

CASE REPORT

A case of accessory pathway between the coronary sinus musculature and the left ventricle

Sou Takenaka MD¹  | Jun Suzuki MD² | Akihiko Ueno MD¹ | Takashi Uchiyama MD¹

¹Department of Cardiovascular Medicine, Toda Chuo General Hospital, Toda, Japan

²Department of Cardiology, Matsumoto Kyoritsu Hospital, Matsumoto, Japan

Correspondence

Sou Takenaka, Department of Cardiovascular Medicine, Toda Chuo General Hospital, Toda, Japan.
Email: soutakenaka@yahoo.co.jp

Abstract

A 64-year-old female underwent catheter ablation of long R-P' tachycardia. Ventricular pacing exhibited retrograde conduction with an identical atrial activation sequence as during tachycardia because of an accessory pathway (AP) with a long VA conduction. A radiofrequency application within the posterior coronary sinus (CS) could achieve a change of activation pattern from distal-to-proximal to proximal-to-distal within CS proximal to the ablation site, caused by conduction block of CS musculature (CSM) at the proximal site. This phenomenon could explain that this AP was connected between the CSM and the left ventricle, in site far away from the discrete connection between the left atrium and CSM.

KEYWORDS

ablation, accessory pathway, coronary sinus musculature

1 | INTRODUCTION

Sun et al hypothesized that some accessory pathways (APs) use the coronary sinus (CS) musculature as the intermediary between the atria and ventricles.¹ We report a case that clearly demonstrates a persistent left superior vena cava (PLSVC) case with AP via CS musculature in a patient with concealed Wolff-Parkinson-White syndrome.

2 | CASE REPORT

A 64-year-old female was suffering from palpitation for 6 years. The 12-lead electrocardiogram revealed with long R-P' supraventricular tachycardia (Figure 1A). She had undergone previous unsuccessful catheter ablation procedure, performed at another institute, and mapping only above and underneath the mitral annulus.

Electrophysiological (EP) study was performed with a decapolar catheter positioned into the CS and the His bundle region, and quadripolar catheters at the high atrium and the right ventricle (RV).

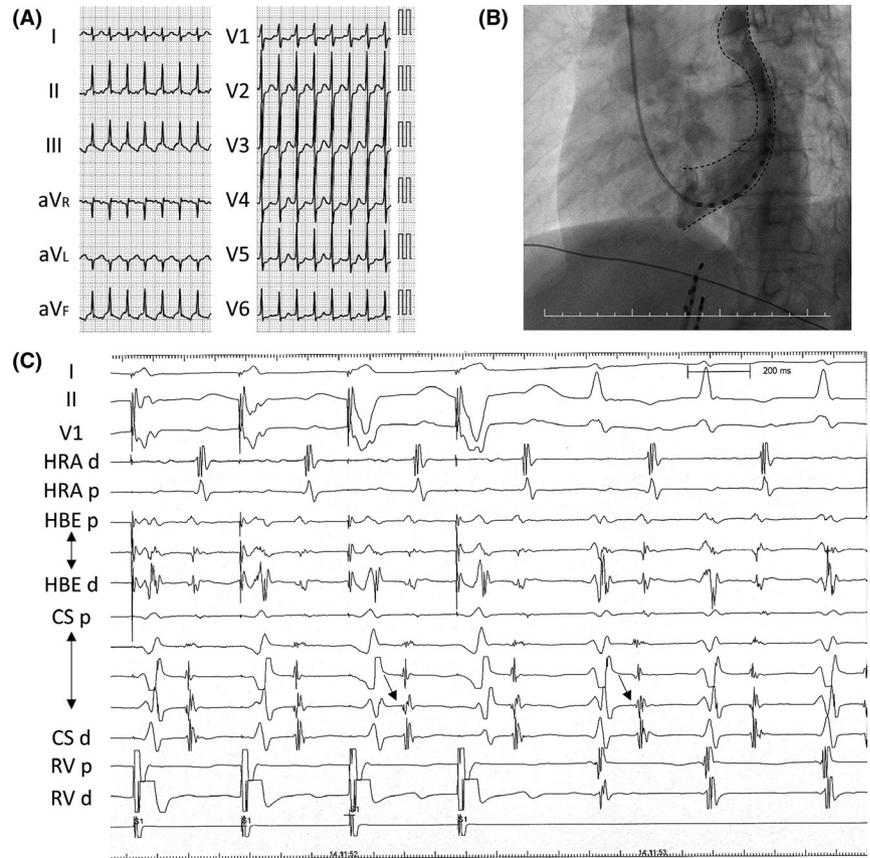
CS angiography revealed that her CS was enlarged and merged with PLSVC (Figure 1B). During RV pacing and atrioventricular re-entrant tachycardia, the earliest site of retrograde conduction was identified at the posterior mitral annulus with a long ventriculo-atrium (VA) of 160 milliseconds (Figure 1C). Her tachycardia was diagnosed as an orthodromic atrioventricular reentrant tachycardia via the left-posterior AP.

Radiofrequency delivery above and underneath the mitral annulus by a transaortic approach could not obtain the elimination of the left-posterior AP conduction. We delivered application energy in the CS. Thus, the activation sequence of the CS proximal to the ablation site changed from distal-to-proximal to proximal-to-distal during application, caused by the conduction block of CS musculature at the proximal site (Figure 2A-C). Three-dimensional mapping in the CS (Figure 2D,E) revealed that the excitation of right ventricular pacing propagated from the AP to CS musculature, then spread distally along CS musculature, and into the left atrium (LA) through the combination of CS musculature and the LA. A portion of this excitation transmitted into the LA spread along the mitral annulus to the atrial septum, and

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2019 The Authors. *Journal of Arrhythmia* published by John Wiley & Sons Australia, Ltd on behalf of the Japanese Heart Rhythm Society.

FIGURE 1 A, Twelve-lead electrocardiogram during the patient's tachycardia. Tachycardia cycle length = 350 milliseconds. B, Coronary sinus angiography. The patient's coronary sinus (dot lines) was expanding and merged with the persistent left superior vena cava. C, Surface and intracardiac electrograms during the ventricular pacing and the tachycardia. Induction of supraventricular tachycardia by single ventricular burst pacing with an interval of 380 milliseconds. The earliest site of retrograde conduction (arrow) was identified at the posterior mitral annulus with a long VA of 160 milliseconds. HRA, high right atrium; HBE, His bundle region; CS, coronary sinus; RV, right ventricle



from the atrial septum into the coronary sinus (Figure 2C). This phenomenon could explain that the AP was connected directly to CS musculature in site far away from the discrete connection between the LA and CS musculature.

Three-dimensional mapping in the CS could also indicate the junction of the AP and the CS musculature (Figure 2D,E). An additional radiofrequency application within posterior CS could eliminate the conduction of this AP (Figure 2F-H). Thereafter, the clinical tachycardia could never be induced with atrial or ventricular program stimuli.

3 | DISCUSSION

Several reports previously suggested that some posteroseptal and left-posterior APs could result from connections between a cuff of coronary sinus musculature and the ventricle.^{1,2} To the best of our knowledge, this is the first report that has clarified and visualized the connection between the CS musculature and the left ventricle in a patient with PLSVC.

An epicardial oblique atrioventricular AP has a long course, so the VA conduction becomes longer.^{2,3} Note, in this case, the excitation from the AP extended in both directions in the mitral annulus initially (Figure 1C). After the radiofrequency application within the CS, the excitation changed in one direction distally to the coronary sinus, and the activation sequence at the proximal side of the CS changed

from distal-to-proximal to proximal-to-distal (Figure 2A). This result provided that the conduction of CS musculature was blocked, and the present AP was conducting through the CS musculature, distinguishing accurately between a CS musculature associated AP and an epicardial oblique atrioventricular AP.

In this case, the patient's CS was enlarged and merged with the persistent left superior vena cava (Figure 1B). Because of the dilated CS, CS musculature was extensively observed, and detailed mapping into CS could be done.

Three-dimensional mapping in the CS after the CM musculature conduction block (Figure 2D,E) showed that the excitation of CS musculature seemed to have propagated into LA. However, we did not perform LA endocardial mapping. The following possibility remains that this special propagation pattern was caused by longitudinal dissociation in coronary sinus musculature.

In this case, there was a long interval between ventricular and CS musculature potential even in the ablation catheter (Figure 2A). Sun et al¹ described that there were some difficulties to identify CS extension of small cardiac veins. We could not find any CS diverticulum and small cardiac veins (Figure 1A) at the ablation site. Therefore, this AP did not include the CS extension of CS diverticulum and small veins.

The CS musculature is a cardiac structure that plays an important role in the electrical connection between the right and left atria.⁴ The CS musculature is usually connected to the LA at multiple sites.⁵ In this case, the CS musculature and LA was connected only

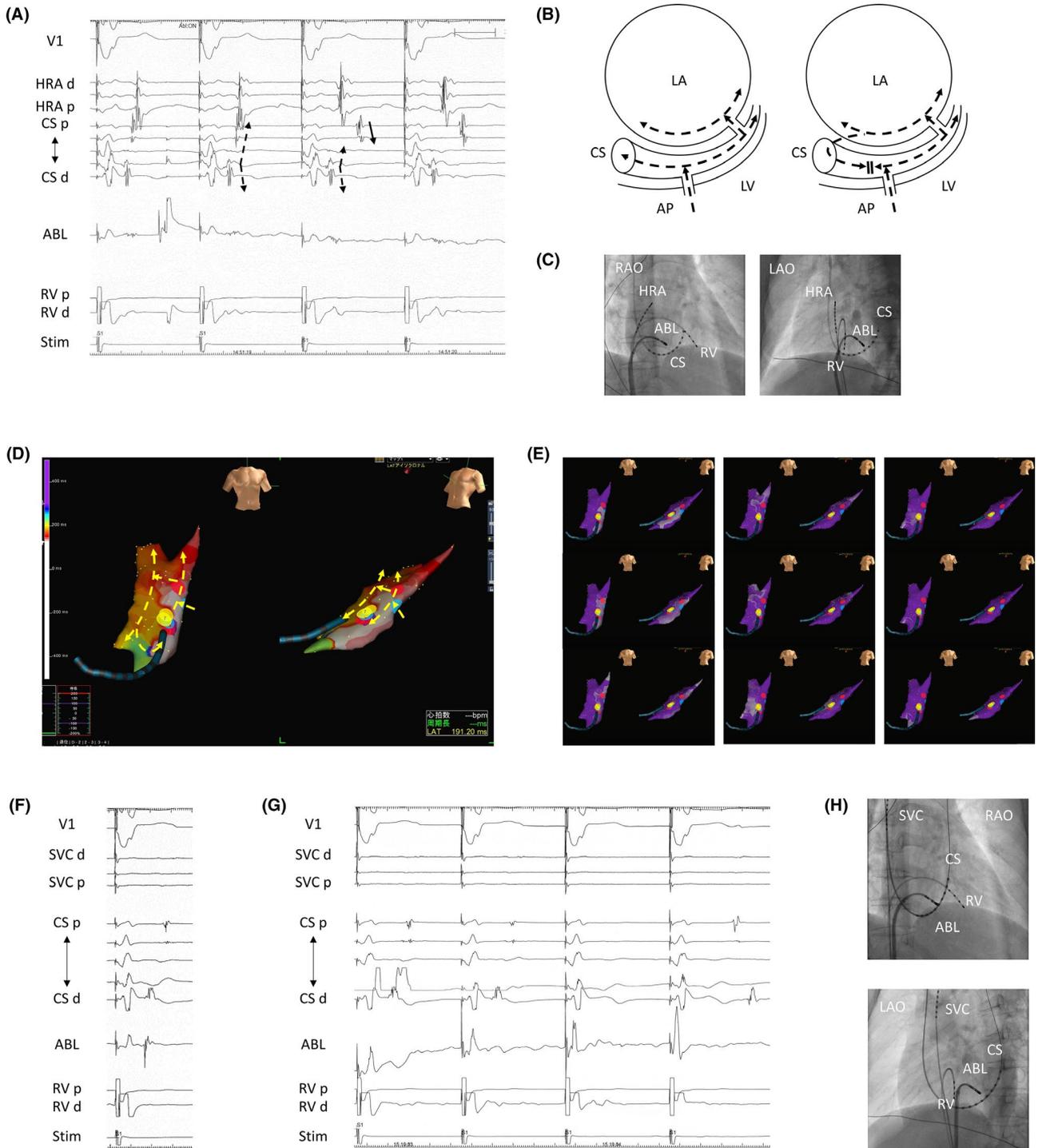


FIGURE 2 A, Surface and intracardiac electrograms during ventricular pacing in the 1st and 2nd cycles before the CS musculature block, the activation sequence of the CS proximal to the ablation site was distal-to-proximal (dot arrow). In the 3rd and 4th cycles after the CS musculature block, the sequence changed to proximal-to-distal (solid arrow). B, Schematic representation of the retrograde AP conduction pattern in this case. The AP connected the LV with the LA via the CSM. Left panel was before, right panel was after the CS musculature block. The course of the retrograde AP conduction is shown (dot arrow). The double lines (right panel) indicate the conduction block by ablation. C, The tip of the ablation catheter (ABL1-2) was located near CS4-5 along the posterior mitral annulus within the CS. D, The activation mapping of the CS after the CS musculature block. The course of the retrograde AP conduction is shown (yellow dot arrow). The yellow tag is the point of CS musculature block. The red circle tag is the successful point of this accessory pathway. E, The propagation mapping of the CS after the CS musculature block. F, The local potential at the success site. The local ventriculo-atrial conduction time was 80 milliseconds. G, Surface and intracardiac electrograms during the application of energy on the success site. In the 3rd and 4th cycles, ventriculo-atrial conduction disappeared. H, The angiogram of the success site. HRA, high right atrium; CS, coronary sinus; RV, right ventricle; LA, left atrium; LV, left ventricle; AP, accessory pathway; RAO, right anterior oblique; LAO, left anterior oblique

at one site (Figure 2C-E). Therefore, we could certify such a unique conduction between a CS musculature and an accessory pathway.

CONFLICT OF INTEREST

Authors declare no conflict of interests for this article.

ORCID

Sou Takenaka  <https://orcid.org/0000-0002-5867-2091>

REFERENCES

1. Sun Y, Arruda M, Otomo K, Beckman K, Nakagawa H, Calame J, et al. Coronary sinus-ventricular accessory connections producing posteroseptal and left posterior accessory pathway. Incidence and electrophysiological identification. *Circulation*. 2002;106:1362–7.
2. Nakamura K, Naito S, Kaseno K, Oshima S. Antegrade and retrograde decremental conduction properties of an accessory

pathway associated with the coronary sinus musculature. *Indian Pacing Electrophysiol J*. 2015;15:55–61.

3. Takenaka S, Yeh SJ, Wen MS, Yeh K-H, Wang C-C, Lin F-C, et al. Characteristics and radiofrequency ablation in posteroseptal and left free-wall subepicardial accessory pathways. *J Electrocardiol*. 2005;38:69–76.
4. Antz M, Otomo K, Arruda M, Scherlag BJ, Pitha J, Tondo C, et al. Electrical conduction between the right atrium and the left atrium via the musculature of the coronary sinus. *Circulation*. 1998;98:1790–5.
5. Akiyama M, Kaneko Y, Taniguchi Y, Nakajima T, Manita M, Ito T, et al. Coronary sinus recordings of double potentials associated with retrograde conduction through left atrioventricular accessory pathways. *J Cardiovasc Electrophysiol*. 2004;15:1371–6.

How to cite this article: Takenaka S, Suzuki J, Ueno A, Uchiyama T. A case of accessory pathway between the coronary sinus musculature and the left ventricle. *J Arrhythmia*. 2019;35:748–751. <https://doi.org/10.1002/joa3.12235>