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CASE REPORT

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A case of ventricular ectopy eliminated by catheter ablation: Diversity of the potentials on the left coronary cusp

Takatsugu Kajiyama MD | **Hitoshi Hachiya MD, FJCS** | **Yoshito Iesaka MD**

Cardiovascular Center, Tsuchiura Kyodo Hospital, Tsuchiura, Ibaraki, Japan

Correspondence
Takatsugu Kajiyama, MD, Cardiology Division, Cardiovascular Center, Tsuchiura Kyodo Hospital, 4-1-1 Otsuno, Tsuchiura, Ibaraki 300-0028, Japan.
Email: tak4poincar@gmail.com

Abstract

An 18-year-old man without organic heart disease underwent catheter ablation for frequent monomorphic ventricular ectopic beats(VEBs). The origin of the VEB was presumed located on the left coronary cusp(LCC) regarding his electrocardiography. Local activation in the right ventricular outflow tract was not so early. On the LCC, four different prepotentials were obtained by slight relocation of the catheter. Finally, on the site with positive discrete prepotential recorded on the distal electrodes, an application of radiofrequency current immediately eliminated the VEB. Although LCC is considered as a small structure, detailed mapping may be important to find the most optimal ablation site.

KEYWORDS

aortic coronary cusps, catheter ablation, electoroanatomical mapping, ventricular arrhythmia, ventricular tachycardia

1 | INTRODUCTION

The ventricular outflow tract is the most common arrhythmogenic area of ventricular arrhythmias without organic heart disease. The left coronary cusp is a small but a major origin of outflow tract ventricular arrhythmias (OTVAs).[1] In this report, we describe that dense mapping revealed a diversity of potentials within the left coronary cusp (LCC) and helped to determine the optimal ablation site in a case of an idiopathic OTVA.

2 | CASE REPORT

An 18-year-old man who complained of chest discomfort presented to our hospital. He had no history of cardiac disease and exhibited no abnormal findings. His 12-lead electrocardiogram revealed frequent monofocal ventricular ectopic beats(VEBs)(Figure 1A). The morphology of the dominant VEB exhibited a QS pattern in lead-I, aVR/aVL<1, high amplitude in the inferior leads, transitional zone at V3-V4, R wave in V1/V2, and peak deflection index of 0.74. The coupling interval from the QRS of sinus beat to the VEB was wandering between 400 ms and 500 ms, whereas no fusion beat suggested that the etiology of the VEB may not have been parasystole. There were no abnormal findings on the transthoracic echocardiography. A total of 20635 monomorphic VEBs out of 87022 total heart beats were recorded during Holter monitoring. No ventricular tachycardia was recorded. He was diagnosed with an idiopathic OTVA and was admitted for catheter ablation.

The procedure was performed using a 3D mapping system (CARTO3, Biosense-Webster, Diamond Bar, CA). A 10-pole electrode catheter was advanced into the distal great cardiac vein via the coronary sinus. A quadripolar electrode catheter was inserted into the right ventricular apex. An 8Fr long sheath(SL0, AF Division, SJM, Minneapolis, MN) was also inserted into the right atrium. A 7Fr sheath was inserted into the femoral artery for retrograde ventricular access. Mapping with an ablation catheter with a nonirrigated 4-mm tip(Navistar D curve, Biosense Webster) was subsequently performed.

First, although the RVOT was mapped and revealed that the earliest local activation was 20 ms before the onset of the QRS, which

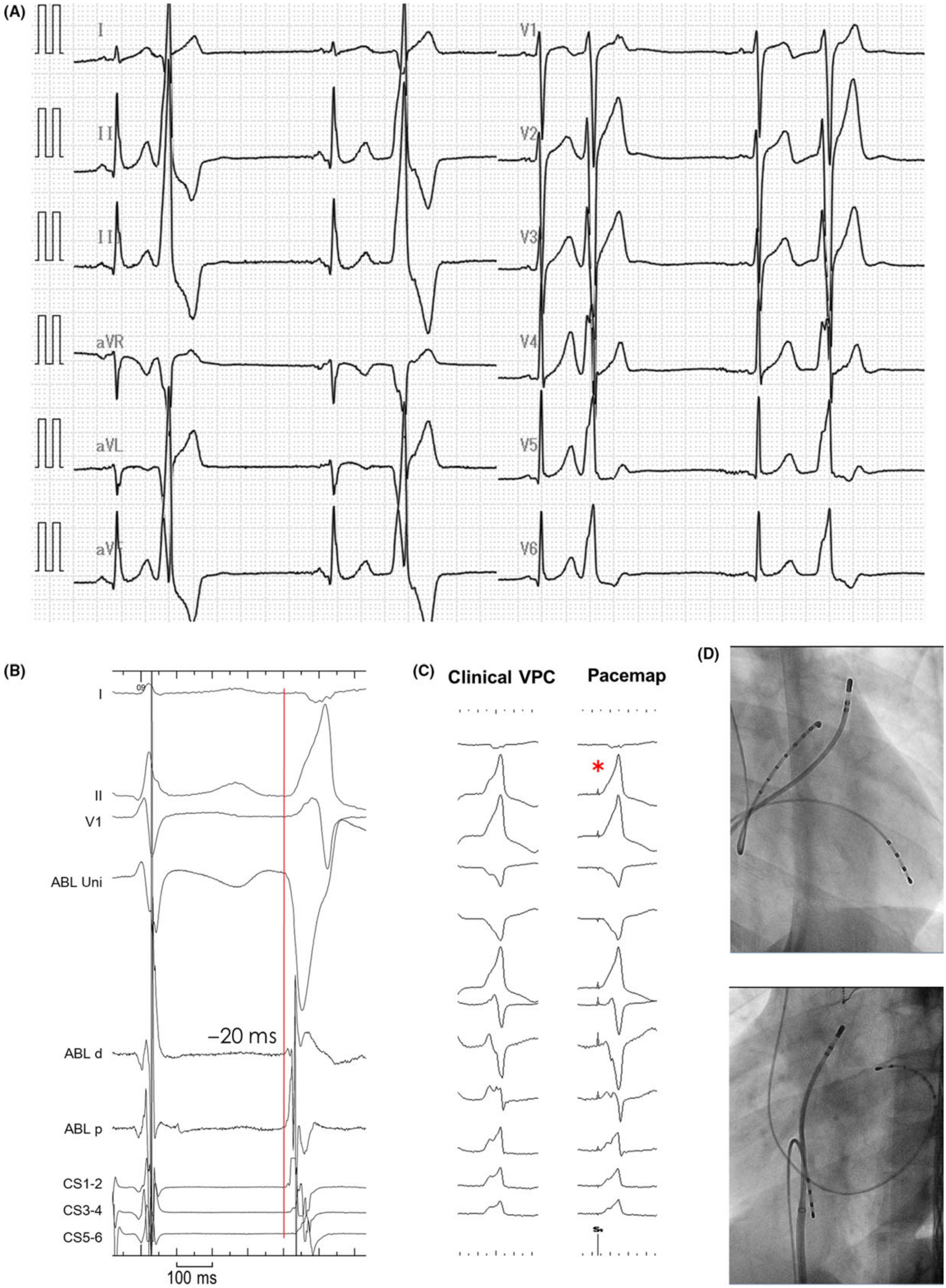

FIGURE 1 A, Clinical ventricular ectopic beats recorded on the 12-lead electrocardiogram. Sinus rhythm at 67 beats per minute and a QRS axis of +83° was frequently interrupted by ventricular ectopic beats (inferior axis, QS in lead I, aVR/aVL<1, high amplitude in the inferior leads, transitional zone at V3-V4, peak deflection index of 0.74, and relatively high r wave in lead V1, V2). B, Local potentials at the earliest site preceded the QRS by 20 ms. C, Results of the pacemapping (indicated by the red asterisk). The morphology was similar in the limb leads, but the transitional zone was totally different. D, Catheter position. The upper and lower panel indicates the RAO35° and LAO45° views, respectively

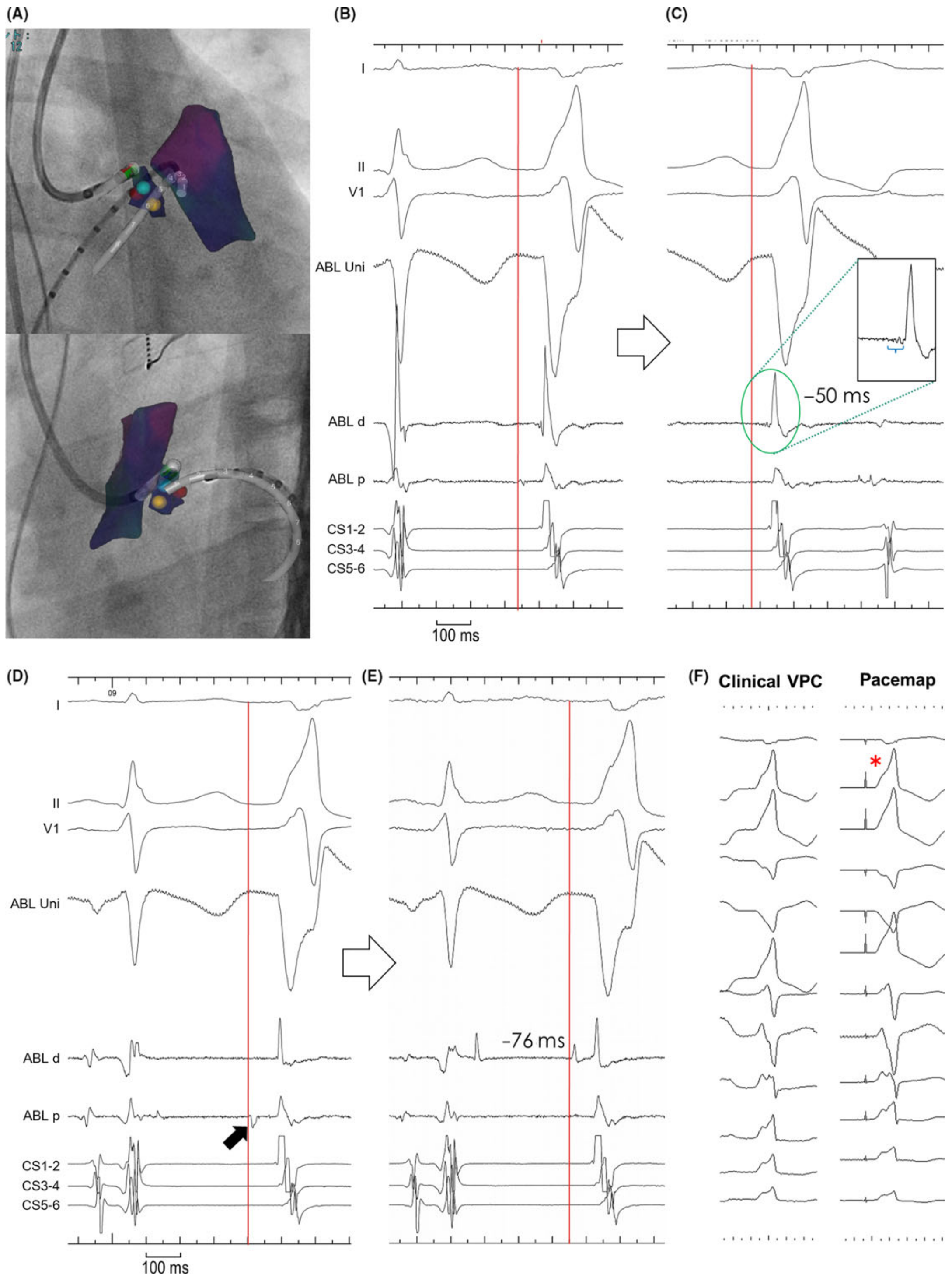

FIGURE 2 The result of the detailed mapping on the left coronary cusp. A: A CARTO3 map overlaid on a fluoroscopic image of the successful ablation site. The colored area represents a contour of part of the right ventricular outflow tract. B, The local potential at the yellow tag in (A). Mapping within the LCC was started from a portion closer to the right coronary cusp. A dull prepotential was recorded by the proximal electrodes of the ablation catheter and it preceded the QRS by 46 ms. C, The local potential at the blue tag. A slightly superior relocation of the catheter tip revealed a fractionated potential recorded at the distal tip that preceded the QRS by 50 ms. D, The local potential at the red tag. The area close to the noncoronary cusp was mapped to obtain discrete prepotentials mainly consisting of a negative component at the proximal tip. E, The local potential at the white tag. A slight relocation of the catheter tip to a superior location revealed a sharp prepotential with a positive first component recorded at the distal tip that preceded the QRS by 76 ms. These prepotentials always preceded the QRS with an isoelectric line between them. F, A perfect pacemap (12/12) indicated by the red asterisk was observed at the white tag in (A) with a stimulus-QRS interval of 70 ms

was the same as that obtained in the distal great cardiac vein(Figure 1B), the pace mapping score was poor(Figure 1C). Therefore, the LCC was examined. Figure 2A shows a map using a CARTO3 system overlaid on a fluoroscopic image of the successful ablation site. Mapping within the LCC was started from a portion closer to the right coronary cusp. At the yellow tag in Figure 2B, a dull prepotential was recorded by the proximal electrodes of the ablation catheter and it preceded the QRS by 46 ms. A slightly superior relocation of the catheter tip revealed a fractionated potential recorded by the distal tip that preceded the QRS by 50 ms at the blue tag(Figure 2C). Then, the area close to the noncoronary cusp was mapped and obtained a discrete prepotential mainly consisting of a negative component at the red tag(Figure 2D). A slightly cranial relocation of the catheter tip revealed a sharp prepotential with a positive first component recorded by the distal tip that preceded the QRS by 76 ms at the white tag (Figure 2E). Those prepotentials always preceded the QRS with an isoelectric line between them. A perfect pacemap (12/12) with a stimulus-QRS interval of 70 ms was observed at this point by 10V bipolar pacing(Figure 2F). In total, we examined 18 sites in the LCC. Radiofrequency current of up to 30W was applied on this point. We found the distance between this point and the ostium of the left coronary artery was 10 mm by angiographical evaluation. The clinical VEB was eliminated within 2.2 seconds from the start of a 90-second application and never reappeared even under the administration of isoproterenol and adenosine triphosphate. Holter monitoring was performed 1 month after the ablation and no VAs were recorded.

3 | DISCUSSION

Since Shimoike et al. reported a case in 1999[2] and Hachiya et al. reported a series of 8 cases in 2000,[3] catheter ablation on the aortic coronary cusps, especially on the LCC, has become a general therapeutic procedure for VAs arising from the LVOT. Because the LCC is attached to a part of the interventricular septum and left ventricular anterior-free wall, catheter ablation on the cusps is considered to be sufficiently effective to eliminate specific VAs arising from the epicardial/septal portion of the ventricle.

In the present case, various potentials were identifiable by dense mapping within the LCC. The fractionated continuous potential recorded at the blue tag in Figure 2C was assumed to represent conduction between the origin of the VA and the ventricular muscle.[4] Moreover, the discrete prepotential with an isoelectric line preceding the ventricular potential suggested the existence of an origin at the base of the LCC. Further mapping enabled a successful ablation at the site where the bipolar prepotential with a positive first component and the earliest activation was observed. Although each finding was previously reported,[4] it was assured that comparing the potentials altered by even a slight motion of the catheter tip is vital to determining the optimal ablation site in the LCC.

Jatene et al. reported that the circumferential length and longitudinal height of the LCC were 30 and 15 mm, respectively, in an average of 100 healthy men.[5] This fact suggests there is a significant surface area for a 4-mm tip catheter to come in contact with the myocardium, which would enable acquiring different potentials within the LCC. Although it is always important to avoid creating unnecessary lesions, minimal ablation is crucial, especially on the coronary cusps with regard to the risk of coronary artery injury or cusp perforation. In this context, detailed mapping with an ablation catheter was deemed to be critical even in small structures such as the LCC for a successful and safe ablation of OTVAs.

CONFLICT OF INTEREST

Authors declare no Conflict of Interests for this article.

ORCID

Takatsugu Kajiyama http://orcid.org/0000-0003-3990-7120

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