

Simultaneous re-isolation of the left pulmonary veins and termination of peri-mitral flutter with only an ethanol infusion in the vein of Marshall: killing two birds with one stone

Kazuyasu Yoshitani^{1*}, Kazuto Kujira¹, and Kaoru Okishige²

¹Department of Cardiovascular Medicine, Hyogo Prefectural Amagasaki Hospital, 1-1-1 Higashidaimotsu, Amagasaki, Hyogo 660-0828, Japan and ²Heart Center, Yokohama-city Bay Red Cross Hospital, Yokohama, Japan

* Corresponding author. Tel: +81 6 6482 1521; fax: +81 6 6482 7430, E-mail: kazuyasu.y@gmail.com

A 65-year-old male patient had a recurrent peri-mitral atrial tachycardia (AT) after a previous ablation of atrial fibrillation and peri-mitral AT. An ethanol infusion in the vein of Marshall led to the re-isolation of the reconnected left pulmonary veins, termination of the peri-mitral AT, and achievement of bidirectional conduction block of the mitral isthmus.

Case report

A 65-year-old male patient was admitted for ablation of a recurrent atrial tachycardia (AT) after a previous ablation of persistent atrial fibrillation (AF) that consisted of a bilateral pulmonary vein (PV) isolation, electrogram-based ablation, and linear ablation at the mitral isthmus (MI) and cavotricuspid isthmus (CTI). During the index procedure, the AF converted to a peri-mitral AT with an electrogram-based ablation

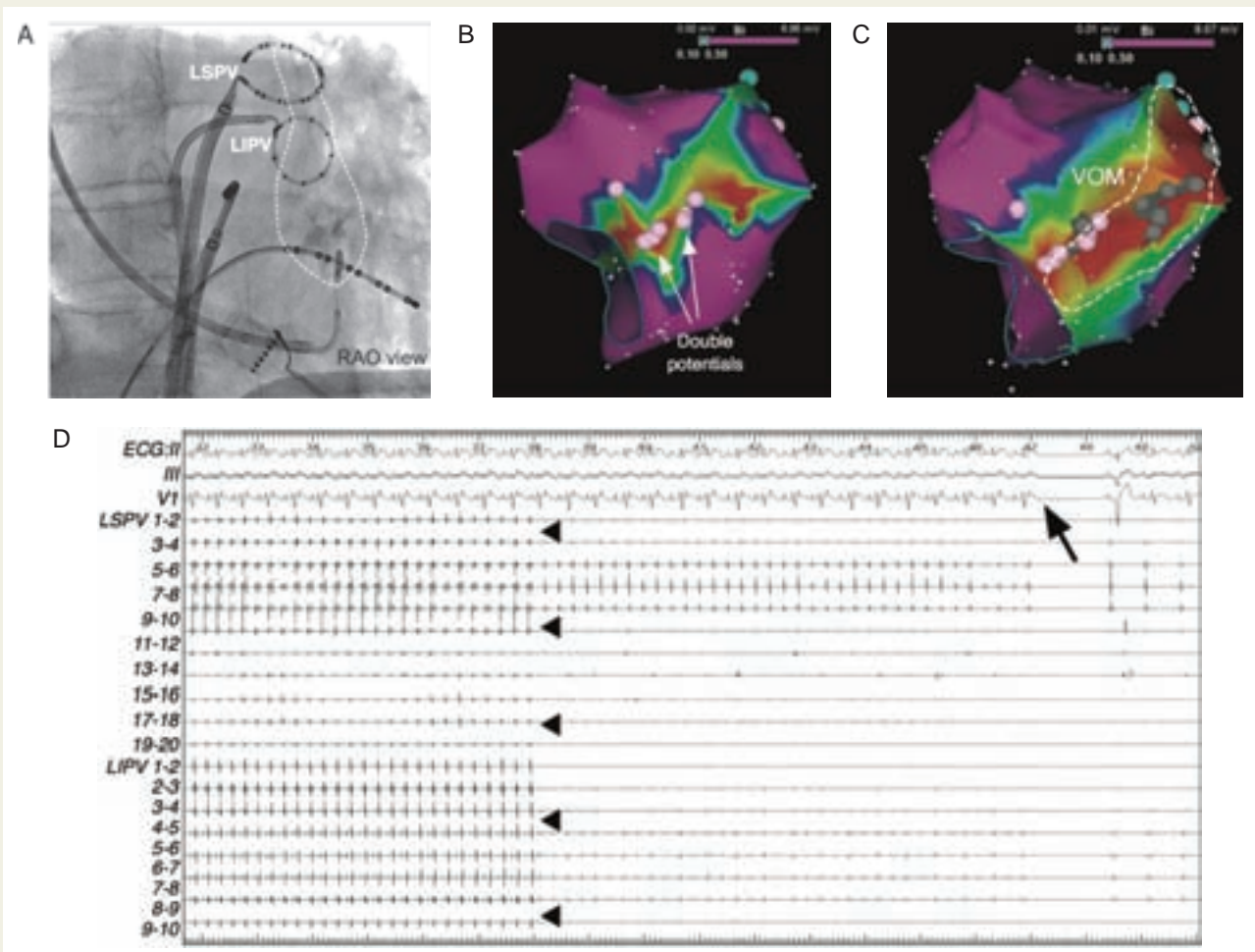


Figure 1 Ethanol infusion in the VOM. (A) Right anterior oblique (RAO) angiographic view of a selective VOM venogram (white dotted line). (B and C) Three-dimensional bipolar voltage maps of the left atrium before (B) and after (C) the VOM ethanol infusion. The low voltage area in the MI region became larger after the VOM ethanol infusion. (D) Termination of the peri-mitral AT. During the VOM ethanol infusion, the left upper and lower PVs were isolated simultaneously (arrow heads). The AT terminated 9 s later (arrow). LSPV, left superior pulmonary vein. LIPV, left inferior pulmonary vein.

on the left atrial inferior wall, and sinus rhythm was restored by an MI ablation. A bilateral PV isolation and bidirectional block of the CTI were confirmed at the end of the procedure. However, bidirectional block of the MI could not be achieved in spite of a meticulous endocardial radiofrequency (RF) ablation as well as from inside the coronary sinus.

The patient, who had a recurrence of AT 3 months after the index procedure, consented to an ethanol infusion into the vein of Marshall (VOM) as an adjunctive procedure to RF ablation. In the second procedure, a recurrent peri-mitral AT was confirmed by activation mapping and entrainment mapping. Reconnection of the left PVs was also confirmed using double circular diagnostic catheters. Then a VOM ethanol infusion was performed as previously described.¹ Briefly, a subselector catheter was inserted into the VOM through a long sheath. An angioplasty balloon was advanced as distally as possible over an angioplasty wire inserted into the VOM. While the balloon was inflated, an injection of 100% ethanol (1.5 cc over 90 s) was administered through the balloon lumen into the VOM. (Figure 1A) The left PVs were isolated 30 s after the beginning of the infusion, and AT was terminated 9 s after the PV isolation (Figure 1D). Two additional bonus injections of ethanol were administered into more proximal portions of the VOM, following which bidirectional conduction block of the MI was confirmed with a differential pacing technique. Finally, a voltage map revealed a larger low-voltage zone in the MI region than before the infusion (Figure 1B and C). There were no complications, and the patient became free from any type of atrial tachyarrhythmia without any antiarrhythmic drugs after a 1-year follow-up.

Discussion

The problem in this case was how to treat the intractable peri-mitral AT as well as the reconnection of the left PVs. The ridge between the left PVs and the left atrial appendage might have been too thick to ablate transmurally with only RF ablation. That hypothesis was based on two observations. First, the 3D map showed wide-split double potentials in the ventricular MI region, which indicated that the ridge was the critical isthmus of the AT.² Secondly, the left PVs were reconnected presumably due to an incomplete RF lesion at the anterior aspect of the left PVs.³ In that situation, it would not have ensured success if another RF ablation were attempted. The ethanol infusion in the VOM, located on the epicardial side of the ridge, successfully ablated the epicardial MI myocardium, Marshall bundle, and PV muscle fibres where the RF energy could not reach.

Conflict of interest: none declared.

References

1. Báez-Escudero JL, Morales PF, Dave AS, Sasaridis CM, Kim YH, Okishige K *et al*. Ethanol infusion in the vein of Marshall facilitates mitral isthmus ablation. *Heart Rhythm* 2012;**9**: 1207–1215.
2. Takatsuki S, Fukumoto K, Igawa O, Kimura T, Nishiyama N, Aizawa Y *et al*. Ridge-related reentry: a variant of perimitral atrial tachycardia. *J Cardiovasc Electrophysiol* 2013;**24**: 781–787.
3. Makita Y, Nakano Y, Oda N, Suenari K, Sairaku A, Kajihara K *et al*. Use of preprocedural multidetector computed tomography to decrease atrial fibrillation recurrence following extensive encircling circumferential pulmonary vein isolation. *J Cardiol* 2012;**60**:236–241.