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Case Report

Atrial tachycardia originating from an incompletely isolated box lesion in a patient undergoing thoracoscopic left atrial appendectomy and surgical ablation for long-standing persistent atrial fibrillation

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ABSTRACT

The efficacy of pulmonary vein isolation for persistent atrial fibrillation or long-standing persistent atrial fibrillation is limited. Thoracoscopic surgical ablation was introduced as an alternative treatment, but additional catheter ablation is needed to treat postoperative atrial tachycardia in some cases. Little is known about electrophysiological characteristics or mapping techniques of recurrent tachycardia after total thoracoscopic surgical ablation and left atrial appendectomy. A 63-year-old man underwent catheter ablation of atrial tachycardia after total thoracoscopic left atrial appendectomy and surgical ablation of atrial fibrillation lasting longer than 5 years. Catheter ablation was performed using a three-dimensional mapping system. Electroanatomical mapping outside the box lesion revealed a centrifugal activation pattern with the origin located at the gap of the roofline, and further activation mapping inside the box lesion was conducted again with the reference catheter positioned at the left atrial posterior wall, which revealed localized reentrant atrial tachycardia. Atrial tachycardia was smoothly treated with activation mappings. This case indicated the utility of activation mappings separating outside the box lesions from inside the box lesions.

<**Learning objective:** Electroanatomical mapping outside a box lesion might help to ablate postoperative atrial tachycardia in a patient undergoing surgical box isolation, and reentry localized in the left atrial posterior wall could be visualized using a three-dimensional mapping system with the reference catheter positioned at the box lesion. Confirmation of a completely isolated box lesion is vital, because such patients have a sufficiently enlarged left atrium that has the arrhythmogenicity to maintain atrial tachycardia.>

Introduction

Atrial fibrillation is associated with an increased risk of thromboembolism and reduced quality of life [1]. Pulmonary vein isolation (PVI) is an established treatment for paroxysmal atrial fibrillation, but evidence for the efficacy of PVI for persistent atrial fibrillation or long-standing persistent atrial fibrillation is limited [2]. To overcome this limitation, recent studies have suggested alternative techniques such as stepwise ablation or thoracoscopic surgical ablation [3]. Thoracoscopic surgical ablation, which creates a transmural lesion, includes durable PVI and left atrial posterior wall isolation (box isolation) and vagal denervation. Some cases have revealed left atrial reentrant tachycardia or atrial flutter after surgical ablation [4]. Therefore, even thoracoscopic surgical ablation is not associated with satisfactory outcomes, and additional catheter ablation is often needed to treat postoperative atrial tachycardia.

Anticoagulant drugs are effective for decreasing the risk of thromboembolism, but bleeding becomes a problem, especially in elderly patients. To prevent atrial fibrillation-induced stroke, thoracoscopic left atrial appendectomy was introduced [5]. Our institute performs total thoracoscopic surgical ablation and left atrial appendectomy for patients with non-paroxysmal atrial

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fibrillation, for whom catheter ablation is unsuitable. Such patients have long-standing atrial fibrillation and enlarged left atrium, which are reported to be predictors of recurrence after PVI. Patients who do not regain sinus rhythm despite cardioversion undergo only left atrial appendectomy, while patients who regain sinus rhythm after cardioversion undergo thoracoscopic left atrial appendectomy and surgical ablation. To date, little is known about recurrent tachycardia and catheter ablation after these procedures. We experienced notable electrophysiological findings, which indicated the importance of complete left atrial posterior wall isolation and report the catheter ablation of atrial tachycardia in a patient who underwent thoracoscopic surgical ablation for long-standing persistent atrial fibrillation and left atrial appendectomy.

Case report

A 63-year-old man with atrial fibrillation lasting longer than 5 years was referred to our hospital for ablation. He underwent total thoracoscopic left atrial appendectomy and surgical ablation of atrial fibrillation. Epicardial PVI, linear ablation at the left atrial roof and bottom lines, superior vena cava isolation, and ganglionated plexus ablation were performed. One month after the procedure, atrial tachycardia was detected in the outpatient clinic. He had sick sinus syndrome during amiodarone administration and was admitted for catheter ablation of atrial tachycardia. Electrophysiological study revealed persistent atrial tachycardia with a tachycardia cycle length of 261 ms. The procedure was performed under intravenous sedation and esophageal temperature monitoring using a probe (Esophaster, Japan Lifeline, Tokyo, Japan). Intravenous heparin was administered to maintain the activated clotting time between 300 and 350 s. A 20-polar electrode catheter (BeeAT, Japan Lifeline) was placed in the coronary sinus. Electroanatomical mapping was performed using a three-dimensional mapping system (CARTO3 System, Biosense-Webster, Diamond Bar, CA, USA). Intracardiac electrograms were filtered at 50–500 Hz. After a single transseptal puncture, an ablation catheter and a 20-polar electrode ring catheter (LASSO, Biosense-Webster) were introduced into the left atrium. Radiofrequency ablation was performed with a quadripolar 3.5-mm tip open irrigated radiofrequency ablation catheter (ThermoCool SmartTouch, D/F curve, Biosense Webster). Electrical isolations of all pulmonary veins were confirmed, but electrical potentials remained in the left atrial posterior wall. The activation map of the whole left atrium did not reveal the circuit of the atrial tachycardia (Fig. 1A). We successfully ablated the atrial tachycardia using the following method. A 20-polar electrode ring catheter (Lasso) was positioned as a reference catheter at the left anterior side of the left atrium, where the left atrial appendage used to exist before the procedure. Mapping with an ablation catheter started from the earliest activation site of the reference catheter. When the ablation catheter was positioned at one point of the roofline, the ablation catheter recorded the fractionated potential. Atrial tachycardia was terminated 2 s after the delivery of radiofrequency energy to this site (roofline gap) (Fig. 2). After atrial tachycardia termination, atrial tachycardia with the same tachycardia cycle length (261 ms) continued in the box lesion (Fig. 3). Further activation mapping was conducted again with the reference catheter (PentaRay, Biosense-Webster) positioned at the left atrial posterior wall,

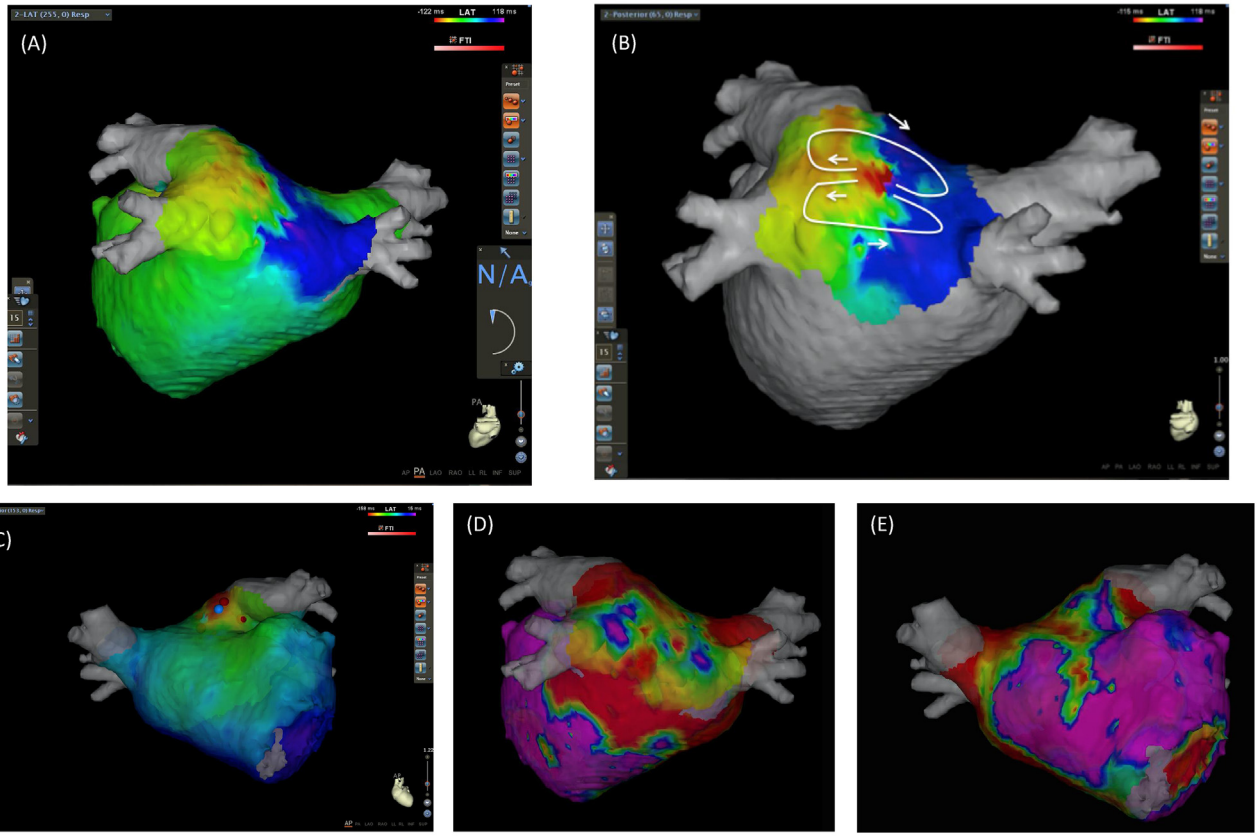

Fig. 1. The activation map of the whole left atrium did not reveal the circuit of the atrial tachycardia. (A) The activation map inside the box lesion revealed a figure-of-eight reentry localized in the left atrial posterior wall. (B) The activation map outside the box lesion revealed a centrifugal activation pattern with the origin located at the roofline gap. The blue tag indicates the successful ablation point. The red tags are additional ablation points. (D, E) The voltage map showed that electrical potentials remained in the posterior wall and a portion of the roofline.