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Case Report

Successful radiofrequency catheter ablation assisted by the CartoSound® system for outflow tract origin nonsustained ventricular tachycardia in a patient with a severely deformed thorax

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ABSTRACT

We report the case of a 72-year-old man with a nonsustained ventricular tachycardia and a history of palpitations. He had a severely deformed thorax since childhood due to spinal caries. An integrated computed tomography image of the outflow tract region from the CartoSound® system revealed the detailed anatomical information around the origin of the tachycardia and that the left anterior descending coronary artery was very close (< 10 mm) to the target site. We carefully ablated that site with a 3.5-mm cooled-tip catheter while confirming it in the sound view, and succeeded without any complications.

1. Introduction

The origin of a nonsustained ventricular tachycardia (NSVT) can usually be estimated with the 12-lead electrocardiogram (ECG) [1–3]; however, anatomical abnormalities sometimes make it difficult to confirm the origin. We report a case in which we confirmed the accurate origin and an adjacent anatomical obstacle, and safely ablated the target by using the CartoSound® system (Biosense Webster, Diamond Bar, CA, USA) in a patient with a severely deformed thorax.

2. Case report

A 72-year-old man was referred to our institute for radiofrequency catheter ablation therapy of an NSVT. His main complaints were palpitations and occasional dyspnea on exertion. His thorax was severely deformed by spinal caries since childhood (Fig. 1). The 12-lead ECG revealed an NSVT with an inferior axis and left bundle branch block (LBBB) morphology (Fig. 2). The transitional zone of the first QRS complex of the NSVT and isolated ventricular premature contractions (VPCs) shifted from V2–V3 to V3–V4. Such a finding might suggest not only a right ventricular outflow tract (RVOT) but also a left ventricular outflow tract (LVOT) origin. However, we could not determine the accurate origin by using only the 12-lead ECG because of his thoracic deformity. Therefore, first we explored the RVOT region, especially the septal region, using the CartoSound® system. We could easily obtain a perfect pace map in the anterior attachment area (Fig. 3). When higher-output pacing was delivered, a perfect pace map was obtained. This suggested that the VT origin could be a slightly remote or epicardial site and the alteration in the VT morphology was due to a change in the VT exit through a preferential pathway. Therefore, we decided to use an irrigation catheter for the ablation. An integrated computed tomography (CT) image of the outflow tract region obtained with the CartoSound® system provided detailed anatomical information and revealed that the left anterior descending coronary artery (LAD) was very close (< 10 mm) to the target site (Fig. 3). We carefully ablated that site with a 3.5-mm cooled-tip catheter (maximum 30 W) while confirming it in the sound view, and succeeded without any complications.

3. Discussion

We reported the case of an NSVT with an unusual morphological alteration and its successful ablation with the aid of the CartoSound® system.

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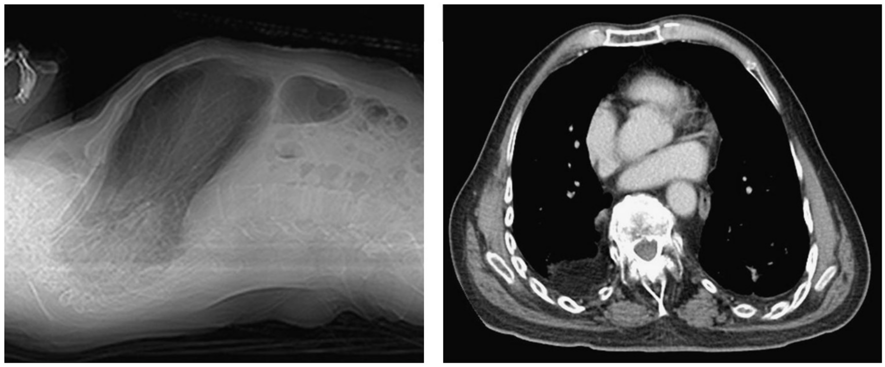

Fig. 1. Chest X-ray and computed tomography images showing a severely deformed thorax due to spinal caries.

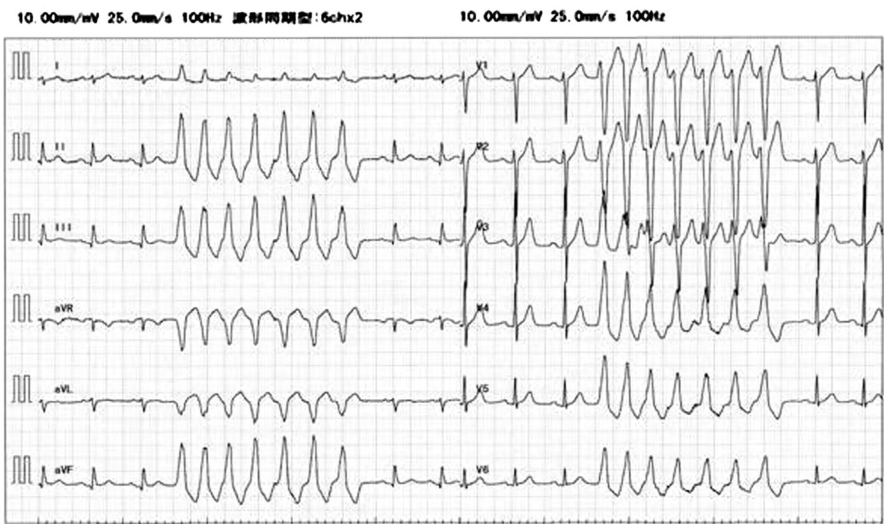

Fig. 2. Twelve-lead electrocardiogram of the nonsustained ventricular tachycardia (NSVT) in the patient. The NSVT had an inferior axis and left bundle branch block morphology. However, the transitional zone shifted from V2–V3 in the first QRS complex of the NSVT to V3–V4 during the NSVT. The QS amplitude of aVR > aVL suggested an origin in the posterolateral attachment of the right ventricular outflow tract, and the prominent R wave in V1 suggested an origin in the posterolateral attachment or in the left ventricular outflow tract.

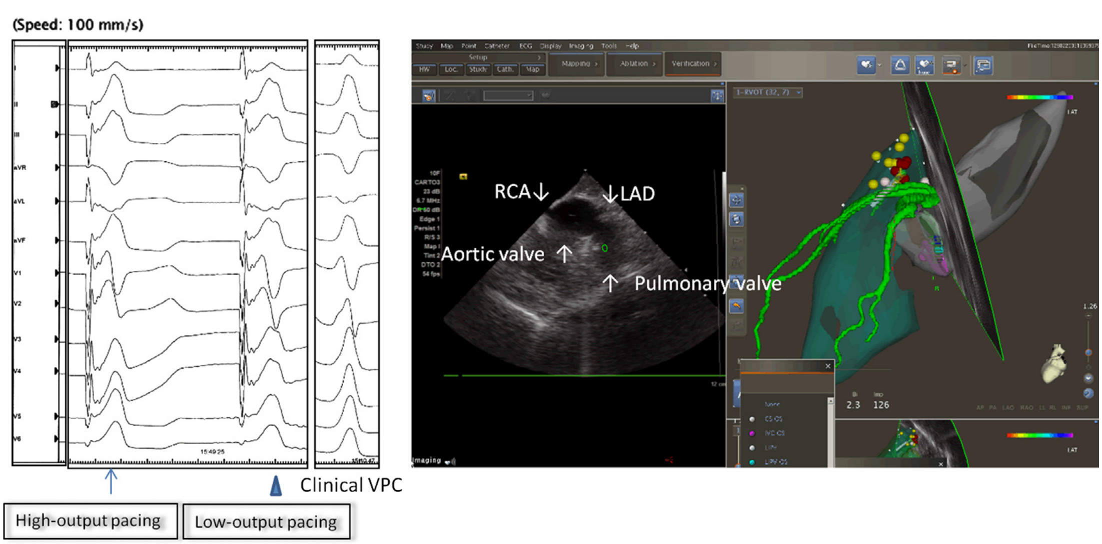

Fig. 3. Left: Pace mapping at the anterior attachment of the right ventricular outflow tract (RVOT). We could easily obtain a perfect pace map in this area (arrow) with high-output pacing. During pacing with a lower power output, a notch in II, III, and aVF was observed (arrowhead). Right: CartoSound® image. On the left is an ultrasound image obtained with the SoundStar® catheter, and on the right is the merged computed tomography image. The ultrasonic fan shows the real-time intracardiac echo catheter image of the right ventricular outflow tract and coronary arteries. The green circle in the ultrasound image indicates the ablation catheter. The red dots show the ablation points and the yellow dots are the pace map points. VPC, ventricular premature contraction; RCA, right coronary artery; LAD, left anterior descending coronary artery.

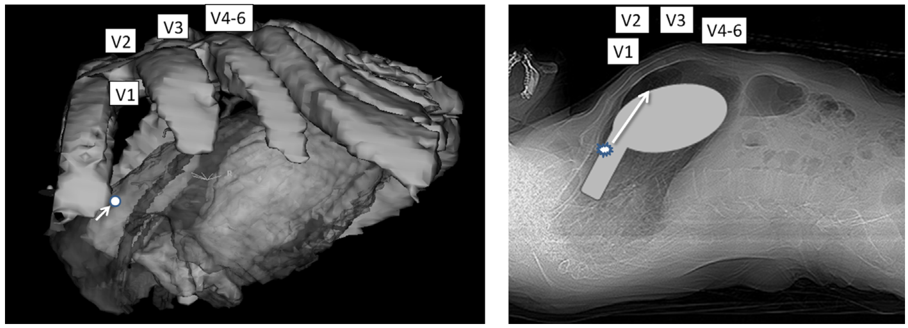

Fig. 4. Left: The merged computed tomography image combined with the ribs of the patient with the assistance of the CartoSound® system helped in easily identifying that the right ventricular outflow tract (RVOT) is directed backward in comparison with an ordinal case. The dot is the successful ablation point. Right: The schema of the RVOT in the patient. The star indicates the origin of the ventricular tachycardia/ventricular premature contractions (VT/VPCs), and the arrow shows the direction of the VT/VPCs. The RVOT is directed backward because of the patient's severely deformed thorax, and the origin of the VT/VPCs at the anterior attachment of the RVOT moves in the direction of V1 in the 12-lead ECG; thus, the R wave in V1 is prominent.

In the 12-lead ECG, the NSVT had an inferior axis and LBBB morphology, and the transitional zone of the first QRS complex of the NSVT shifted from V2–V3 to V3–V4. Using the classic algorithm, we speculated the origin of the VT/VPCs to be from the RVOT with multiple exits from the septal wall slightly to the free wall side of the right ventricle [1,2]. The QS amplitude of aVR > aVL suggested an origin in the posterolateral attachment of the RVOT, and the prominent R wave in V1 suggested an origin in the posterolateral attachment or in the LVOT (Fig. 2). Further, the VT/VPCs could have possibly broken out through the side of the LVOT because the V2 transition ratio was 1.4 (> 0.6) [3].

However, in this case, the real origin was at the anterior attachment of the RVOT. The reason for such a paradoxical finding might be associated with the patient's RVOT deviation due to his severely deformed thorax (Fig. 4). Furthermore, the origin might have been located epicardially with a preferential pathway, which may have made it difficult to detect the accurate origin by using only surface ECG.

When higher-output pacing was delivered, a perfect pace map was obtained. Therefore, the origin was speculated to be remote from the pacing site, such as an epicardial site or a site covering a broad area. Namely, the alteration in the VT morphology might be due to a change in the exit through a preferential pathway from the origin. Therefore, we decided to use an irrigation catheter to create an adequate ablation lesion.

However, in this case, the LAD was very close (< 10 mm) to the ablation target site. For a safe ablation, it is reported that the distance from the ablation catheter tip to both the left and right coronary ostia should always be at least 10 mm [4,5]. Further, not only in the case of LVOT ablation but also with RVOT ablation, the distance between the RVOT ablation target site and LAD could be short [6]. Therefore, by being able to visualize the coronary artery with the CartoSound® system, we were able to assure the safety of the procedure during the radiofrequency application.

If the patient's coronary artery is very close to the ablation target site, or if the origin of the VT/VPCs cannot be estimated by only the 12-lead ECG, for example, because of a severely deformed thorax or an alteration in the morphology of the VT, the CartoSound® system can be a useful tool for assisting the catheter ablation procedure, understanding the precise anatomical relation, and managing safe energy deliveries even with an irrigated-tip catheter [7,8].

Conflict of interest

All authors have no conflicts of interest to declare.

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