the anatomical characteristics of the interatrial septum combined with potential cause of volume and/or pressure cardiac overload might have been a trigger for a very late erosion of the septum primum.

FIGURE 5 Device Erosion and Interatrial Shunt (Right Atrial Side)



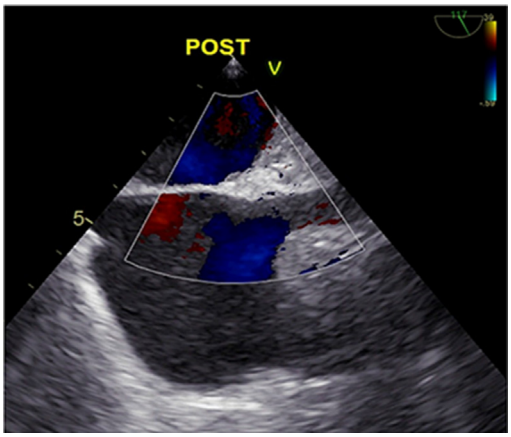
On the **left**, atrial septal erosion **(red arrow)** seen en face from the right side (true view technique), with left-to-right color-Doppler flow, on the **right** (glass technique).

FIGURE 6 The Surgical Approach



Intraoperative picture showing device removal.

FIGURE 8 No Residual Interatrial Shunt After Surgery



Midesophageal bicaval view confirming no residual interatrial shunt at the end of the procedure.

A septum primum erosion, resulting in a significant interatrial defect, must be identified and treated as soon as possible to avoid the possible complications related to it. The choice between a cardiac surgery and a repeated interventional approach must be considered case by case, based on the interatrial septum anatomy and erosion characteristics.[4,7] In this case, percutaneous implantation of a second device would have been very challenging considering the presence of an extremely thin and mobile ASA combined with the initial device dislodgement.

This case highlights the importance of a longer follow-up after a percutaneous ASD closure, considering the possibility of even very late complications. Clinical and echocardiographic hallmarks might inform the suspicion and the rapid identification of this condition avoiding other worse events related to it.

FIGURE 7 The Surgically Removed Device

Erosions can also occur very late, when the device is fully endothelialized (as this figure shows).

FOLLOW-UP

The patient had no further symptoms or adverse events after hospital discharge. One-month echocardiographic follow-up confirmed the atrial septum integrity without any residual interatrial shunt. A 6-month follow-up was scheduled.

CONCLUSIONS

Iatrogenic erosion of the septum primum, resulting in a new ASD after a percutaneous ASD closure, is a very rare but potentially relevant complication that can also occur very late. So, a longer term echocardiographic follow-up is essential for timely diagnosis and treatment of this condition.

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KEY WORDS atrial septal defect, echocardiography, occluder, pregnancy, three-dimensional imaging

APPENDIX For supplemental videos, please see the online version of this paper.