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Sinus node injury during adjunctive superior vena cava isolation in a patient with triggered atrial fibrillation

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ABSTRACT

Introduction: Atrial fibrillation is the most common sustained heart arrhythmia. Premature beats arising from foci other than pulmonary veins have been related to its pathogenesis.
Methods and results: A 64-year-old female underwent superior vena cava (SVC) isolation after triggers were identified originating from the SVC following pulmonary vein isolation; immediately after SVC isolation, she developed junctional rhythm with symptomatic hypotension requiring emergent management. Apical motion abnormalities were noticed in the echocardiography suggesting stress-induced cardiomyopathy which resolved 48 hours later. Although received a dual chamber pacemaker, intact sinus node function returned 2 weeks later.
Conclusion: Superior vena cava isolation in those with trigger mediated atrial fibrillation following pulmonary vein isolation (PVI) is performed to enhance long-term outcomes. Sinus node injury has been related previously to this procedure. We present the first case of time course of recovery of sinus node function, injured during SVC isolation.

1. Introduction

Atrial fibrillation (AF) is the most common sustained arrhythmia; its incidence increases with aging. This condition could increase morbidity and mortality due to its high potential to cause heart failure, thromboembolic events and the related conditions associated to its treatment such as bleeding. The cornerstones for the management of atrial fibrillation are anticoagulation to prevent embolic events, control symptoms and avoid deterioration of heart function.

AF arising from the pulmonary veins (PV's) was recognized by Haissaguerre et al. [1], in a study that showed 94% of the time PVs are implicated. However, there is some evidence showing that non-pulmonary veins (NPV's) premature beats could trigger AF in up to 28% of cases. The most common NPV foci include the left atrial posterior wall (38%) and superior vena cava – SVC –(37%). Other areas acting as NPV include *crista terminalis*, coronary sinus, ligament of Marshall and interatrial septum.

Catheter techniques looking for the electrical isolation of PV antrum and other atrial tissue originating premature beats has emerged as therapeutic option for symptomatic patients with atrial fibrillation, providing symptomatic benefit. Although rare, complications have been associated with ablation procedures to treat AF. We present a clinical case of a patient who developed a transient sinus node block as a complication during PVI and superior vena cava isolation (SVCI)., Although patient did receive a dual chamber pacemaker, two weeks later, sinus node function returned back to baseline, identifying the time course of recovery of sinus node function.

2. Clinical case

A 64 Year-old female with drug refractory AF and atrial flutter underwent PVI and cavotricuspid isthmus(CTI) ablation.

Basal measurements and conduction study were considered normal. During the isoproterenol testing the patient developed recurrent episodes of recurrent atrial tachycardia (AT), left bundle branch block (LBB) and rapid ventricular response AF (cycle length up to 410 msec). PVI was carried out with irrigated radiofrequency (RF) ablation and lesions were tagged on geometry created using

Abbreviations: AF, Atrial fibrillation; PVI, Pulmonary vein isolation; NPV, Non-pulmonary vein; SVC, Superior vena cava; SVCI, Superior vena cava isolation.

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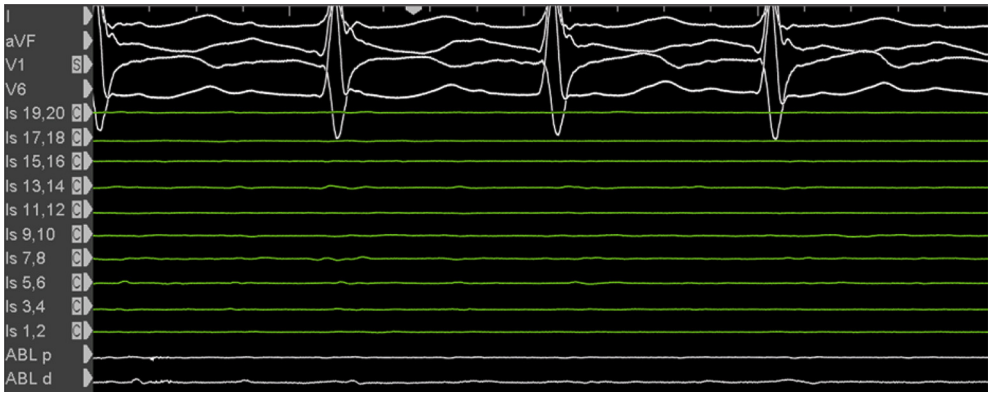

Fig. 1. Entrance block proved in the proximity Superior Vena Cava.

CARTO 3D sound system (Biosense Webster, Diamond Bar, CA, USA); we did a wide area circumferential ablation on all four PV's including carinal ablations, with evidence of entrance block. However, triggered AF was inducible with isoproterenol, and triggers in vein of Marshall was successfully ablated. Further testing revealed SVC origination of NPV triggers and SVCI was performed (see Figs. 1 and 2).

During immediate observation, junctional rhythm at 36 bpm (Fig. 3) with hypotension requiring emergency administration of epinephrine and temporary transvenous pacemaker insertion was needed. An echocardiogram showed apical motion abnormalities, and coronary angiogram was negative for coronary artery disease. Patient was implanted with a permanent pacemaker after failure of recovery of sinus node function at 48 hours. On weekly observations in clinic, recovery of sinus node function was noted 2 weeks post implantation.

3. Discussion

NPV as source of trigger mediated atrial fibrillation is well recognized. Yamaguchi et al. showed that in those patients with NPV foci PVI alone is not enough to reach long term responses suggesting that they should always be addressed during the index ablation procedure [2]. Controversies still exist about the NPV foci management especially with SVC triggers and conflicting evidence exists based on randomized control trials (RCT). Wang et al. showed in 2003 that there were no difference between patients randomly assigned to PVI versus PVI + SVCI regarding AF recurrence after ablation [3]. However in a more recent clinical trial evaluating 2 randomly assigned groups to PVI compared to PVI + SVCI, the

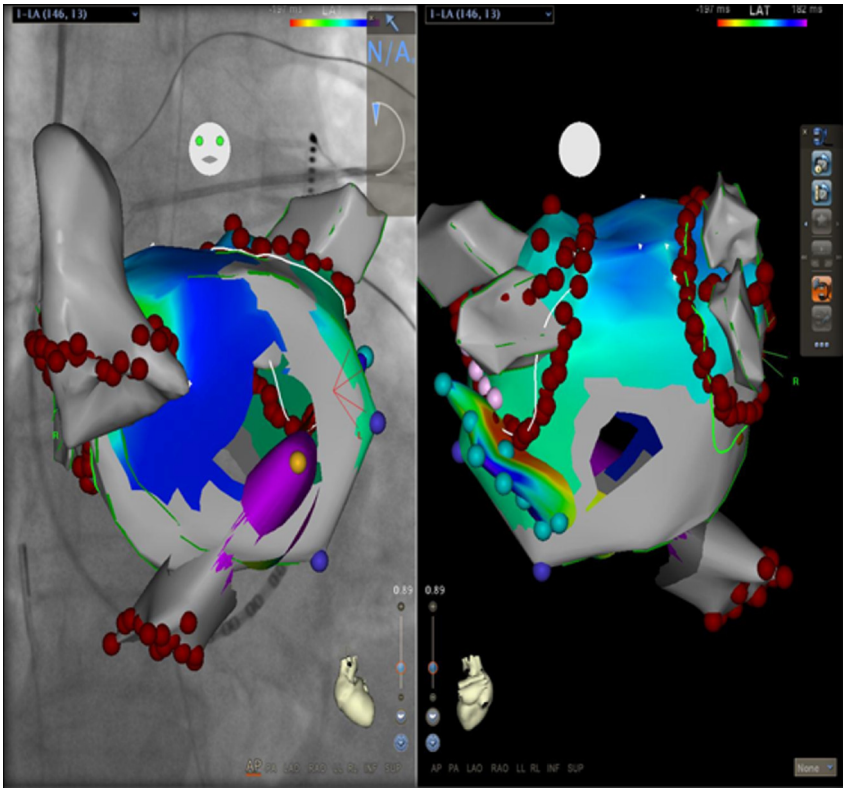

Fig. 2. Left panel: SVC isolation lesions (superiorly), cavotricuspid isthmus ablation line (inferiorly with the red dots). Right panel: PVI lesions (red dots), ablation inside of the vein of Marshall (teal colored dots). PVI: Pulmonary vein isolation, SVC: Superior vena cava.

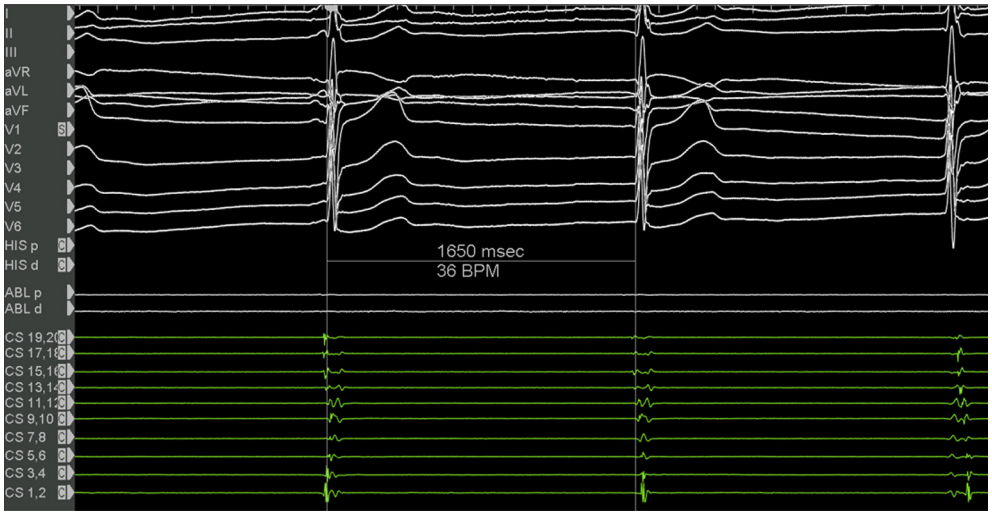

Fig. 3. Sinus node block with junctional escape rhythm with a heart rate of 36 beats per minute. This rhythm was developed soon after SVC isolation and required multiple interventions in order to maintain the hemodynamic stability of our patient.

authors found that those patients who underwent both procedures were significantly less prone to paroxysmal AF after 12 months of follow-up [4].

PVI is not an innocuous procedure and adverse effects have been related to it. The most common are SVC stenosis, phrenic nerve damage with diaphragmatic paralysis and sinus node injury (SNI). Chen et al. described 6 patients who developed SNI after SVCI, in this clinical study 5 patients had transient junctional rhythm that resolved in the first 48 hours postprocedure and just one patient required permanent pacemaker implantation [5]. Probably the SNI is due to the damage to the atrial muscle sleeve that extends into the SVC and contains sinus node pacemaker activity [6]. To the best of our knowledge ours is the first report of SNI associated with PVI + SVCI where time course of recovery of sinus node function was noted.

PVI is commonly performed for drug refractory AF. identification of NPV triggers and subsequent successful ablation is performed in order to get higher responses in the long term follow up after the index procedure. Premature beats arising from SVC triggering AF is infrequent but when present has to be approached cautiously due to proximity of phrenic nerve and inadvertent sinus node injury.

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