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SPOTLIGHT

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Left coronary cusp ablation for elimination of left ventricular summit premature ventricular complex

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A 44-year-old man was referred for catheter ablation of symptomatic idiopathic premature ventricular complex (PVC) manifested as single morphology without salvos of ventricular tachycardia. Twelve-lead electrocardiographic features were compatible with epicardial left ventricular (LV) summit origin adjacent to anterior interventricular vein (Figure 1).

Activation mapping of the LV outflow tract was performed by using retrograde transaortic approach with 8F 3.5 mm irrigated tip, 1-6-2 mm interelectrode spacing, mapping/ablation catheter. Distal bipolar electrode recorded local abnormal ventricular activities (LAVA) above the left coronary cusp both during PVC and sinus rhythm (Figures 2 and 3).

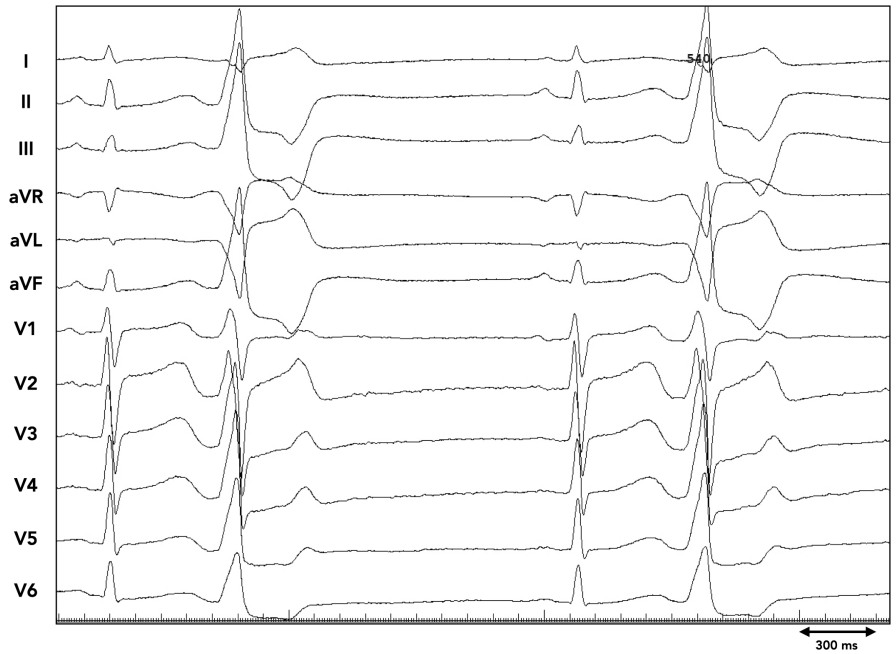

FIGURE 1 Twelve-lead electrocardiogram demonstrated sinus rhythm with PVC in bigeminal pattern. PVC displayed QRS duration of 138 ms, rightward inferior axis, rS pattern in lead V1 with R/S ratio of 0.67, precordial R/S transition in lead V3, R wave pattern break in lead V2 (R/S ratio = 0.54), QS morphology in lead I with steep notch on downstroke deflection, absence of Q wave in inferior leads, delayed time to maximum deflection of 85 ms in lead II, MDI = 0.61 in the precordial leads and Q wave ratio of 1.57 in lead aVL/aVR. All surface electrocardiographic features of PVC were consistent with apical site of epicardial LV summit origin in the vicinity of anterior interventricular vein (inaccessible area). MDI, maximum deflection index; PVC, premature ventricular complex.

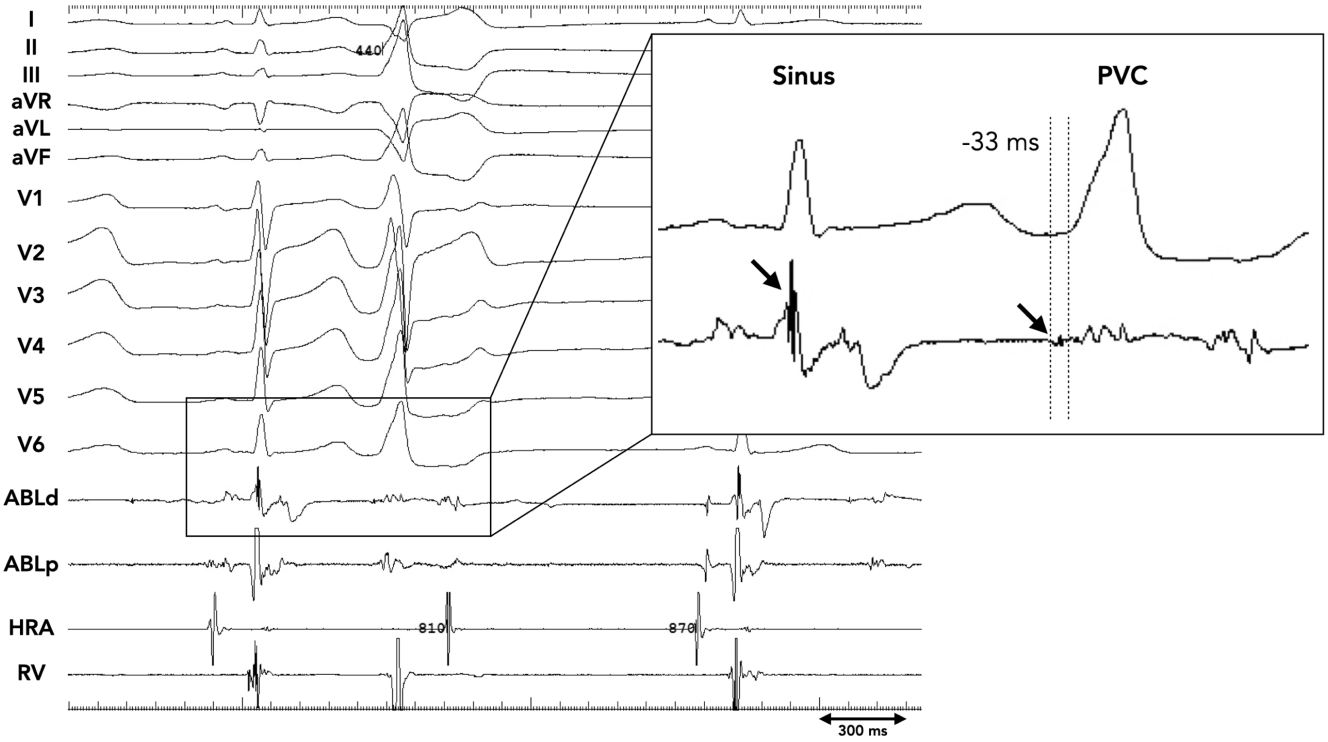

FIGURE 2 Distal bipolar electrode of 3.5 mm irrigated tip ablation catheter, 1-6-2 mm interelectrode spacing, placed at the left coronary cusp recorded LAVA both during sinus rhythm and PVC. LAVA was the earliest signal during PVC displaying as high frequency low-amplitude potentials distinct from far-field ventricular electrogram 33 ms preceding QRS onset (arrow) and initial fractionated signal buried in the far-field ventricular potentials during sinus rhythm (arrow). ABLd, distal bipolar electrode of ablation catheter; ABLp, proximal bipolar electrode of ablation catheter; HRA, high right atrial catheter; LAVA, local abnormal ventricular activities; RV, right ventricular catheter.

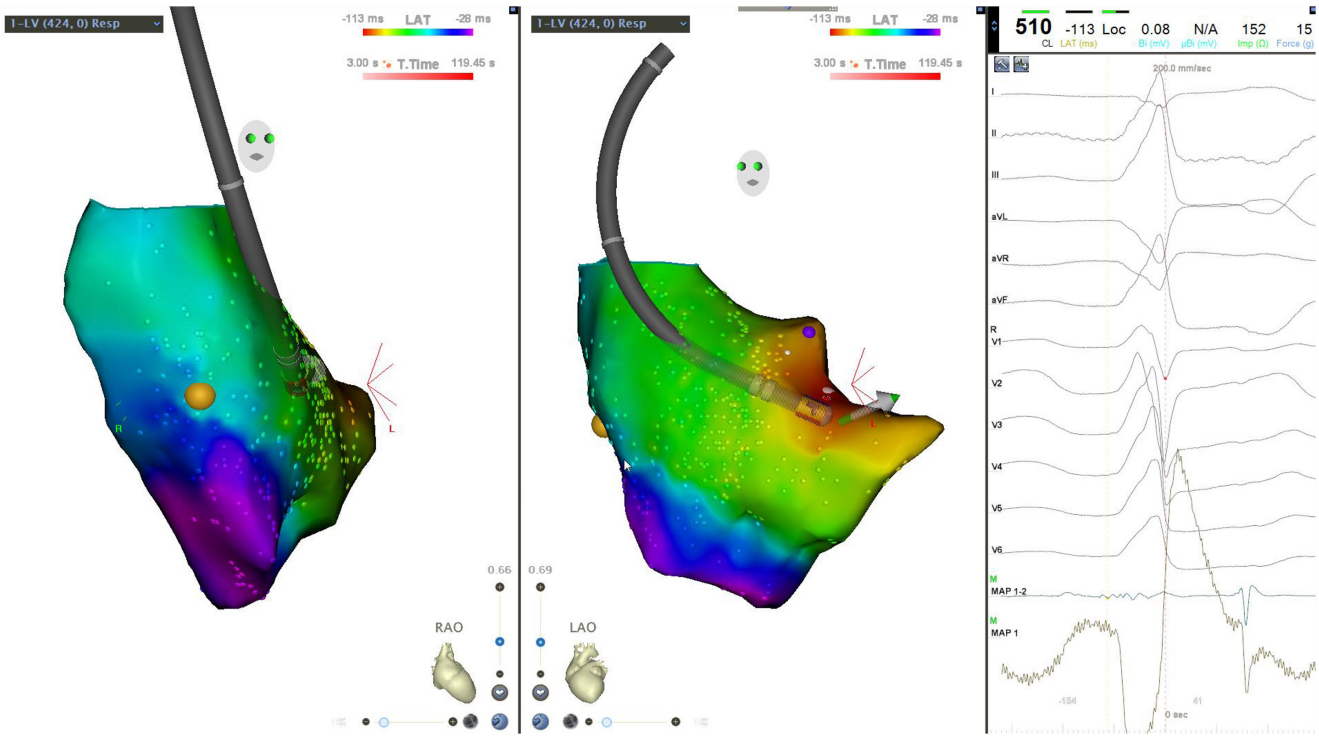

FIGURE 3 Three-dimensional activation mapping of the left ventricular outflow tract. LAVA recorded at the left coronary cusp was the earliest activation signal during LV summit PVC preceding QRS onset by 33 ms with sharp QS complex on the unipolar electrogram. purple tag = left main coronary ostium; yellow tag = His potentials; MAP 1 = unipolar recording of the ablation catheter; MAP 1–2 = distal bipolar electrode of the ablation catheter; Other abbreviations as in Figures 1 and 2.

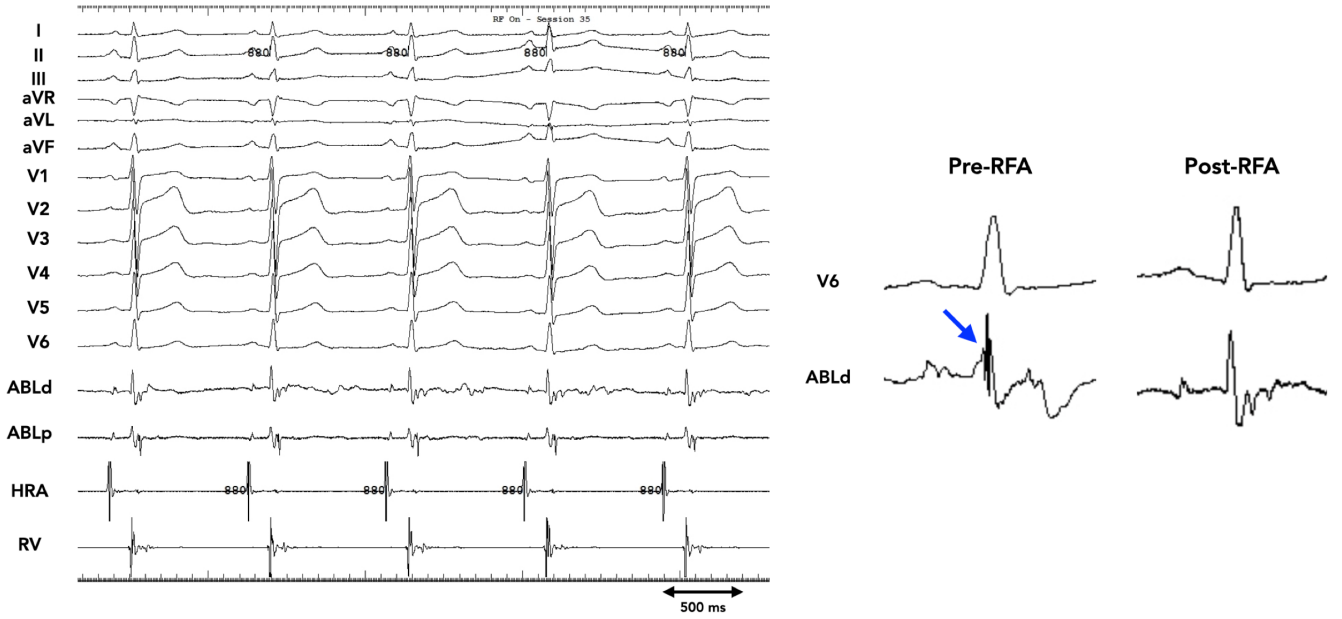

FIGURE 4 Surface electrocardiogram and intracardiac electrogram after 35 consecutive attempts of radiofrequency energy application on the LAVA site, above and below the left coronary cusp. PVC disappeared and became noninducible. Initial fractionated signal buried in the far-field ventricular potentials during sinus rhythm (blue arrow) before ablation was completely eradicated. RFA, radiofrequency ablation; Other abbreviations as in Figure 2.

Pacemapping with variable outputs failed to capture LAVA. Radiofrequency (RF) energy was delivered using a maximum power of 35 W, limiting temperature less than 50°C and targeting an impedance drop of 10–15 Ω. RF ablation at the LAVA site acutely terminated and suppressed PVC. LAVA was completely eradicated after 35 consecutive attempts of RF energy application both above and below the left coronary cusp (Figure 4). PVC became noninducible using programmed ventricular pacing with and without intravenous isoproterenol. LAVA was defined as high frequency, fractionated or pluricomponent signals distinct from far-field ventricular potentials found during either sinus rhythm or PVC. It represented local electrical activity arising from the pathological tissue. Anatomical proximity of the left coronary cusp insertion and epicardial LV summit[1] allows successful elimination of epicardial LAVA and acute PVC suppression from transmural heat conduction directly from the cusp to the LV summit. Komatsu et al.[2] used earliest activation potentials recorded on 2F microcatheter inside the communicating veins between the aortic and pulmonary annuli to serve as a landmark to facilitate successful ablation from the adjacent anatomical structures in the closest proximity under fluoroscopic guidance. Aortic cusp was the target ablation site in 4 out of 14 patients. Phanthawimol et al.[3] demonstrated that left coronary cusp ablation was able to eradicate epicardial LAVA inside the communicating veins and suppressed LV summit ventricular arrhythmias. Recent study showed that some LV summit ventricular arrhythmias with an abrupt transition in V3 pattern on the surface electrocardiogram, which had the earliest activation in the great cardiac and anterior interventricular veins were completely suppressed after direct RF energy application at the left coronary cusp.[4] We first reported that epicardial LAVA in the LV summit can be mapped and PVC was completely eliminated by RF ablation above the left coronary cusp using single catheter technique.

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CONFLICT OF INTEREST STATEMENT

All authors report no conflicts of interest.

DECLARATIONS

Informed Consent: Yes. *Registry and Registration No*: Not applicable. *Animal Studies*: Not applicable.

ETHICS APPROVAL STATEMENT

Not applicable.

CLINICAL TRIAL REGISTRATION

Not applicable.

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