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Preferential conduction travelling from the left coronary cusp to the right ventricular outflow tract via the right coronary cusp of the aorta

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ABSTRACT

This report describes a case of premature ventricular contractions with the preferential pathway traveling from the left coronary cusp (LCC) to the right ventricular outflow tract (RVOT) via the right coronary cusp (RCC). The earliest activation was recorded within the LCC, while the successful ablation site was the RCC, where the second earliest prepotential was recorded. The remediable ablation site for ventricular arrhythmias (VAs) arising from the left ventricular (LV) ostium may not necessarily be the site of the earliest activation, but may be the site with the potential representing the preferential pathway.

Introduction

The ostium of the left ventricle (LV) is known to be a major source of idiopathic ventricular arrhythmias (VAs) [1–3]. When a breakout site suggested by an excellent pace map is remote from a VA origin confirmed by successful ablation, these findings may be explained by the involvement of preferential conduction over myocardial fibers [4]. Anatomical studies have revealed that there is little ventricular myocardium and much fibrotic tissue at sites closer to the LV ostium, so this unique structure may provide a substrate for preferential conduction [1–4]. However, the patterns of conduction around the LV ostium have not yet been fully elucidated.

Case presentation

A 56-year-old man was referred for catheter ablation of frequent premature ventricular contractions (PVCs). At baseline, monomorphic PVCs exhibited a left bundle branch block pattern and right inferior axis QRS morphology (Fig. 1A).

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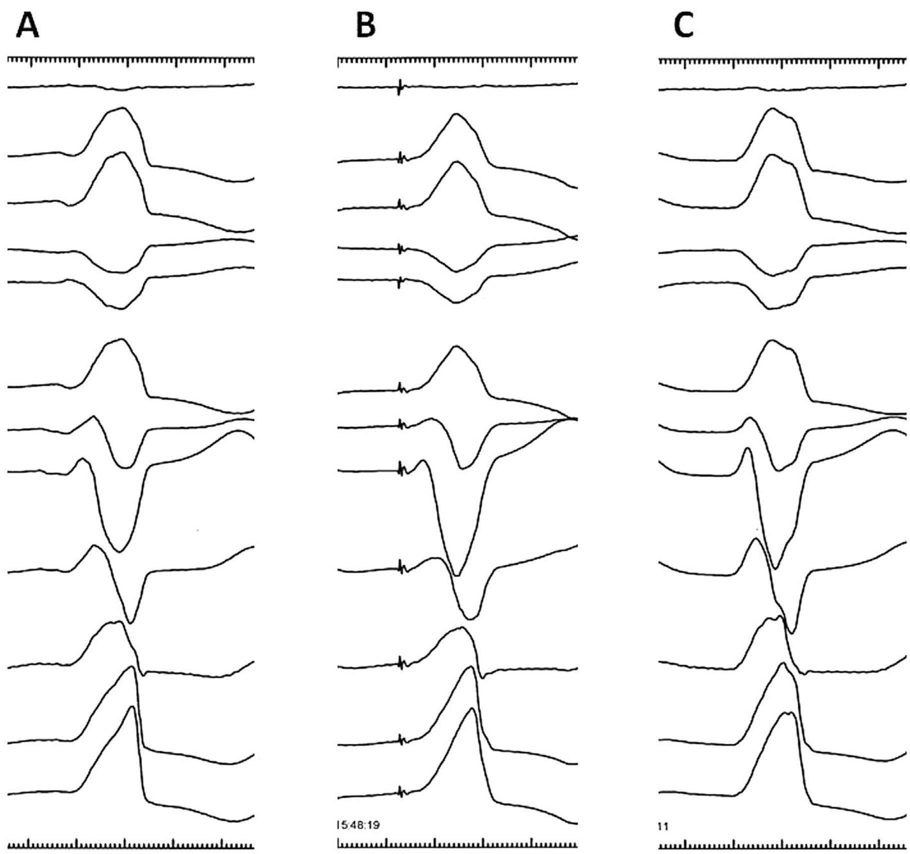

Fig. 1 – Twelve-lead electrocardiographies of the clinical PVC (A), the pace map at the RVOT (B), and the PVC slightly altered by the RF application at the RVOT (C).

Initially, activation mapping in the right ventricular outflow tract (RVOT) was performed. The earliest activation site was the posterior septum (Fig. 2A), where local ventricular activation preceded QRS onset by 12 ms, and the best pacemap was obtained (Fig. 1B). A radiofrequency (RF) application (50 W) failed to suppress PVCs but produced a slight change in the QRS morphology (Fig. 1C). Mapping in the LV ostium was then carried out. The earliest activation was recorded within the left coronary cusp (LCC) of the aorta that constantly preceded QRS onset by the same interval of 75 ms (Fig. 2B). Pacing never captured the myocardium despite using the maximum output of 9.9 V/2 ms. RF application (30 W) at the site had no effect on the PVCs or prepotentials. Subsequently, the right coronary cusp (RCC) was mapped to find the potential that preceded QRS onset by 48 ms at the anterior bottom of the RCC (Fig. 2C). Again, pacing with the maximum output did not capture the ventricle. RF application (30 W) at the site successfully eliminated PVCs. The distances between the LCC and the RVOT, the RCC and the RVOT, and the LCC and the RCC calculated with the EnSite NavX system were 32 mm, 32 mm and 14 mm, respectively (Fig. 3).

Discussion

Recent studies have suggested the presence of myocardial fibers associated with preferential conduction in the LV ostium, which travels between the site of origin and the site of breakout in the larger mass of the myocardium [3,4]. Hachiya et al. observed the discrete prepotential in the coronary cusp VA, and whenever a discrete prepotential with >50 ms activation was recorded, radiofrequency catheter ablation was successful at the site [5]. They reported that the discrete prepotential represents activation of a tract connecting the arrhythmia focus to the ventricular myocardium.

In the present case, the best pacemap was recorded at the RVOT and a slight change in the QRS morphology of PVCs occurred after RF application, which indicates that a part of the breakout existed at the RVOT. The earliest deflection, which constantly preceded QRS onset by 75 ms, was recorded within the LCC, while the second prepotential, which preceded QRS onset by 48 ms, was recorded within the RCC, where RF application successfully eliminated PVCs. These

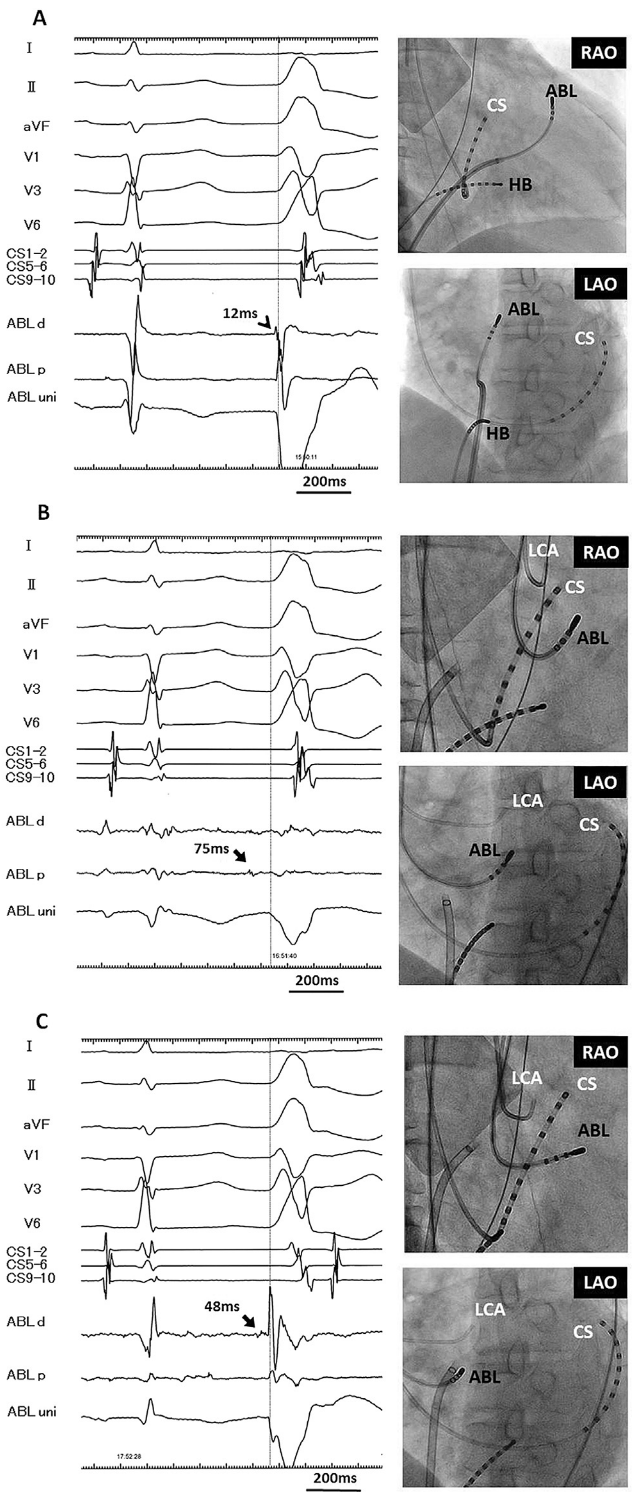

Fig. 2 – Cardiac tracings recorded during activation mapping of PVCs at the RVOT (A), LCC (B) and RCC (C). The cine images indicate the location of the mapping catheter. The arrowhead indicate the local ventricular potential proceeding the QRS onset and the arrows the prepotentials; ABL d, p (the distal and proximal electrode pairs of the mapping catheter); ABL uni (the distal unipolar electrode of the mapping catheter); CS (coronary sinus); HB (His-bundle region); LCA(left coronary artery ostium).

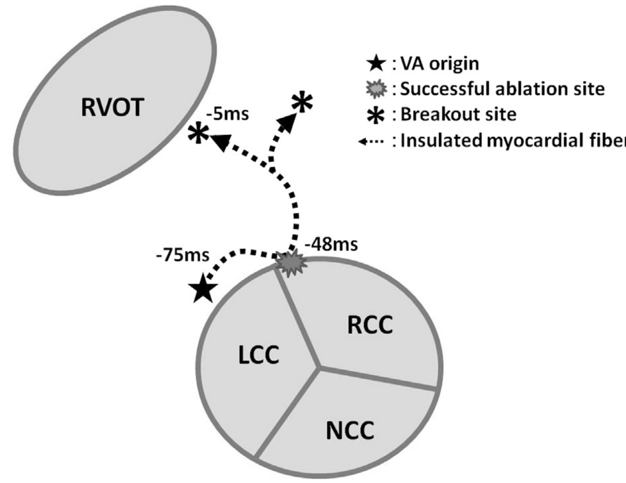

Fig. 3 – The schema of the presumed preferential pathway of the PVC. Numerals show the time by which the local earliest potential preceded the QRS onset of the PVC within the LCC, RCC and RVOT.

findings suggest that the site of origin of the PVC was most likely located at a site adjacent to the LCC but too far to ablate from the LCC. Preferential conduction ran toward the RVOT via a site close to the RCC. Catheter ablation succeeded by breaking the preferential pathway from the RCC.

In conclusion, the remediable ablation site for VAs arising from the LV ostium may not necessarily be the site of the earliest activation, but may be the site with the potential representing the preferential pathway.

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