Case Report

Iatrogenic Atrio-esophageal Fistula Following a Video-Assisted Thoracoscopic Maze Procedure: Is Esophageal Instrumentation Justified Even When the Diagnosis is Equivocal?

Abstract

A 74-year-old female underwent an uneventful bilateral thoracoscopic maze procedure for persistent atrial fibrillation with continuous transesophageal echocardiographic (TEE) guidance. She presented six weeks later with persistent fever and focal neurological signs. Computed tomography of the thorax revealed air in the posterior LA, raising suspicion for an abscess versus an atrioesophageal fistula (AEF). Before undergoing an exploratory median sternotomy, an esophagogastroduodenoscopy (EGD) was performed by the surgeon to check for any esophageal pathology. This however, resulted in sudden hemodynamic compromise that required intensive treatment with vasopressors and inotropes. In this case-report, we review the various intraoperative risk factors associated with the development of AEF during cardiac ablation procedures as well as the potential hazards of esophageal instrumentation with TEE, naso- or oro- gastric devices, and/or an EGD when an AEF is suspected.

Keywords: *Atrial fibrillation ablation, esophagogastroduodenoscopy, iatrogenic trioesophageal fistula, transesophageal echocardiography, video-assisted thoracoscopic maze procedure complications*

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Introduction

Among the several complications associated with cardiac ablation procedures for atrial fibrillation (AF), atrio-esophageal fistula (AEF), although rare, is probably the most life-threatening. Its incidence is estimated to be 0.01%–0.2% for ablations performed percutaneously but is much higher (1.0%–1.5%) when done surgically.[1] Video-assisted thoracoscopic (VATS) left atrial (LA) maze procedure is a minimally invasive epicardial approach that has been shown to be feasible and efficacious in treating persistent, recurrent AF.[2] We present the clinical dilemmas associated with the diagnosis and management of AEF which developed several weeks after our patient underwent this ablation technique.

Case Report

A 74-year-old Caucasian female with a body mass index of 29.3 and chronic AF underwent an uneventful VATS-LA maze procedure under general anesthesia. The procedure involved sequential one lung ventilation which was accomplished using an EZ-Blocker endobronchial blocker (Teleflex Inc., Morrisville, NC, USA). Transesophageal echocardiography (TEE) was used to guide exclusion of the LA appendage as well as to assess the flow in the pulmonary veins both before and after ablation. The ablation lesions were created with a bipolar radiofrequency catheter, however due to the presence of the TEE probe, an esophageal temperature probe was not inserted.

Six weeks later, the patient presented to the emergency department with persistent fever, altered mental status, and left upper extremity weakness. Neither initial computed tomography (CT) nor magnetic resonance imaging/angiography (MRI) of the head indicated any acute intracranial process. A CT of the thorax, however, revealed that air had collected in the posterior LA, raising the suspicion for an LA wall abscess or an AEF [Figure 1].

A surgical exploration through median sternotomy with cardiopulmonary

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bypass (CPB) on standby was planned. The patient had already been intubated the night prior due to worsening mental status. In the OR, a 9F double-lumen central venous catheter was inserted in the right internal jugular vein under ultrasound guidance. Due to poor distal circulation in both upper and lower extremities, an 18-G catheter inserted in the right axillary artery was used for blood pressure monitoring as well as blood sampling. Before the sternotomy, an esophagogastroduodenoscopy (EGD) was performed to rule out any esophageal pathology. This decision was influenced by a higher degree of suspicion for an LA wall abscess based on the interpretation of the CT scan. While no obvious esophageal pathology was detected, toward the end of the EGD, the patient developed sudden severe hypotension which was treated with multiple boluses of phenylephrine followed by norepinephrine and epinephrine. The scope was immediately replaced by a TEE probe to assess the patient's cardiac function; considerable air could be visualized within the LA, left ventricle, and aortic root [Figure 2 and Videos 1 and 2].

This prompted emergent median sternotomy and institution of CPB. As no obvious or probe-patent lesion was readily identified, a nasogastric (NG) tube was placed and aliquots of up to 60 mL of air were injected through it to visualize the AEF. This allowed identification of the fistula opening into the posterior wall of the LA between the right and left superior pulmonary veins. The defect was patched using bovine pericardium, and the integrity of the repair was again assessed by injecting additional aliquots of air through the NG tube. At the end of the procedure, the patient was transferred to the surgical intensive care unit, intubated and mechanically ventilated, where she continued to deteriorate neurologically. On postoperative day (POD) 1, an MRI revealed numerous punctate and confluent hyperintensities involving vital structures of the pons and caudal midbrain bilaterally, many areas within the posterior cerebral artery territory, and a few foci in bilateral middle cerebral and anterior cerebral artery territories as well. Two days later, global slowing could be seen on EEG, indicative of a global disturbance of cortical function. The patient's family chose to withdraw care on POD 10 in light of the profound neurologic injury and poor prognosis.

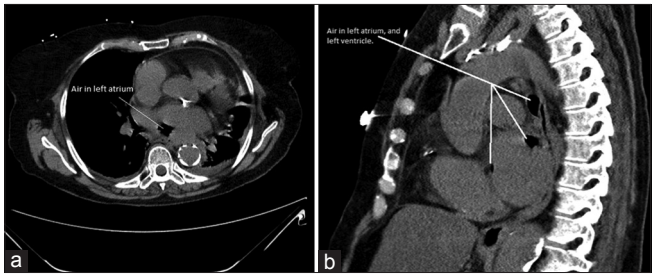

Figure 1: Computed tomography of the thorax showing cross section (a) and sagittal (b) views showing air in the left atrium and left ventricle

Discussion

The VATS-LA maze procedure involves a bilateral minimally invasive approach to create transmural lesions in the posterior LA to ablate the arrhythmogenic foci of AF as well as the macroreentry circuit around the mitral valve. It, therefore, requires sequential lung isolation with either a bronchial blocker or double lumen tube.[3]

Several complications associated with ablation procedures, both surgical and catheter-based, have been reported in the literature. These include cardiac tamponade (15.6%), phrenic nerve injury (0%–0.48%), thromboembolism (0%–7%), AEF (0.25%), and more infrequently, air embolism, acute coronary artery occlusion, pericarditis, mediastinitis, vagal nerve injury, stroke, and radiation exposure.[2] While thermal injuries are reported in up to 47% of patients undergoing catheter-based ablation, most resolve without significant sequelae.[4] The proximity of the esophagus to the LA makes it vulnerable to a full spectrum of postablation injuries ranging from minor erythema, erosions, and ulcerations to the catastrophic development of an AEF.[2]

AEF is a common cause of mortality that occurs after catheter-based ablation for AF (16%) and is second only to cardiac tamponade (25%).[5] Its incidence following percutaneous ablation ranges from 0.01% to 0.2%, whereas it can be as high as 1.0%–1.5% for patients undergoing surgical ablations including the maze procedure. Moreover, a combined surgical and catheter-based ablative approach may increase the incidence of complications in patients with AEF by as much as 4%.[3,6]

AEFs can occur as early as 2 days to 6 weeks postprocedure and often present as a diagnostic dilemma requiring a high index of suspicion.[3] Common presentations include heart block and ischemia in the distribution of the right coronary artery, massive air embolism, mental status changes, seizures, and focal neurologic signs. It can also

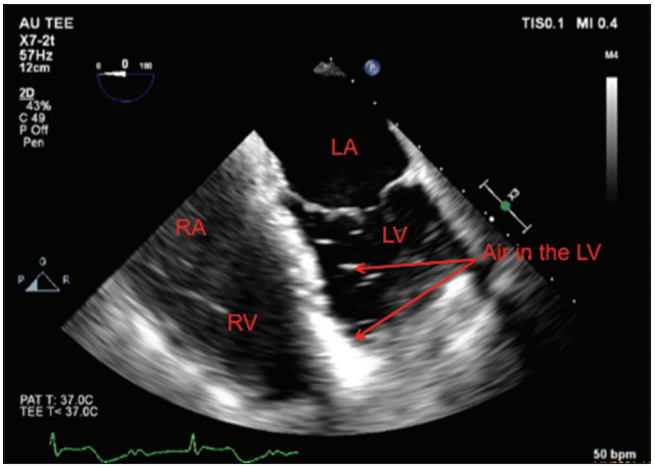

Figure 2: Intraoperative transesophageal echocardiogram, mid-esophageal four chamber view showing air in the left atrium and left ventricle

present as dysphagia, nausea, heartburn, pericardial or pleural effusions, sepsis, endocarditis, embolic stroke, hematemesis, or melena.[7]

Air, food, and bacterial emboli occur much more often than upper gastrointestinal bleeding in the setting of AEF. This is caused by high resistance to flows in the fistula tract and the frequent presence of one-way tissue flaps.[7] Intra-atrial air on CT or MRI is diagnostic, as is extravasation of oral (from the esophagus to the LA) or intravascular (from the LA to the esophagus) contrast material. Whereas transthoracic echocardiography may be useful in some cases, TEE should be avoided to prevent further esophageal injury.[1] Similarly, EGD is usually contraindicated in the presence of AEF as it could potentially open the tissue flap and cause massive iatrogenic air embolism as well as life-threatening bleeding.[8] However, esophageal ultrasound has been proposed as an option when the diagnosis of AEF is extremely challenging.[9]

Several risk factors for AEF after AF ablations have been identified [Table 1]. That intraoperative TEE is a risk factor is particularly noteworthy from the cardiac anesthesiologist's viewpoint as it is needed not only to monitor cardiac function, rule out LA thrombus, and ensure that an LA appendage is completely removed but also to assess left and right pulmonary vein inflow velocities before and after ablation to detect early pulmonary vein stenosis.[3] As the TEE probe is positioned directly behind the LA, the electrical charge over the head of the probe can interact with the electrocautery, especially if it is unipolar, and produce excessive heat in the area.[1] Moreover, the presence of a TEE probe may preclude the placement of a temperature probe and could potentially fix the esophagus in a position nearest to the posterior wall of the LA, theoretically increasing the risk of injury.[10,11] Severe gastroparesis following radiofrequency ablation has also been documented and may contribute to esophageal injury.[12]

Several strategies have been proposed to mitigate these risks and include the use of preprocedural imaging such as CT or MRI to assess the relationship of the LA to the esophagus; intraprocedural topographical tagging of the esophagus; reducing the power and duration of ablation applications; using bipolar rather than unipolar radiofrequency; frequently moving the catheter tip when ablating close to the esophagus; limiting esophageal temperature to 30°C; withdrawing the TEE probe to a more cephalad position in the esophagus; and proton pump inhibitor prophylaxis in patients with a history of esophageal lesions. Although these strategies have been used previously either alone or in combination, they have not been proven to be consistently effective.[2,13,14]

Table 1: Risk factors for development of atrio-esophageal fistula after a left atrial ablation procedure

Risk factors
Small, thin patient (less overall body fat)
General anesthesia
Nasogastric tube
Combined surgical and catheter based procedure
Unipolar cautery
High esophageal luminal temperatures
Smaller distance between esophagus and left atrium (less fat)
Transesophageal echocardiography probe
High power and longer duration

In our patient, multiple interventions – intubation for general anesthesia, placement of the TEE probe in the esophagus throughout the surgery, and replacement of the probe with an NG tube at the end of the surgery may have increased the risk for an AEF. While esophageal temperature monitoring was not done, a bipolar ablation catheter was used to mitigate the risk of thermal injuries to the esophagus and neighboring structures.

Intracardiac echocardiography is yet another intervention that can help prevent excessive tissue damage during ablation by monitoring for microbubbles. Although not 100% sensitive or specific, microbubbles may be an early sign of overheating, even before changes in catheter impedance and temperature and should prompt the operator to reduce or cease delivery of power.[15,16] It is used by the cardiac electrophysiologists during percutaneous ablation procedures and is generally not used in surgical ablations as it would require an additional femoral venous access.

It is universally understood that conservative management of an AEF will result in death. That said, surgical management can be accomplished through: (1) the right or left transthoracic approach, either without CPB or with CPB and femoral cannulation or (2) a median sternotomy with CPB with either femoral or conventional central cannulation.[17] During an open repair, when it is not readily obvious where the fistula opens into the LA, we suggest performing an EGD after going on CPB and opening the LA. With the LA filled with saline, direct visualization of the air bubbles entering through the posterior LA wall may help to locate the AEF. Esophageal stenting has recently been proposed as an alternative to open surgery. However, stenting should be reserved as a temporary bridge only.[1,18] When it is used, CO_2 should be used cautiously at very low flow rates, avoiding air as much as possible. Alternatively, it could be performed completely under fluoroscopy to prevent the insufflation of any gas.[14]

Conclusion

This case should raise awareness of the risk factors as well as the signs and symptoms associated with the development of AEF as a rare but life-threatening complication of surgical AF ablation procedures. Although diagnosing AEF is not within the anesthesiologist's domain, when

the diagnosis is uncertain, suspicion is high, esophageal instrumentation with a TEE or naso- or oro-gastric tube should be avoided. We emphasize the importance of close communication among health-care providers to prevent manipulating the esophagus with an EGD in such circumstances.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

References

1. Al-Alao B, Pickens A, Lattouf O. Atrio-oesophageal fistula: Dismal outcome of a rare complication with no common solution. Interact Cardiovasc Thorac Surg 2016;23:949-56.
2. Calkins H, Kuck KH, Cappato R, Brugada J, Camm AJ, Chen SA, *et al.* 2012 HRS/EHRA/ECAS expert consensus statement on catheter and surgical ablation of atrial fibrillation: Recommendations for patient selection, procedural techniques, patient management and follow-up, definitions, endpoints, and research trial design. Europace 2012;14:528-606.
3. Dagres N, Kottkamp H, Piorkowski C, Doll N, Mohr F, Horlitz M, *et al.* Rapid detection and successful treatment of esophageal perforation after radiofrequency ablation of atrial fibrillation: Lessons from five cases. J Cardiovasc Electrophysiol 2006;17:1213-5.
4. Schmidt M, Nölker G, Marschang H, Gutleben KJ, Schibgilla V, Rittger H, *et al.* Incidence of oesophageal wall injury post-pulmonary vein antrum isolation for treatment of patients with atrial fibrillation. Europace 2008;10:205-9.
5. Cappato R, Calkins H, Chen SA, Davies W, Iesaka Y, Kalman J, *et al.* Prevalence and causes of fatal outcome in catheter ablation of atrial fibrillation. J Am Coll Cardiol 2009;53:1798-803.
6. Tan C, Coffey A. Atrioesophageal fistula after surgical unipolar radiofrequency atrial ablation for atrial fibrillation. Ann Thorac Surg 2013;95:e61-2.
7. Chavez P, Messerli FH, Casso Dominguez A, Aziz EF, Sichrovsky T, Garcia D, *et al.* Atrioesophageal fistula following ablation procedures for atrial fibrillation: Systematic review of case reports. Open Heart 2015;2:e000257.
8. Wuestenberghs F, Pirson N, Bulpa P, Fervaille C, Dive A. Iatrogenic cerebral air embolism revealing an atrial-esophageal fistula. Intern Emerg Med 2017;12:715-6.
9. Khan MY, Siddiqui WJ, Iyer PS, Dirweesh A, Karabulut N. Left atrial to esophageal fistula: A case report and literature review. Am J Case Rep 2016;17:814-8.
10. Martinek M, Meyer C, Hassanein S, Aichinger J, Bencsik G, Schoefl R, *et al.* Identification of a high-risk population for esophageal injury during radiofrequency catheter ablation of atrial fibrillation: Procedural and anatomical considerations. Heart Rhythm 2010;7:1224-30.
11. Nair AV, Nazar P, Sekhar R, Ramachandran P, Moorthy S. Morel-lavallée lesion: A closed degloving injury that requires real attention. Indian J Radiol Imaging 2014;24:288-90.
12. Lee DS, Lee SJ. Severe gastroparesis following radiofrequency catheter ablation for atrial fibrillation: Suggestion for diagnosis, treatment, and device for gastroparesis after RFCA. Case Rep Gastrointest Med 2014;2014:923637.
13. Ren JF, Lin D, Marchlinski FE, Callans DJ, Patel V. Esophageal imaging and strategies for avoiding injury during left atrial ablation for atrial fibrillation. Heart Rhythm 2006;3:1156-61.
14. Zellerhoff S, Lenze F, Schulz R, Eckardt L. Fatal course of esophageal stenting of an atrioesophageal fistula after atrial fibrillation ablation. Heart Rhythm 2011;8:624-6.
15. Banchs JE, Patel P, Naccarelli GV, Gonzalez MD. Intracardiac echocardiography in complex cardiac catheter ablation procedures. J Interv Card Electrophysiol 2010;28:167-84.
16. Saliba W, Thomas J. Intracardiac echocardiography during catheter ablation of atrial fibrillation. Europace 2008;10 Suppl 3:iii42-7.
17. Cazavet A, Muscari F, Marachet MA, Léobon B. Successful surgery for atrioesophageal fistula caused by transcatheter ablation of atrial fibrillation. J Thorac Cardiovasc Surg 2010;140:e43-5.
18. Yousuf T, Keshmiri H, Bulwa Z, Kramer J, Sharjeel Arshad HM, Issa R, *et al.* Management of atrio-esophageal fistula following left atrial ablation. Cardiol Res 2016;7:36-45.