Pericardial-esophageal fistula complicating cryoballoon ablation for refractory atrial fibrillation

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Introduction

Atrial fibrillation affects an estimated 2.7–6.1 million people in the United States and accounts for more than 750,000 hospitalizations per year.[1] Pulmonary vein isolation (PVI) has been well established as the most effective ablation treatment available for patients with symptomatic and medication-refractory atrial fibrillation.[2] Previously, radiofrequency (RF) ablation was the mainstay for PVI. However, this was not without complications, which have been well documented,[3,4] the most feared complication being atrioesophageal fistula formation, which carries an estimated 0.01%–0.25% risk and an estimated mortality of 60%–75%.[2] The introduction of cryoballoon (CB) ablation therapy changed the landscape of treatment as it made PVI easier, faster, and, presumably, safer compared with RF.[5] The first generation of cryoballoons showed an improved safety profile with regard to esophageal damage; in fact, the first case report of an atrioesophageal fistula with the first-generation CB was not reported until 2012[6] and Medtronic, Inc reportedly has only noted 3 atrioesophageal fistulas in 35,000 cases with the first-generation balloon.[7] A second-generation CB has been developed to improve PVI by creating larger and more homogenous areas of freezing with more uniform cooling and provide better pulmonary vein isolation.[7] This second-generation CB carries a similar esophageal risk profile, and studies have shown healing of these esophageal thermal lesions (ETLs) without fistula formation.[5,8,9] Nonetheless, there have been 5 reported cases of atrioesophageal fistula formation with the use of CB ablation to date.[7,10] However, there have not been any known reported cases of pericardial-esophageal fistula formation following CB ablation, which is the case we present here.

Case report

The patient is a 70-year-old woman with a history of nonischemic cardiomyopathy, suspected to be tachycardia mediated, who presented to our tertiary care center for evaluation of medically refractory atrial fibrillation. With regard to prior treatment, she previously had undergone an RF ablation procedure and had been on sotalol, amiodarone, and eventually dofetilide, all of which failed to maintain sinus rhythm. Given that her reduced left ventricular function was likely owing to tachycardia related to the atrial arrhythmia, which was medically refractory, the decision to undergo cryoballoon ablation was made.

The patient was brought to the electrophysiology laboratory and the procedure was performed under general anesthesia; sedation was maintained with the use of propofol and remifentanil. Radial arterial monitoring, an esophageal temperature probe, and intracardiac echocardiography were all employed during the procedure. Heparin was used for anticoagulation to maintain activated clotting time >350 seconds. Right and left femoral vein access was employed for the procedure; an SL1 sheath and guidewire were used for the transseptal puncture under fluoroscopic and ultrasound guidance. Four pulmonary veins with separate ostia were identified with ultrasound. Using a 28-mm Arctic Front cryoballoon (Medtronic, Inc, Minneapolis, MN) supported by a cryo lasso catheter (Achieve, Medtronic, Inc), cryoablation was performed at the ostium of all 4 pulmonary veins. Each ablation lasted up to 3 minutes, achieving balloon temperatures between -30°C and -45°C. A total of 9 cryoablation lesions were placed. The left inferior pulmonary vein (LIPV) underwent 2 separate ablations; the first ablation was 180 seconds at -34°C. Of note, during the second ablation, which occurred 56 seconds after the first, the esophageal temperature was noted to be 24.8°F and the ablation was immediately terminated (171 seconds of application). Phrenic nerve pacing was performed during

KEYWORDS Esophageal fistula; Atrial fibrillation ablation; Cryoballoon ablation (Heart Rhythm Case Reports 2017;3:2–6)

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http://dx.doi.org/10.1016/j.hrcr.2016.12.002

KEY TEACHING POINTS

- Although cryoballoon ablation has been shown to have a safer complication profile compared with radiofrequency ablation, it is still an invasive procedure and carries real risk with regard to damage to surrounding structures.
- This is the first reported case of pericardial-esophageal fistula formation with sparing of the atrium, the mechanism of which is up for debate. Early recognition and treatment can potentially prevent a more complex complication with higher mortality.
- Although complications are unfortunate, they do occur and it is important to make adjustments to protocols or institutional structure when able and appropriate. Unfortunately, in this case, the esophageal probe had not been registering correctly during the case; we have made adjustments at our institution and now employ a different and more stable monitoring system.

ablation of the right pulmonary veins with a quadripolar catheter placed in the superior vena cava. A St. Jude catheter HD (St. Jude Medical, St. Paul, MN) was used for voltage gradient mapping. The patient was successfully externally cardioverted to sinus rhythm. After exit and entry block in each pulmonary vein was established, protamine was given to reverse the anticoagulation effect of heparin and sheaths were removed without complication. She was subsequently admitted for observation and dofetilide was initiated. The patient was discharged 2 days later after an uneventful hospital course in sinus rhythm. She received omeprazole 20 mg and sucralfate 1 G, both twice daily, while hospitalized and was discharged with 14 days of sucralfate and omeprazole for postprocedure care.

About 10 days later, the patient presented locally with complaints of crushing chest pain, worse with lying down and respiration but without hemoptysis or fever. Initial electrocardiogram and cardiac enzymes did not suggest myocardial ischemia. Computed tomography (CT) of the chest was obtained, which showed evidence concerning for pneumopericardium and pericardial effusion (Figure 1); this prompted transfer to our facility for a higher level of care. In transit, the patient developed hypotension, which was stabilized with intravenous fluids and vasopressors; owing to the concern for an infected pericardium, broad-spectrum antibiotics were also initiated. Cardiothoracic surgery was promptly consulted and the patient was taken to surgery the following day. During surgery, she was found to have a gross amount of fibrinous exudate surrounding and on the surface of the heart. This was cleansed with copious irrigation, at which time there was blood-tinged fluid noted within the pericardium. To enable full inspection of the area, the patient was placed on cardiopulmonary bypass. However, after aortic cannulation, there was no blood flow through the aortic cannula and a bluish hue was noted on the surface of the ascending aorta extending from the cannulation site proximally. Epiaortic ultrasound confirmed a hematoma in the adventitia in addition to a dissection flap at the area of the cannulation. The patient's right axillary artery was then

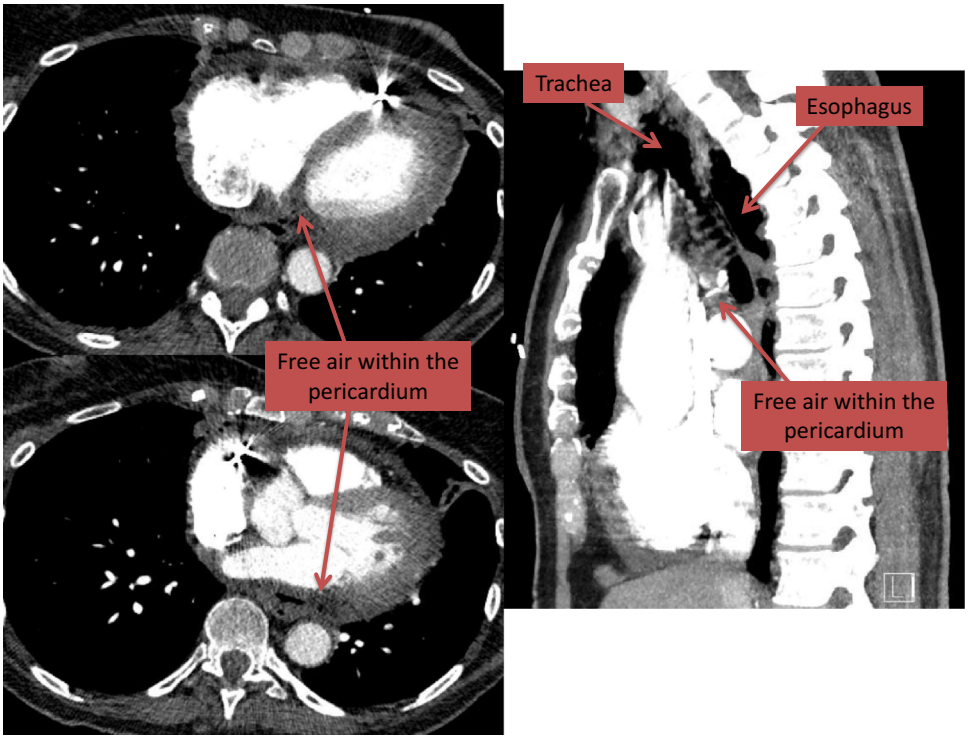

Figure 1 Chest computed tomography images showing free air within the posterior pericardium.