INTRODUCTION

Atrial fibrillation (AF) is the most common cardiac arrhythmia, affecting >3 million people in the United States alone. AF impairs cardiac function, resulting in significant morbidity and mortality, and is a major risk factor for thromboembolic stroke. AF can be classified as either valvular (typically defined as developing in the context of rheumatic heart disease or valve replacement) or non-valvular (developing in the absence of significant valvular heart disease). The left atrial appendage (LAA) is the most common site of thrombus formation in AF. Specifically, the LAA is the site of thrombus formation in approximately 91% of patients with non-valvular AF and 57% of patients with valvular AF. Although exclusion of the LAA is frequently performed as an adjunct to other cardiac procedures, the mainstay of thromboembolism prophylaxis in AF has traditionally been systemic anticoagulation therapy using warfarin or the direct oral anticoagulants. As systemic therapies for a frequently local disease, all anticoagulants have significant bleeding risks and may be contraindicated in certain patients.

Percutaneous LAA occlusion has revolutionized the treatment of nonvalvular AF, using a local therapy for a local disease. At present, there are two categories of percutaneous LAA occlusion devices: endocardially delivered and epicardially delivered. In the United States, available endocardially delivered devices are the Watchman (Boston Scientific, Maple Grove, MN) and Amplatzer Amulet (St. Jude Medical, Minneapolis, MN). The Lariat device (Sentre-HEART, Palo Alto, CA) is epicardially delivered.

Two-dimensional and increasingly three-dimensional transesophageal echocardiography (TEE) is essential for preprocedural screening, device sizing, intraprocedural guidance, and assessment of procedural success.

We describe the first US case of endocardial percutaneous LAA occlusion using the novel Coherex WaveCrest 1.3 device (Biosense Webster, Irvine, CA). This device is currently under investigation in the United States in the WaveCrest II trial, a non-inferiority randomized controlled trial evaluating the safety and effectiveness of the WaveCrest device compared with the Watchman device.

The WaveCrest 1.3 device consists of a self-expanding nitinol frame with 20 anchoring points, covered by an expanded polytetrafluoroethylene (ePTFE, also known as Gore-Tex) fabric. It comes in three sizes (22, 27, and 32 mm), as shown in Figure 1.

The following manufacturer’s Web page provides an animated description of the WaveCrest procedure: https://coherex.com/the-wavecrest-option/.

This device has a number of unique features, which are listed in Table 1.

Of note, the WaveCrest 1.3 device is an upgrade from the previous WaveCrest 1.2 device, which received a Conformité Européenne mark in Europe. The major differences between the WaveCrest 1.2 and 1.3 devices are that the 1.3 device has more anchors and has an extended ePTFE cover.
deployed on the distal, rather than proximal, edge of the device. Stability of the device is then assessed using a “tug test.” If excessive motion of the device is absent, it is released from the delivery sheath.

Although TEE is essential for transseptal puncture guidance, LAA sizing, and device deployment, acoustic shadowing due to the presence of air between layers of WaveCrest ePTFE fabric may partly hinder echocardiographic assessment of device seal. This limitation is overcome by complementary use of fluoroscopy with injections in both the left atrium and LAA.

On 45-day follow up, TEE is performed to reassess device seal and to confirm the absence of device-associated thrombus. At this time point, endothelialization typically has begun, which decreases the amount of air between the layers of ePTFE fabric. This improves the quality of echocardiographic imaging (Figure 5, Videos 3 and 4).

**DISCUSSION**

Enthusiasm for percutaneous exclusion of the LAA from systemic circulation has been increasing with the emergence of multiple new occluder designs. Because two-dimensional and three-dimensional TEE is an integral component of these procedures, echocardiographers must be aware of specific characteristics of each individual device.

We describe the first case in the United States of the novel WaveCrest LAA occlusion device. Overall, the echocardiographic guidance of the WaveCrest is very similar to other endocardially delivered LAA occluders, such as the Watchman; unique features of the WaveCrest device design and imaging guidance are shown in Table 1.

**CONCLUSION**

This case demonstrates the first US use of a novel percutaneous LAA occluder, the WaveCrest 1.3 device, which is currently under clinical investigation. The WaveCrest device is similar to the Watchman in that it is endocardially delivered using a transeptal puncture but has unique features such as separation of positioning from anchoring, seal along the distal rather than proximal margin of the device, and Gore-Tex fabric. Although TEE is essential for transseptal puncture guidance, LAA sizing and device deployment, acoustic shadowing due to the presence of air between layers of WaveCrest ePTFE fabric may partly hinder echocardiographic assessment of device seal. This limitation is overcome by complementary use of fluoroscopy with injections in both the left atrium and LAA. Acoustic shadowing diminishes and echocardiographic imaging improves after device endothelialization.
Figure 2 LAA device sizing for WaveCrest on two-dimensional TEE. To size the LAA for the WaveCrest occluder, LAA orifice diameter and depth are measured on two-dimensional TEE at 0°, 45°, 90°, and 135°, similar to the sizing done for the Watchman device.

Figure 3 Intraprocedural imaging of WaveCrest device on two-dimensional and three-dimensional TEE. Intraprocedural TEE of the WaveCrest device after deployment (midesophageal LAA view at 0°). Yellow arrows point to the WaveCrest device, and white arrows point to acoustic shadowing caused by air between device fabric layers on two-dimensional (A) and three-dimensional (B) TEE. AO, Aorta; LA, left atrium.
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