INNOVATIVE COLLECTIONS

COMPLEX CASE STUDY

Crescendo SVC Obstruction Following Ablation for Inappropriate Sinus Tachycardia

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ABSTRACT. A 28-year-old female developed rapidly progressive symptomatic superior vena cava (SVC) obstruction following the most recent of four radiofrequency ablation procedures to the SVC–right atrial junction area for inappropriate sinus tachycardia. This required urgent and elaborate open-heart surgical repair. Indications for and application of radiofrequency energy delivery at or adjacent to the SVC should be considered carefully, and warrants vigilance during follow-up.

KEYWORDS. inappropriate sinus tachycardia, radiofrequency ablation, sinus node modification, superior vena cava obstruction, superior vena cava–right atrial junction.

Case report

A 28-year-old female executive presented for implantation of a pacemaker for symptomatic sinus node dysfunction. She had undergone four sinus node modification procedures over 8 years (2001, 2004, 2009, and 2010) at two separate hospitals for recurrent severely symptomatic inappropriate sinus tachycardia (120–200 bpm), refractory to medical therapy. The third attempt during CARTO mapping had been terminated prematurely because the patient experienced junctional rhythm during lesion application to the high crista. One month following this, her sinus tachycardia (120 bpm) recurred. The fourth and most recent procedure, 6 months after the previous ablation attempt and 8 weeks prior to the current presentation, had targeted the cranial portion of the sinoatrial node following electroanatomic mapping of the right atrium with CARTO. Twenty-five radiofrequency (RF) applications had been delivered with an irrigated tip catheter (cumulative time 1020 s). Post-procedural electrocardiogram (ECG) showed ectopic atrial rhythm at 80 bpm with normal response to isuprel. All palpitations resolved.

Present symptoms were of episodic dizziness and “fullness of her head.” This had progressed from a discomfort while lying down, noted immediately after her most recent procedure, to continuous headache as if “hanging upside down.” Physical examination was remarkable apart from a slow regular pulse with occasional pauses. She had good capillary return of her nail beds and no arm or neck swelling. Her jugular venous pressure was not visualized. ECG showed sinus rhythm (54 bpm). The patient’s dizziness correlated with daytime sinus pauses (2.6–2.8 s) on Holter monitoring. Nighttime pauses exceeded 5 s.

Sinus node dysfunction is a known complication of ablation for inappropriate sinus tachycardia. However, the striking continuous headache was unusual. Superior vena cava (SVC) syndrome was considered given the nature of her previous procedures, despite lack of classical physical findings. TEE demonstrated increased thickness of SVC–RA junction creating severe narrowing of the SVC lumen (3 × 3 mm diameter) and significant flow acceleration (peak velocity, 1.7 m/s; peak gradient, 12 mmHg). Stenosis appeared as a circumferential hypertrophic ring measuring 15 (length) × 8 mm (thickness). These findings were confirmed on cardiac magnetic resonance imaging (Figure 1).

The lesion was considered unfit for percutaneous intervention because of risk of rupture and/or emergent
need for pacing. Surgical repair required stripping of scarred and fibrotic tissue from SVC–RA junction and superior part of the atrial septum, autologous patch augmentation of most of RA free wall up to mid-SVC, and implantation of pacing leads epicardially. The postoperative recovery was uneventful.

Discussion

This case of extreme SVC stenosis following SVC–RA junction ablation demonstrates a rare and dramatic complication of intervention for inappropriate sinus tachycardia. In contrast, in sporadic previous reports,
post-radiofrequency ablation SVC narrowing was clinically silent and only incidentally discovered when SVC instrumentation was attempted for endocardial pacing. Therefore, the frequency of post-procedural SVC obstruction may be underestimated, but when symptomatic may herald imminent obstruction.

Practice points emerge. Firstly, the indication for the procedure itself should be carefully considered, given its indifferent success rates, frequent requirement for multiple attempts, and that SVC complications (and their treatment) have significant long-term consequences in younger patients. Although the potential need for a permanent pacemaker following sinus node modification is included during informed consent for this procedure, this routinely does not include discussion of epicardial placement. Techniques to avoid SVC injury are not well established. Intraprocedurally, Intra-cardiac echocardiography (ICE) may indicate edema formation, though relationship to chronic injury is unknown. Repeat procedures demand preparatory imaging to detect concealed chronic stenosis as this case may have resulted from aggravation of a pre-existing problem resulting from previous ablation attempts. RF power and time, and extent of ablation may be factors. The SVC sleeve is variable and may invite prolonged and extensive energy application. SVC syndrome has also been reported after isolation performed for atrial fibrillation (AF) ablation. Many operators restrict energy application to the septal aspect of the SVC, but scarring noted here indicates that this region is not immune to reactive fibrosis. Alternative energy sources may avoid injury.

References