

# Successful left atrial appendage closure in a patient with prior patent foramen ovale occlusion



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## Introduction

Cardioembolic stroke is the most common complication associated with nonvalvular atrial fibrillation (AF) and occurs as a result of thrombus in the left atrial appendage (LAA). Anticoagulation with vitamin K antagonists or direct oral anticoagulants is the standard of care for patients with AF who are at high risk for stroke.<sup>1</sup> However, up to 40% of at-risk patients have a contraindication to anticoagulation, mostly because of clinically significant hemorrhage.<sup>2,3</sup> In these patients, LAA occlusion may be warranted. LAA occlusion has been shown to be noninferior to oral anticoagulation in limiting stroke, systemic embolism, and cardiovascular death and, when performed by experienced proceduralists, has modest complication rates.<sup>4,5</sup>

LAA occlusion is performed via puncture of the interatrial septum. Transseptal puncture is considered a precise and rate-limiting aspect of the procedure, as puncture at the correct site facilitates the optimal approach for device deployment.<sup>6</sup> The presence of an atrial septal closure device (patent foramen ovale [PFO] or atrial septal defect [ASD]) complicates transseptal puncture and has been listed as a relative contraindication to percutaneous LAA closure.<sup>7</sup> Although LAA closure via an open PFO or ASD has been presented in case series,<sup>8–10</sup> LAA closure subsequent to ASD or PFO occlusion has been seldom described.<sup>6,8,11</sup> Here we present a case of successful LAA closure in a patient with prior PFO occlusion.

## Case report

A 76-year-old woman presented for elective LAA closure in the context of AF, a contraindication to anticoagulation, and previous PFO occlusion with a 25-mm Amplatzer PFO occluder (St. Jude Medical, Saint Paul, MN).

The patient had a history of multiple embolic strokes. The first occurred in 1983 at age 40 years, and other clinically

## KEY TEACHING POINTS

- Left atrial appendage (LAA) occlusion has been presented as a noninferior therapeutic option in patients with nonvalvular atrial fibrillation.
- The presence of an atrial septal closure device previously has been considered a relative contraindication to LAA occlusion, but LAA occlusion can be safely performed in patients with a prior intra-atrial septal closure device.
- Transseptal puncture preferably should be made inferior and posterior to the preexisting atrial septal defect or patent foramen ovale device. However, it is possible to safely perform transseptal puncture inferior and anterior to the device.

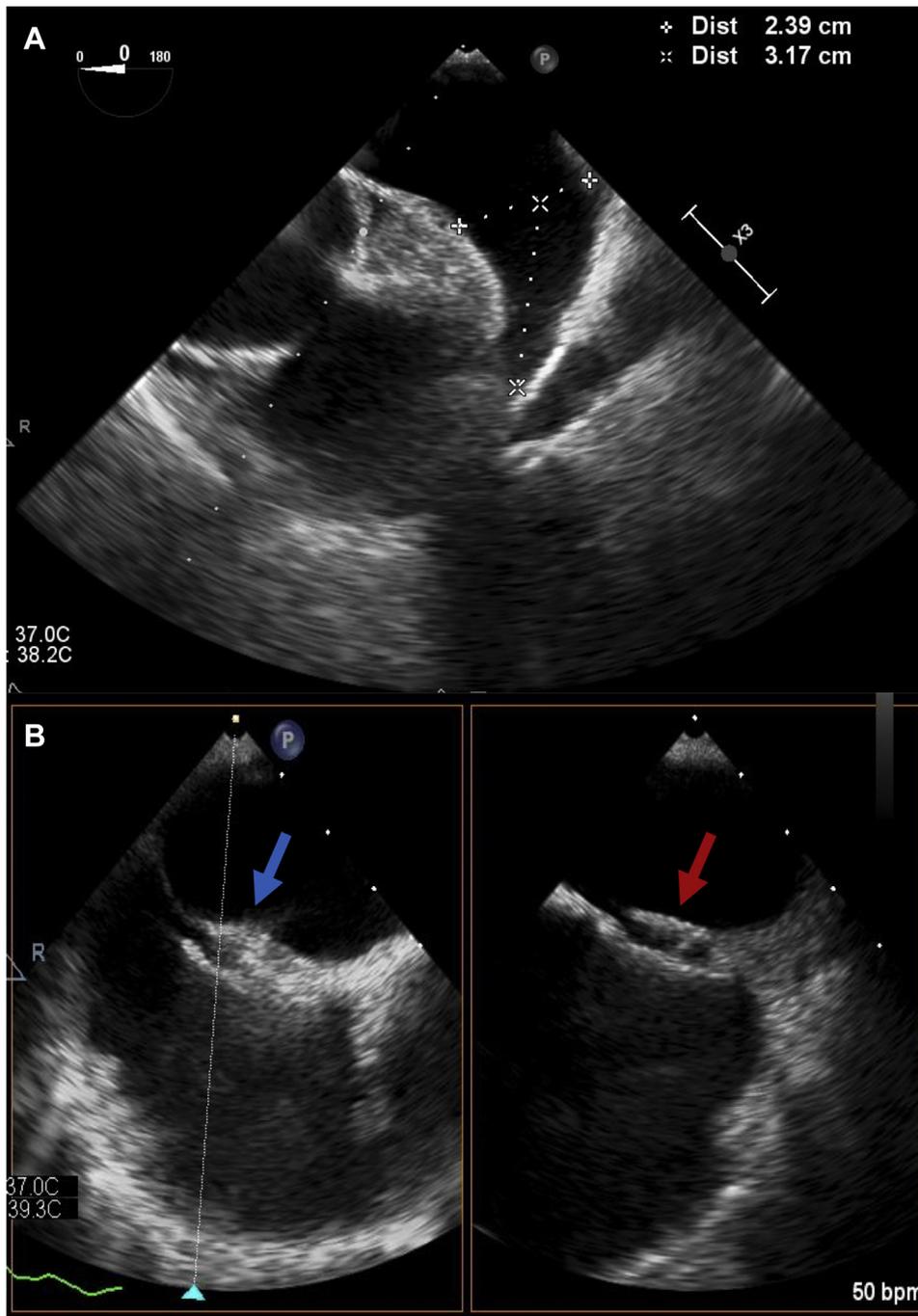
significant events occurred in 1988 and 2003. In the absence of another cause but with a known PFO, she underwent PFO occlusion in 2004. In 2008, she was diagnosed with paroxysmal AF (CHADSVASc score = 4; age 65–74 = 1, prior stroke = 2, female = 1) and was started on oral anticoagulation with warfarin. She had no other relevant medical history.

In February 2018, the patient presented to the emergency department of a tertiary hospital with a 4-day history of increasing headache. She was diagnosed with a spontaneous subdural hemorrhage in the context of a therapeutic international normalized ratio, which required urgent neurosurgical drainage.

Given her high risk for cardioembolic stroke and her contraindication to anticoagulation, she was referred to our center for consideration of LAA closure. Transthoracic echocardiography demonstrated normal cardiac size and function, with a sclerotic aortic valve causing trivial incompetence and mild functional mitral regurgitation. Transesophageal echocardiography (TEE) demonstrated normal left atrial size with a windsock variant LAA measuring 24 mm wide and 33 mm deep at 0° (Figure 1A). The appearance was deemed suitable for attempted LAA closure; however, the

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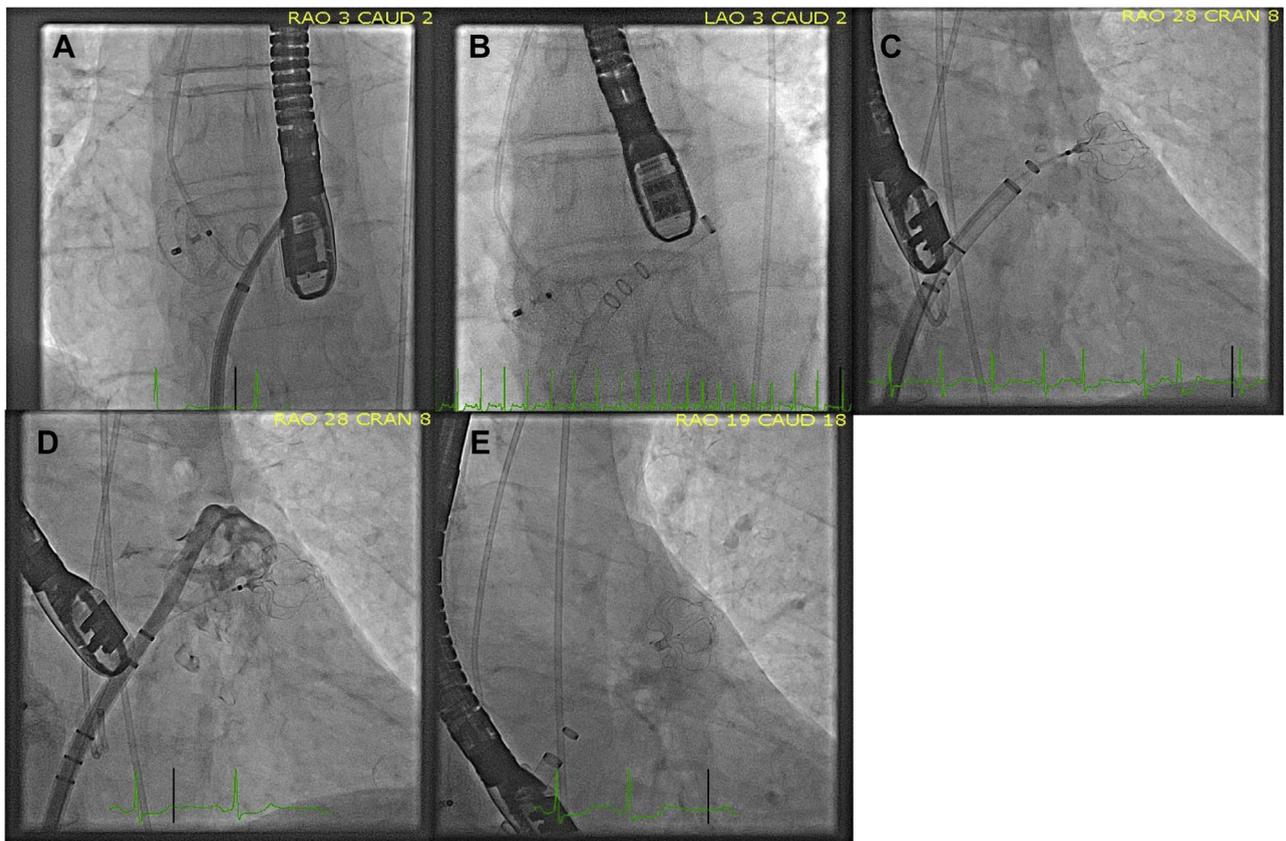


**Figure 1** Two-dimensional transesophageal echocardiography. **A:** A windsock variant left atrial appendage measuring 24 mm wide  $\times$  32 mm deep at 0°. **B:** X-plane showing the patent foramen ovale occluder device (arrows) with free atrial septum inferior and posterior to the device.

concomitance of a PFO closure device was believed to make device positioning challenging because it would necessitate transseptal puncture in an inferior and posterior or inferior and anterior position (Figure 1B). After multidisciplinary team discussion, the benefits of LAA occlusion were believed to outweigh the procedural risk, and the patient underwent the procedure in September 2018.

LAA closure was performed via the right femoral vein using TEE and fluoroscopic guidance with the patient

under general anesthesia. Transseptal puncture was performed with a BRK1 transseptal needle. An initial approach inferior and posterior to the PFO occluder was attempted but was believed to be high risk for posterior wall rupture, so puncture ultimately was made inferior and anterior to the PFO device (Figures 2A and 3B). Immediately after transseptal puncture, a coronary wire was advanced into the left atrium to keep the transseptal needle away from the aorta and allow safe passage of an



**Figure 2** Fluoroscopy and angiography. **A:** Transseptal puncture inferior to the patent foramen ovale occluder device. **B:** Positioning of the Watchman double-curve catheter access system. **C:** Positioning of the 24-mm Watchman left atrial appendage (LAA) occluder. **D:** Angiography of the left atrium confirming adequate placement of the LAA device. **E:** Successful deployment of the 24-mm Watchman occluder.

8.5F Swartz transseptal catheter and dilator. Subsequently, a Watchman double-curve catheter access system (Boston Scientific, Marlborough, MA) was advanced into the left atrium, and a 24-mm Watchman device was placed in the LAA (Figure 2B and C). Angiography and TEE confirmed good placement without any leakage, and a tug test confirmed stability before device release (Figures 2D, 2E, and 3D).

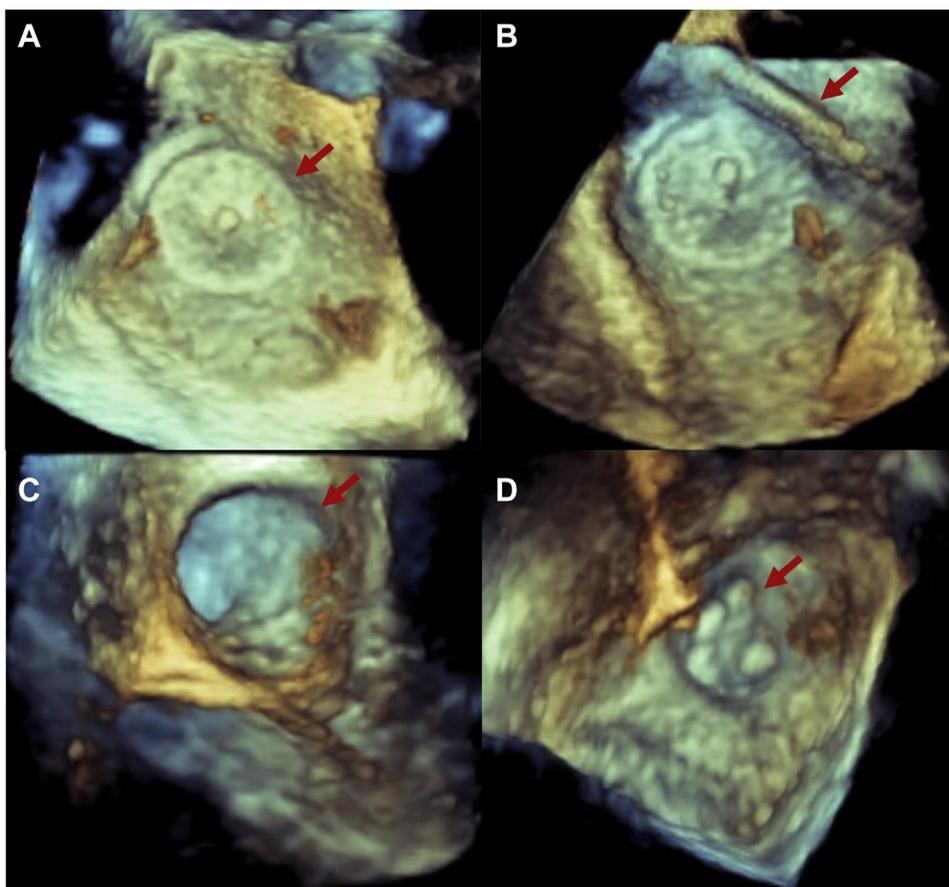
Postprocedural TEE demonstrated a well-placed LAA occluder and an intact Amplatzer PFO occluder without any evidence of transseptal flow on color Doppler. The patient's recovery was unremarkable, and she was discharged day 1 after LAA closure on aspirin indefinitely and clopidogrel for 8 weeks.

## Discussion

Thromboembolic stroke is a well-established complication of AF. Vitamin K antagonists and direct oral anticoagulants are proven therapies for reducing this outcome.<sup>1</sup> Nonetheless, oral anticoagulants can cause complications such as bleeding, which may necessitate cessation of their use. LAA closure has been shown to be noninferior compared to oral anticoagulation in patients who are at high risk for embolic events and bleeding as a result of anticoagulation.<sup>12</sup>

Transseptal puncture is a critical step in percutaneous LAA occlusion, as puncture at an appropriate site provides a technical advantage for device positioning and deployment. The presence of an occluder device in the interatrial septum is a major limitation of LAA occlusion given the reduction of available septum for puncture and reduced operator maneuverability of access systems. Despite these difficulties, some data—limited to case reports or small series—of favorable outcomes after interatrial septal closure are available.<sup>6,8,10</sup>

Successful transseptal puncture after interatrial occluder implantation was first described by Zaker-Shahrak et al,<sup>13</sup> although they did so to perform catheter ablation of AF. With regard to transseptal puncture for LAA closure after ASD/PFO occluder, most reports have described LAA occlusion after ASD closure. Gafoor and colleagues<sup>8</sup> have reported the only case of successful LAA closure after PFO occlusion. In their case, a 15-mm PFO occluder device was *in situ*, and transseptal puncture was performed inferior and posterior to the device. Inferior and posterior puncture to previous ASD/PFO implantation is the most commonly described approach; however, both anterior and transdevice access have been described.<sup>8,14</sup> It is important to note that when approaching septal puncture anterior to the ASD/PFO device, care should be taken to avoid the aorta. To our knowledge, this is the only case of successful LAA



**Figure 3** Three-dimensional transesophageal echocardiography. **A:** Patent foramen ovale (PFO) occluder device (*arrow*). **B:** Successful transseptal puncture inferior and anterior to the PFO occluder without device compromise. *Arrow* indicates transseptal needle. **C:** Left atrial appendage (LAA) (*arrow*). **D:** Successful deployment of the LAA occluder in the LAA (*arrow*).

occlusion after PFO closure in an inferior and anterior position and adds to the limited data available on successful LAA occlusion in patients with a preexisting interatrial septal closure device.

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