

Intra-atrial reentrant tachycardia originating from the pulmonary vein cuff anastomosis in a lung transplantation patient: Ultra-high-density 3-dimensional mapping



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Introduction

In patients who underwent lung transplantation, the cuffs of the pulmonary veins originate from the donor, and therefore, anastomosis lines develop around the pulmonary veins in the left atrium (LA) of lung transplantation recipients.¹ These anastomosis lines have the potential to be an arrhythmogenic substrate.² We describe a case wherein ultra-high-density 3-dimensional (3-D) mapping and radiofrequency catheter ablation (RFCA) were used to treat intra-atrial reentrant tachycardia originating from the anastomosis around the pulmonary vein cuff in a bilateral lung transplantation recipient.

Case report

A 62-year-old man visited the outpatient clinic for palpitations. He underwent bilateral lung transplantation for idiopathic pulmonary fibrosis 10 months prior. Electrocardiography revealed atrial tachycardia (AT) (Figure 1). AT and his symptoms persisted despite medical therapy. We performed an electrophysiological study and used a 3-D electro-anatomical mapping system (Rhythmia, Boston Scientific, Marlborough, MA) and an Orion catheter (Boston Scientific). AT was sustained and the tachycardia cycle length was 271 ms. After transseptal puncture, pulmonary venography (Figure 2A) and 3-D ultra-high-density mapping were performed. Prolonged high-frequency fragmented signals between the A-A activities were observed along the ridge between the left atrial appendage and left pulmonary veins,

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KEY TEACHING POINTS

- Lung transplantation recipients have anastomosis lines around the right and left pulmonary veins in the left atrium.
- The anastomosis lines between the donor's pulmonary vein cuffs and the recipient's left atrium can be an arrhythmogenic substrate.
- An ultra-high-density mapping system is useful for visualizing the critical isthmus of the tachycardia circuit involving the anastomosis lines.

which corresponded to the anastomosis line (Figure 2B and C). Three-D activation and propagation maps revealed figure-of-eight intra-atrial macroreentrant tachycardia around the ridge (Figure 3A, Supplementary Video). The slow conduction zone was located in the ridge, which corresponded to the area of the prolonged high-frequency fragmented signals. A voltage map during AT revealed that the low (≤ 0.5 mV) and borderline (0.5–1.5 mV) voltage zones corresponded to the anastomosis lines (Figure 3B). Linear ablation was

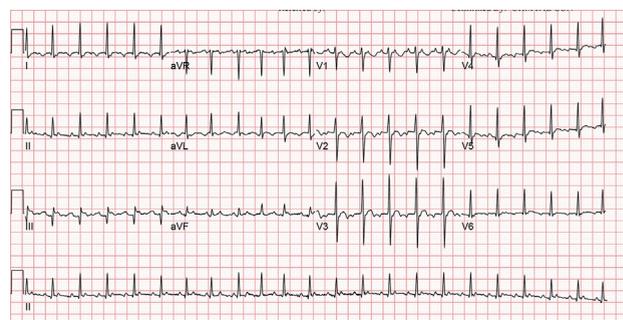


Figure 1 Electrocardiography at the outpatient clinic.

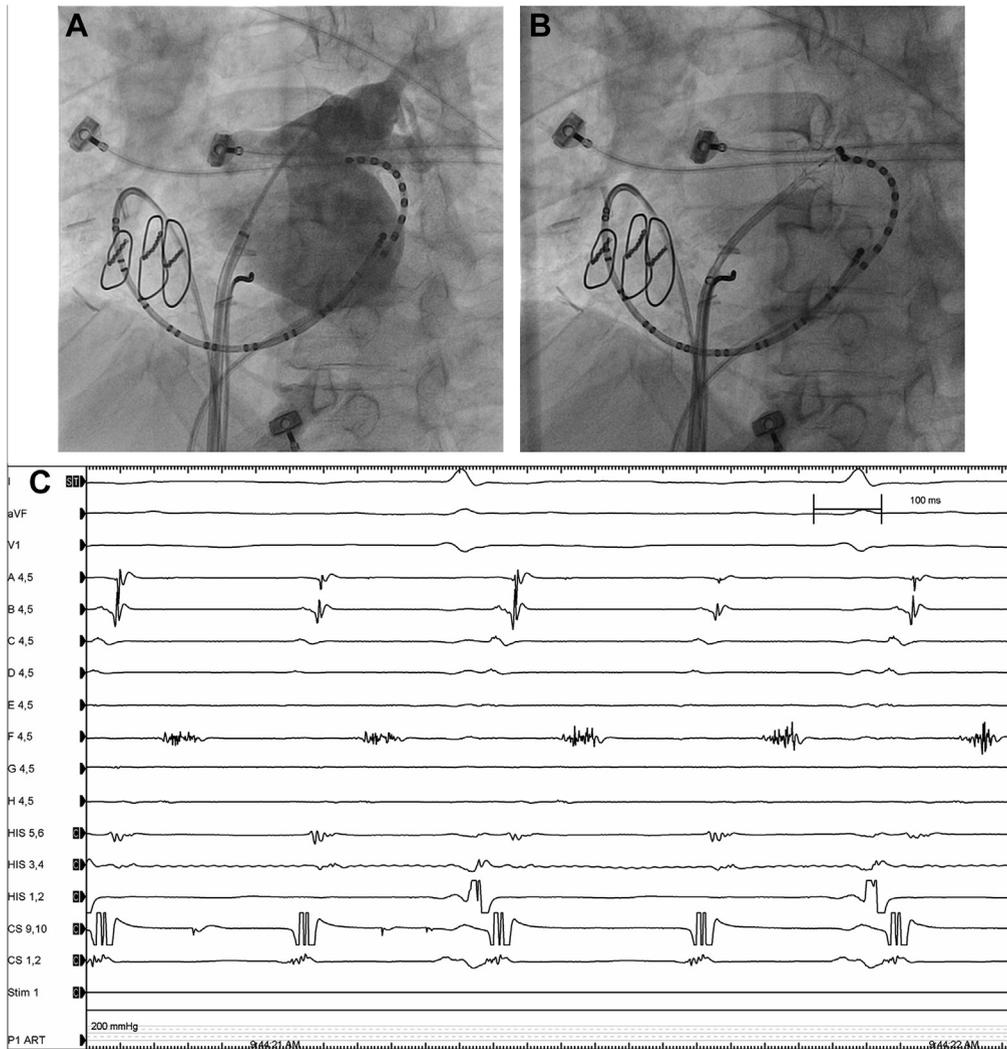


Figure 2 **A:** Left pulmonary venography. **B:** The position of the Orion catheter during the mid-diastolic prolonged fragmented electrogram. **C:** The mid-diastolic prolonged fragmented electrogram recorded with the Orion catheter during atrial tachycardia. The electrograms in A4,5 to H4,5 were recorded from the Orion catheter.

performed along the ridge (Figure 3A). After RFCA, we confirmed that there were no electric signals along the ablation line. AT was not induced by incremental and ramp pacing. Electrical reconnections were observed in the 4 pulmonary veins. AT did not recur in the 6 months following RFCA.

Discussion

As a result of bilateral lung transplantation, anastomosis lines form around the right and left pulmonary veins in the LA of the recipient. The anastomosis lines can have both arrhythmogenic and antiarrhythmogenic effects. In bilateral lung transplantation recipients, the LA is similar to that in patients who underwent the cut-and-sew Cox-maze procedure. Therefore, the long-term prevalence of paroxysmal atrial fibrillation is lower in bilateral lung transplantation recipients than in patients who undergo other thoracic surgeries.^{3,4} However, cases of atrial tachyarrhythmias related to anastomosis lines have been

reported.^{5,6} It can be because inflammatory processes and heterogeneity in conduction properties exist along the anastomosis lines. Furthermore, electrical reconnection of the pulmonary veins was observed in a considerable number of patients who underwent lung transplantation.⁷ Several studies have reported prolonged fractionated potentials recorded on the anastomosis lines, as observed in the present case.^{2,6} In the present case, the conduction of electrical impulses along the anastomosis line was very slow. As a result, the anastomosis line worked as the critical isthmus of the reentry circuit. A high-density 3-D mapping system was useful for visualization of the critical isthmus in detail.

Conclusion

The anastomosis lines in the LA of lung transplantation recipients can be an arrhythmogenic substrate. An ultra-high-density mapping system is useful for visualization of the

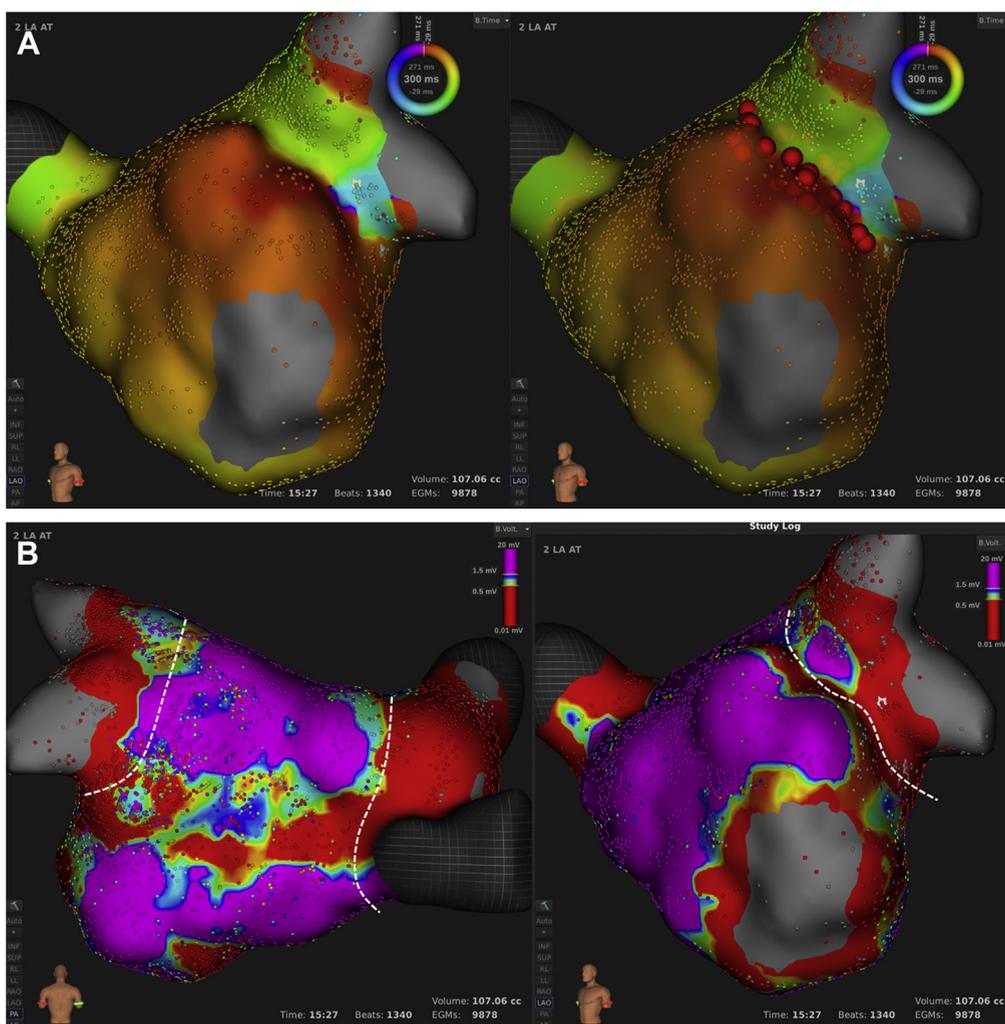


Figure 3 **A:** Ultra-high-density 3-dimensional activation map of the tachycardia shows figure-of-eight intra-atrial reentrant tachycardia with the slow conduction zone at the anastomosis line between the left atrial appendage and the left pulmonary veins. Radiofrequency catheter ablation was performed along the ridge between the left atrial appendage and the left pulmonary veins. The red-filled circles indicate ablation lesions. **B:** Ultra-high-density 3-dimensional voltage map during tachycardia shows the low and borderline voltage along the anastomosis lines (*dotted lines*).

critical isthmus of the tachycardia circuit involving the anastomosis lines.

Appendix Supplementary data

Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.hrcr.2018.01.009>.

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