Use of a lumenless bipolar lead in the right atrial septum in a patient with extensive right atrial scar

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Introduction

Extensive right atrial (RA) scarring, even without previous atrial surgery, has been shown to be the nidus for RA macroreentrant tachycardias.[1] The RA scarring is distinctively posterolateral and lateral and the circuits typically occur around the scar, as a channel through the scar, or as a focal tachycardia.[2] The majority of these patients have more than 1 tachycardia circuit and usually have clinical evidence of typical isthmus-dependent atrial flutter as well. The posterolateral scarring in these patients can often lead to sinus node dysfunction as it extends into the sinoatrial node region.[2] We present a case of sinus node dysfunction in a patient with extensive RA scar and previous ablation of RA macroreentrant tachycardia and cavotricuspid isthmus. We explore the challenges of conventional stylet-driven lead placement in a patient with extensive scarring and offer a unique approach to septal lead placement with a lumenless bipolar lead.

Case report

A 70-year-old male patient, with a past medical history of RA macroreentrant tachycardia and typical atrial flutter status post radiofrequency ablation of the right lateral RA inferior to the RA appendage (RAA) and the cavotricuspid isthmus, respectively; sleep apnea; hypertension; and type II diabetes presented to the emergency room with new-onset dizziness and near syncope from home. Upon arrival, the patient's heart rate was noted to be in the 40s with frequent sinus pauses.

The patient had been maintained on flecainide since 2020 owing to breakthrough tachycardia after the ablation. As the patient had symptomatic bradycardia and required a class IC antiarrhythmic medication to maintain normal sinus rhythm, it was decided to proceed with a dual pacemaker for sinoatrial node dysfunction. Dual-chamber pacing was selected to avoid any anticipated pacemaker syndrome.

KEYWORDS Pacemaker; Lumenless lead; Typical atrial flutter; Macroreentrant right atrial tachycardia; Atrial scar tissue
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KEY TEACHING POINTS

- Right atrial (RA) macroreentrant tachycardias caused by "spontaneous scar" with subsequent ablation can lead to sinus node dysfunction.
- Conventional stylet-driven lead placement in the right atrium with extensive scar can be difficult owing to poor atrial sensing.
- Lumenless bipolar leads offer an alternative to conventional stylet-driven leads and can be placed successfully at the RA septum.

The patient was brought to the electrophysiology lab and placed under general anesthesia. The subclavian area was prepped and draped in the usual sterile fashion. The area was anesthetized, and a pocket was created using blunt and sharp dissection. The subclavian vein was accessed twice using the modified Seldinger technique. Using the Medtronic Select Secure™ system (a fixed-shaped catheter delivery sheath, Model C315; Medtronic, Minneapolis, MN), the Medtronic Select Secure 3830 lead (a lumenless 4.1F diameter pacing lead) was advanced into the right atrium under fluoroscopy. Left bundle pacemapping was performed and the 3830 lead was fixed within the ventricular septum. Using the 7F peel-away sheath, the Medtronic bipolar screw-in steroid-eluting lead (Model 5076) was advanced into the right atrium. The lead was placed in multiple areas in the right atrium with no sensing of atrial activity. The only region with sensing of atrial activity was the RA septum. The 5076 lead was attempted to be placed septally with a preformed J stylet multiple times with no success, which resulted in abandoning the 5076 lead. The Medtronic C315HIS

Table 1 Acute sensing, impedance, and threshold measurements at implant

	Atrial lead	Ventricular lead
Sensing	2.4 mV	5.9 mV
Impedance	750 ohms	1029 ohms
Threshold	1.2 volts	0.8 volts

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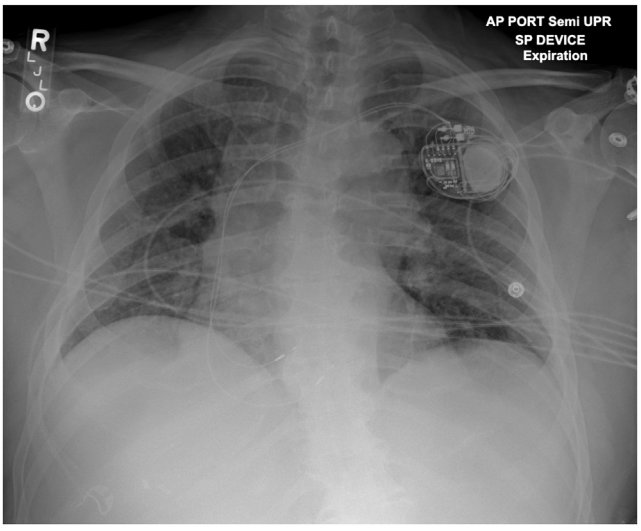

Figure 1 Postoperative chest radiograph with a 3830 lead (Medtronic, Minneapolis, MN) at the left bundle position and low right atrial septum.

catheter and 3830 lead were then advanced into the right atrium under fluoroscopy. The 3830 lead was fixated in the low atrial septum with acceptable sensing and pacing values. Acute measurements were taken at 0.50 ms pulse width and are listed in Table 1.

Both leads were sutured into place and connected to a pacemaker generator (Azure XT DR; Medtronic). The pocket was closed and the patient left the electrophysiology lab in stable condition. Postoperative chest radiograph and electrocardiogram are displayed in Figures 1 and 2, respectively.

Discussion

Extensive RA scar was observed in the lateral wall, inferior to the RAA where a macroreentrant tachycardia was ablated, when reviewing the patient's RA voltage map from his ablation in 2018 (Figure 3). The patient also underwent ablation of the cavotricuspid isthmus for typical atrial flutter. The patient had no previous history of RA surgery. Stevenson and colleagues[2] described, in a series of patients undergoing radiofrequency ablation of RA macroreentrant tachycardias, that 8 patients had "spontaneous scarring." The regions of scar were in the posterolateral and lateral right atrium and encompassed the sinoatrial node. After ablation, long-term follow-up revealed 5 out of the 8 patients developed sinus node dysfunction and required permanent pacing. Wang and colleagues[3] found more sinus node dysfunction in patients with spontaneous scar vs those with a history of prior cardiac surgery. The spontaneous scar along with ablation of the RA macroreentrant tachycardia caused an "atrial compartmentation" leading to sinus node dysfunction and atrial standstill.

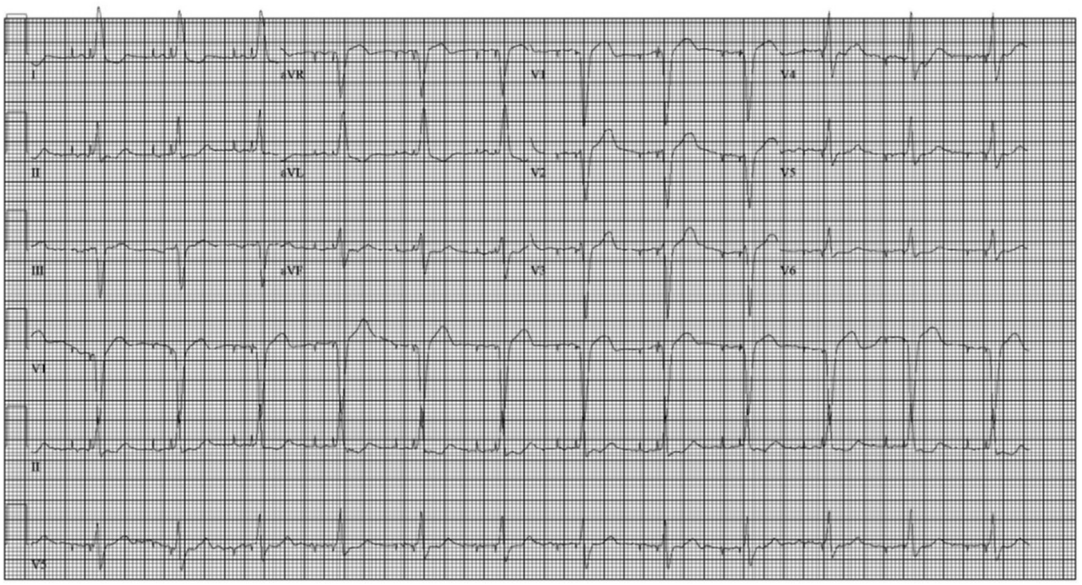

Figure 2 Electrocardiogram postoperatively with A-V sequential pacing, paced QRS duration of 130 ms.

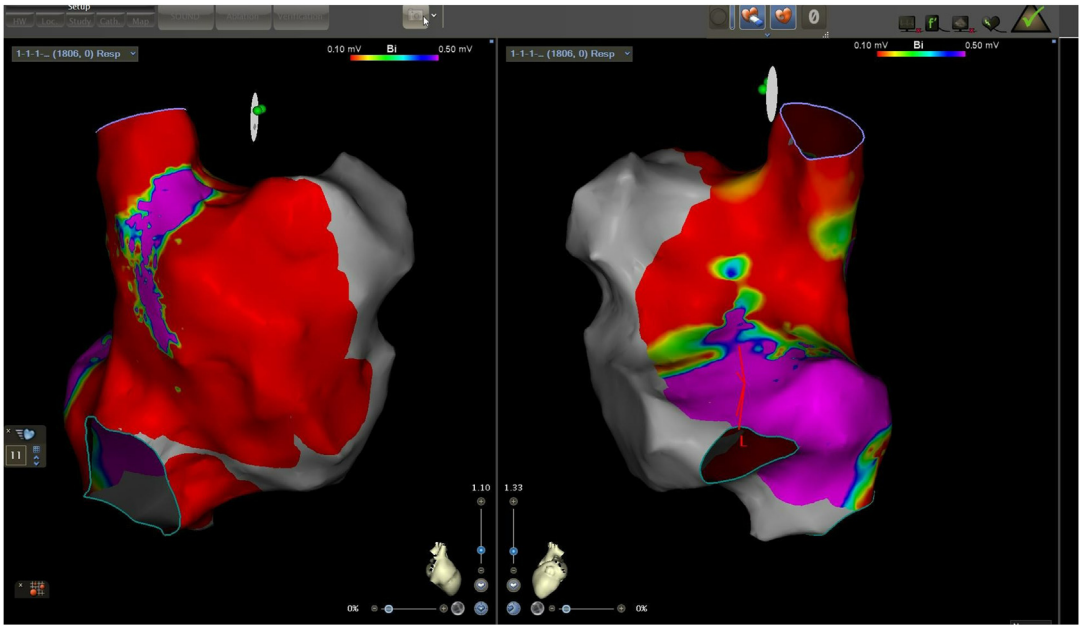

Figure 3 Electroanatomic bipolar right atrial voltage map using the CARTO mapping system (Biosense Webster, Diamond Bar, CA) from right atrial macroreentrant atrial tachycardia and cavotricuspid isthmus ablations, revealing significant low-voltage regions, defined as <0.05 mV (*red*). Left image is a right lateral view and right is a posterior right lateral view.

This extensive scar did not allow for placement of the standard stylet-driven pacing leads near the RAA or lateral wall (typical pacing sites) owing to poor or no atrial sensing. The stylet-driven lead also proved to be too bulky to be placed in a septal location. The placement of bipolar lumenless leads in the atrium has been previously described in pediatric and adult patients with congenital heart disease[4] and has been proven to exhibit long-term stability with low rates of complications.[5] Using a lumenless pacing lead and a preformed sheath is a unique approach for RA lead placement in a septal location in patients that have extensive RA lateral/posterolateral scar.

Conclusion

Extensive RA scarring or "spontaneous scar" has been shown to provide substrate for RA macroreentrant tachycardias. Ablation of the RA macroreentrant tachycardias and the scar itself contributes to sinus node dysfunction in the long term. Low-voltage areas make placement of a traditional stylet-driven lead difficult in the lateral right atrium or RAA and these leads can often be too bulky to be placed in a septal location. Lumenless bipolar leads offer an alternative to conventional stylet-driven leads and can be placed successfully at the RA septum.

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