Idiopathic Right Ventricular Arrhythmias With Changes in the QRS Morphology After Ablation

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Idiopathic ventricular arrhythmias (VA) is defined as premature ventricular complexes (PVCs) or ventricular tachycardias (VT) that occur in the absence of structural heart disease. Endocardial radiofrequency (RF) ablation is often curative for idiopathic VA. The success of the procedure depends on the ability to localize the abnormal foci accurately. These arrhythmias typical originate from the right ventricular outflow tract (RVOT), specifically from the superior septal aspect, but can also originate from the left ventricular outflow tract (LVOT) and the coronary cusps.[1] The QRS electrocardiogram (ECG) characteristics have been helpful in patients with VAs, patient with accessory pathways and patients who have pacemakers.[2] VAs originating from the RVOT have typical ECG findings with a left bundle branch block (LBBB) morphology and an inferior axis.[3]

In the current issue of the Journal of Cardiovascular Electrophysiology, Hisazaki et al. describe five patients with idiopathic VA suggestive of RVOT origin and who required ablation in the left-sided outflow tract (OT) in addition to the initial ablation in the RVOT for cure to be achieved. Patients exhibited monomorphic, LBBB QRS pattern with an inferior axis on ECG, consistent with the morphology of VAs originating from the RVOT. Interestingly, all patients had a common distinct ECG pattern: qs or rs (r [?] 5 mm) pattern in lead I, Q wave ratio[aVL/aVR]>1, and dominant S-waves in leads V1 and V2. Mapping of the right ventricle demonstrated early local activation time during the VA in the posterior portion of the RVOT, matching the QRS morphology obtained during pacemapping. Despite RF energy delivery to the RV, the VAs recurred shortly after ablation in four patients and had no effect at all in one patient. A change in the QRS morphology was noted on the ECG that had never been observed before the procedure. The new patterns were suggestive of left-sided OT origin: the second VAs exhibited an increase in the Q wave ratio [aVL/aVR] and R wave amplitude in lead V1, decrease in the S wave amplitude in lead V1, and a counterclockwise rotation of the precordial R-wave transition. Early activation of the second VA could not be found in the RVOT, and the earliest activation time after mapping the LV was found to be relatively late. Real-time intracardiac echocardiography and 3D mapping systems were used to determine the location immediately contralateral to the initial ablation site in the RVOT. Energy was then delivered to that site which successfully eliminated the second VA. The authors postulated that the second VAs shared the same origins as the first VAs, and the change in QRS morphology is likely attributed to a change in the exit point or in the pathway from the origin to the exit point. The authors further explained that the VAs originated from an intramural area of the superior basal LV surrounded by the RVOT, LVOT and the transitional zone from the great cardiac vein to the anterior interventricular vein (GCV-AIV).

A limitation of this study is that GCV-AIV ablation was not attempted; however, the authors' approach is safer and was successful in eliminating VA. Another limitation is that left-sided OT mapping was not initially performed. Nevertheless, given the ECG characteristics, local activation time, and mapping, it was appropriate to attempt a RVOT site ablation.

Overall, the authors should be commended for their effort to describe in detail patients with idiopathic VAs that required ablation in the left-sided OT following ablation in the RVOT. Although change in QRS morphology after ablation has been previously described, the authors were the first to describe the ECG patterns of these patients.[4–7] The results of this study have important clinical implications. First, the authors have demonstrated the importance of anatomical approach from the left-sided OT for cure to be achieved. Second, insight into the location of the origin of the VA may be helpful to physicians managing patients with VAs from the RVOT. Finally, continuous monitoring of the ECG during ablation for a change in QRS morphology should be considered to identify patients who will require further ablation. We have summarized in Table 1 important ECG characteristics indicative VA of specific origins, based on the findings of this study and previous studies in the literature.[3,8–15]

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