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The usefulness of ventricular pacing during atrial fibrillation ablation in a persistent left superior vena cava: A case report

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ABSTRACT

A 69-year-old woman with palpitations was referred to our hospital for a second session of atrial fibrillation (AF) catheter ablation. She had a history of AF ablation including pulmonary vein (PV) isolation and persistent left superior vena cava (PLSVC) isolation. Electrophysiologic studies showed the veno-atrial connections that had recovered. After PV isolation was performed, AF was induced by atrial premature contraction (APC) from the PLSVC, and AF storm occurred. During PLSVC isolation, AF was not induced by APC from the PLSVC. PLSVC isolation continued during sinus rhythm. The elimination of the PLSVC potential was difficult to confirm because of the far-field potential of the left ventricle. Then, we performed right ventricular pacing. The remaining PLSVC potential was identified. After that, the PLSVC isolation was successful during right ventricular pacing. Complications were not observed. The patient had no recurrence of AF thereafter.

1. Introduction

In the embryonic developmental process, pacemaker cells with myocardial sheath extension and catecholamine sensitivity are present in the persistent left superior vena cava (PLSVC), which is thought to be the foundation of atrial fibrillation (AF) [1]. Some reports showed that a PLSVC is important in the non-pulmonary vein foci of AF [1]. While PLSVC ablation was reported to be safe and effective, the best therapeutic strategy, such as ablation point and far-field potential, has not been determined [1,2]. Here, we report a case in which right ventricular pacing was useful during AF ablation of the PLSVC.

2. Case

A 69-year-old woman with palpitations was referred to our hospital for a second session of AF catheter ablation. She had a history of AF ablation including pulmonary vein (PV) isolation and PLSVC isolation. No significant abnormalities were noted on physical examination or 12-lead electrocardiogram. Echocardiography demonstrated normal cardiac function. Propofol combined with dexmedetomidine by drip infusion was used for sedation. A circular mapping catheter (Libero, Japan Lifeline Co. Ltd., Tokyo, Japan) was placed in the PV and PLSVC above the LA roof level. Electrophysiologic studies showed the veno-atrial connections that had recovered (Fig. 1). We recognized a non-PV trigger originating from the PLSVC. Using an open irrigated contact force catheter (ThermoCoolSmartTouchSF, Biosense Webster, Diamond Bar, CA, USA) with electroanatomical mapping system (CARTO 3 system, Biosense Webster, Diamond Bar, CA, USA), ablation was performed. After PV isolation (Fig. 2), AF was induced by atrial premature contraction (APC) from the PLSVC (Fig. 3a), and AF storm occurred. The earliest activation site of APC was recorded by the circular catheter located above the LA roof level. The earliest activation site preceded the P-wave onset by 182 msec (Fig. 3a). During PLSVC isolation, AF was not induced by APC from the PLSVC (Fig. 3b). PLSVC isolation continued during sinus rhythm. The elimination of the PLSVC potential was difficult to confirm because of the far-field potential of the left ventricle (Fig. 4a). Then, we performed right ventricular pacing. The remaining PLSVC potential was identified (Fig. 4b). After that, PLSVC isolation was successful during right ventricular pacing (20–25W, 10–15g) (Fig. 5). Dormant conduction was not

Abbreviations: Atrial fibrillation, (AF); Pulmonary vein, (PV); Persistent left superior vena cava, (PLSVC); Atrial premature contraction, (APC); Left atrial appendage, (LAA); Left ventricle, (LV).

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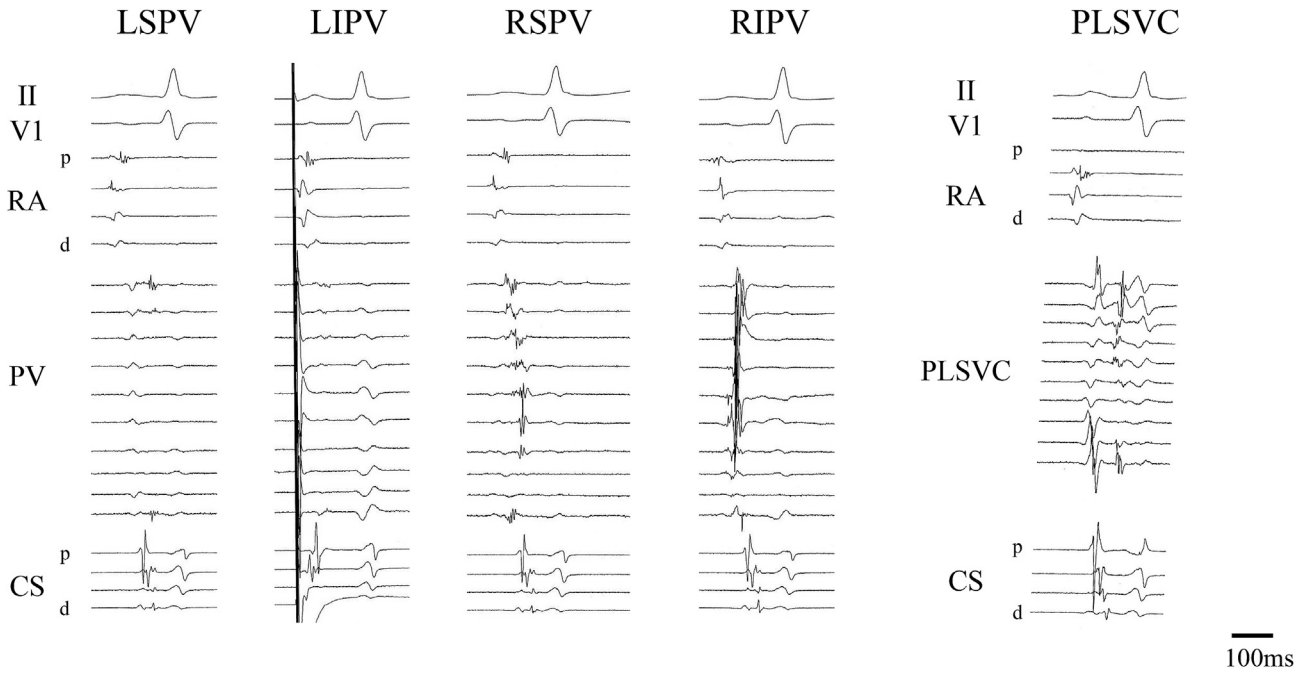

Fig. 1. Reconnection of the pulmonary vein and persistent left superior vena cava potential. PV: pulmonary vein, PLSVC: persistent left superior vena cava.

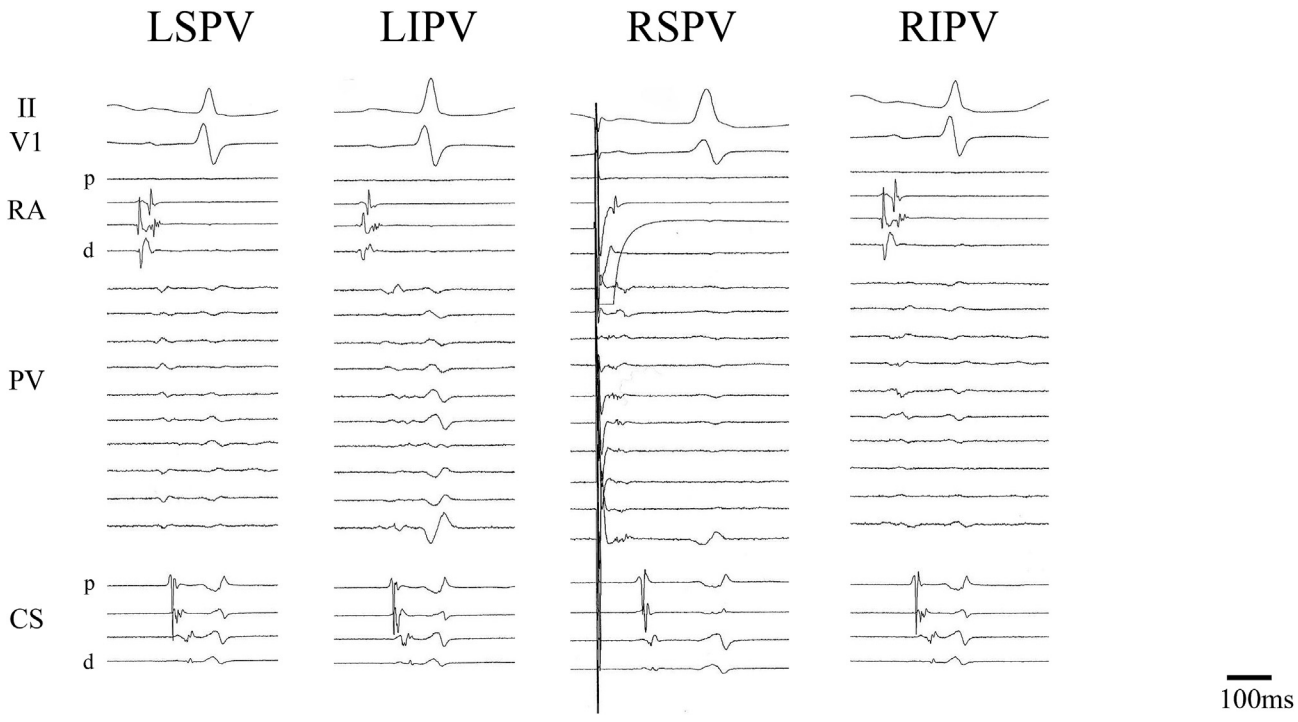

Fig. 2. Elimination of the pulmonary vein potential after isolation PV: pulmonary vein.

observed with isoproterenol infusion (3.3μg/min) and adenosine triphosphate (ATP 15mg) injection. Complications were not observed. The patient had no recurrence of AF thereafter.

3. Discussion

To the best of our knowledge, this is the first report of PLSVC isolation during right ventricular pacing. Pacing from the left atrial appendage (LAA) and PLSVC has been previously performed [1]. Wissner E et al. reported that the procedural success rate of AF ablation in patients with PLSVC was low [2]. We think that it is important to distinguish the PLSVC potential with LAA and left ventricle (LV) potentials.

The PLSVC crosses the posterolateral LA between the LAA and

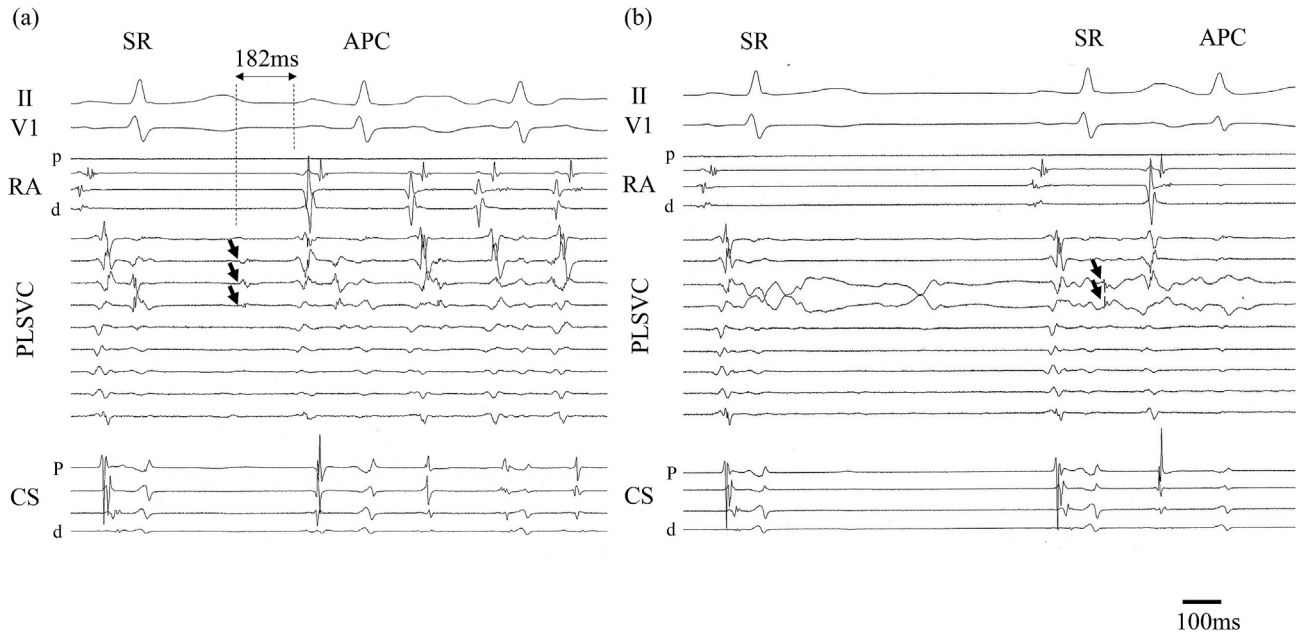

Fig. 3. (a) Atrial fibrillation induction by atrial premature contraction from the persistent left superior vena cava. The earliest activation site preceded the P-wave onset by 182 msec. (b) No induction of atrial fibrillation by atrial premature contraction from the persistent left superior vena cava. AF: atrial fibrillation, APC: atrial premature contraction, PLSVC: persistent left superior vena cava.

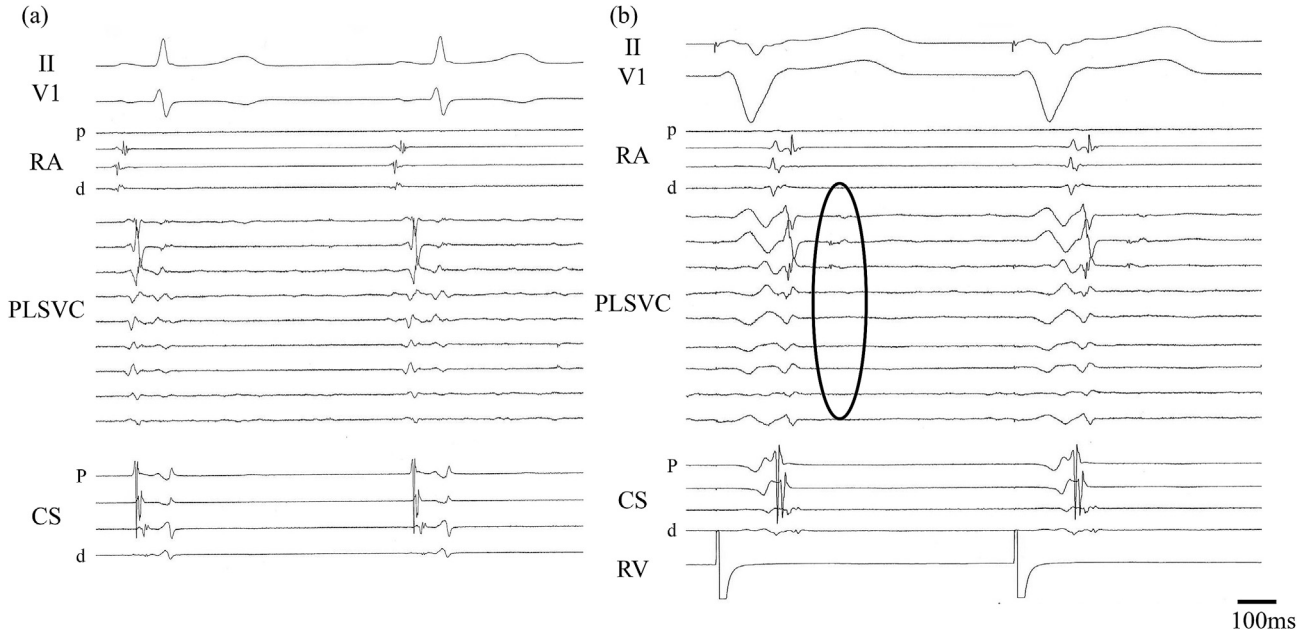

Fig. 4. (a) An uncertain persistent left superior vena cava potential because of left ventricle far-field potential. (b) Residual persistent left superior vena cava potential revealed by ventricular pacing. PLSVC: persistent left superior vena cava, LAA: left atrial appendage, LV: left ventricle.

the left PVs, and is directly connected to the mid-coronary sinus [3]. We think that the PLSVC potential is influenced by the far-field potential of the LV because it is anatomically closer to the LV than the PV.

In the current case, robust electric isolation was required due to recurrent AF. However, elimination of the PLSVC potential was difficult to confirm because of the far-field potential of the LV. As mentioned above, the remaining PLSVC potential was confirmed by performing right ventricular pacing. PLSVC isolation was successful during right ventricular pacing in this case. On the other hand, left SVC ablation may lead to left phrenic nerve paralysis, and pacing at high output (output 10 V, pulse width 1 msec) was useful to detect the proximity to the phrenic nerve in our case.

The therapeutic strategy of PLSVC isolation has not been established up to now. Hsu et al. showed that PLSVC isolation blocked the connections of LA-PLSVC and CS-PLSVC [1]. Although

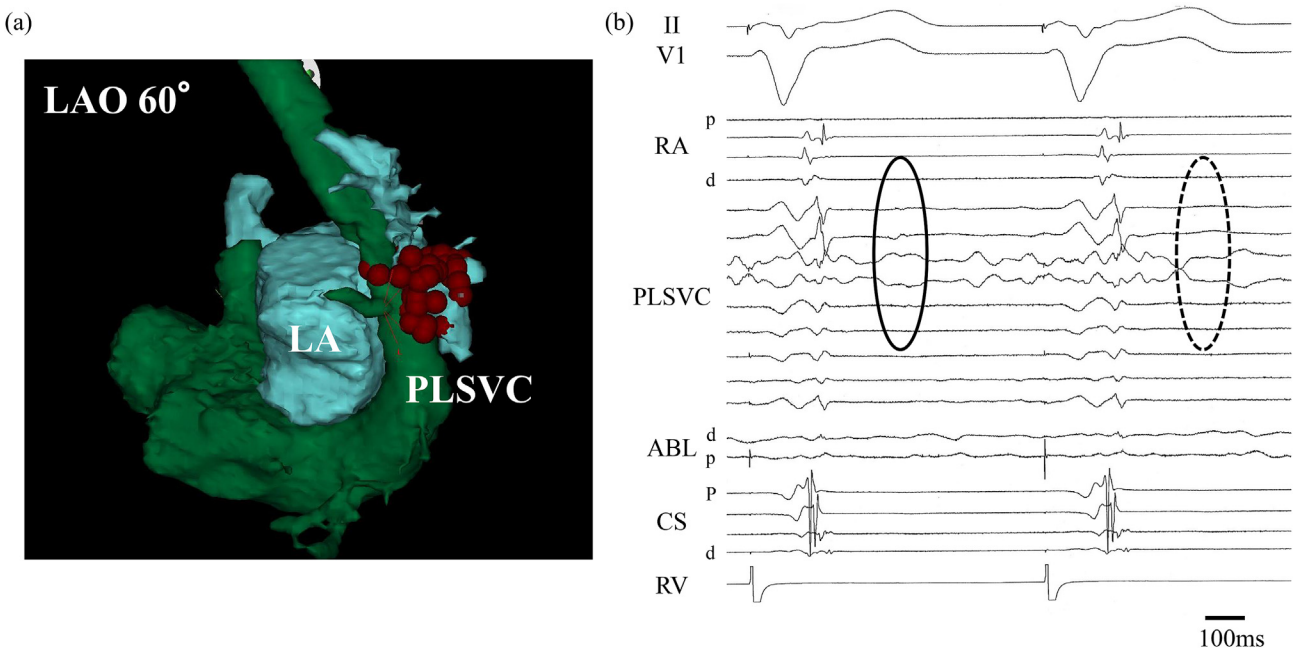

Fig. 5. (a) Persistent left superior vena cava ablation points. Red tags: ablation points. (b) Successful persistent left superior vena cava isolation during ventricular pacing.

we did not examine these connections in this case because we selected circular ablation as our strategy, the end point was the elimination of all PLSVC potentials. Goya et al. showed that superior vena cava (SVC) isolation could be achieved by point ablation targeting the breakthrough point of the extension from the atrial muscle into the SVC [4]. Tsutsui et al. showed that AF originating from proximal and distal PLSVC was observed [5]. The success of our case was achieved by circumferential isolation of the PLSVC at a level higher than the LA roof. The technique of PLSVC ablation might warrant further investigation, as only small studies are currently available [1,2,4,5].

Conflicts of interest

None.

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