Recurrence of device-related thrombus 3 years after left atrial appendage occlusion

Omar Cantu-Martinez, MD,*† Ruchika Bhargav, DO,†‡ Sumeet Mainigi, MD, FHRS†‡

*From the *Department of Medicine, Jefferson Einstein Medical Center, Philadelphia, Pennsylvania, †Sidney Kimmel College of Medicine, Thomas Jefferson University, Philadelphia, Pennsylvania, and ‡Division of Cardiology, Jefferson Einstein Medical Center, Philadelphia, Pennsylvania.*

Introduction

Over the last decade, left atrial appendage occlusion (LAAO) has become an alternative for stroke reduction and systemic embolism in patients with atrial fibrillation (AF) who are not good long-term candidates for anticoagulation.[1,2] Device-related thrombus (DRT) is a concern in the early months following implantation. As a result, antiplatelet and anticoagulant therapy is indicated. The original postprocedure medical regimen mandated, based on the PROTECT-AF and PREVAIL trials, was aspirin and warfarin.[1,2] Dual antiplatelet therapy has recently been approved as a postprocedural medication option.[3] A transesophageal echocardiogram (TEE) is recommended approximately 45 days postimplantation to ensure appropriate closure of the left atrial appendage (LAA), at which time anticoagulants can be discontinued, and dual antiplatelet therapy either started or maintained.[4] If there is inadequate LAA closure on the original TEE, continuing surveillance TEEs are recommended.[4] DRT after LAAO is uncommon, with a 3%–5% prevalence, and recurrent DRT post-Watchman implantation has not been described.[4,5]

KEY TEACHING POINTS

- Device-related thrombus (DRT) may occur any time following left atrial appendage occlusion (LAAO), and follow-up imaging may be necessary 1 year or more after LAAO in patients at risk for DRT, given the predisposition of having a stroke with a DRT.
- Patient risk factors for DRT: history of stroke, venous thromboembolism, permanent atrial fibrillation, vascular disease, ejection fraction less than 50%, hypercoagulability disorder, pericardial effusion, discontinuing anticoagulation or DAPT before the prescribed regimen is finished, and a larger left atrial appendage (LAA) diameter.
- Procedural risk factors for DRT: larger device size, deep implantation of the device below the ostial plane (>10 mm from pulmonary vein ridge/limbus; leaving uncovered residual LAA), and peri-device flow.

Case report

A 75-year-old woman with hypertension, obstructive sleep apnea, end-stage renal disease with a deceased donor kidney transplant 15 years earlier, and renal cell carcinoma with past nephrectomy underwent an elective LAAO with Watchman owing to long-standing persistent AF on anticoagulation that was complicated by gastrointestinal bleeding with diverticulosis and hemorrhoids requiring multiple transfusions. Following the LAAO, she was placed on anticoagulation with apixaban for a planned 45 days. However, she had gastrointestinal bleeding 10 days later, and apixaban was discontinued and clopidogrel initiated. Figure 1 shows the event timeline. A 45-day follow-up TEE showed an initial laminar DRT (Figure 2A). Therefore, clopidogrel was stopped, and the patient was started on warfarin until the DRT resolution was seen at a 26-month follow-up TEE (Figure 2B).

Three and a half years after the LAAO procedure, at 78 years old, she presented to the emergency department with severe left lower extremity pain that had been intermittent for the previous 3 weeks and worsened before arrival. She reported decreased mobility owing to pain and denied a history of deep vein thrombosis (DVT) or tobacco use. Vital signs on arrival showed a heart rate of 80 beats/min, blood pressure of 172/79 mm Hg, respiratory rate of 20, and oxygen saturation of 94% on room air. The physical examination revealed a body mass index of 40, no respiratory distress, irregular heart rhythm, and left lower extremity edema with warmth and tenderness.

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Address reprint requests and correspondence: Dr Omar Cantu-Martinez, 5501 Old York Rd, Philadelphia, PA 19144. E-mail address: omar.cantumartinez@jefferson.edu.

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Investigations

Given her presentation, she underwent a left lower extremity Doppler ultrasound that showed acute occlusive DVT in the distal left iliac vein extending into the common femoral vein. Therefore, a computed tomography venogram was performed that confirmed the thrombus's extension to the inferior vena cava and incidentally found an 11 × 13 mm left atrial thrombus extending from the Watchman into the left atrium (Figure 3A). She was admitted for refractory pain secondary to DVT and DRT. To further characterize the DRT, she underwent a TEE confirming the thrombi overlying the device and protruding into the left atrial cavity measuring 11 × 13 × 15 mm without peri-device flow (Figure 3B).

Management

After the DVT and DRT were diagnosed, she was immediately started on unfractionated heparin. She was subsequently transitioned to enoxaparin and then bridged to warfarin.

Initial LAAO procedure and patient characteristics

The peri-procedure TEE showed a widened LAA with the following measures: at 0 degrees, width of 2.5 cm, depth of 4.1 cm; at 45 degrees, width of 2.4 cm, depth of 3.6 cm; at 90 degrees, width of 2.4 cm, depth of 3.5 cm; and at 135 degrees, width of 2.8 cm, depth of 3.9 cm. A 33 mm Watchman closure device was placed just below the coumadin ridge bulb. A postprocedure TEE showed no peri-device flow, the measurement from the ostial plane to the device was 16 mm (Supplemental Figure 1).

Follow-up

She was discharged home in stable condition and able to continue her activities of daily living. Then, a week after, she presented to the emergency department for a single episode of hematuria. She was treated with antibiotics for a urinary tract infection and advised to continue warfarin. Three months later, she followed up in the Electrophysiology clinic with a therapeutic International Normalized Ratio level and no active complaints. She followed up at a hematology-oncology clinic outpatient, and no hypercoagulability work-up was requested.

Discussion

We present a unique case of DRT recurrence 3.5 years after LAAO with the Watchman device and a history of laminar DRT diagnosed 2 months after LAAO that resolved after 2 years of anticoagulation. The recurrent DRT was incidentally found after admission to the hospital for symptomatic DVT.

Risk factors for device-related thrombus

DRTs may be laminar on the surface, contained within, or protruding from the device, and it is essential to ensure proper endothelialization of the device before stopping dual

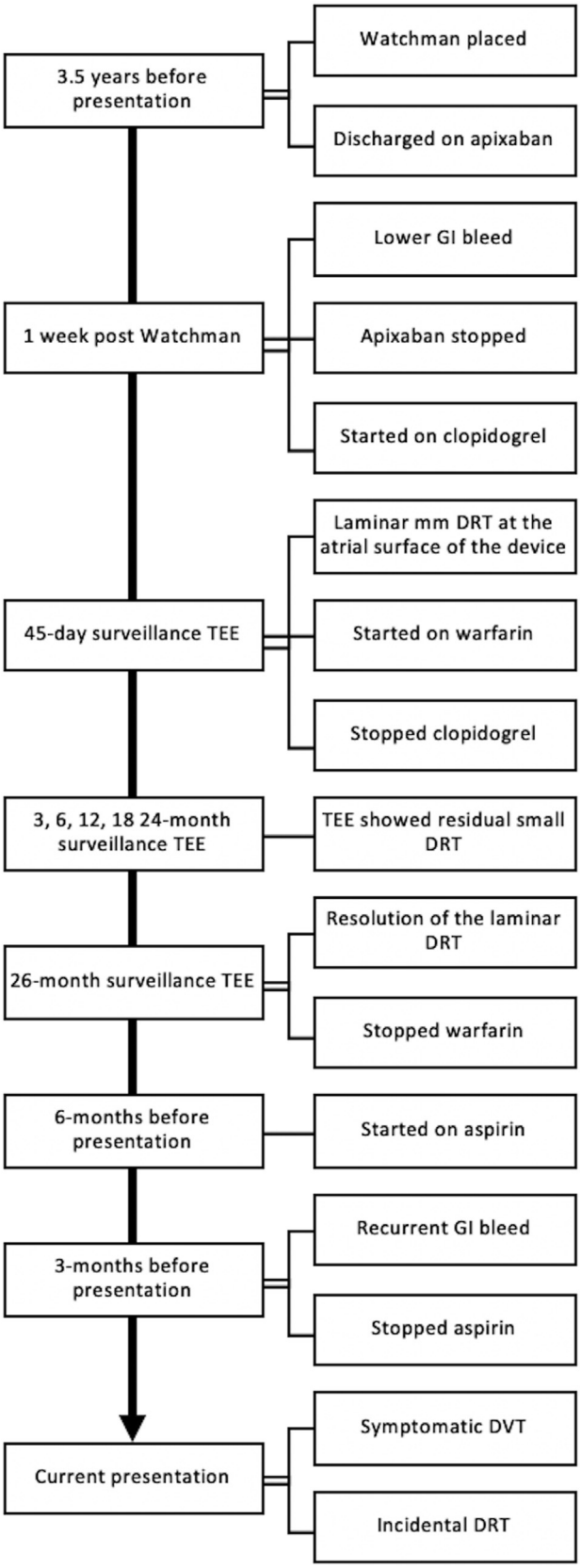

Figure 1 Timeline after left atrial appendage occlusion (LAAO). DRT = device-related thrombus; DVT = deep vein thrombosis; GI = gastrointestinal; TEE = transesophageal echocardiogram.

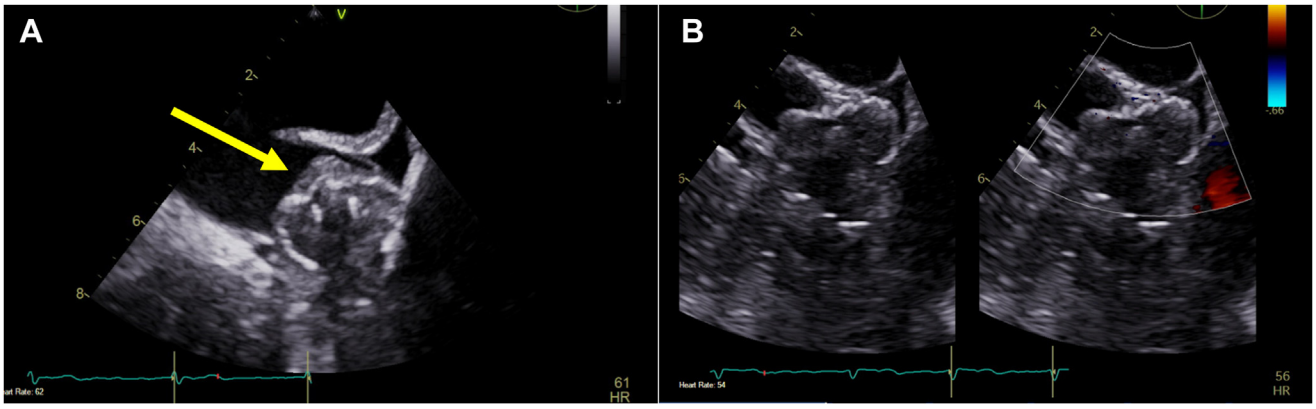

Figure 2 **A:** Transesophageal echocardiogram (TEE) at 90 degrees shows a laminar device-related thrombus (DRT) (*yellow arrow*). **B:** TEE showing the resolution of the laminar DRT.

antiplatelet therapy (DAPT) or anticoagulation after LAAO. Several patient, device, and procedure characteristics have been described to play a role in developing DRT. Patient risk factors include a history of stroke, venous thromboembolism, permanent AF, vascular disease, chronic kidney disease, ejection fraction less than 50%, hypercoagulability disorder, pericardial effusion, discontinuing anticoagulation or DAPT before the prescribed regimen is finished, previous DRT, and a larger LAA diameter.[4–7] Device and procedure risk factors include a larger device size, deep implantation of the device below the ostial plane (>10 mm from pulmonary vein ridge/limbus; leaving uncovered residual LAA), and peri-device flow.[4–7]

Other delayed device-related thrombus case reports

Although most DRTs occur acutely or subacutely after implantation, delayed DRT has been reported. One previous report describes a 68-year-old man who developed a DRT between the pulmonary vein ridge and the device 2 years after LAAO with Watchman. Owing to elevated bleeding risk, he had surgical removal of the DRT, which in situ showed the device did not cover the LAA entirely and was not fully reendothelialized.[8] In contrast, an 81-year-old woman presented with dyspnea 4 years after LAAO, and TEE showed a DRT. Owing to the high bleeding risk, the DRT was removed with vacuum-assisted catheter aspiration via transseptal access with a cerebral protection system.[9] DRTs may also occur many years after LAAO, as previously described. However, a patient in his late 70s developed a DRT 10 years after LAAO. His surveillance TEEs up to a year after LAAO were negative. He presented with symptomatic aortic stenosis; the TEE described a 21 × 18 mm DRT on the atrial surface.[10] Several studies describe follow-up imaging until 12 months postprocedure, underlying the importance of more prolonged follow-up.

Complications and comorbidity burden in atrial fibrillation

In patients with AF, several studies, including the SPAF and AFASAK trials, have shown stroke risk reduction by comparing anticoagulation to placebo or aspirin alone.[11] In

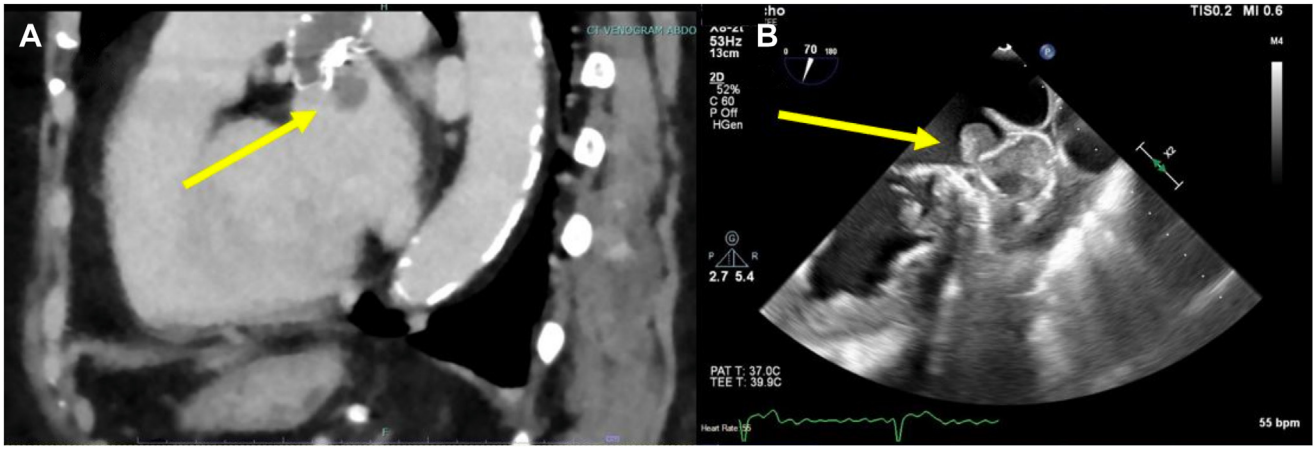

Figure 3 **A:** Computed tomography venogram sagittal view reveals a 1.1 × 1.3 cm intraluminal filling defect (*yellow arrow*) extending from the Watchman into the left atrium. **B:** Transesophageal echocardiogram shows a 1 × 1.3 × 1.5 cm thrombus (*yellow arrow*) overlying the Watchman device and protruding into the left atrial cavity.

the SPAF trial, the placebo had a 7.4% stroke rate yearly.[12] Additionally, AF not only increases the risk for stroke but also causes an increased risk of disability, 30-day and 1-year mortality, and more patients on permanent social security benefits compared to not having AF.[13,14]

Benefits and risks of left atrial appendage occlusion

The PROTECT-AF and PREVAIL trials showed the noninferiority of LAAO compared to anticoagulation in both short- and long-term follow-up.[1,2] As previously mentioned, following an LAAO, there is a 3%–5% documented risk of DRT and a 5%–10% prevalence of major bleeding within the first year after the procedure.[3–5] We must consider the inherent risks of this procedure and balance that with the higher risk of developing a stroke and its complications or cardiovascular death in patients with AF off anticoagulation.

Conclusion

Our case highlights that DRT can occur both immediately postprocedure and even 3 years after, posing the question of whether 12-month post-LAAO surveillance TEE should be routinely performed to diagnose potential cases of LAA thrombi that ultimately predispose patients to strokes and negate the purpose of LAAO device implantation. Although LAAO decreases the risk of stroke in patients who are unsuitable candidates for long-term anticoagulation, these devices have inherent risks. These risks include potential complications around the implantation procedure and bleeding risks associated with postprocedural anticoagulation or DAPT in an often fragile patient population. If patients cannot tolerate anticoagulation or DAPT postprocedurally, these medications may need to be discontinued before device endothelialization has occurred, increasing the risk of DRT and potential embolic events. During implantation, it becomes a balance to have the LAAO device deep enough to cover everything and not have it implanted too deep in the chamber. In addition, some patients may have persistent peri-device leaks requiring longer-term anticoagulation. Newer devices afford more size options for individual patient characteristics. It is important that the care team carefully consider these risks and patient characteristics and discuss them with the patient before implanting the closure device.

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Appendix

Supplementary Data

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.hrcr.2023.11.003.

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