Use of a circular mapping and ablation catheter for ablation of atypical right ventricular outflow tract arrhythmia

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A new technique for ablation of persistent ectopic activity with atypical electrocardiographic characteristics at the vicinity of the right ventricular outflow tract is described. A new circular mapping and ablation catheter initially designed for pulmonary vein ablation was used. Abolition of ectopic activity was achieved with minimal fluoroscopy and ablation times.

Ablation of right ventricular outflow tract (RVOT) arrhythmia can be cumbersome despite the use of three-dimensional electroanatomic mapping. The anatomy of this area is more complex than initially thought due to important extracardiac structures in the vicinity of the ventricles and the curvature of the ventricular septum.1 Identification of the origin of the arrhythmia cannot always be relied upon electrocardiographic criteria,2 and arrhythmia of undetermined or apparently left ventricular origin may be approached from the RVOT.3 We describe the use of a dedicated, circular catheter for mapping and ablation that was initially designed for pulmonary vein ablation, in this setting. A 56-year-old man with drug-resistant, persistent ventricular bigeminy, or quadrigeminy originating at the right or left ventricular outflow tract in the context of a normal heart verified by magnetic resonance imaging, was referred for catheter ablation. Although the presence of an S wave in V6 suggested left ventricular origin of the arrhythmia,2 and the axis was not typical for RVOT VT, detailed mapping at the aortic sinus cusps and the RVOT indicated that the focus of the arrhythmia could be best approached from the right endocardial outflow tract side. However, a previous attempt with electroanatomic mapping from the RVOT had failed to completely eliminate the arrhythmia. Successful ablation was accomplished with the use of an over-the-wire, circular, decapolar mapping, and ablation catheter with a 25 mm diameter array at the distal tip (PVAC, Ablation Frontiers, Inc.), initially designed for pulmonary vein ablation.4

This catheter is steerable and there is also an option for a steerable sheath that was not used in our case. The platinum electrodes (3 mm long, 1.5 mm outer diameter, 3 mm spacing) have a thermocouple under the surface on the anterior side. Mapping is per-

Figure 1 Positioning of the circular catheter at the RVOT (left panel). Mapping of the ectopic beat during bigeminy detected earliest activation in pairs 3 and 4.
formed by five bipolar recordings through adjacent electrode pairs. The diameter of the electrode array can be effectively altered by engaging the array against anatomic structures. Radiofrequency (RF) energy is provided by a multichannel generator (GENius, Ablation Frontiers, Inc.) that is capable of independently delivering energy to 12 electrodes. Radiofrequency energy can be delivered in either unipolar (from the electrodes at the catheter tip to the dispersive electrodes on the patient’s back) or bipolar (between adjacent selected pairs of electrodes on the catheter tip) current with a fixed duty-cycle by a phase difference between the channels. During RF application, energy delivery to individual electrodes is temperature controlled by a software algorithm that modulates power to reach the user-defined target temperature (60°C in our case), avoiding overshoot, but limits power to a maximum of 8–10 W per electrode. Lesion depth and fill between electrodes are controlled by varying the energy settings on the generator, with depth achievable up to 7 mm.

In our case, rotation of the catheter shaft and positioning at the RVOT was facilitated by use of the 0.032 in. guidewire which was advanced to the main pulmonary artery. The arrhythmia focus was mapped at the antero-lateral wall of the RVOT (Figure 1). Radiofrequency energy was delivered pairs 3 and 4, in a 4:1 bipolar/unipolar setting. Complete abolition of the ectopic activity was achieved following four ablation sessions for 1 min each (Figure 2). Fluoroscopy and procedure times were 3 and 20 min, respectively. Three months post-ablation, the patient remains asymptomatic on a low dose β-blocker.

The main advantage of this technique is that it allows simultaneous mapping of multiple points around the RVOT endocardium. This is particularly useful when dealing with ectopic activity or non-sustained ventricular tachycardia. In addition, the relative stability of the ablation catheter allows easier accomplishment of permanent lesions at the indicated mapping sites. A potential limitation of this approach is that the thermocouple is on the front of the electrodes, whereas the contact in the wider RVOT may be more lateral on the electrodes. Thus, the displayed temperature could be around 10°C lower than the real contact temperature. In this case, an overshoot of power to reach target temperature is possible.

Conflicts of interest: none declared.

References