Emergency Percutaneous Closure of an Iatrogenic Atrial Septal Defect Causing Right-to-Left Shunt and Severe Refractory Hypoxemia After Pulmonary Vein Isolation

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A 60-year-old man with arrhythmogenic right ventricular dysplasia, dilated right heart chambers, moderate tricuspid regurgitation, and mild pulmonary hypertension (systolic pulmonary pressure of 45 mm Hg) underwent pulmonary vein isolation (PVI) under general anesthesia due to symptomatic atrial fibrillation. Using a single transseptal puncture–double transseptal approach, a 12-F FlexCath Advance steerable sheath (Medtronic, Heerlen, the Netherlands) and an 8.5-French SL1 long sheath (St. Jude Medical, Plymouth, Minnesota) were placed into the left atrium. PVI and radiofrequency ablation were performed. The patient developed severe hypoxemia (SpO2, 65%) after the removal of the sheaths from the left atrium. A transesophageal echocardiogram showed a continuous right-to-left (R-L) jet through an iatrogenic atrial septal defect (iASD) (Figure 1, Online Video 1). The hypoxemia improved partially as the 12-French sheath was replaced across the iASD, supporting the impression that the hypoxemia was related to the shunt. We decided to proceed with emergency transcatheter closure of the iASD. The stop-flow diameter was measured at 10.5 mm with a sizing balloon. The defect was successfully closed with a 12-mm Figula Flex ASD closure device (Occlutech GmbH, Jena, Germany) (Figure 2, Online Videos 2 and 3). There was no shunt post-procedure and the SpO2 was maintained at 100%. The patient was extubated the next morning and was discharged 3 days later. He was fully functional when examined 8 weeks post-procedure.

Previous studies report a high incidence of iASD after transseptal puncture but agree that all iASDs are clinically benign as no patient experienced any clinical events (1–3). Our case demonstrates that patients with remodeled right heart chambers, increased intracavity pressures, and tricuspid regurgitation may rarely experience severe R-L shunting through an iASD after a transseptal puncture. The anatomic location of the iASD in our patient may have allowed...
streaming of the blood from the inferior vena cava through the defect, thus leading to a clinically significant R-L shunt. Emergency transcatheter closure may be lifesaving in this unusual setting. Invasive cardiologists should be very cautious when performing interventions requiring a transseptal puncture in patients with this profile.

**FIGURE 1 Right-to-Left Shunt**

Transesophageal echocardiography showing continuous right-to-left shunt through an iatrogenic atrial septal defect (Online Video 1).

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KEY WORDS atrial fibrillation, atrial septal closure, iatrogenic, pulmonary vein isolation, right-to-left shunt

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

FIGURE 2  Device Deployed Across the Defect

Transesophageal echocardiography showing a 12-mm Figula Flex ASD closure device (Occlutech GmbH, Jena, Germany) deployed across the interatrial defect; no shunt is present (top). Three-dimensional image of the deployed device (bottom) (Online Videos 2 and 3).