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CLINICAL CASE REPORT

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A Case Report of Renal Sympathetic Denervation for the Treatment of Polymorphic Ventricular Premature Complexes

Expanding Horizons

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Abstract: Premature ventricular complexes are very common, appearing most frequently in patients with hypertension, obesity, sleep apnea, and structural heart disease. Sympathetic hyperactivity plays a critical role in the development, maintenance, and aggravation of ventricular arrhythmias. Recently, Armaganijan et al reported the relevance of sympathetic activation in patients with ventricular arrhythmias and suggested a potential role for catheter-based renal sympathetic denervation in reducing the arrhythmic burden.

In this report, we describe a 32-year-old hypertensive male patient presenting with a high incidence of polymorphic premature ventricular complexes on a 24 hour Holter monitor. Beginning 1 year prior, the patient experienced episodes of presyncope, syncope, and tachycardia palpitations. The patient was taking losartan 100 mg/day, which kept his blood pressure (BP) under control, and sotalol 160 mg twice daily. Bisoprolol 10 mg/day was used previously but was not successful for controlling the episodes. The 24 hour Holter performed after the onset of sotalol 160 mg twice daily showed a heart rate ranging between 48 (minimum)–78 (average)–119 (maximum) bpm; 14,286 polymorphic premature ventricular complexes; 3 episodes of nonsustained ventricular tachycardia, the largest composed of 4 beats at a rate of 197 bpm; and 14 isolated atrial ectopic beats. Cardiac magnetic resonance imaging with gadolinium perfusion performed at rest and under pharmacological stress with dipyridamole showed increased left atrial internal volume, preserved systolic global biventricular function, and an absence of infarcted or ischemic areas. The patient underwent bilateral renal sympathetic denervation.

The only drug used postprocedure was losartan 25 mg/day. Three months after the patient underwent renal sympathetic denervation, the mean BP value dropped to 132/86 mmHg, the mean systolic/diastolic 24 hour ambulatory BP measurement was reduced to 128/83 mmHg, and the 24 hour Holter monitor showed a heart rate ranging between 51 (minimum)–67 (average)–108 (maximum) bpm, 854 polymorphic premature ventricular complexes, and no episodes of nonsustained ventricular tachycardia.

(*Medicine* 94(50):e2287)

Abbreviations: BP = blood pressure, HR = heart rate, NSVT = nonsustained ventricular tachycardia, PVC = premature ventricular complex.

INTRODUCTION

Premature ventricular complexes (PVCs) are very common, appearing most frequently in patients with hypertension, obesity, sleep apnea, and structural heart disease.[1] In general, PVCs in the structurally normal heart are considered benign,[2] though they have been associated with a more than 2-fold higher risk of cardiovascular complications, including stroke[3] and death.[4] Reentry is the likely mechanism for PVCs originating from regions of fibrosis or infiltration in cardiomyopathies such as ischemic heart disease, arrhythmogenic right ventricular cardiomyopathy, sarcoidosis, Chagas disease, hypertrophic cardiomyopathies, primary dilated cardiomyopathies, valvular cardiomyopathy, congenital heart disease, muscular dystrophies (eg, myotonic dystrophy, Emery–Dreifuss muscular dystrophy), and metabolic disorders such as Fabry disease, Pompe disease, Danon disease, and mitochondrial diseases. PVCs can also arise due to reentry around surgical scars. Fascicular PVCs are due to small reentry circuits involving the fascicles[5,6] or to triggered or enhanced automaticity.[7]

PVCs have increasingly been recognized as a primary cause for worsening left ventricular systolic function and heart failure in some patients, once obvious causes such as cardiac ischemia, valvular disease, toxic metabolic or infiltrative diseases, and persistent tachycardia have been excluded. The pathogenesis of PVC-mediated cardiomyopathy is uncertain, and hypotheses include ventricular dyssynchrony, hemodynamic impairment, increased oxygen demand, autonomic dysregulation, alterations in intracellular calcium handling, and altered heart rate (HR) dynamics.[8,9] Although PVCs are fairly infrequent and asymptomatic in most cases, some patients may experience more frequent PVCs and symptoms such as palpitations, chest pain, and dyspnea. The spectrum of benign outflow tract PVCs ranges from single PVCs to repetitive nonsustained ventricular tachycardia (NSVT) to paroxysmal sustained ventricular tachycardia.[10] In rare cases, short-coupled right ventricular outflow tract PVCs can trigger polymorphic ventricular tachycardia,[11] while even shorter-coupled PVCs often originating from the fascicular system or papillary muscles can trigger ventricular fibrillation.[7,12] However, the best course of action to

Editor: Meihua Zhu.
Received: August 31, 2015; revised: November 3, 2015; accepted: November 19, 2015.
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The authors have no funding and conflicts of interest to disclose.

ISSN: 0025-7974
DOI: 10.1097/MD.0000000000002287

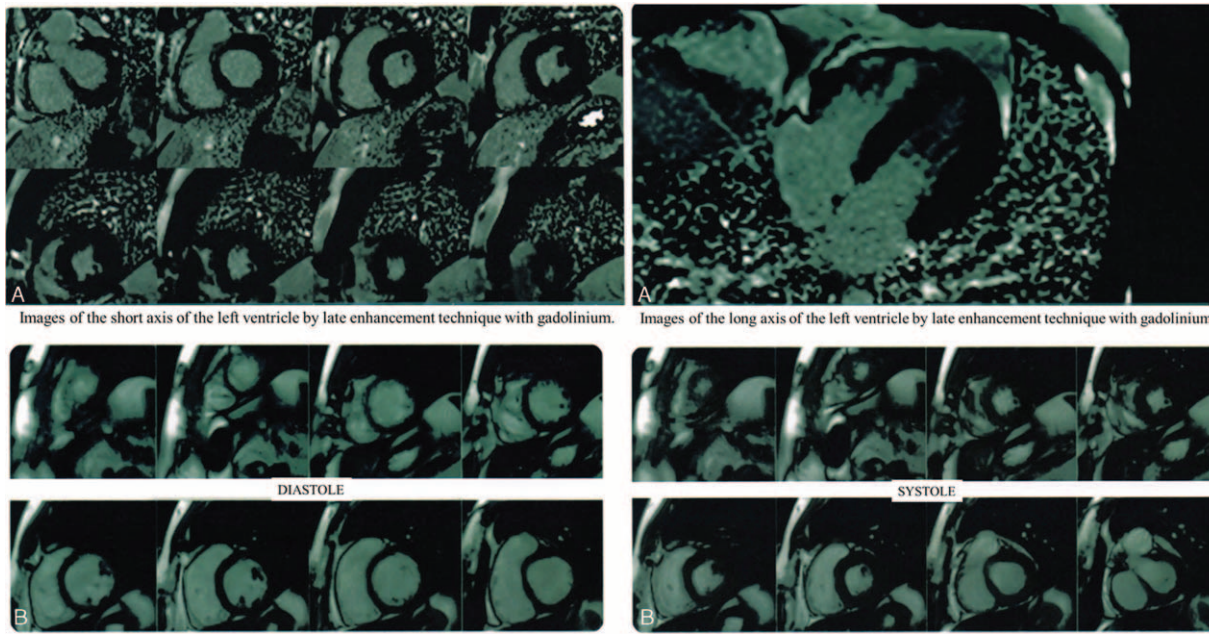

FIGURE 1. Cardiac magnetic resonance imaging with gadolinium perfusion at rest and under pharmacological stress with dipyridamole. Necrosis/fibrosis evaluation: (A) images of the short and long axes of the left ventricle using a late enhancement technique with gadolinium. Evaluation of ventricular function: (B) diastole and systole.

pursue for PVCs that are polymorphic and refractory to medical treatment is not clear. Potential treatment options include mapping and ablating them one by one or attempting a new, alternative therapy.

Sympathetic hyperactivity plays a critical role in the development, maintenance, and aggravation of ventricular arrhythmias.[13] Recently, Armaganijan et al[14] reported the relevance of sympathetic activation in patients with ventricular arrhythmias and suggested a potential role for catheter-based renal sympathetic denervation in reducing the arrhythmic burden.

In this report, we describe a 32-year-old hypertensive male patient presenting with a high incidence of polymorphic PVCs on a 24 hour Holter monitor. One year prior, the patient began experiencing episodes of presyncope, syncope, and tachycardia palpitations. The ethics committee, comprising Paola Baars Gomes Moises, Luis Marcelo Rodrigues Paz, Humberto Cesar Tinoco, and Jonny Shogo Takahashi, approved this case study. Written informed consent was provided by the patient. The patient was taking Losartan 100 mg/day, which kept his blood pressure (BP) under control, and sotalol 160 mg twice daily. Bisoprolol 10 mg/day was used in the past but was not successful in controlling the episodes. The physical examination of the patient was normal, with the exception of high BP (mean of 4 measures taken during 2 different office visits, BP = 162/100 mmHg) and PVCs. The electrocardiogram and treadmill stress test showed a sinus rhythm and no abnormalities aside from PVCs. Furthermore, on the treadmill test the patient did not present ischemia and his metabolic equivalents of task (METs) reached 8.23. The mean systolic/diastolic 24 hour ambulatory BP measurement was 144/95 mmHg. The first 24 hour Holter monitor, performed before the use of bisoprolol or sotalol, showed an HR ranging between 64 (minimum)–85 (average)–136 (maximum) bpm; 28,983 polymorphic PVCs; 8 episodes of NSVT, the largest composed of 11 beats at a rate of 201 bpm; and 100 isolated atrial ectopic beats. The second 24 hour Holter monitor, performed after the onset of sotalol 160 mg twice daily, showed an HR ranging between 48 (minimum)–78 (average)–119 (maximum) bpm; 14,286 polymorphic PVCs; 3 episodes of NSVT, the largest composed of 4 beats at a rate of 197 bpm; and 14 isolated atrial ectopic beats. The echocardiogram and tilt table test were normal. We further investigated this patient's symptoms using cardiac magnetic resonance imaging with gadolinium perfusion at rest and under pharmacological stress with dipyridamole. This assessment showed an increased left atrial internal volume (101 mL), preserved systolic global biventricular function (with a left ventricular ejection fraction measured by Simpson method of 58.2%), and the absence of infarcted or ischemic areas. Arrhythmogenic right ventricular cardiomyopathy was not observed (Figure 1A and B). The final step of this investigation involved an electrophysiological study, which showed normal sinus function, normal electrical conduction through the His-Purkinje system, atrial electrical stability, and ventricular electrical stability (without triggering sustained ventricular tachycardia), as shown in Figure 2.

The renal sympathetic denervation procedure was performed in the catheterization laboratory with direct visualization using fluoroscopy and a radiopaque contrast agent. We used the EnSite Velocity three-dimensional mapping system (St. Jude Medical, St. Paul, MN) to construct the anatomy of the renal arteries and aorta, as well as for radiofrequency application at the selected sites. The patient remained under unconscious sedation. The patient underwent catheterization of the right femoral artery by the standard Seldinger technique, which was performed using a 7-Fr valved short sheath after subcutaneous injection of local anesthetic. Subsequently, this was replaced with a steerable long sheath (Agilis, St. Jude Medical) using the standard ''over the wire'' technique. Unfractionated heparin was administered intravenously, targeting an activated

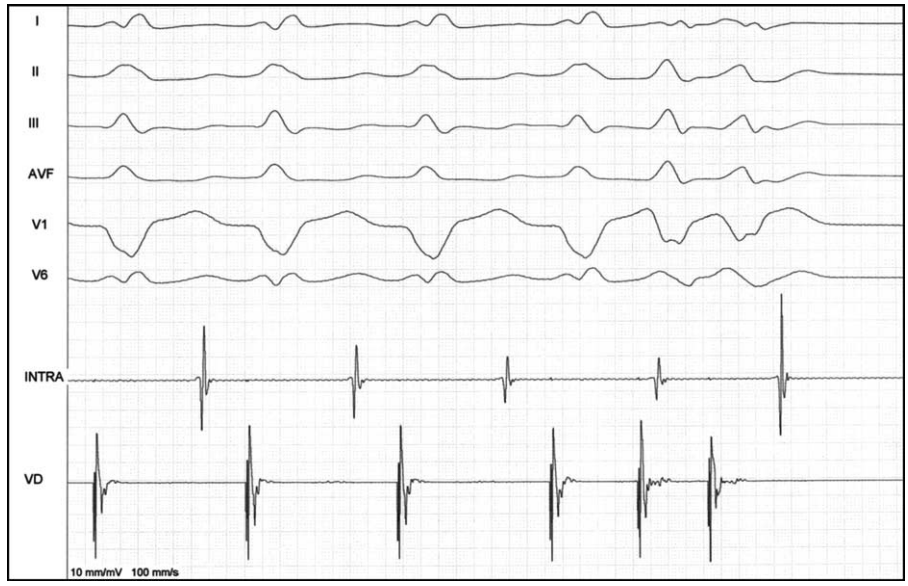

FIGURE 2. Electrophysiological study showing ventricular electrical stability.

coagulation time between 250 and 350 seconds. This sheath was advanced to the level of the renal arteries, and the ostia was located using nonselective aortography. The introducer was then carefully deflected to anchor at the ostium of each renal artery to introduce the ablation catheter with an open irrigated tip (St. Jude Medical), as shown in Figure 3. The procedure was performed with no complications, and the patient remained clinically stable and awoke properly from sedation. Intravenous protamine was infused at the end of the procedure, manual compression of the femoral artery was performed for 15 minutes, and a compressive dressing was applied. No vascular complications resulted from the procedure. The patient was discharged after a 24 hour hospitalization period, and he was clinically stable and walking without difficulty.

We were unable to find an electrical signal in the kidney, even while creating an extensive map of the renal arteries in search of electric potential from the autonomic nervous system. However, the sympathetic nerves are largely located in the adventitia layer, 1.5 to 2 mm from the lumen of the renal artery,[15] and the SYMPLYCITY HTN-3 trial[16] found that a greater number of ablated spots was a predictor of success, as this may cause more destruction of the sympathetic arterial nerves.

The only drug used after the procedure was losartan 25 mg/day. Three months after the patient underwent renal sympathetic denervation, the mean BP value taken in our office dropped to 132/86 mmHg, the mean systolic/diastolic 24 hour ambulatory BP measurement was reduced to 128/83 mmHg, and the

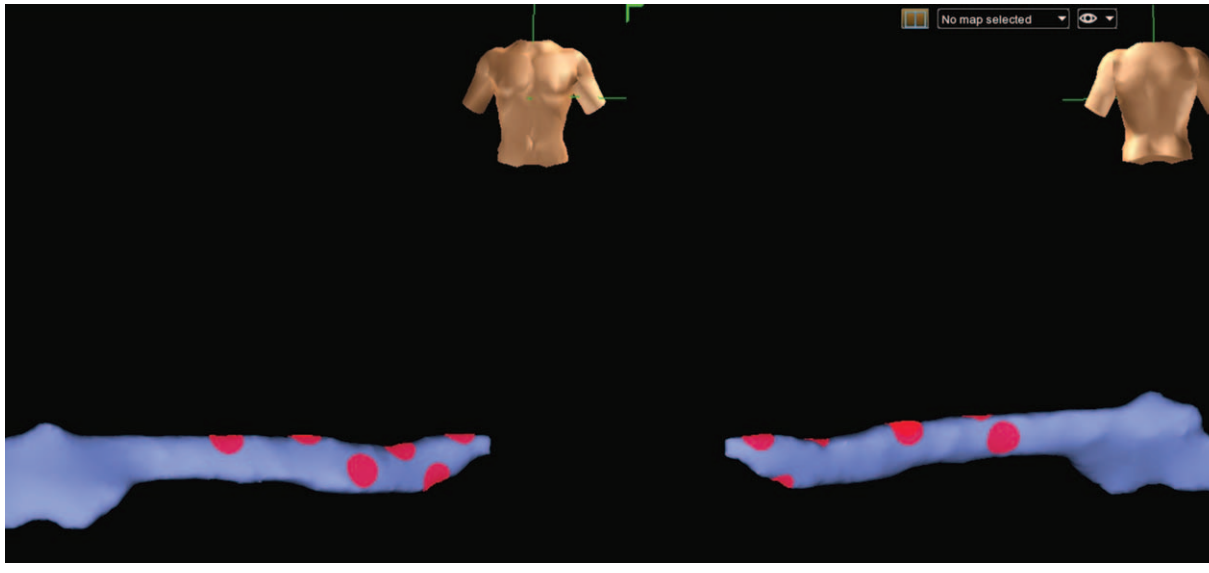

FIGURE 3. Using the EnSite Velocity three-dimensional mapping system for constructing the anatomy of the renal arteries and for radiofrequency application in the selected sites.

24 hour Holter monitor showed an HR ranging between 51 (minimum)–67 (average)–108 (maximum) bpm, 854 polymorphic PVCs, and no episodes of NSVT.

Even though the technique used herein is not the standard technique, we opted to perform renal sympathetic denervation because we believe that sympathetic hyperactivity is closely related to the appearance of PVCs. Other treatment options for ventricular arrhythmias, such as endocardial and epicardial ablation, which is considered the gold standard, could be utilized and should be considered for future cases.[17,18]

ACKNOWLEDGEMENTS

The authors thank Mr. Sérgio Oliveira and Pacemed for their technical support.

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