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CASE REPORT

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Successful catheter ablation approach above the aortic sinus cusp eliminating a ventricular arrhythmia arising from the myocardial crescent beneath the interleaflet triangle: Late gadolinium enhancement magnetic resonance imaging assessment

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Abstract

A 61-year-old female with 50 000 ventricular premature contractions and a reduced left ventricular ejection fraction of 35% was referred to our center. Although the origin was considered to originate from the junction between the left and right coronary cusp, a single radiofrequency application above the aortic sinus cusp could eliminate it. LGE-MRI was able to reveal the exact location of the single RF lesion.

KEYWORDS

interleaflet triangle, myocardial crescent, radiofrequency catheter ablation, ventricular arrhythmia

1 | INTRODUCTION

The imaging quality of late gadolinium enhancement magnetic resonance imaging (LGE-MRI) has been dramatically improved. Recently, the ablation lesion as well as preexisting myocardial fibrosis could accurately visualized. This indicated the possibility that LGE-MRI could reveal the exact location of arrhythmia origin.

2 | CASE HISTORY

A 61-year-old woman who felt slight dyspnea on effort was admitted to our center. The 24-hour electrocardiogram (ECG) showed a total of 50 000 ventricular premature contractions, and the left ventricular ejection fraction (LVEF) was reduced to 35%. Of interest, this ventricular arrhythmia (VA) had a unique electrocardiographic characteristic of a qrS pattern in at least one of leads V1-V3 and an abrupt V3 transition (Figure 1A). This indicated that the VA originated from the junction between the left and right coronary cusps.[1,2] Normally, to position the tip of the ablation catheter at this site you need to deflect the loop of the ablation catheter in the left ventricular cavity or on the non-coronary cusp, but this technique made it relatively difficult to stabilize the ablation catheter due to the limited anatomical space. The signal within the aortic cusp was significantly earlier than that within the anterior interventricular vein (AIV) and great cardiac vein (GCV; Figure 1B, lower panel). Detailed activation mapping within the aortic sinus cusps (ASCs) could demonstrate the earliest site at the middle of the right coronary cusp (RCC; Figure 1B, upper panel). Although the electrogram recorded by the ablation catheter within the middle of the RCC was sub-optimal, a single RF application above the ASCs could terminate the VA (Figure 1C). Her symptoms disappeared immediately after the procedure, and no VPCs recurred and her LVEF normalized 6 months after the procedure. To identify the extent of the radiofrequency lesion, high-resolution LGE-MRI was

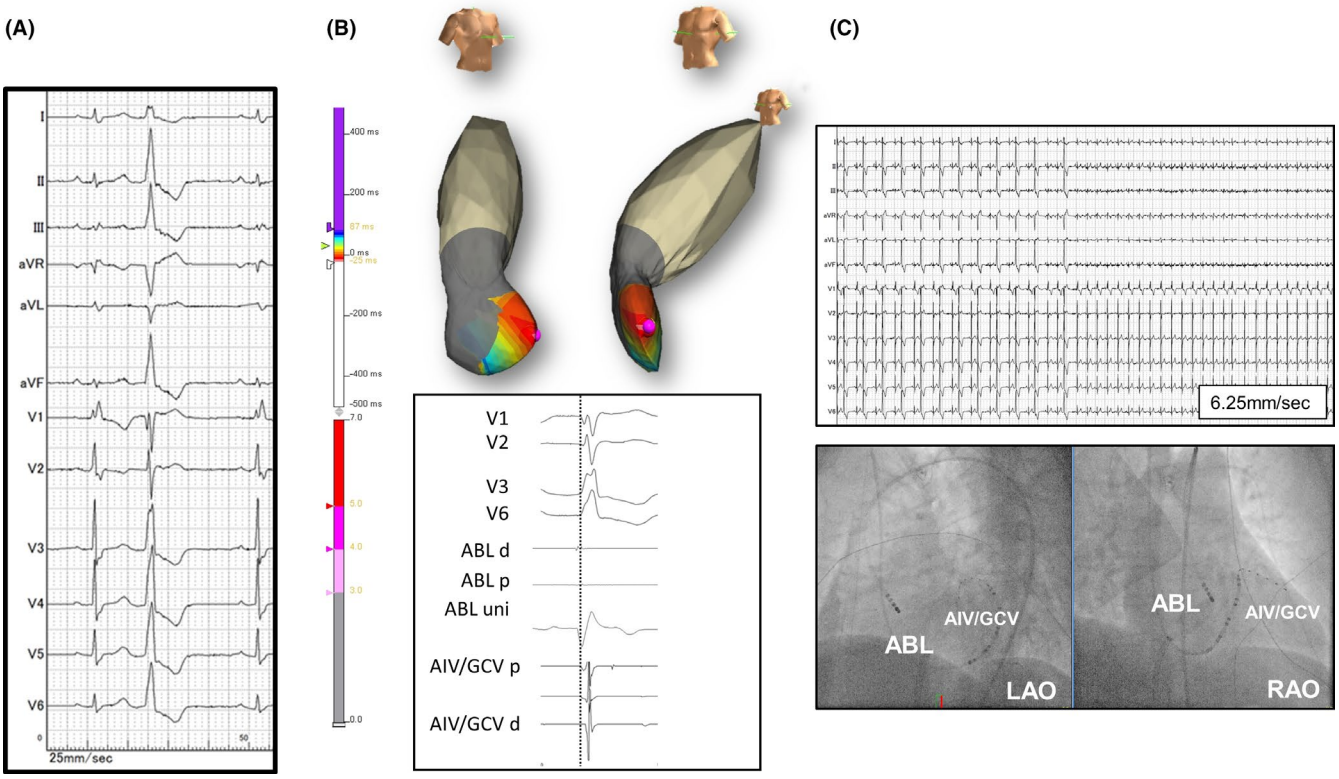

FIGURE 1 A, Twelve-lead electrocardiograms during a ventricular arrhythmia and sinus rhythm. Note the qrS pattern in V1 and abrupt R-wave transition in V3. B, An activation map of the ASC (upper panel). The local electrogram at the successful ablation site (lower panel). The tiny dull ventricular signal preceded the QRS onset by 28 ms. The earliest signal within the GCV/AIV proceeded the QRS onset by only 2 ms. C, A single RF application could eliminate the VA (upper panel). Ablation catheter position at the success site in the LAO 55° and RAO 30° views (lower panel). ABL, ablation catheter; AIV, anterior interventricular vein; GCV, great cardiac vein; LAO, left anterior oblique; RAO, right anterior oblique

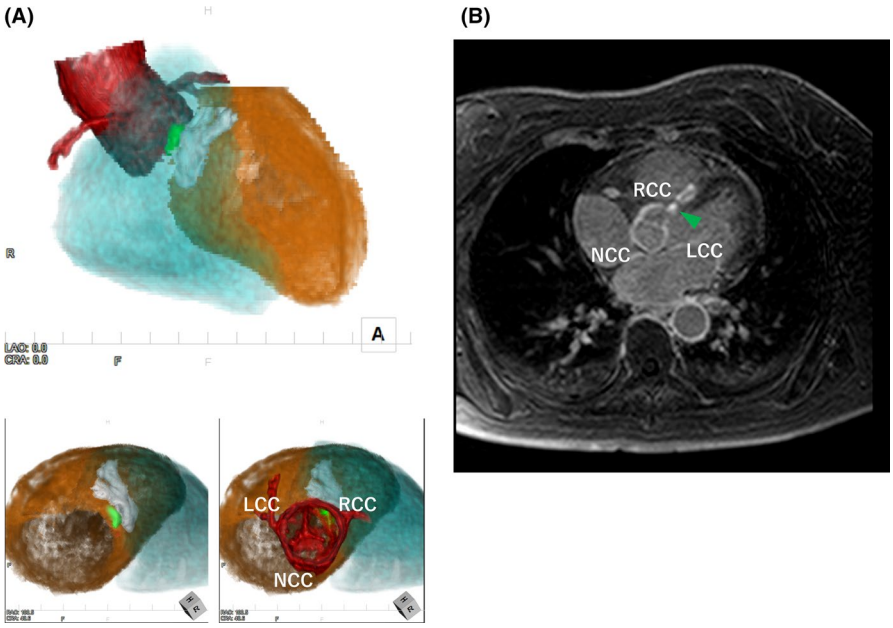

FIGURE 2 A, Three-dimensionally reconstructed Late gadolinium enhancement magnetic resonance imaging of the RV, LV, and ASC. The lower panel shows the LV ostium with and without the ASC in the cranial view. The late gadolinium enhancement area (RF lesion) is colored by light green. B, The RF lesion on the LGE-MRI. The light green arrowhead indicates the RF lesion at the myocardial crescent just beneath the ASC where the RF lesion extends from the myocardial crescent beneath the middle of the RCC to beneath the RCC-LCC junction. ASC, aortic sinus cusp; LAO, left anterior oblique; LCC, left coronary cusp; NCC, noncoronary cusp; RAO, right anterior oblique; RCC, right coronary cusp

performed 3 months after the catheter ablation. The LGE-MRI of the ASC and left ventricle was acquired using a 3D inversion recovery, respiration navigated, electrocardiogram-gated, T1-FFE sequence in the transverse plane 15 minutes after the contrast injection, as previously reported. The typical parameters were as follows: repetition time/echo time = 4.7/1.5 ms, voxel size = 1.43 × 1.43 × 2.40 mm (reconstructed to 0.63 × 0.63 × 1.20 mm), flip angle = 15°, SENSE = 1.8, and 80 reference lines. The inversion time (TI) was set at 280-320 ms using a Look-Locker scan. The LGE-MRI could excellently visualize the RF lesion and could show it extending from the myocardial crescent beneath the middle of the RCC to beneath the interleaflet triangle (Figure 2A,B). Therefore, it is better reached by an approach from below the ASC with caution to avoid damage to the thin interleaflet triangle.

3 | DISCUSSION

Idiopathic VAs from the ostium of the left ventricle could be eliminated by RF applications within the ASCs. The VAs originating from the junction between the left and right coronary cusp are rare, and their elimination requires an RF application below the aortic cusps.[3] However, we recently demonstrated by computed tomography that the LCC-RCC junction does not involve the myocardial crescents.[4] That site corresponds to the myocardium beneath the interleaflet triangle, which is located within the left ventricle.

In the current case, the local electrogram at the successful ablation site had a tiny dull ventricular potential with a low R-wave amplitude. The distal tip of the ablation catheter on fluoroscopy was located behind the coronary sinus catheter in the right anterior oblique view (Figure 1C). These findings suggested that the ablation catheter was more likely to be located close to the LCC-RCC junction within the RCC above the ASCs.[1,5] Furthermore, the LGE-MRI demonstrated a strong LGE in the ventricular myocardium beyond the RCC, the so-called myocardial crescents. Furthermore, it extended into the myocardium beneath the interleaflet triangle. In cases when accurate mapping and catheter stability are difficult beneath the ASCs, careful mapping and RF applications close to the LCC-RCC junction within the RCC above the ASCs might be an acceptable option to eliminate VAs arising from the myocardium beneath the interleaflet triangle.

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CONFLICT OF INTEREST

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AUTHOR CONTRIBUTIONS

KK: mainly wrote the manuscript. YI: contributed to the MRI and 3D visualization. HT: contributed to the MRI and 3D visualization. KF: advised the electrophysiological assessment of the VT ablation. MT: checked the imaging quality in the manuscript. K-iH: checked the discussion section in the manuscript.

ETHICS APPROVAL

The study was approved by the local ethics committee and complied with the Declaration of Helsinki (Committee of 2014.10.31., Approval No. 1663).

DATA AVAILABILITY STATEMENT

The data underlying this article will be shared upon reasonable request to the corresponding author upon approval from the Ethics Committee of the institution.

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