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CASE REPORT

INTERMEDIATE

CLINICAL CASE

Late Presentation of Pulmonary Artery-Left Atrial Appendage Fistula Formation After Left Atrial Appendage Device Closure

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ABSTRACT

Atrial fibrillation is the most common arrhythmia in clinical practice with indication for anticoagulation in those patients whose annual risk for thromboembolism is >2%. Left atrial appendage closure is growing as an alternative to anticoagulation. We present a case of pulmonary artery-left atrial appendage fistula seen after left atrial appendage closure. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2020;2:814–8) © 2020 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/).

An 85-year-old woman with paroxysmal atrial fibrillation was evaluated for left atrial appendage closure (LAAC). She was deemed to be a good candidate because of her history of repetitive traumatic falls while on anticoagulation. She was scheduled for percutaneous LAAC with a Boston Scientific WATCHMAN device (Boston Scientific, Marlborough, Massachusetts).

Intraoperative transesophageal echocardiography (TEE) showed no LAA thrombus or pericardial effusion at baseline. Transseptal puncture using a Brockenbrough 1 needle (Medtronic, Minneapolis, Minnesota) under intracardiac echocardiography, TEE, and fluoroscopic guidance was performed. Measurements of the LAA ostium were obtained by TEE at 0°, 45°, 90°, and 135°. The greatest ostial diameter measured 24 mm. A 27-mm WATCHMAN device was deployed using standard techniques. Postoperative TEE images showed the WATCHMAN device to be in good position. There was no paradevice leak visualized at a Nyquist limit of 30 cm/s and no evidence of communication between the LAA and pulmonary artery (PA) (**Figure 1**). Overall left and right ventricular systolic function remained normal. A small de novo post-procedural septal defect was visualized at the site of transseptal puncture. No new pericardial effusion was appreciated. The LAA was engaged only once, and the device was implanted on the first attempt. She had an uneventful recovery. Postoperative TEE images showed no evidence of new pericardial

LEARNING OBJECTIVES

- To appreciate that LAA-pulmonary artery fistula formation is a rare but potentially fatal complication of LAA closure.
- To better understand the anatomical relationship between the LAA and pulmonary artery utilizing multimodality imaging.

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the *JACC: Case Reports* author instructions page.

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effusion. Although she was at risk for bleeding, she was also at significantly increased risk for stroke. The decision was made for the patient to complete 45 days of anticoagulation to prevent on-device thrombus formation as per the PROTECT AF (WATCHMAN Left Atrial Appendage System for Embolic PROTECTion in Patients With Atrial Fibrillation) trial protocol.

On postoperative day 45, she returned for follow-up TEE, which showed the 27-mm WATCHMAN device to still be in good position. However, there were 2 peridevice leaks now present, both with vena contracta <5 mm. Images also showed that a fistulous track formed between the LAA and the main PA (**Figure 2**, Video 1).

PAST MEDICAL HISTORY

Her past medical history included chronic obstructive pulmonary disease, paroxysmal atrial fibrillation (CHA_2DS_2-VASc [congestive heart failure, hypertension, age ≥75 years, diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism, vascular disease, age 65-74 years, sex category] score = 3), atrial flutter, prior cavotricuspid isthmus ablation, sick sinus syndrome requiring a dual-chamber permanent pacemaker, and severe pulmonary hypertension.

DIFFERENTIAL DIAGNOSIS

Along with LAA-PA fistula, other possible causes for the abnormal findings seen by TEE could include migration of the device, with the fabric no longer creating a complete seal around the ostium of the LAA with resultant peridevice leak, and LAA-pulmonary vein fistula.

INVESTIGATION

Computed tomography angiography (CTA) with pulmonary artery mapping was performed to better understand the anatomical relationship between the LAA and nearby vascular structures (**Figures 3 and 4**). Images showed the WATCHMAN device to be in good position without evidence of any anchor wire fracture or perforation of the wall. The maximum diameter at the shoulder of the LAA was 24 mm. The LAA-PA fistula was not identified, although contrast could be seen within the LAA.

MANAGEMENT

Despite the abnormal TEE findings at postoperative day 45, the patient remained asymptomatic. Treatment options included percutaneous placement of

ABBREVIATIONS AND ACRONYMS

CTA = computed tomography angiography

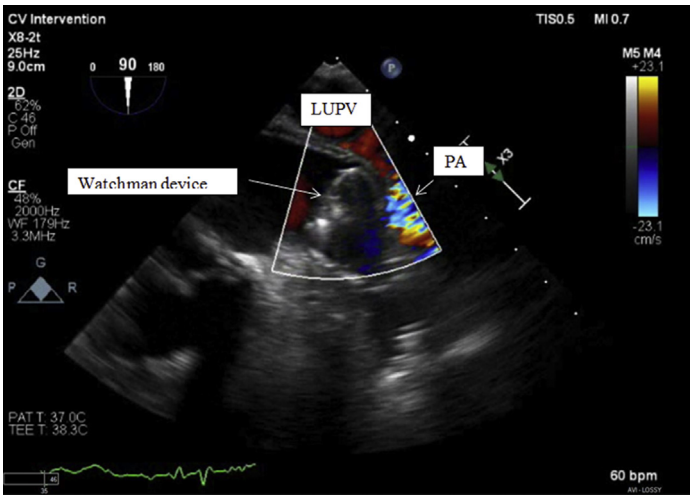
LAA = left atrial appendage

LAAC = left atrial appendage closure

PA = pulmonary artery

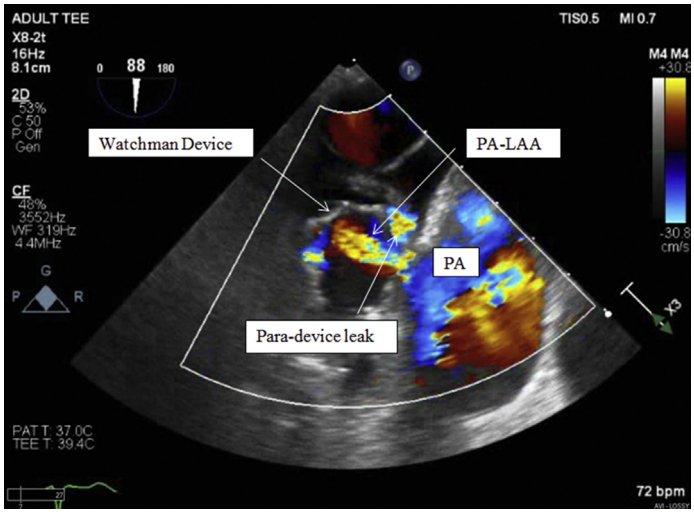
TEE = transesophageal echocardiography

FIGURE 1 Intraoperative Transesophageal Echocardiography



Intraoperative transesophageal echocardiography images immediately after placement of left atrial appendage closure device showing no evidence of left atrial appendage-pulmonary artery (PA) fistula. LUPV = left upper pulmonary vein.

FIGURE 2 Postoperative Transesophageal Echocardiography: 45 Days



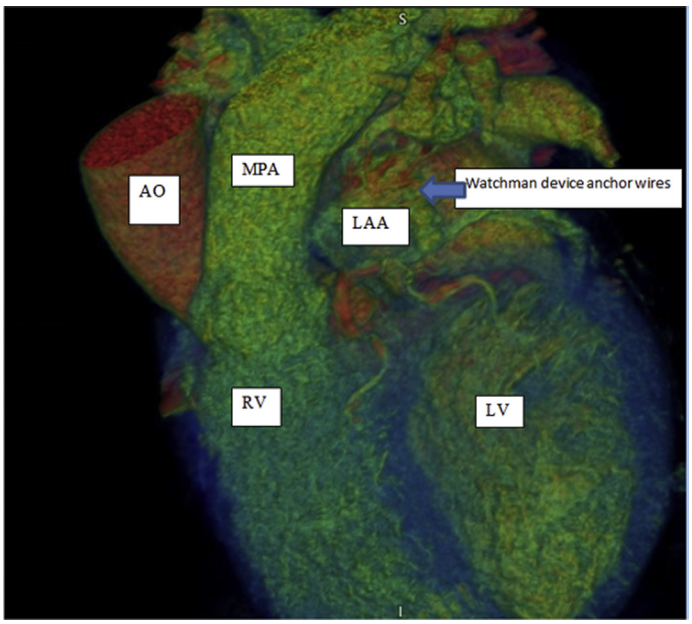
Transesophageal echocardiography images obtained 45 days post-left atrial appendage (LAA) closure showing pulmonary artery (PA)-LAA fistula and paradevice leak along the limbus side.

coils within the LAA, surgical repair, or continued medical management with close follow-up. She was felt to be too frail for open-heart surgery, and there was concern that the placement of coils may increase the size of the peridevice leaks, prolonging her need for anticoagulation. The decision was made to continue with medical therapy and close observation. Apixaban (5 mg bid) was stopped and she was

FIGURE 3 Computed Tomography Angiography of the WATCHMAN Device and Surrounding Structures

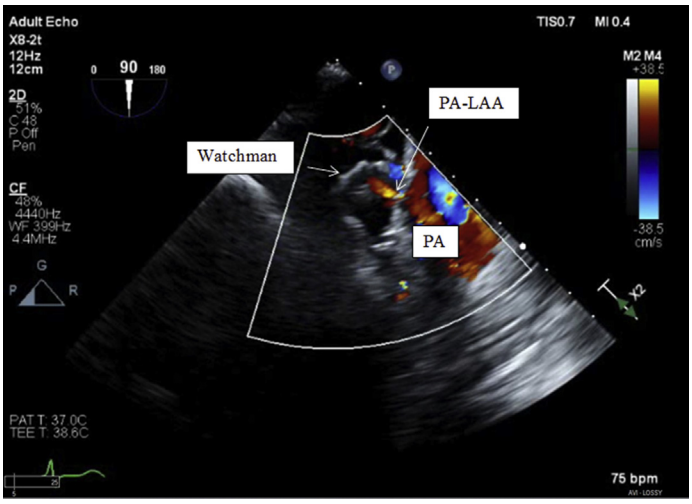
Pulmonary artery and WATCHMAN device computed tomography angiography. All 10 Watchman anchor wires were intact. There was no pericardial effusion.

FIGURE 4 Computed Tomography Angiography With 3D Image Rendering of the WATCHMAN Device and Surrounding Structures



Computed tomography angiography 3-dimensional rendering of the main pulmonary artery, WATCHMAN device, and its anchor wires. The contact point of the LAA and main pulmonary artery (MPA) can be appreciated. AO = aorta; LV = left ventricle; RV = right ventricle; other abbreviations as in Figure 2.

FIGURE 5 Postoperative Transesophageal Echocardiography: 4 Months



Transesophageal echocardiography images 4 months post-LAA closure showing diminished PA-LAA fistula. Paradevice leak was no longer appreciated. Abbreviations as in Figure 2.

prescribed aspirin (81 mg daily) and clopidogrel (75 mg daily).

A follow-up TEE was performed 4 months postoperatively that showed the peridevice leaks were no longer present and the fistulous tract had greatly diminished in size (**Figure 5**, Video 2). Doppler gradient across the orifice measured 1 mm Hg. Shunt ratio was normal, at 1.0. Bubble study showed no bubbles within the left atrium or the LAA. As there was no evidence of paradevice leak, it was decided to stop antiplatelet therapy.

DISCUSSION

Although complications are rare, the LAAC procedure is not entirely without risk (1,2). Cases of delayed PA perforation, tamponade, and LAA-great cardiac vein fistula formation caused by implantable LAAC devices have been reported previously (3–8). This has led to greater interest in the spatial relationship between the LAA and other nearby structures such as the left upper pulmonary vein, left circumflex artery, and pulmonary artery (9,10). Halkin et al. (9) studied 100 patients with atrial fibrillation who underwent cardiac-gated CTA of the left atrium. They identified 3 types of LAA-PA anatomical relationships: 1) no contact (type 1); 2) proximal contact (type 2; within 15 mm of the ostium of the LAA); and 3) distal contact (type 3). Proximal contact occurred in 28% of observed patients and was the location where fixation components of most LAAC devices were positioned (9). TEE images show that this patient likely has a type 2 LAA-PA anatomical relationship and that the fistulous tract formed within 15 mm of the ostium of the LAA.

FOLLOW-UP

The patient remains hemodynamically stable. She completed 5 months of dual antiplatelet therapy and is now taking aspirin 81 mg daily. We plan to perform repeat TEE in 1 to 3 months.

CONCLUSIONS

To our knowledge, this is the first case in which a LAA-PA fistula formed, tamponade did not ensue, surgical intervention was not performed, and follow-up TEE showed evidence of progressive tract closure. We felt that it was prudent to stop the anticoagulation after the initial recognition of the LAA-PA fistula, given the concern for possible hemopericardium and her high bleeding risk. Pulmonary CTA was very helpful in documenting the integrity of the WATCHMAN device, lack of pericardial effusion, and device stability. Cardiac surgery or percutaneous coil for the LAA-PA fistula occlusion would have carried not insignificant risk for this elderly and frail patient.

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KEY WORDS 3-dimensional imaging, anticoagulation, complication, echocardiography, postoperative, pulmonary circulation, stroke

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