

Biatrial Macroreentry Atrial Tachycardia after Atrial Fibrillation Ablation

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Catheter ablation is an important therapy for atrial fibrillation (AF) in the last decade. In parallel, atrial tachycardia (AT) has become the most common type of arrhythmia after AF ablation, especially after extensive left atrial (LA) substrate modification.^[1] The occurrence of AT after AF is due to the conduction gaps of ablation lines and the conduction obstacle caused by the ablation lesions.^[2] Most of these ATs locate in LA, and here, we described a biatrial macroreentry AT (MAT) after AF ablation.

A 63-year-old woman, who had AF ablation one year ago, felt palpitation for 8 months. Electrocardiogram (ECG) showed AT, and the symptom cannot be relieved by amiodarone and metoprolol. The patient was admitted in Guangdong Cardiovascular Institute for catheter ablation on November 8, 2012. The last AF ablation procedure included the circumferential pulmonary veins ablation (CPVA) and linear ablations of cavotricuspid isthmus and LA roof. The P-waves of surface ECG were negative/positive in the inferior limb leads [Figure 1a], and positive in V1. It was difficult to identify polarity of the waves in other leads. A standard decapolar catheter was placed in the coronary sinus (CS). Activation sequence in the CS was from lateral to septal. Baseline total cycle length (TCL) was 280 ms [Figure 1a]. Pacing by distal CS entrained this AT with a short postpacing interval (PPI = 304 ms). Entrainment mapping at the anterior wall of LA by a pulmonary vein catheter (Inquiry AFocus II, St. Jude Medical, St. Paul, MN, USA), which

was advanced into the LA through a transeptal puncture, depicted a PPI equaling the TCL. These results indicated that the AT may be a perimitral MAT. A high-density activation mapping of LA was completed by the pulmonary vein catheter under the guidance of EnSite NavX 3D mapping system (St. Jude Medical). The AT appeared like a focal activation shown on the color-coded mapping picture [Figure 1b]. The wavefront spread centrifugally from the right upper anterior wall of LA, detoured to the posterior wall through the mitral isthmus, and was blocked by the scar around the right pulmonary veins. The local activation time (LAT) of the earliest activation area (white site) was -141 ms according to the reference. The LAT of the latest activation area (purple site) was 58 ms. The mapping cycle length was 199 ms, accounting only 70% of the circuit. This short cycle length was not consistent with the definition of the MAT, which the mapping cycle length accounted for at least 90% of the TCL. To locate the reentry circuit, another electroanatomical map in the right

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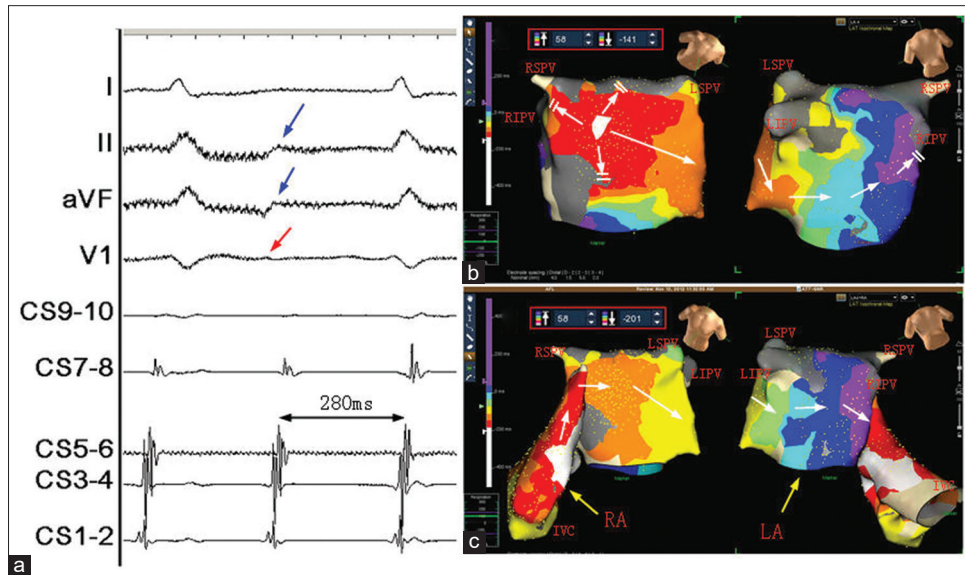


Figure 1: (a) Surface electrocardiogram (I, II, aVF, V1) and intracardiac electrocardiograms (CS1-2–CS9-10). P-waves were negative/positive in the inferior limb leads (blue arrow), and positive in V1 (red arrow). (b) High-density activation mapping in LA. Left: The earliest activation area (white) on endocardial map; right: The latest activation area (purple). The scars (gray area) were around the pulmonary vein, at the roof and the septum of LA. Red rectangle at the left upper of the map showed the LAT of color high (58 ms) and color low (–141 ms). (c) High-density activation mapping of RA + LA. Left: The earliest activation area (white) was at the septum of RA; right: The latest activation area. Red rectangle at the left upper of the map shows the LAT of color high and color low (–201 ms, 58 ms). White arrows indicated the direction of the wavefront; double white solid line: Block site. LA: Left atrial; LAT: Local activation time; RA: Right atrial; RSPV: Left superior pulmonary vein; RIPV: Right inferior pulmonary vein; LSPV: Left upper pulmonary vein; LIPV: Left inferior pulmonary vein; IVC: Inferior vena cava.

atrial (RA) was performed. The mapping showed that the septum of RA was involved in the circuit and the wavefront broke out into the LA through the Bachmann's bundle, detoured to the posterior wall, and returned to the RA from the CS region [Figure 1c]. The LAT of the septum of RA was earlier than the LAT of the earliest area of LA (–201 ms vs. –141 ms). The LAT of latest activation was also 58 ms. The mapping cycle was 259 ms, accounting for 92% of the TCL. Entrainment mapping revealed that the PPI-TCL was 28, 68, and 108 ms in the right septum, left interatrial septum, and the RA free wall, respectively. It indicates that only the right septum involved in the reentry. Thus, a biatrial MAT was disclosed. The tachycardia was terminated by ablating the channel between the roof line and the scar of LA septal.

The incidence of AT after AF ablation reaches up to 31% after CPVA and is usually higher when additional ablation lines are incorporated during procedure.^[3] Most of these ATs locate in LA, and approximately 90% of ATs after CPVA are reentrant due to the conduction gaps located in the prior ablation lines and the conduction obstacle caused by the ablation lesions.^[2] However, here, we first demonstrated a biatrial MAT after AF ablation. It exhibited as a focal AT with a short cycle length (70% TCL) when completed the three-dimensional electroanatomic map in LA. However, a whole circuit (92% TCL) had found after the electroanatomical map was completed in the RA. The color-coded picture showed that the wavefront broke out into the LA through the Bachmann's bundle, and return to the RA over the CS from the posterior wall of LA to be a biatrial MAT. Lemery *et al.*^[4] had confirmed that Bachmann's bundle and

the CS provided muscular connections between both atrials. The true septum (the fossa ovalis and its limbus) of the RA and LA is asynchronous and discordant, usually without contralateral conduction. The potential mechanism was that the roof ablation line of LA blocked the wavefront conducting to posterior wall, caused the wavefront conducting through the anterior to the posterior wall of LA, and returned to RA from CS finally. A MAT involving two different atrials after AF ablation had never been reported. This case revealed that the lesion of the AF ablation can modify the substrate of the atria. Adding roof, cavotricuspid isthmus, or mitral isthmus ablation lines in the atria might develop more ATs. Recently, a strategy of selective atrial substrate modification in sinus rhythm after CPVA isolation is more effective to prevent the AT than the traditional stepwise approach for nonparoxysmal AF ablation (3.5% vs. 30%).^[5] It is proven that AT is partly an iatrogenic arrhythmia after AF ablation. The valuable clue for the diagnosis of this case was that a short mapping cycle length had been mapped in LA, which was not consistent with the definition of the MAT. The short cycle length reminded us to map the RA and found another segment of the circuit in RA surprisingly. This case indicated that the operator should keep in mind that sometimes the macroreentrant circuits may not locate in one chamber, and paying attention to the paradoxical clues might guide to the right result.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Gerstenfeld EP, Callans DJ, Dixit S, Russo AM, Nayak H, Lin D, *et al.* Mechanisms of organized left atrial tachycardias occurring after pulmonary vein isolation. *Circulation* 2004;110:1351-7. doi: 10.1161/01.CIR.0000141369.50476.D3.
2. Chae S, Oral H, Good E, Dey S, Wimmer A, Crawford T, *et al.* Atrial tachycardia after circumferential pulmonary vein ablation of atrial fibrillation: Mechanistic insights, results of catheter ablation, and risk factors for recurrence. *J Am Coll Cardiol* 2007;50:1781-7. doi: 10.1016/j.jacc.2007.07.044.
3. Deisenhofer I, Estner H, Zrenner B, Schreieck J, Weyerbrock S, Hessling G, *et al.* Left atrial tachycardia after circumferential pulmonary vein ablation for atrial fibrillation: Incidence, electrophysiological characteristics, and results of radiofrequency ablation. *Europace* 2006;8:573-82. doi: 10.1093/europace/eul077.
4. Lemery R, Soucie L, Martin B, Tang AS, Green M, Healey J. Human study of biatrial electrical coupling: Determinants of endocardial septal activation and conduction over interatrial connections. *Circulation* 2004;110:2083-9. doi: 10.1161/01.CIR.0000144461.83835.A1.
5. Yang G, Yang B, Wei Y, Zhang F, Ju W, Chen H, *et al.* Catheter ablation of nonparoxysmal atrial fibrillation using electrophysiologically guided substrate modification during sinus rhythm after pulmonary vein isolation. *Circ Arrhythm Electrophysiol* 2016;9:e003382. doi: 10.1161/CIRCEP.115.003382.