Interatrial Electrical Dissociation After Catheter-Based Ablation for Atrial Fibrillation and Flutter

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A 58-year-old man with hypertension and diabetes with recurrent persistent symptomatic atrial fibrillation resistant to sotalol-facilitated cardioversions was referred for ablation. Catheter-based radiofrequency ablation for persistent atrial fibrillation was performed, which consisted of isolation of all 4 pulmonary veins; linear ablations along the left atrial roof; and ablation of areas with complex fractionated atrial electrograms along the posterior mitral annulus, anterior septum, and base of left atrial appendage. After these ablation lesions, the atrial fibrillation converted to a focal right atrial tachycardia, which was terminated by ablation in the inferior crista terminalis. The patient remained in sinus rhythm after the procedure for 2 weeks but returned with an incessant atrial tachycardia requiring repeat electrophysiological study. Electroanatomic mapping revealed earliest atrial activation in the proximal coronary sinus. Entrainment from the cavo-tricuspid isthmus returned long postpacing intervals. Postpacing interval identical to tachycardia cycle length was obtained with entrainment from the ostium of the coronary sinus. A linear ablation from the ostium of the coronary sinus to the inferior vena cava terminated tachycardia and rendered the patient noninducible for atrial arrhythmias.

Atrial tachycardia recurred after 3 weeks. The patient’s antiarrhythmic medication was switched from sotalol to amiodarone, but the tachycardia remained resistant to cardioversion. Electrophysiological study was repeated. An atrial tachycardia at a cycle length of 290 ms was entrained with postpacing intervals equal to tachycardia cycle length along the left atrial side of the posterior septum. Areas along the left atrial roof and perimital areas were out of the circuit. A linear ablation was performed to extend from the right inferior pulmonary vein to the mitral annulus along the septum, with termination of tachycardia. Further programmed stimulation induced right-sided atrial flutter, which terminated after ablation in the cavo-tricuspid isthmus. At this point, we observed progressive interatrial block (left to right atrium) with coronary sinus pacing. Right atrial pacing confirmed bidirectional interatrial block (Figure 1). Intracardiac electrograms during sinus rhythm revealed complete electric isolation of the left atrium, with intermittent dissociated electric activity in the left atrium (Figure 2). Complete isolation of the left atrium from the right atrium was confirmed by mapping in the coronary sinus, left atrial appendage, and posterior left atrium. Postoperative ECG showed similar P-wave morphology and amplitude to the patient’s baseline ECG performed during a period of sinus rhythm before the last ablation. A subsequent transthoracic echocardiogram performed during sinus rhythm showed absence of any discernible diastolic A wave of left atrial contraction on the mitral inflow Doppler echocardiographic analysis (Figure 3). Amiodarone was stopped, and the patient was continued on warfarin therapy.

The patient remained in sinus rhythm off antiarrhythmic medications with no recurrence of supraventricular arrhythmias. A transthoracic echocardiogram 2 months later showed return of active synchronous left atrial contractions (Figure 4), indicative of resumption of interatrial conduction. The patient has remained asymptomatic in sinus rhythm on follow-up over 10 months.

The duration of radiofrequency application was 120.8 minutes for the first ablation procedure, 29.92 minutes for the second procedure, and 21.92 minutes for the third procedure.

Discussion

Multiple ablation procedures are not uncommon in persistent atrial fibrillation, particularly for management of postablation atrial tachycardias. Recent case series have described inadvertent isolation of the left atrial appendage because of extensive left-sided and interatrial ablations.1 However, to our knowledge, there are no prior reports of complete isolation of the left atrium after endocardial catheter ablation. The primary sites for interatrial electric connection are presumed to be along the Bachmann bundle, interatrial septum (primarily fossa ovalis), and the musculature of the proximal coronary sinus.2 In the patient, the Bachmann bundle was likely affected by ablations to encircle the right-side veins and along the left atrial roof.
The connections across the interatrial septum were likely disrupted by ablations along the left atrial aspect of the septum. Likewise, the proximal coronary sinus connections were affected by ablation from the ostium to the inferior vena cava and further by ablation in the medial cavotricuspid isthmus. Total left atrial isolation, thus produced, was not associated with any overt adverse effects and was temporary in nature with recovery of atrial activity as evidenced by echocardiography 2 months later. It is possible that therapy with amiodarone may have contributed to the conduction block and that cessation of the drug allowed for resumption of conduction.

Figure 1. Pacing in CS with conduction block into the RA. RA remains in sinus rhythm (arrows). CS indicates coronary sinus; RA, right atrium.

Figure 2. Isolated electric activity in the LAA and CS (arrows) during sinus rhythm. LAA indicates left atrial appendage. Other abbreviations as in Figure 1.
Left atrial isolation was one of the earliest surgical techniques for management of chronic atrial fibrillation, leaving the left atrium in a state of fibrillation with sinus rhythm in the rest of the heart.\(^3\) That approach was abandoned because of the continued thromboembolic risk in the fibrillating left atrium. Left atrial standstill is well recognized in patients with chronic atrial scarring associated with valvular heart disease.\(^4\)–\(^6\) However, to our knowledge, there are no reports of left atrial isolated activity in nonvalvular atrial fibrillation.

**Conclusions**

We describe a case of inadvertent complete isolation of the left atrium after multiple ablation procedures for atrial fibrillation and atrial tachycardias. In this era of sequential ablations for atrial arrhythmias, all operators need to be aware of the risk of such unexpected electric sequelae. Interatrial connections recovered after a few months in the patient, likely reflecting recovery of injured myocardial fibers. However, if prolonged or permanent left atrial isolation occurs as a result of ablation of atrial fibrillation, oral anticoagulation will have to be continued even in the absence of recurrent atrial fibrillation because of the persistent risk of thrombus formation due to left atrial standstill.

**Disclosures**

None.

**References**


**Key Words:** atrial fibrillation ■ ablation ■ atrium
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