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EDITORIAL COMMENT

Epicardial Radiofrequency Ablation for Ventricular Tachycardia

Old Techniques, New Risks?*

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Ventricular tachycardia (VT) ablation has become a well-established therapy for the management of management of VT, usually when medical therapy is insufficient.[1]

Percutaneous epicardial VT ablation was initially described by Sosa et al[2] to treat the epicardial VT substrate in Chagas disease. Epicardial VT ablation has become a standard technique at high-volume centers for both ischemic and nonischemic cardiomyopathies to treat epicardial substrate that cannot be successful treated with endocardial ablation. Frequently a combined endocardial-epicardial approach is necessary to fully treat the arrhythmic substrate.[3]

The puncture is usually made in the subxiphoid area and can be directed anteriorly or posteriorly depending on the targeted substrate. Complications can occur that include hemopericardium, left phrenic nerve injury, and damage to the epicardial coronary arteries, noted acutely during the procedure as a result of thermal injury or becoming evident during follow-up. The most common complication is pericarditis, which is not surprising given the nature of the procedure, and operators often instill intrapericardial steroids at the end of the procedure to reduce the incidence of pericarditis. Other potential complications include liver and diaphragmatic injury related to the subxiphoid route of entry.[4]

The number of epicardial VT ablations performed worldwide is significantly less than the number of ablation procedures performed for atrial fibrillation, and operators must always be vigilant for rare complications to help in understanding and refining the risks associated with these procedures. One of the most devastating complications of atrial fibrillation ablation is atrio-esophageal fistula (AEF) formation. A recent report with contemporary data looking at 129,286 AF ablation procedures suggests an incidence rate of 0.026%, all occurring after radiofrequency ablation, with previous reports suggesting a range from 0.02% to 0.1%. The outcome was poor with an overall mortality rate of 60% and significantly better outcomes with surgery (30% mortality).[5] Given these worrying outcomes, the identification of potential esophagus-related complications with epicardial VT ablation is noteworthy.

In this issue of *JACC: Case Reports*, Edward et al[6] report an esophago-pericardial fistula (EPF) as a rare and life-threatening complication of epicardial VT ablation. Epicardial VT ablation was performed as part of a combined endocardial-epicardial procedure where ablation was performed at the basal to mid-inferior epicardium. Unfortunately, the patient presented 2 weeks later with a 10-day history of pleuritic chest pain as well as shortness of breath and subjective fevers. Prompt early diagnosis with the use of computed tomography and barium imaging to confirm the diagnosis allowed early definitive surgical repair with a good outcome. Interestingly, fluoroscopic images during the ablation and the barium swallow suggest that the esophagus was in close proximity to the ablation site in a vertically orientated heart.

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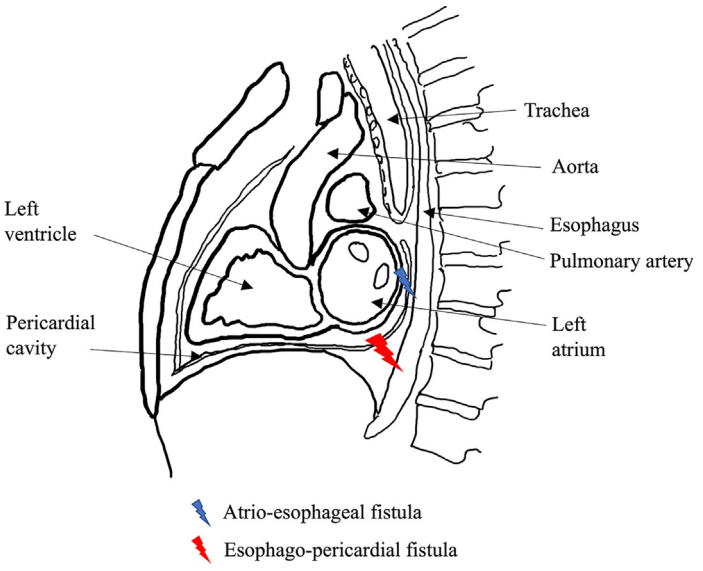
In general, AEFs present a median of 21 days (IQR: 11-28 days) after the onset of the procedure with nonspecific and constitutional symptoms such as fever/sepsis, neurological deficits, dysphagia, altered mental status, and chest pain.[7] Hematemesis also occurs less commonly as the AEF usually acts as a 1-way valve from the esophagus to the atrium. EPFs following AF ablation without a communication to the left atrium are described less commonly than AEFs, can present in similar manner, and may do better with nonsurgical management compared with AEFs.[8] In this case, as the authors point out, the symptom onset of the EPF appeared to be similar to that of an AEF.

Other rare fistula-related complications following epicardial VT ablation have been documented in case reports, such as esophago-mediastinal fistula, esophago-pleural fistula, peritoneal-pericardial fistula, and pleuropericardial fistula, as mentioned in this report by Edward et al.[6]

These unusual potential complications can be predicted based on general anatomic relationships as well as patient-specific anatomic factors. **Figure 1** shows the general anatomic relationships of the heart, esophagus, and pleura, and sites of potential fistula formation can be predicted. Of course, such as in this patient, there may be specific anatomic relationships that may increase the likelihood of rare complications. Often preprocedural imaging with computed tomography or magnetic resonance is undertaken before ablation, and that can be reviewed before the procedure to reduce procedural risk. It seems that epicardial ablation at the basal inferior region of the left ventricle closest to the esophagus could be a risk factor for the development of EPFs, at least based on the present report. The thicker left ventricular wall is likely to be protective against the development of a direct fistulous connection from the left ventricle to the esophagus compared with the thin-walled left atrium.

Given the severity of esophagus-related complications, it is incumbent on operators to be vigilant for patient- and procedure-related factors that might increase the risk of these complications. In addition, ablation parameters can be adjusted, such as decreasing power delivery and duration when in close proximity to the esophagus, and the use of esophageal temperature probes may be useful (although it did not appear to help in this case) to reduce the risk of inadvertent thermal injury to the esophagus. Other techniques, such as esophageal deflection and intrapericardial balloon inflation or intrapericardial air instillation (normally used to avoid phrenic nerve injury), could theoretically be tried in selected cases.[9] Potentially, pulsed-field ablation technologies may be able to avoid collateral esophageal injury, owing to its specificity for myocardial tissue, and could be useful in the future.

FIGURE 1 Locations of Fistulous Connections



Sagittal section of the thorax indicating the general anatomic relationships of the heart, pericardial cavity, and esophagus together with indicative sites for an atrio-esophageal fistula and an esophago-pericardial fistula. The exact site will vary depending on individual patient anatomy and the ablation site.

In conclusion, epicardial VT ablation is a mainstay of treatment for epicardial VT substrates, but rare complications can occur. Knowledge of the anatomic relationships of the relevant structures in an individual patient may be useful to anticipate these complications.[10]

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