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/).
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.

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.

**ABBREVIATIONS AND ACRONYMS**

| Abbreviation          | Definition                                    |
|-----------------------|-----------------------------------------------|
| INR                   | International normalized ratio                |
| LAA                   | Left atrial appendage                         |
| LAAO                  | Left atrial appendage occluder                |
| TEE                   | Transesophageal echocardiogram                |
| DRT                   | Device-related thrombus                       |
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,
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.

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KEY WORDS atrial fibrillation, occluder, thrombus

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