JACC: CASE REPORTS VOL. 2, NO. 6, 2020

MINI-FOCUS ISSUE: COMPLICATIONS

INTERMEDIATE

IMAGING VIGNETTE: CLINICAL VIGNETTE

1% Aspiration, 99% Perspiration

Acute Left Atrial Thrombus During Percutaneous Left Atrial Appendage Occlusion

Pankaj Jain, MBBS, Neil Jacobs, MBBS, David W.M. Muller, MBBS, MD, Brendan Gunalingam, MBBS

ABSTRACT

A 71-year-old man with chronic atrial fibrillation underwent insertion of a left atrial appendage occlusion device. Before release, a large thrombus was noted within the left atrium, attached to the left atrial appendage occluder delivery system. With continuous negative pressure, the device was deployed and thrombus successfully aspirated with no clinical sequelae. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2020;2:866–9) © 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/).

PRESENTATION

A 71-year-old man with chronic atrial fibrillation was referred for insertion of a left atrial appendage (LAA) occlusion device on a background of multiple peripheral embolic events despite anticoagulation with warfarin, as well as recurrent gastrointestinal bleeding and iron-deficiency anemia.

MEDICAL HISTORY

The patient's medical history was significant for both coronary and peripheral arterial disease, on a background of hypertension, type 2 diabetes mellitus, and dyslipidemia. He had undergone percutaneous coronary intervention for lesions in the left anterior descending and left circumflex arteries 15 years earlier. He had also previously undergone stenting of the bilateral infrapopliteal arteries, bilateral superficial femoral arteries, right common iliac artery, and superior mesenteric artery. Despite these measures, the patient experienced an episode of acute limb ischemia in 2019, with computed tomography angiography revealing widespread emboli to both mesenteric and lower limb circulations.

In addition, the patient had recurrent gastrointestinal bleeding events and iron-deficiency anemia requiring multiple blood transfusions. The anemia persisted despite conversion from apixaban to warfarin and a stable international normalized ratio (INR). Upper and lower gastrointestinal tract endoscopy had failed to identify a source of bleeding, and it was believed possibly related to mesenteric ischemia, either atherosclerotic or due to recurrent emboli. The patient's CHA_2DS_2-VASc (congestive heart failure, hypertension, age ≥75 years, diabetes mellitus, stroke/transient ischemic attack, vascular disease, age 65 to 74 years, sex category) score was 7, with a HAS-BLED (hypertension, abnormal renal/liver function [1 or 2 points], stroke, bleeding history or predisposition, labile INR, elderly [age >65 years], drugs/alcohol concomitantly [1 or 2 points]) score of 4.

From the Cardiology Department, St. Vincent's Hospital, Sydney, New South Wales, Australia. Dr. Muller has received research funds from Johnson & Johnson. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose. 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.

Manuscript received January 9, 2020; revised manuscript received February 24, 2020, accepted March 11, 2020.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2020.03.010

INVESTIGATIONS

Pre-procedural transesophageal echocardiography (TEE) performed 6 weeks before the procedure revealed severely impaired left atrial mechanical function with severe left atrial spontaneous echocardiographic contrast but no formed thrombus. The LAA dimensions were suitable for percutaneous closure (minimum ostial diameter 20 mm, minimum depth 34 mm). Following discussion among the heart team, the decision was made to proceed with insertion of a Watchman (Boston Scientific, Marlborough, Massachusetts) percutaneous LAA occluder (LAAO). In light of the pre-procedural TEE findings, warfarin was continued peri-procedurally due to very high perceived thromboembolic risk.

ABBREVIATIONS AND ACRONYMS

DRT = device-related thrombus

INR = international normalized ratio

LAA = left atrial appendage

LAAO = left atrial appendage occluder

TEE = transesophageal echocardiogram

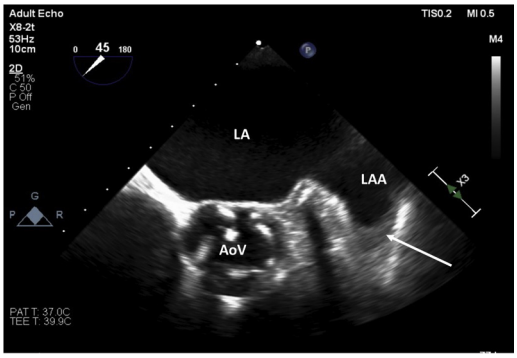
MANAGEMENT

Insertion of the LAAO was performed under general anesthesia with TEE guidance. The patient's INR was 2.5 at the time of the procedure. Intraprocedural TEE again showed severe spontaneous echocardiographic contrast within the body of the left atrium; however, on this occasion, formed thrombus was visualized at the LAA apex (**Figure 1**, Video 1). Given the patient's high ongoing embolic risk and limited alternative treatment options, the decision was made to proceed with device insertion despite active LAA thrombus being a relative contraindication.

Via 12-F right femoral venous access, trans-septal puncture was performed in the inferior-posterior quadrant of the atrial septum using an 8.5-F Swartz guiding catheter and a BRK-1 trans-septal needle. These were advanced into the left atrium over an Ironman wire (Abbott Vascular, Santa Clara, California) to minimize the risk of perforation of the posterior left atrial wall. An Amplatz Extra-Stiff wire (Cook Medical, Bloomington, Indiana) was advanced to the left upper pulmonary vein and the trans-septal guide catheter exchanged for a 14-F Watchman delivery sheath. The activated clotting time before heparin administration was 146 s, and thus 7,000 IU (65 IU/kg) unfractionated heparin was delivered directly into the LAA. A 30-mm Watchman LAAO was positioned proximally within the LAA, so as not to disrupt the apical thrombus.

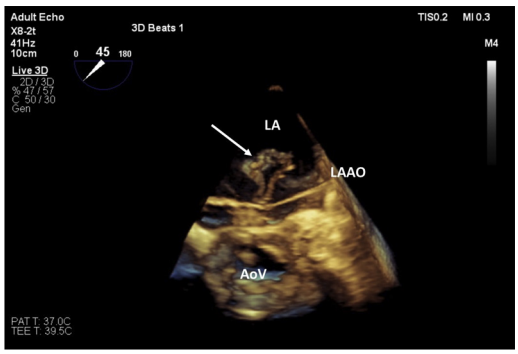
Before final release, a large, highly mobile, complex bifid thrombus was noted within the left atrium, attached to the Watchman delivery system (**Figure 2**, Video 2). A further 8,000 IU of unfractionated heparin was delivered through the device into the left atrium, and a subsequent activated clotting time was measured at 324 s. The decision was made to attempt suction of the thrombus into the delivery sheath. Under continuous negative pressure via the delivery sheath, the device was released and the delivery system withdrawn into the delivery sheath and removed. TEE revealed no residual thrombus within the left atrium, and no further aspiration through the sheath was possible, consistent with successful thrombus retrieval into the delivery sheath. The sheath was promptly withdrawn into the right atrium and removed while under continuous negative pressure. Final TEE showed adequate device compression with no peri-device leak, confirming exclusion of the pre-existing apical LAA thrombus from the circulation (**Figure 3**, Video 3). Flushing the sheath

FIGURE 1 Initial Intraprocedural TEE



Intraprocedural 2-dimensional transesophageal echocardiography in the mid-esophageal short-axis view before trans-septal puncture, showing formed thrombus **(white arrow)** within the left atrial appendage (LAA). AoV = aortic valve; LA = left atrium.

FIGURE 2 Pre-Deployment 3-Dimensional TEE



Intraprocedural 3-dimensional transesophageal echocardiography, before release of the occluder device, showing complex acute thrombus **(white arrow)** attached to the device delivery system. Abbreviations as in Figure 1.

after removal produced two 4-cm segments of fresh thrombus (Figure 4). The patient had an uneventful recovery, with no clinical evidence of cerebral or peripheral emboli.

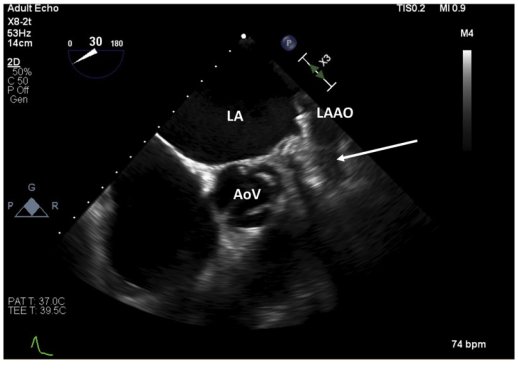
DISCUSSION

Device-related thrombus (DRT) is a well-recognized complication of percutaneous LAA occlusion; it occurs in 3.7% to 7.4% of patients and is an independent predictor of systemic embolism (1,2). DRT is, however, generally considered to be a medium- to long-term complication, and there are no reports of acute thrombus formation during device delivery. In the current case, a large, acute DRT formed spontaneously despite therapeutic anticoagulation with warfarin and further intraprocedural administration of unfractionated heparin.

Although mechanistically unrelated to the acute DRT, the pre-existing apical LAA thrombus in the presence of therapeutic INR clearly indicated a high baseline propensity for clot formation. This may have been due to a range of factors, including very poor left atrial mechanical function, inherited hypercoagulability, or an acquired hypercoagulable state such as malignancy, autoimmune disorder, metabolic cause (e.g., insulin resistance) (3), or increased viscosity (e.g., hypergammaglobulinemia). In this patient, however, no specific cause of systemic hypercoagulability was found apart from known type 2 diabetes mellitus.

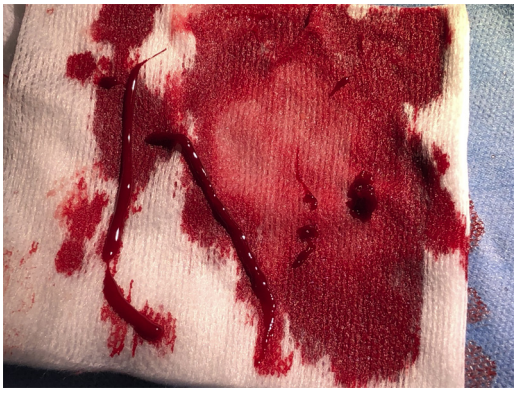
A critical decision-making juncture in this case occurred upon identification of the acute DRT. Procedural options at this point included recapture of the device into the delivery sheath and abandoning the procedure,

FIGURE 3 Post-Deployment TEE



Intraprocedural 2-dimensional transesophageal echocardiography in the mid-esophageal short-axis view after device deployment, showing successful exclusion of the subacute thrombus at the LAA apex **(white arrow)**. Abbreviations as in Figure 1.

FIGURE 4 Thrombi Retrieved After Removal and Flushing of the Delivery Sheath



device deployment under continuous negative pressure (ultimately performed), or surgical thrombectomy. It was believed that attempting to retrieve the device into the sheath would increase the risk of clot dislodgement and embolization. Similarly, the risks of further clot propagation and/or embolization before sternotomy and surgical thrombectomy were believed to be prohibitively high. Device deployment under negative pressure, in contrast, minimized embolic risk by minimizing both mechanical forces on the thrombus as well as procedural time.

The evidence for the use of cerebral protection devices in the setting of LAAO insertion is limited to a small single case series (4) in which all patients studied exhibited evidence of debris embolization. Prospective, controlled studies are required to determine the clinical benefits of cerebral protection, particularly given the lack of significant stroke reduction seen in the transcatheter aortic valve replacement population despite very high rates of debris capture (5). Nevertheless, in the current case, the dramatic presentation and clear potential for catastrophic neurologic sequelae highlight a potential role for cerebral protection devices during LAAO insertion, either as routine or ad hoc when the patient is deemed to be at high risk of thromboembolism based on clinical or intraprocedural findings.

FOLLOW-UP

The patient remains well on warfarin therapy, with no further embolic events or evidence of gastrointestinal bleeding 6 months' post-procedure.

CONCLUSIONS

In this case of large, spontaneous thrombus formation during LAA occlusion, device deployment under continuous negative pressure permitted successful thrombus aspiration and removal without clinical sequelae.

ADDRESS FOR CORRESPONDENCE: Dr. Pankaj Jain, Cardiology Department, Level 4, Xavier Building, St. Vincent's Hospital, 390 Victoria Street, Darlinghurst, New South Wales, Australia 2010. E-mail: pankaj.jain@svha.org.au. Twitter: @pankajjain185.

REFERENCES

1. Dukkipati SR, Kar S, Holmes DR, et al. Device-related thrombus after left atrial appendage closure. Circulation 2018;138:874–85.

2. Fauchier L, Cinaud A, Brigadeau F, et al. Device-related thrombosis after percutaneous left atrial appendage occlusion for atrial fibrillation. J Am Coll Cardiol 2018;71:1528–36.

3. Ozkul A, Turgut ET, Akyol A, et al. The relationship between insulin resistance and hypercoagulability in acute ischemic stroke. Eur Neurol 2010;64:201–6.

4. Meincke F, Spangenberg T, Kreidel F, et al. Rationale of cerebral protection devices in left atrial appendage occlusion. Catheter Cardiovasc Interv 2017;89:154–8.

5. Kapadia SR, Kodali S, Makkar R, et al. Protection against cerebral embolism during transcatheter aortic valve replacement. J Am Coll Cardiol 2017;69:367–77.

KEY WORDS atrial fibrillation, occluder, thrombus

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