IMAGE

A case of pseudo-endocardial gap during mitral flutter: Pitfalls of the auto-annotation algorithm on the ultra-high-resolution mapping system

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We herein report a 53-year-old man with atrial tachycardia (AT) recurrence after atrial fibrillation ablation. In the initial procedure, pulmonary vein isolation for atrial fibrillation and a mitral isthmus (MI) line for the intraprocedural mitral flutter were successfully performed. In the second procedure for recurrent AT, an endocardial activation map with an ultra-high-resolution mapping system (Rhythmia™; Boston Scientific, Marlborough, MA) showed clockwise mitral flutter (cycle length [CL]: 240 ms) via epicardial fiber with a breakout site 11 mm posterior from the previous MI line that simultaneously demonstrated a residual endocardial gap near the left inferior PV (Supplemental Movie). A hexapolar 1.6F catheter (EP Skinny; FMD Co, Ltd, Tokyo, Japan) advanced into the vein of Marshall (VOM) to assess the epicardial potentials clearly showed sharp epicardial potentials at the opposite site of the endocardial gap on the MI line with tiny and dull potentials (Figure 1A). The activation map of endocardial and epicardial mapping satisfied the entire AT CL, and the postpacing intervals during entrainment pacing at the septal and inferior region along the mitral annulus and the VOM were equal to AT CL, but they were much longer than AT CL at the great cardiac vein (Figure 2). These findings indicated a diagnosis of mitral flutter via VOM and the residual endocardial MI gap was considered to be bystander. After accidental AT termination by catheter stimulation, we targeted the epi-endo breakout sites along the ridge during pacing from the proximal coronary sinus, and MI was successfully established without any radiofrequency application to the previous MI line (Figure 1B). This case demonstrated a pseudo-endocardial gap at the previous MI line using the auto-annotation algorithm of the ultra-high-resolution mapping system; however, these signals were in fact far-field potentials of the epicardial signals. It is important to correctly interpret the activation

KEY TEACHING POINTS

- Although the ultra-high-resolution mapping system (Rhythmia; Boston Scientific, Marlborough, MA) is useful to identify the detailed mechanisms of complex atrial tachycardia, there is a limitation for the detection of the epicardial conduction.
- A micro-mapping catheter (1.6F) can help make a diagnosis of mitral flutter via epicardial connection along the vein of Marshall (VOM) that occurs after mitral isthmus (MI) linear ablation.
- It is important to correctly interpret the activation map when using an auto-annotation algorithm of an ultra-high-resolution mapping system. Differentiation between local near- and far-field potentials around the MI region can sometimes be difficult owing to the presence of epicardial connection along the VOM. We need to incorporate multiple techniques and identify epicardial structures for accurate diagnosis.

KEYWORDS Catheter ablation; Ultra-high-resolution mapping; Vein of Marshall; Mitral flutter; Auto-annotation
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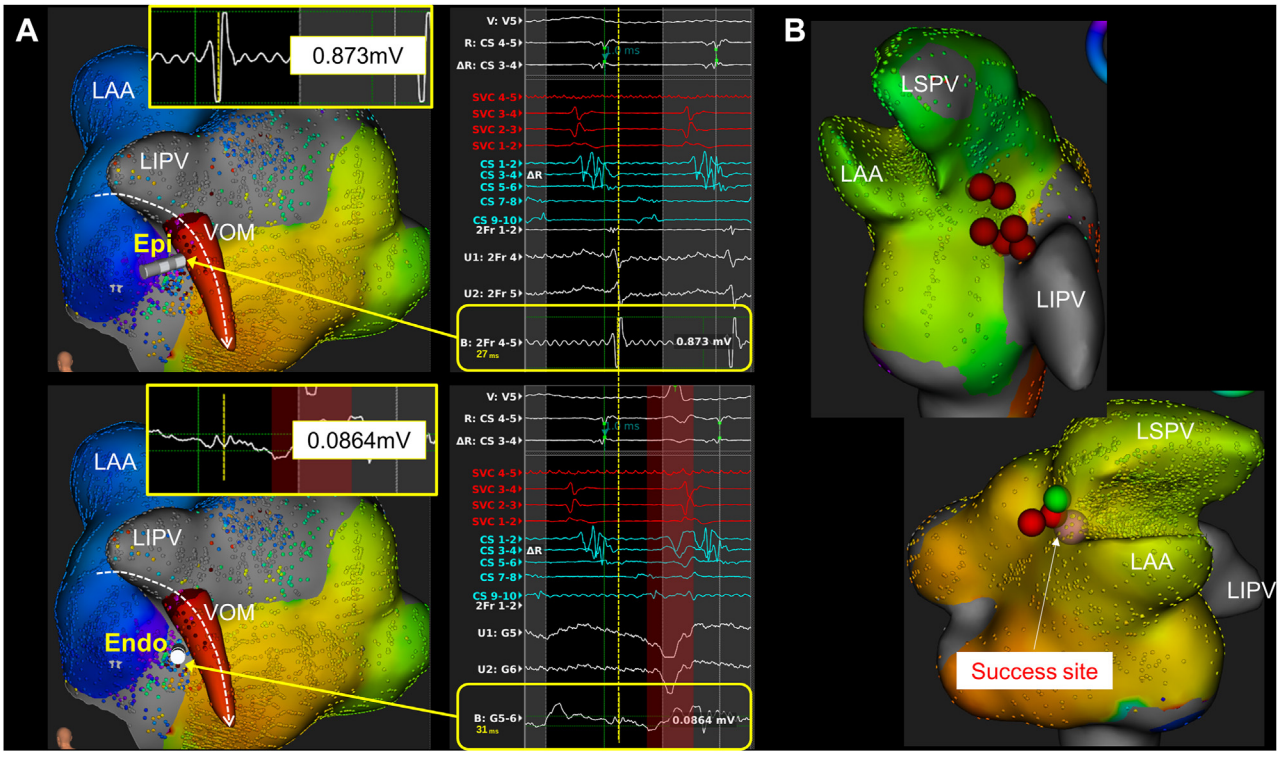

Figure 1 **A:** Endocardial (Endo) and epicardial (Epi) local signals at the previous mitral isthmus (MI) line during atrial tachycardia. Ultra-high-resolution mapping showed tiny and dull potential (0.0864 mV) at the endocardium (pseudo-endocardial signals) that was identical to the conversely large and sharp epicardial signals (0.873 mV) in the vein of Marshall (VOM). **B:** Successful ablation site for the MI line. The MI line was completed by sequential radiofrequency (RF) application at the low- and high-ridge region with endo-epi connection sites, whereas no RF application was required at the previous MI line. LAA = left atrial appendage; LIPV = left inferior pulmonary vein; LSPV = left superior pulmonary vein.

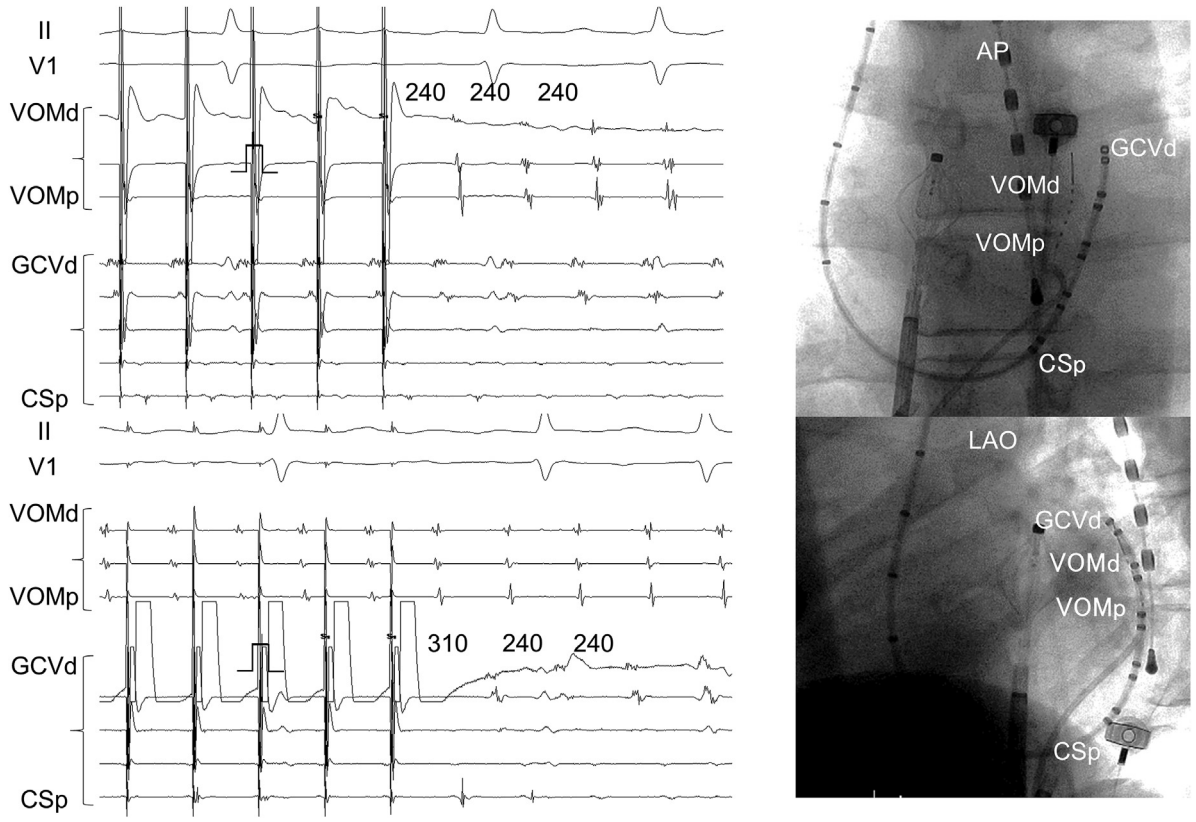

Figure 2 Postpacing intervals (PPIs) during entrainment pacing at the vein of Marshall (VOM) and at the great cardiac vein (GCV). PPI during entrainment pacing at the VOM was equal to AT CL (PPI-AT CL = 0 ms), while PPI at the GCV was much longer than AT-CL (PPI-AT CL = +70 ms). AP = anteroposterior view; CS = coronary sinus; GCVd and CSp = distal electrode of GCV and proximal electrode of CS; LAO = left anterior oblique view; VOMd = distal electrode of VOM; VOMp = proximal electrode of VOM.

map when using an auto-annotation algorithm of an ultra-high-resolution mapping system. Differentiation between local near- and far-field potentials around the MI region can sometimes be difficult owing to the presence of epicardial fibers, such as VOMs.

Appendix

Supplementary Data

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.hrcr.2022.10.010.