Successful catheter ablation of ventricular premature complexes from the right atrial side of the atrioventricular septum with good contact force

Marina Arai MD1 | Seiji Fukamizu MD, PhD1 | Iwanari Kawamura MD1 | Satoshi Miyazawa MD1 | Rintaro Hojo MD1 | Harumizu Sakurada MD, PhD2 | Masayasu Hiraoka MD, PhD3

1Department of Cardiology, Tokyo Metropolitan Hiroo Hospital, Shibuya-ku, Tokyo, Japan
2Tokyo Metropolitan Health and Medical Treatment Corporation, Ohkubo Hospital, Shinjuku-ku, Tokyo, Japan
3Department of Cardiovascular Diseases, Tokyo Medical and Dental University, Bunkyo, Tokyo, Japan

Correspondence
Marina Arai, Department of Cardiology, Tokyo Metropolitan Hiroo Hospital, Shibuya-ku, Tokyo, Japan. Email: marina7arai@yahoo.co.jp

Abstract
The acquisition of good contact force for radiofrequency catheter ablation of ventricular premature complexes (VPCs) originating from the basal septum of the left ventricle (LV) is often difficult. We describe a case of VPCs originating from the basal septum of the LV, which were successfully eliminated by applying radiofrequency at the right atrium (RA) side of the atrioventricular septum (AVS) without causing any significant impairment of atrioventricular conduction because the ablation catheter could obtain better contact force through the RA approach. Moreover, intracardiac echocardiography (ICE) and RA angiography effectively demonstrated the AVS.

Keywords
atrioventricular septum, contact force, intracardiac echocardiography, right atrium angiography, ventricular premature complex

1 | INTRODUCTION

It has been reported that radiofrequency catheter ablation (RFCA) is ineffective for ventricular premature complexes (VPCs) originating from the basal septum of the ventricle. One of the reasons behind this is the close proximity of ablation site to the His-bundle recording site. Previous studies have demonstrated the characteristics of electrocardiogram1 as well as the usefulness of left bundle branch mapping2 and appearance of junctional rhythm (JR) during the application of radiofrequency (RF)3 in avoiding atrioventricular block. Another explanation is the technical difficulty in stabilizing the catheter position. We experienced a case with VPCs that were successfully eliminated by applying RF at the right atrium (RA) side of the atrioventricular septum (AVS) without causing any significant impairment to the atrioventricular conduction, because the ablation catheter could obtain better contact force from the RA side than from the left ventricle (LV), with support of intracardiac echocardiography (ICE) and the RA angiography which are effective in representing the AVS.

2 | CASE REPORT

A 46-year-old man with a past history of old inferior myocardial infarction underwent a 24-h 12-lead Holter electrocardiography (ECG) as a regular medical checkup for his cardiac function. His records demonstrated VPCs of 30 000 beats per day, and the dominant VPCs showed left bundle branch block morphology with a superior axis, positive lead I, and a precordial R-wave transition between V1 and V2 (Figure 1A). His chest X-ray revealed an increased cardiac silhouette.
with a cardiothoracic ratio of 61% and pulmonary congestion. Echocardiography demonstrated decreased LV ejection fraction (LVEF) of 40% with hypokinesis of the inferior wall.

Electrophysiological analysis and RFCA targeting the VPCs were performed using a 3-dimensional electro-anatomical mapping system (CARTO UNIVU; Biosense-Webster, Diamond Bar, CA, USA). We first performed pace-mapping in the RV using an ablation catheter (ThermoCool; Biosense-Webster) (Figure 1B). A good pace-map (PASO 0.894) was achieved at the basal septum of the RV, but no prepotential preceding the surface QRS was recorded. Further, we approached the LV using an ablation catheter inserted into the LV by trans-septal approach and a Pentaray catheter (Biosense-Webster) by trans-aortic approach (Figure 1C). A perfect pace-map (PASO 0.978) was achieved at the basal septum of the LV with a prepotential preceding the surface QRS at 45 ms using the Pentaray catheter. RF energy (40°C, 30W) was applied at this site, which resulted in reduced numbers of the targeted VPCs without complete elimination.

Further, we examined ICE (Sound Star; Biosense-Webster) together with the RA angiography (Figure 2A), which demonstrated that the perfect pace-mapping site was located on the LV side of the AVS (Figure 2B). Owing to unsuccessful ablation using the LV approach with trans-septal and trans-aortic, the search for ablation site was changed to the RA. The ablation catheter in the RA recorded a prepotential preceding the surface QRS at 26 ms, and QS pattern was recorded by unipolar lead of the ablation catheter during the VPCs. Moreover, the ablation catheter recorded both of the A and V waves, in which A/V ratio was 0.31 during the sinus beats (Figure 2C). The better contact force was obtained on the RA side, 22 g, than that at the LV side, 4 g. After tagging the His-bundle potential by the ablation catheter, the RF energy was applied to this site on the RA side of the AVS (40°C, 30W). With appearance of JR at a cycle length of 600 ms during RFCA (Figure 2D), the targeted VPCs were completely eliminated without causing atrioventricular block.

One year and 10 months after the session, he underwent a 24-h Holter ECG and echocardiography again. The Holter ECG-demonstrated VPCs were decreased to 5900 beats per day, and the echocardiography-demonstrated LVEF was improved to 45%.

### DISCUSSION

The AVS contains a narrow area that separates the RA and the LV, as the levels of the tricuspid annulus (TA) and the mitral annulus (MA) are not exactly on the same plane. While we achieved a perfect pace-map together with a prepotential preceding the surface QRS by 45 ms in the LV, the prepotential at the opposite side of the AVS in the RA preceded by only 26 ms. This apparent conflict could be explained by the fact that the prepotential in the LV was recorded by the Pentaray catheter, which achieved smaller potentials. We considered because the focus of the targeted VPCs was in the deep layer at the LV side in the AVS, the ablation catheter obtained better contact force by approaching from the RA side rather than the LV side, or because of RFCA from the LV side, the exit would transfer a little to the RA side. In fact, the morphology of the targeted VPCs seemed a little changed after RFCA from the LV side.

Sasaki et al. reported that JR was observed in RFCA for ventricular arrhythmia originating from the basal septum of the RV, because the ablation site in the RV was located close to the His-bundle recording site. Therefore, appearance of JR might be regarded as a safety sign unless its cycle length was <500 ms with three successive beats. In our case, JR was also observed during application of RF energy from the RA side, which is reasonable as the AV node is located in the AVS. The cycle length was 750 ms, and hence, AV conduction disturbance did not develop in the present case. In addition, we recorded the His-bundle potential by the ablation catheter before RF energy application for the safety.
4 | CONCLUSION

We present a rare case of VPCs originating from the AVS, which were eliminated by RFCA on the RA side of the AVS without causing AV block. The RA-sided approach to the AVS under ICE visualization is effective for RFCA of VPCs originating from the LV basal septum, because the ablation catheter can obtain better contact force from the RA side rather than the LV side.

ACKNOWLEDGEMENTS

The authors would like to thank the all members of the Department of Cardiology, Tokyo Metropolitan Hiroo Hospital.

CONFLICTS OF INTERESTS

Authors declare no conflict of interests for this article.

ORCID

Marina Arai  http://orcid.org/0000-0002-7557-1727
Iwanari Kawamura  http://orcid.org/0000-0002-6431-9278

REFERENCES

1. Yamauchi Y, Aonuma K, Takahashi A, et al. Electrocardiographic Characteristics of repetitive monomorphic right ventricular tachycardia originating near the His-bundle. J Cardiovasc Electrophysiol. 2005; 16:1041–8.
2. Pathak KR, Betensky PB, Santangeli P, Dixit S. Distinct electrocardiographic form of idiopathic ventricular arrhythmia originating from the left bundle branch. J Cardiovasc Electrophysiol. 2017; 28:115–9.
3. Sasaki K, Sasaki S, Kimura M, et al. Catheter ablation of ventricular arrhythmias arising from the basal septum of the right ventricle: characteristics and significance of junctional rhythm appearing during ablation. J Interv Card Electrophysiol. 2016;45:159–67.

How to cite this article: Arai M, Fukamizu S, Kawamura I, et al. Successful catheter ablation of ventricular premature complexes from the right atrial side of the atroventricular septum with good contact force. J Arrhythmia. 2018;34:201–203. https://doi.org/10.1002/joa3.12038