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Transcatheter Closure of a Post-Surgical Left Atrial Appendage Ligation Leak Using a Patent Foramen Ovale Occluder

CASE REPORT

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INTRODUCTION

Incomplete surgical ligation of the left atrial appendage (LAA) is a well-recognized clinical challenge, with success rates reported as low as 40% when assessed by transesophageal echocardiography (TEE).[1] These residual post-surgical leaks are associated with blood stasis and an elevated risk of thromboembolic events, even in patients maintained on oral anticoagulation (OAC).[2] While dedicated LAA closure devices are engineered for native anatomies, post-surgical remnants often present with shallow depths and fibrotic borders, necessitating innovative transcatheter solutions.

CASE REPORT

A 74-year-old female with a history of hypertension, atrial fibrillation (AF), and prior bioprosthetic mitral valve replacement combined with surgical LAA ligation (performed 6 months earlier due to a documented LAA thrombus) presented with exertional dyspnea and palpitations. Despite strict adherence to apixaban (5 mg BID), she had suffered a cardioembolic cerebrovascular event 2 months prior to admission. Physical examination revealed an irregular pulse and bilateral pulmonary crackles. An electrocardiogram (ECG) confirmed AF with a ventricular rate of 118 bpm. Transthoracic echocardiography showed a left ventricular ejection fraction of 40%, a left ventricular end-diastolic diameter of 52 mm, a left atrial anteroposterior diameter of 46 mm, and a normally functioning bioprosthetic mitral valve. Catheter AF ablation was planned due to symptomatic arrhythmias.

Pre-procedural TEE identified a 6-mm post-surgical leak with significant flow on color Doppler (Video 1). Cardiac computed tomography (CT) confirmed the LAA leak with an internal diameter of 18 mm and a neck diameter of 8 mm (Figure 1A). Notably, CT imaging revealed that the LAA remnant was in close proximity to the pulmonary artery (PA) and the circumflex artery (Figure 1B and 1C).

Following successful radiofrequency AF ablation, percutaneous LAA leak closure was scheduled for a separate session. One month later, the procedure was performed under general anesthesia and uninterrupted OAC with TEE and fluoroscopic guidance. After an infero-posterior transseptal puncture, unfractionated heparin was administered to maintain an activated clotting time of 300-350 seconds. Due to the narrow and fibrotic nature of the leak site, conventional delivery sheaths lacked sufficient maneuverability. Consequently, a steerable radiofrequency (RF) ablation catheter (Marinr; Medtronic Inc., Minneapolis, MN, USA) was utilized to provide additional support and ensure coaxial alignment, facilitating the delivery sheath's entry into the LAA remnant (Video 2).

The choice of the occlusion device was guided by pre-procedural CT. To prevent potential mechanical trauma or perforation of the adjacent pulmonary and circumflex arteries by the anchoring hooks of conventional LAA devices, an Amplatzer Patent Foramen Ovale (PFO) Occluder (25/18 mm) (Abbott, USA) was selected. The 25-mm proximal disc ensured complete coverage of the ostium, while the 18-mm distal disc provided secure anchoring within the shallow 18-mm

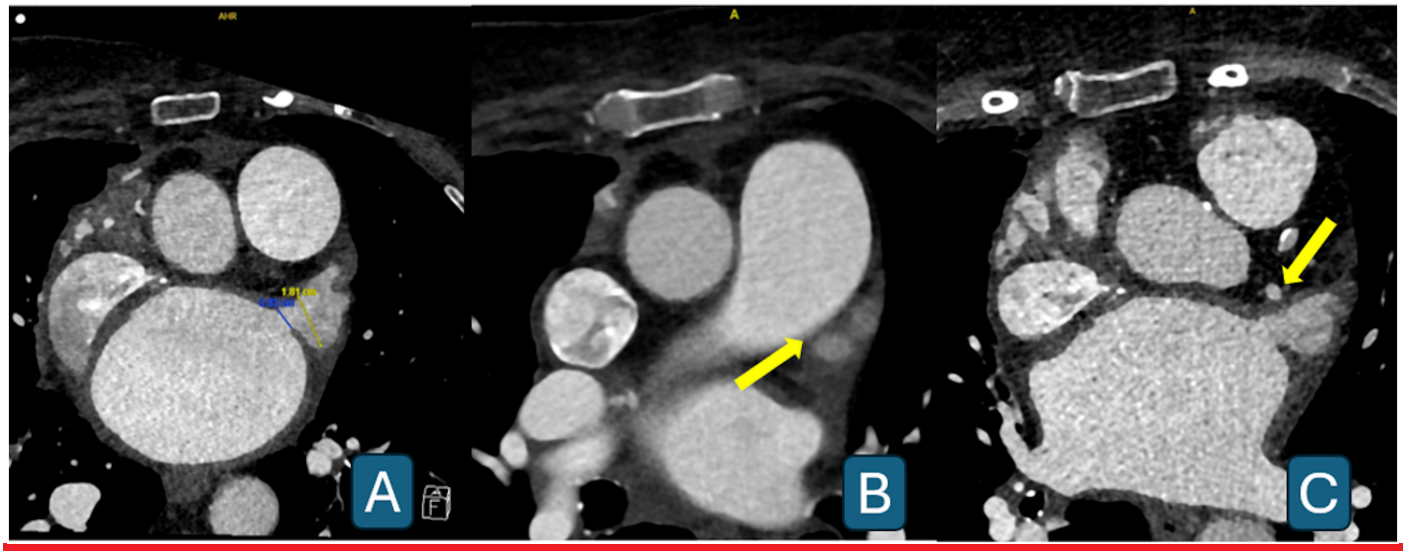

Figure 1. Pre-procedural Cardiac Computed Tomography (CT) Imaging. (A) Cardiac CT demonstrating the left atrial appendage (LAA) remnant with an internal diameter of 18 mm and a neck diameter of 8 mm. (B) CT image illustrating the close anatomical proximity of the leak site to the pulmonary artery. (C) CT image showing the proximity of the LAA remnant to the circumflex (Cx) artery.

internal cavity (Video 3). Stability was confirmed via a "tug test" (Video 4). Post-deployment TEE and angiography demonstrated complete occlusion without interference with the bioprosthetic mitral valve (Video 5). The patient was discharged on apixaban (5 mg BID) and aspirin (100 mg) for 1 month. At the 1-month follow-up, TEE confirmed stable device positioning with no residual leakage.

DISCUSSION

Currently, there is no definitive consensus or established algorithm in the literature regarding the management of leaks following percutaneous or surgical LAA closure. Although some studies provide evidence that leaks smaller than 3 mm can be managed conservatively, other research suggests that leaks of any size are associated with adverse thromboembolic events.[3,4] Furthermore, it has been demonstrated that leaks with visible flow on TEE have a stronger prognostic correlation with thromboembolic events compared to findings on CT.[3]

Despite the lack of a standardized algorithm, percutaneous leak closure should be strongly considered in patients—such as the one in the current case—who experience thromboembolic events despite prior surgical LAA ligation (performed due to the presence of an LAA thrombus during mitral valve surgery), especially when the surgical risk for re-intervention is high. Studies have shown that endocardial leak closure is an effective and safe procedure, with a complication rate of less than 3%.[5]

The selection of the appropriate technique and device is paramount for procedural success. Depending on the leak volume and anatomical characteristics, various techniques including device-based closure, RF ablation, coil embolization, and "stump space closure" have proven feasible.[4] Notably, RF ablation has been reported as an effective method for managing surgical leaks in certain cases.[6] Pre-procedural planning via CT is essential to evaluate the external, internal, and neck diameters of the leak site to guide device selection. For instance, in a case where a leak developed following a Lariat procedure, the Amplatzer Talisman PFO Occluder was successfully utilized due to its smaller distal disc and expandable waist.[7] Similarly, septal occluders have been effectively used in patients whose anatomy is not suitable for conventional closure devices.[8]

Furthermore, the anatomical proximity of the LAA to adjacent structures—such as the left superior pulmonary vein, the PA, and the circumflex (Cx) artery—must be carefully considered. Due to the anchoring mechanisms (hooks/barbs) of standard LAA closure (LAAC) devices, there is a rare but potential risk of perforation, particularly of the PA, which can lead to catastrophic outcomes.[9] In the current case, given the close proximity to both the PA and the Cx artery, a PFO closure device was used to minimize the risk of perforation. Additionally, in cases with a shallow appendage morphology where depth is insufficient, PFO devices may serve as a viable alternative for LAA leak closure.

CONCLUSION

Percutaneous closure of post-surgical LAA leak is an effective strategy to mitigate thromboembolic risk, but the procedure has technical challenges. A patient-centered approach is mandatory, requiring a comprehensive assessment of the LAA anatomy and its surrounding structures to determine the most appropriate device and technique. In cases involving shallow anatomy or proximity to vital adjacent vessels, PFO occluders may be safe and versatile alternatives. Success in these complex interventions requires meticulous pre-procedural imaging and a patient-specific approach to device selection.

Availability of data and materials: The data are presented in the manuscript files.

Informed Consent: Written and verbal informed consent was obtained from the patient for the publication of this case report, including all personal and clinical details and accompanying images.

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Video 1: Color Doppler TEE imaging showing significant flow through the 6-mm post-surgical LAA leak.

Video 2: Fluoroscopic guidance demonstrating the use of a steerable radiofrequency (RF) ablation catheter to provide support and coaxial alignment for the delivery sheath.

Video 3: Fluoroscopic sequence showing the deployment of the 25/18 mm Amplatzer PFO Occluder within the LAA remnant.

Video 4: The "tug test" is performed under fluoroscopy to confirm the stable positioning and secure anchoring of the PFO occluder.

Video 5: Post-procedural TEE assessment demonstrating complete occlusion of the leak with no residual flow and no interference with the bioprosthetic mitral valve.

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