Atrioesophageal Fistula After Radiofrequency Ablation Presenting With Status Epilepticus: A Case Report

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Radiofrequency (RF) ablation for atrial fibrillation is commonly performed. Atrioesophageal fistulas are an uncommon complication of RF ablation and can present with status epilepticus due to an extensive vascular air embolus. Initial treatment may require a high level of suspicion of this rare occurrence to help prevent further injury and increase the likelihood of a meaningful recovery. (A&A Practice. 2019;13:352–5.)

GLOSSARY

AF = atrial fibrillation; **AEF** = atrioesophageal fistula; **ASD** = atrial septal defect; **CT** = computed tomography; **EEG** = electroencephalogram; **EKG** = electrocardiogram; **EMS** = emergency medical services; **ER** = emergency room; **MRI** = magnetic resonance imaging; **RF** = radiofrequency; **TEE** = transesophageal echocardiography; **TTE** = transthoracic echocardiogram

Radiofrequency (RF) ablation has long been a treatment option for atrial fibrillation (AF) refractory to electrical cardioversion or the patient's unwanted use of long-term medications. Atrioesophageal fistulas (AEFs) are rare complications from atrial ablation, occurring with an incidence of about 0.04%.^{1,2} Patients with an AEF have a high mortality rate and may present with cerebral air embolus, sepsis, or hemorrhagic shock. Written informed consent was obtained from the patient's spouse for the following case report.

CASE

A 24-year-old man with an 8-year history of atrial fibrillation underwent successful RF ablation at an outside institution. Aside from a mild headache, his initial recovery was uncomplicated and he was discharged home the following day. Two weeks later, he presented to his local primary care physician with a 3-day history of fever, chills, generalized malaise, and a severe headache. The patient denied having any changes in his stool. He was prescribed metoprolol for a suspected migraine, and his headache resolved by the next day.

Two days afterward, he had complained of feeling cold, dizzy, and left-sided paresthesias. He went to a rural emergency room (ER) but was discharged home after a brief evaluation. He had a syncopal episode later that day, and his wife found him in what was described as a seizure. Once Emergency Medical Services (EMS) arrived, the patient's mental status was described as postictal but did not have a bitten tongue or any urinary incontinence. He was transported to an outlying hospital where he was found to have a fever of 104.6°F and a new heart murmur. His

electrocardiogram (EKG) showed sinus tachycardia with a heart rate of 109 and incomplete right bundle branch block. His head computed tomography (CT) scan and chest X-ray showed no significant findings. He was admitted with suspicion of endocarditis.

The next day, he developed his first reported episode of hematemesis and had a witnessed generalized tonic-clonic seizure. He was given lorazepam, levetiracetam, and phenytoin. He underwent a difficult intubation for airway protection, being mask ventilated for several minutes in between attempts. He was started on prophylactic antibiotics for possible meningitis. A second CT scan of the brain showed findings suspicious for intravascular air and diffuse air in the subarachnoid space surrounding bilateral cerebral hemispheres.

According to medical records, he was sedated with continuous infusions of propofol, lorazepam, and ketamine. However, he had continued to exhibit clinical seizures. Transfer to our tertiary care hospital was delayed due to weather conditions, but he was subsequently transported with ongoing sedation. On arrival, he did not respond to noxious stimuli, and his pupils were nonreactive. His Glasgow Coma Scale was 3T and was not exhibiting any further seizures. All sedatives were turned off. The transthoracic echocardiogram (TTE) showed an ejection fraction of 60%–65% but had no findings of any intracardiac air emboli. His brain magnetic resonance imaging (MRI), depicted in Figure 1, showed extensive bilateral large areas of acute ischemia involving deep watershed regions, right thalamus, bilateral occipital lobes, and bilateral cerebellar hemispheres. He was placed on continuous electroencephalogram (EEG), which showed findings consistent with possible residual medication effect but no epileptiform waveforms. Figure 2 depicts a chest CT showing small foci of air in the left atrium and in the pulmonary trunk. No pneumomediastinum or mediastinal hemorrhage was appreciated.

His neurological examination remained unchanged throughout the following 48 hours without any sedatives. His pupils remained fixed and dilated, and he did not exhibit any cough or gag reflex. EEG showed severe depression globally, reflective of global anoxic brain injury. Apnea testing confirmed brain death, and he was transitioned to

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Figure 1. Brain MRI showing extensive anoxic brain injury with effacement of lateral ventricles (arrows), large bilateral areas of acute ischemia in the watershed zones, and cerebral edema on diffusion-weighted imaging (stars). MRI indicates magnetic resonance imaging.

Figure 2. Chest CT showing small foci of air in the left atrium (A) and in the pulmonary trunk (B).

organ donation care. After organ retrieval, the AEF was grossly identified by the surgeon with a hemostat as shown in Figure 3.

DISCUSSION

The overall incidence of complications from catheter atrial ablations is 6.29% with cardiac complications occurring at a rate of 2.54%.³ RF ablations require relatively high temperatures to create tiny scars to interrupt aberrant electrical generators. Due to the proximity, the esophagus is also at risk of thermal injury, which could lead to local inflammation and fistula formation. In addition, opposing pressure gradients from left atrial contraction and esophageal peristalsis continuously places more stress on this injury. Gastric contents may also passively travel proximally to exacerbate poor wound healing. AEFs are often fatal due to subsequent cerebral air embolisms, massive hemorrhage, and/or septic shock.¹ Treatment goals include utilizing supportive care, preventing any further entrainment of air, and considering attempt to reduce any accessible air emboli.

The risk of vascular air embolization depends on a pressure gradient across the tract facilitating air entry. Therefore, in securing an airway in a patient with a suspected AEF, it is important to avoid positive-pressure mask ventilation to

reduce the risk of worsening air entrainment. This patient was reported to undergo a difficult intubation with multiple attempts, including aggressive mask ventilation and possibly esophageal intubation. Either would have contributed to worsening cerebral air emboli.

A small interatrial transseptal puncture was formed from the ablation procedure and may not have closed by the time of presentation, increasing the risk of air traversing the iatrogenic intracardiac shunt into the right heart. Our patient did have a notable focus of air in the pulmonary artery shown in Figure 2B, which could have been caused by a residual iatrogenic atrial septal defect (ASD). Interestingly, ASDs have been associated with an increased risk of migraines, and the study by Noheria et al⁴ identified a 1.1% incidence of new-onset migraines after an AF catheter ablation. Our patient did present to his primary care physician with a headache 2 weeks after his ablation, which could have been the early symptoms of a new-onset migraine. Unfortunately, on autopsy, the interatrial septum was not specifically examined or noted to have such a defect.

Both surgical repair and esophageal stents are options for the treatment for AEFs. However, in the small study by Mohanty et al,⁵ esophageal stents were placed in 5 patients

Figure 3. Looking caudal, gross identification of atrioesophageal fistula (arrow) after aortic cross-clamp at organ retrieval. Mitral valve (star). Right inferior pulmonary vein (plus sign).

but were associated with 100% 1-week mortality rate. In comparison, 4 patients who underwent surgical repair were all alive at a median follow-up period of 2 years. The authors have thus favored urgent surgical repair and discouraged the use of esophageal stents.⁵ In another study of 29 patients, early primary esophageal repair was associated with fewer postoperative complications compared to esophageal stents.⁶

Transesophageal echocardiography (TEE) has been shown to be able to identify small air emboli⁷ and remains the most sensitive method of ruling out small amounts of air. However, in the setting of a suspected AEF, the risks of atrial disruption, cardiac tamponade, esophageal rupture, or lubricant embolism will preclude many anesthesiologists from placing a TEE probe. In this scenario, transthoracic echocardiography is a reasonable, though less sensitive, alternative to TEE.⁸ Similar risks may also prevent many gastroenterologists from placing an esophageal stent; however, it can still be a reasonable temporizing treatment if the means to undergo primary repair were not immediately available.

In a previously reported case, a left atrial air embolus was identified intraoperatively during cardiac ablation and was successfully aspirated before embolism could occur.⁹ If any large atrial air embolus could be appreciated, it may be reasonable to undergo an arterial catheterization to attempt to remove it, keeping in mind that the incidence of air embolisms during vascular catheter insertion is estimated to be about 2%.¹⁰

Several prophylactic measures have been proposed to prevent AEFs from forming. Prophylactic proton pump inhibitors are suggested to minimize esophageal injury from gastric contents, but no prospective randomized trials have studied their efficacy due to the rarity of this complication.¹¹ Luminal esophageal temperature monitoring with procedural interruption when temperature increases over 38.5°C has been shown to be associated with a reduction in the incidence of esophageal injury when compared to monitoring the power of the RF alone.¹²

A couple of means of decreasing the proximity of the esophagus to the catheter tip have been studied. The use of an endoscope to manually deflect the esophagus away from the posterior wall was found to be likely ineffective since the endoscope has to be removed before ablation to avoid shunting energy away from the site of interest, and the esophagus returned to its original position during the ablation.¹³ A study performed in a porcine model suggested the insertion of a fluid-filled balloon in the pericardial sac between the esophagus and left atrium prevented esophageal thermal injury.¹⁴ However, such a device increases the risk for hemodynamic compromise, and its practicality in humans has yet to be determined.

CONCLUSIONS

If this patient had not sustained such a severe anoxic brain injury, he likely would have undergone urgent surgical ligation of the fistula. Airway difficulties in these patients will increase the likelihood of further entraining vascular air, and intubation necessitates limiting esophageal positive-pressure ventilation. Both provider and patient education of potential complications from cardiac ablation may lead to earlier recognition and mindful management of patients presenting with a recent history of cardiac ablation, improving goal-directed therapies to increase their chance of meaningful survival. ■■

DISCLOSURES

Name: Vinh K. Pham, MD.

Contribution: This author helped to chart review the case and draft the article.

Name: Fernando Salgado, MD.

Contribution: This author helped provide insight on the patient presentation and medical management.

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