A terrible bloody tamponade: A case of delayed hemorrhagic cardiac tamponade post left atrial appendage occlusion

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Introduction

An important objective in treatment of atrial fibrillation is stroke prevention.[1] This is not just because of the significant risk of cardioembolic strokes with atrial fibrillation, but also because of the relatively high morbidity and mortality risk with cardioembolic strokes compared with other stroke types.[2] While anticoagulation therapy is the preferred stroke prevention method, left atrial appendage occlusion (LAAO) has emerged as a noninferior alternative, particularly in patients at risk of stroke who have a contraindication to long-term anticoagulation.[1,3] LAAO procedure is associated with a small risk of cardiac tamponade (1.2%).[4] The specific category of delayed (>7 days) cardiac tamponade is, however, very rare at 0.8%.[5]

In this report, we describe a rare case of hemorrhagic cardiac tamponade about 3 months after an LAAO device procedure, in a patient with heart failure with reduced ejection fraction.

Case report

This is a case of a 67-year-old female patient with medical history of paroxysmal atrial fibrillation and $CHADS_2$-$VASc_2$ score of 3, heart failure with reduced ejection fraction of 25%, status post implantable cardioverter-defibrillator, moderate mitral regurgitation, and chronic kidney disease stage 3a. She had been adherent to guideline-directed therapy for heart failure with sacubitril-valsartan, carvedilol, spironolactone, and empagliflozin. She underwent LAAO with Amulet implant on account of increased bleeding risk from recurrent falls owing to Parkinson disease. She had no perioperative complications. Anticoagulation therapy with apixaban was discontinued following the procedure, and the patient was maintained on aspirin 81 mg daily and clopidogrel 75 mg daily. Transesophageal echocardiogram a month later demonstrated a well-seated device and there was no pericardial effusion; clopidogrel was discontinued at that time.

Eighty-one days after her LAAO procedure, the patient reported to the emergency department with an hour's duration of moderately severe, pressure-like chest pain. She had no history of chest wall trauma. She was hemodynamically unstable with a blood pressure of 67/46 mm Hg and heart rate of 60 beats/min. Her electrocardiogram showed no ST-segment changes and serial troponins were within normal range. Her B-type natriuretic peptide was elevated at 1120 pg/mL. Contrast computed tomography (CT) scan of the chest was revealing for a large pericardial effusion (Figure 1); there was no aortic dissection. The patient was started on 1 L bolus of intravenous normal saline and norepinephrine at 0.65 mcg/

KEY TEACHING POINTS

- While left atrial appendage occlusion (LAAO) procedure is associated with a small risk of cardiac tamponade (1.2%), the specific category of delayed (>7 days) cardiac tamponade is rare at (0.8%).
- Cardiac tamponade can occur as late as 14 months after LAAO.
- Cardiac tamponade following LAAO procedure results from 3 postulated processes: erosion into myocardial wall by the implanted device, microperforation of the left atrial appendage, and chronic nonspecific inflammatory reaction to the implant.
- Management of the complication of cardiac tamponade includes decompression procedures and specific treatment tailored to the mechanism of injury.

KEYWORDS Cardiac tamponade; Atrial appendage occlusion; Pericardial window; Amulet; Atrial fibrillation
(Heart Rhythm Case Reports 2024;10:549–552)

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https://doi.org/10.1016/j.hrcr.2024.05.010

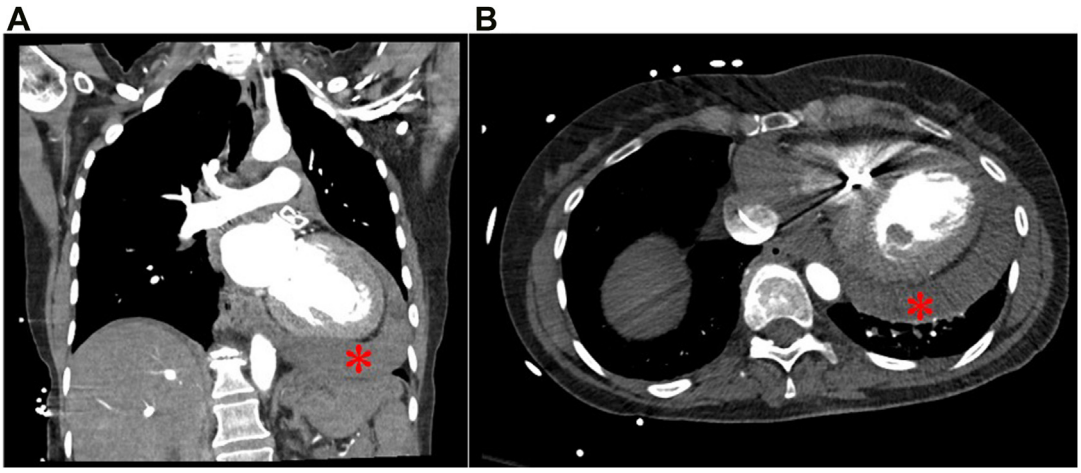

Figure 1 Chest computed tomography scan showing large pericardial effusion (*red asterisk*). **A:** Coronal view. **B:** Transverse view.

kg/min. She was transferred to our facility as the initial facility for higher level of care.

Upon arrival at our facility, the patient was diaphoretic with cold, clammy extremities, blood pressure of 92/64 mm Hg, and heart rate of 60 beats/min; heart sounds were distant; and there was jugular venous distension. She remained on continuous norepinephrine infusion and intravenous fluid. Bedside transthoracic echocardiogram (TTE) confirmed a large pericardial effusion with right ventricle and right atrial collapse. An urgent subxiphoid pericardial window was done. Three hundred milliliters of bloody effusion was drained intraoperatively, with immediate improvement of systolic blood pressure by 50 mm Hg. No active bleeding into the pericardium was observed.

The patient remained hemodynamically stable postoperatively and no longer required norepinephrine infusion. Follow-up high-quality cardiac CT scan on postoperative day 5 showed LAAO device in appropriate position without erosion into the pulmonary artery and no significant pericardial effusion (Figure 2). Pericardial effusion cytology was unremarkable for malignancy. Given her severely reduced ejection fraction of 25%, her clinical stability with low chest tube output, TTEs without evidence of recurrent effusion, and unremarkable high-quality cardiac CT scan, she was not considered a candidate for high-risk elective open Amulet removal. She was discharge on postoperative day 7 with TTE showing residual trivial pericardial effusion. Additionally, TTEs on postoperative days 21 and 112 (Figure 3) showed no recurrence of hemopericardium but stable residual pericardial effusion. The timeline of significant events is summarized in Table 1.

Discussion

LAAO is a generally safe procedure with high success rate. Indeed, Yerasi and colleagues,[4] in their systematic review and meta-analysis, which included 49 studies and 12,415 patients, determined the procedure had an implantation success

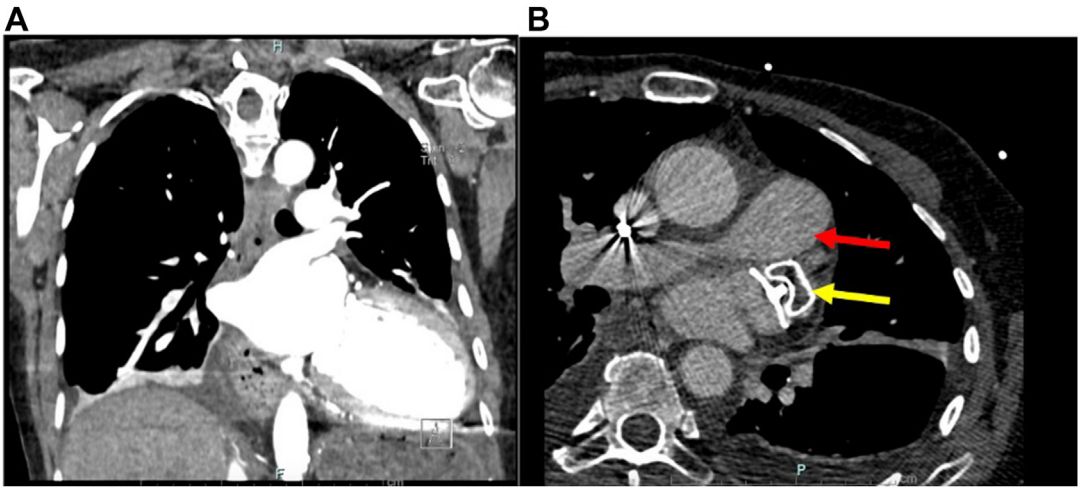

Figure 2 Cardiac computed tomography angiograms post pericardial window. **A:** Coronal view. No significant pericardial effusion. **B:** Transverse view. No erosion of left atrial appendage occlusion device (*yellow arrow*) in pulmonary artery (*red arrow*).

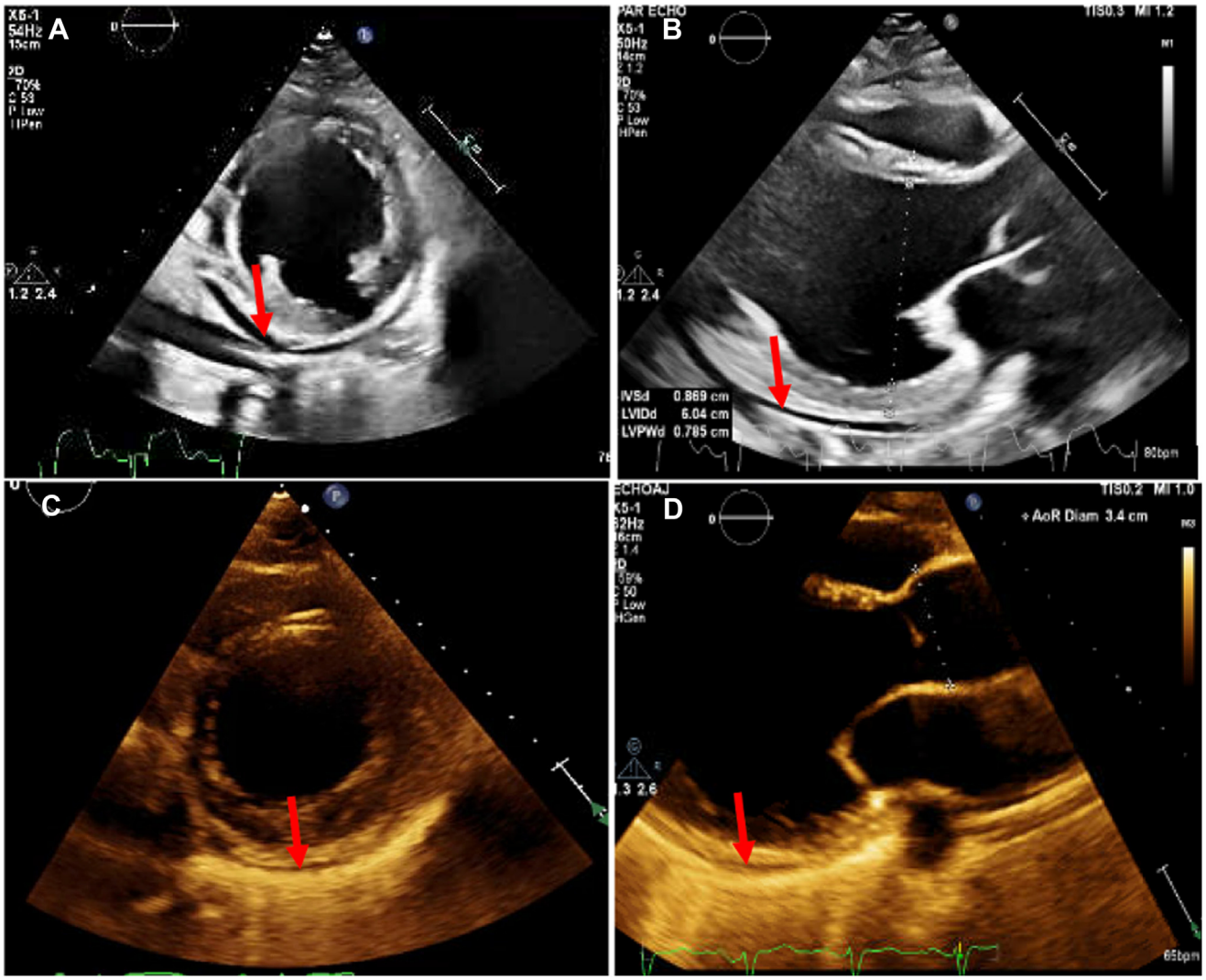

Figure 3 Transthoracic echocardiogram at postoperative days 21 (**A, B**) and 112 (**C, D**); parasternal short-axis (**A, C**) and parasternal long-axis (**B, D**) views show stable residual trivial pericardial effusion (*red arrow*).

Table 1 Timeline of significant events

Time	Events
Day 0	LAAO with Amulet implant
1 month	TEE showed well-seated LAAO device and no pericardial effusion.
Day 81	Cardiac tamponade. Urgent pericardial window successfully drained 300 mL of hemorrhagic effusion.
Day 86	Follow-up cardiac CTA showed LAAO device in appropriate position, no erosion into the pulmonary artery, and no significant pericardial effusion.
Day 88	Follow-up TTE showed no recurrence of hemopericardium. Patient discharged home.
Day 112	TTE shows stable residual trivial pericardial effusion.

CTA = computed tomography angiogram; LAAO = left atrial appendage occlusion; TTE = transthoracic echocardiogram.

rate of 96.2% and low procedure-related mortality of 0.2%. Complications of the procedure are uncommon and include pericardial effusion, cardiac tamponade, stroke, device embolization, and hemorrhage. Deferring rates of procedure complications are reported for the various types of devices used.[4,6]

Data from the National Cardiovascular Data Registry (NCDR) LAAO Registry reveals the incidence of periprocedural pericardial effusion requiring intervention to be 1.8%. However, most of these adverse events happen within 7 days of the procedure.[7] One of the few studies to provide insight into the incidence of delayed pericardial effusion and cardiac tamponade following LAAO is provided by Fu and colleagues[5] in their single-center retrospective study, which included 748 patients with successful LAAO. The authors observed that pericardial effusion / cardiac tamponade occurred as late as 160 days following the procedure, and the incidence of delayed pericardial effusion / cardiac tamponade was very low at 0.8%.[5] Cardiac tamponade occurring as late as 14 months after an LAAO has also been reported.[8] It is

unclear what factors influence the risk of pericardial effusion / cardiac tamponade in the setting of LAAO.[9]

Varied mechanisms have been identified as causing cardiac tamponade following LAAO. Direct mechanical trauma to the myocardium and surrounding structures by the occlusion device is one described mechanism. Specific examples of this mechanism include erosion into the left atrial appendage myocardial wall and pulmonary artery perforation leading to hemorrhagic effusion/tamponade. Surgical exploration and repair with or without extraction of the implant is often required to prevent recurrence.[8–11] Microperforation of the left atrial appendage is another described mechanism of cardiac tamponade following LAAO. This second mechanism is related to trauma from the occlusion device without identifiable break in continuity of gross anatomical structures of the left atrium and associated structure. This mechanism is often implicated in delayed hemorrhagic cardiac tamponade. Relatively less invasive management such as pericardiocentesis or pericardial window to evacuate the effusion is often all that is needed.[5,12] Chronic nonspecific inflammatory reaction to the materials in the occlusion devise used for LAAO has also been hypothesized as a possible mechanism of cardiac tamponade and pericardial effusion. Treatment of this type of pericardial effusion/tamponade may include anti-inflammatory medications such as steroid and colchicine, in addition to decompression procedures. The effusion in this uncommon cause of adverse event is usually nonhemorrhagic and delayed.[5]

It is our hypothesis that our patient's hemorrhagic cardiac tamponade is an example of delayed presentation of adverse event related to her LAAO about 3 months prior to her index presentation. The suspected mechanism in this case would be microperforation, given that the effusion was hemorrhagic and there was no active bleeding noticed intraoperatively. Additionally, follow-up cardiac CT scan was unrevealing for any gross anatomical injury by the LAAO device. Other causes such as aortic dissection, post–myocardial infarction wall rapture, or traumatic effusion were ruled out by history and investigations as already described.

Conclusion

Delayed cardiac tamponade is a rare complication of LAAO. Given that this adverse event is potentially fatal, it is important that patients be followed up in the long term following the procedure. Patient education in terms of symptoms to look out for and the need to seek early medical care cannot be overemphasized. Patients with heart failure with reduced ejection fraction are particularly vulnerable to poor outcomes in the event of early or late complications, and care should be taken in patient selection at the time of implant.

Funding Sources: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Disclosures: No conflicts to disclose.

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