Successful fluoroless deviation of the esophagus during atrial fibrillation ablation

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Introduction

Fluoroless atrial fibrillation (AF) ablation has recently gained much traction owing to concerns on short-term and long-term complications from radiation exposure. Multiple studies have demonstrated the feasibility, safety, and efficiency of AF ablation without use of radiography.[1,2] However, in cases where mechanical deviation may be needed to avoid thermal or cryogenic injury to the esophagus, use of fluoroscopy and radiation exposure are still required to perform such maneuvers.[3] We here present a case where esophagus deviation was successfully performed without fluoroscopy, guided by a 3D mapping system and intracardiac echocardiogram (ICE).

Case report

A 65-year-old white man with a history of symptomatic paroxysmal AF and nonischemic cardiomyopathy (ejection fraction: 30%–35%) was referred to the Borgess Medical Center for AF ablation.

The patient was admitted to an outpatient cardiac unit and was studied in the electrophysiology lab under general anesthesia. An oropharyngeal (OG) tube was placed by the nursing staff and the esophagus position was premapped by an esophageal mapping catheter (Biosense Webster, Diamond Bar, CA). After standard sterile draping, 3 8F venous sheaths were introduced into the right femoral vein under ultrasound guidance. AF ablation through pulmonary vein isolation (PVI) was performed following our previously published fluoroless ablation protocol without left atrial mapping.[2]

After uneventful isolation of the left-sided veins using the wide-area circumferential ablation technique, the Lasso catheter was moved to the right inferior pulmonary vein near the ostium.

At that time, the esophagus was found to be extremely close to the ostium of the right inferior pulmonary vein.

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KEY TEACHING POINTS

- Esophagus deviation may reduce risk of esophagus injury during atrial fibrillation ablation.
- Fluoroless esophagus deviation may be safe and feasible.
- Intracardiac echocardiogram imaging is mandatory in confirming esophagus location after deviation.

This was clearly visualized on the CARTO mapping system (Biosense Webster) as well as on the ICE, which showed the esophagus located directly under the catheter tip where the ablation lesion would ideally need to be placed (Figures 1 and 2). Because of the excellent visualization of the esophagus, by ICE and the CARTO mapping system, decisions were made to deviate the esophagus under both ICE and CARTO guidance without interruption of the fluoroless ablation workflow. First, the esophageal mapping catheter was inserted inside the standard OG tube and used to guide the OG tube into the stomach. The gastric location was confirmed by visualizing the esophageal mapping catheter at least 5 cm below the inferior pulmonary veins, auscultation of gastric gurgling sound, return of gastric content upon suctioning, and the clear anterior or lateral deviation from the usual esophagus course on the CARTO map (Figure 2). After confirmation of gastric location of the OG tube, the esophageal mapping catheter was withdrawn from the OG tube and reinserted into the esophagus at the level of the inferior pulmonary veins, next to and outside the OG tube. An EsoSure esophageal retractor (Northeast Scientific, Boynton Beach, FL) was inserted into the OG tube. After a wait of 30 seconds to allow the temperature-programmed nitinol stylet to form a curve at body temperature, the stylet was then rotated to deviate the esophagus away from the right inferior pulmonary vein. The esophageal mapping catheter was used to monitor the location of the esophagus in relation to the pulmonary veins during the deviation process on the CARTO system and also to remap the esophagus upon completion of esophagus deviation. The esophagus was deviated

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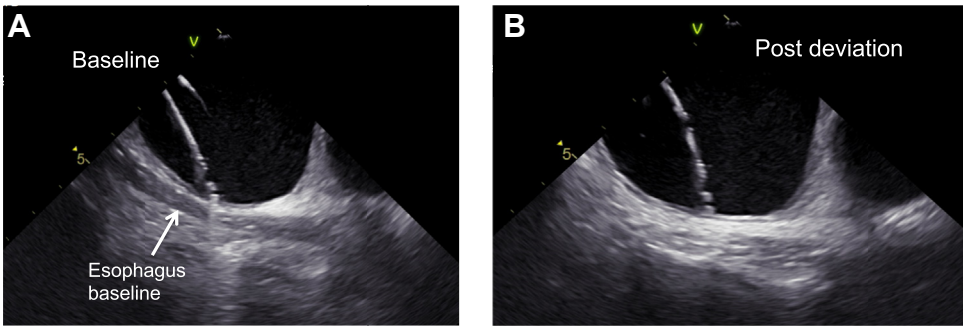

Figure 1 Intracardiac echocardiogram images of ablation catheter location in relation to the esophagus before and after successful deviation. **A:** The ablation catheter was seen at a location near the antrum of the right inferior pulmonary vein, leftward to the ostium where the ablation lesion was going to be placed. The esophagus was seen directly underneath the catheter tip. **B:** After deviation of the esophagus, the ablation was near the same location, but the esophagus is no longer seen near the catheter tip.

anteriorly and leftward with a maximum deviation away from the right inferior pulmonary vein by approximately 3 cm (Figure 2). This was confirmed by ICE imaging, where the catheter tip was seen to be no longer directly on top of the esophagus (Figure 1). Complete right-sided PVI was then achieved using the wide-area circumferential ablation technique without difficulty. Adenosine bolus infusion at the end of PVI was given and did not demonstrate reconnection of any of the pulmonary veins. Near the end of the procedure, typical atrial flutter was induced by electrophysiology study; therefore additional cavotricuspid ablation was performed with bidirectional block achieved. The total procedure time, defined as the time from sheath insertion to sheath removal with achievement of hemostasis, was 97 minutes, of which approximately 5 minutes were spent on deviating the esophagus and confirming the final position with ICE.

The patient did well after the procedure, with no further subjective or objective evidence of recurrent AF. A 5-day noninvasive monitor placed 3 months post ablation showed no evidence of recurrent AF while off antiarrhythmics.

Discussion

Esophageal rupture and/or atrial esophageal fistula are rare but potentially fatal complications of AF ablation at a reported incidence of 0.016%–0.6%.[4,5] A wide range of

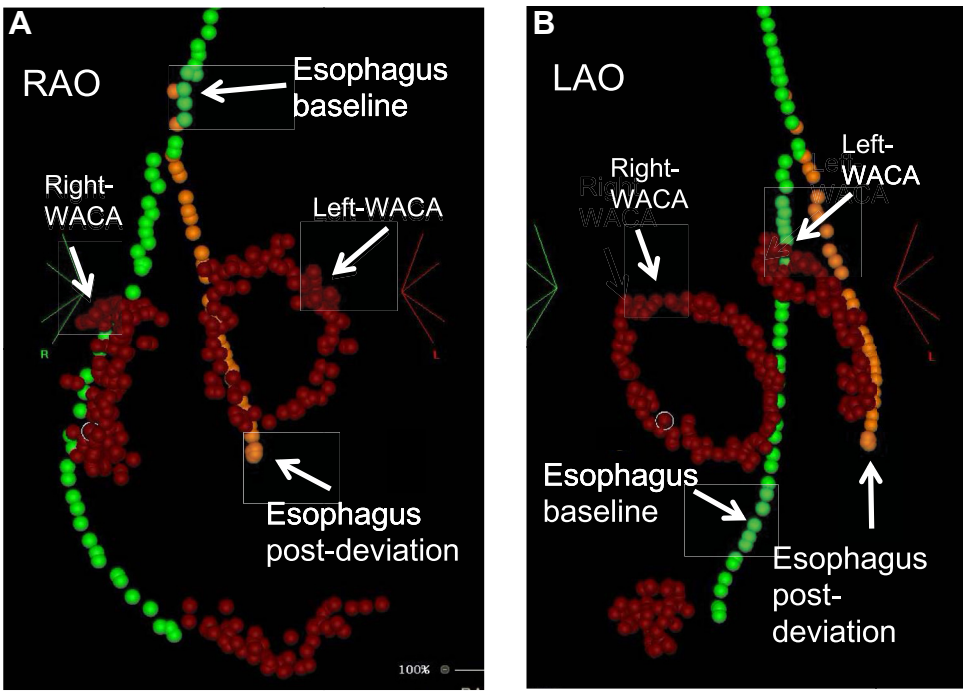

Figure 2 Right anterior oblique (RAO) and left anterior oblique (LAO) views of the esophagus position and radiofrequency lesions placed on the CARTO (Biosense Webster, Diamond Bar, CA) map. **A:** The original esophagus position was seen to overlap the wide area circumferential ablation (WACA) lesion set near the ostium of the right inferior pulmonary vein. However, after deviation of the esophagus anteriorly and leftward, a large gap can be seen between the right-sided WACA circle and the new esophagus position. **B:** Similar observations demonstrated on the LAO view.

precautionary measures have been proposed to try to minimize thermal or cryogenic injury to the esophagus, such as monitoring esophageal temperature, esophagus mapping, and decreasing power/duration of ablation when close to the esophagus.[6,7] None of these measures, however, has been definitively shown to eliminate the risk of atrial esophageal fistula. More recently, mechanical esophagus deviation has been advocated as another alternative to minimize esophagus injury during ablation.[3,8,9] There are currently 2 commercial products available in the United States designed to deviate the esophagus: EsoSure (EsoSure, Boynton Beach, FL) and DV8 inflatable balloon retractor (Manual Surgical Sciences, Minneapolis, MN).[3,9] Both products have undergone relatively small-scale studies showing favorable outcomes.[3,9] We have recently started to adopt the use of the EsoSure device because it seemed to easily fit into our fluoroless ablation protocol, as demonstrated in the case presented here.

Fluoroless deviation of the esophagus has the advantage of avoiding radiation exposure to both the patients and staff, creating additional workspace and convenience for the anesthesia personnel as well as eliminating the need to wear heavy x-ray protection equipment. All this can be achieved without adding excessive procedure time. The total procedure time of the case is not significantly different from the large series we previously reported without using esophagus deviation.[2] It is noteworthy that after the esophagus was deviated, we were able to deliver more power to areas close to the original esophagus position where we would normally ablate with low power. This may have shortened the time needed for complete PVI and compensated for the extra, albeit small, amount of procedure time we spent on deviating the esophagus.

One of the main drawbacks of monitoring the esophagus position during the deviation process using the 3D mapping system is the inability to differentiate whether the mapping catheter is moving with the leading or trailing edges of the esophagus. In other words, the observed deviation of the esophagus on the CARTO map may be simply a result of esophagus stretching instead of true movement of the entire esophagus to a new location. It is therefore imperative to have a secondary measure to assess that. In the case presented here, we were able to confirm that the esophagus is no longer visible under the ablation catheter using ICE. This ultimately allowed safe and successful delivery of radiofrequency ablation energy over the area that may otherwise cause potential injury to the esophagus.

In conclusion, this case demonstrates that fluoroless esophagus deviation is feasible and appears to be safe during fluoroless AF ablation, when combined with ICE imaging. Additional larger-scale studies may help further confirm our findings.

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