Visualization of the preferential conduction pathway in a case of premature ventricular contractions arising from the pulmonary artery

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1 | CASE PRESENTATION

A 50-year-old man was referred to our hospital with a previously diagnosed premature ventricular contractions (PVCs) and unsuccessful ablation attempt twice. The QRS complex of his PVCs was left bundle branch block morphology and inferior axis.

High-resolution mapping was performed in the right ventricular outflow tract (RVOT) and pulmonary artery (PA) using a 16-equidistant electrodes catheter (HD Grid Mapping Catheter Sensor Enabled, Abbott Technologies, Minneapolis, MN).

Figure 1 showed the activation and voltage mapping, the surface electrocardiogram, and intracardiac electrograms during sinus rhythm and PVC. During the mapping into PA, sharp potential and fractionated potentials were recorded before the early phase of the QRS complex during PVCs (Figure 1A–D). In addition, sharp potentials after the late phase of the QRS during sinus rhythm were observed (arrow in Figure 1G). The activation mapping revealed that the earliest site of PVCs (arrow in Figure 1A) was in the PA and about 10 mm above the pulmonary valve (dot lines in Figures 1 and 2; confirming the position of pulmonary valve by the catheter’s hookup), where a sharp potential preceded QRS onset of PVCs by 45 ms (arrow in Figure 1A). The activation mapping also showed that the preferential conduction pathway was well delineated. The PVC excitation traveled 10 mm toward the anterior septum (arrow in Figure 1C) and then 10 mm downward (arrow in Figure 1D), propagating to the RVOT just below the pulmonary valve (arrow in Figure 1E). In other words, the length of the preferential conduction pathway was 20 mm. At the exit site of PVCs, the precedence from the QRS complex was 25 ms (arrow in Figure 1E).

The ablation catheter was advanced into the septal site of PA just above the pulmonary valve, where was directly above the exit site of PVCs. Then we ablated to cross the preferential pathway (round tags in Figure 2) to avoid injury to the PA and prevent conduction of firing from other parts of this preferential pathway to the ventricular muscle. After the elimination of PVCs, spiky potentials (arrow in Figure 3), representing firings of PA myocardial sleeve, were recorded on the ablation catheter repetitively. This meant the conduction block was formed between the origin in PA and the exit of RVOT, which was on the preferential conduction pathway of PVCs.

2 | DISCUSSION

There were several reports about idiopathic ventricular arrhythmias (VAs) arising from myocardial remnants in PA. In this case, the high-density (HD Grid) mapping revealed the propagation of PVCs arising from the PA trunk propagated via the preferential conduction pathway and exiting from the RVOT septum beneath the pulmonary valve into ventricles.

It is well known that ventricle myocardial extensions from the RVOT to the PA show variability, and serve as arrhythmogenic foci for idiopathic VAs. However, the electrocardiographic features of VAs arising from the PA have been discussed. We visualized the preferential conduction pathway of PVCs arising from the PA...
three-dimensionally, and also recorded the firings of these PVCs after ablation. Our report may help elucidate those VAs.

In this case, the activation mapping revealed the width as well as the travel of the preferential pathway, in which potentials were small and fractionated. The preferential pathway might be thin and conduction-delayed, which made it difficult to identify by voltage mapping. In addition, in this case, the preferential pathway was running in a bent position. We believed that the HD grid catheter can instantly record potentials in two directions and can accurately identify the preferential pathway in PVCs arising from the PA.

VAs arising from the PA were 4% of idiopathic VAs, and complete elimination of those VAs could not be achieved with radiofrequency ablation in the RVOT. During the PA mapping, a sharp potential preceding QRS onset during VAs was observed above the pulmonary valve. In addition to all the characteristics of this case being applicable to the characteristics of VAs reported by Tada et al., these sharp potentials were continuously recorded by HD Grid catheter far away from the pulmonary valve.

The high-density mapping can identify the origin and preferential pathway for VAs arising the PA and is useful for ablation for these VAs. Since HD Grid catheter can record potentials in two directions,
it is possible to obtain information on the characteristics of minute potentials and the direction of conduction, which is useful for elucidating the mechanism of complex arrhythmias.

CONFLICT OF INTEREST
No conflict of interest.

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