Atrial tachycardia involving both recipient and donor right atria through two atrioatrial connections in a heart transplant recipient

Lisa Von Wald, APRN, CNP, Henri Roukoz, MD, FHRS

From the Cardiovascular Division, Department of Medicine, University of Minnesota, Minneapolis, Minnesota.

Introduction

Atrial arrhythmias affect between 7% and 12% of heart transplant recipients.[1] Atrial tachycardia (AT) appears to be the most common atrial arrhythmia after transplant. While the bicaval surgical technique is the dominant method for contemporary heart transplantation, older transplantations and some newer ones are performed with biatrial anastomosis between the donor and recipient right atrial tissue owing to lower ischemic time. In patients with bicaval anastomosis, atrial arrhythmias originating in the recipient atrium with recipient-to-donor atrioatrial conduction or vice versa have been described in heart transplant recipients. We report the first case of an AT involving both recipient and donor atria through 2 atrioatrial connections that was treated successfully with ablation.

Case report

An 18-year-old female heart transplant recipient presented with AT requiring multiple cardioversions. She had heart transplantation with biatrial anastomosis technique at age 7 for restrictive cardiomyopathy with multiple episodes of acute rejection subsequently. After failure of sotalol and propafenone therapies, she was referred for an electrophysiology study. The electrocardiogram of the recurrent tachycardia is presented in Figure 1.

Three-dimensional electroanatomic mapping (CARTO RTM version 4; Biosense Webster Inc, Diamond Bar, CA) revealed a reentrant AT circuit involving 2 atrioatrial connections between the recipient and donor atria at the high septal side and the inferolateral side of the atrioatrial anastomosis line. We defined the anastomosis line by mapping double potentials, with the atrioatrial connections having closely spaced or fused double potentials with fractionation. Entrainment could not be achieved owing to easy termination of the AT, but it was initiated and reset with premature atrial complexes from both recipient and donor atria (Figure 2). Radiofrequency ablation with a 3.5 mm open-irrigated ablation catheter applied at the inferolateral connection terminated the AT in both the donor and recipient atria in less than 3 seconds. After ablation, we confirmed the block across the inferolateral connection and persistence of the anterior septal connection (Figure 3 and Video 1). The patient has had no recurrence of arrhythmia in 36 months of follow-up.

KEY TEACHING POINTS

- Atrial tachycardias are the most common atrial arrhythmias after heart transplantation, while atrial fibrillation outside the acute recovery phase is rare. The most common mechanism is macroreentry, but the mechanism also could be microreentrant or focal. Ablation is an effective therapy.
- Atrial tachycardia after heart transplantation usually occur in areas of low voltage around surgical incision and anastomosis lines. Patients with heart transplant with bicaval anastomosis have less atrial arrhythmias and sinus node dysfunction compared to patients with biatrial anastomosis.
- Atrioatrial connections cross the anastomosis line in patients with heart transplantation with biatrial anastomosis. Atrial arrhythmias can originate in the donor or recipient atrium and propagate to the other side of the anastomosis line. We show that multiple atrioatrial connections are possible and these connections can sustain an atrioatrial reentrant atrial tachycardia using both atria in the circuit.

KEYWORDS Ablation therapy; Atrioatrial connections; Atrial tachycardia; Heart transplant; Mapping
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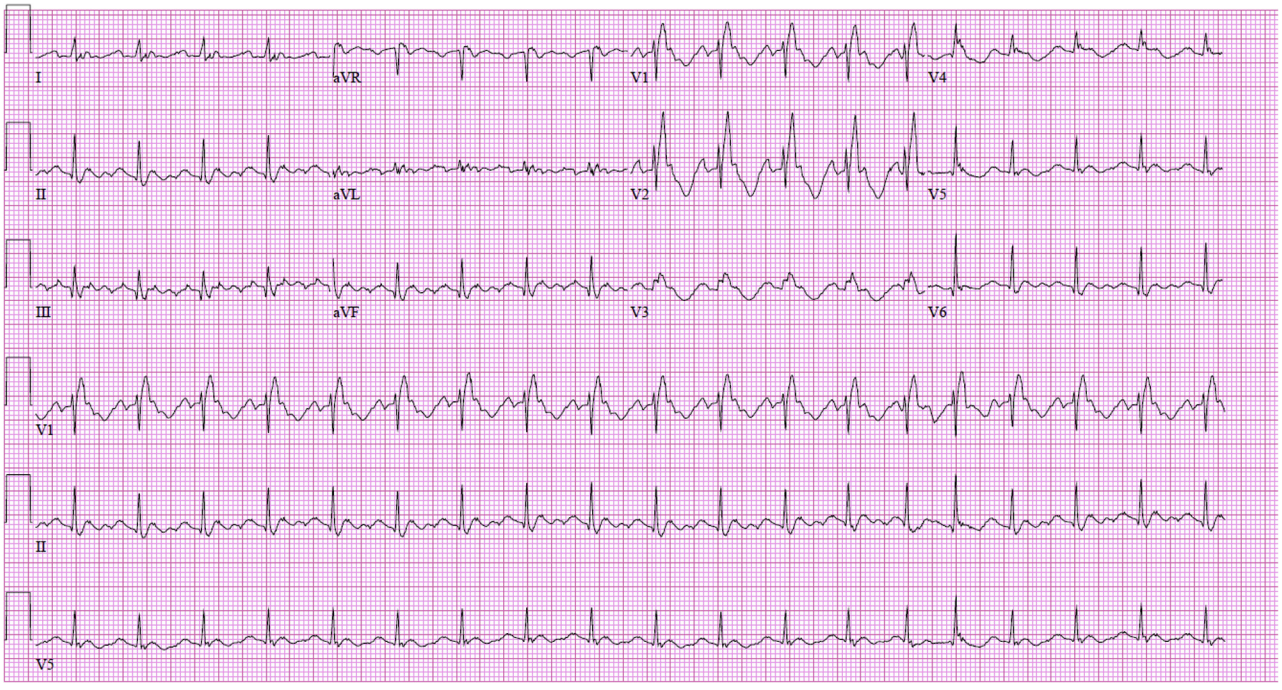

Figure 1 The 12-lead electrocardiogram of the presenting atrial tachycardia.

Discussion

Heart transplant patients have a unique substrate for atrial arrhythmias that is heavily linked to surgical techniques.[1] The bicaval anastomosis is the dominant surgical technique in contemporary heart transplantation. This technique largely replaced the biatrial anastomosis that connected a large remnant cuff of the recipient right atrium to the back of the donor right atrial tissue. Although more simple with slightly

Figure 2 Intracardiac tracings of the atrial tachycardia showing the reset with 1 paced beat. The tachycardia cycle length was 280 milliseconds. The green tracings show coronary sinus signals and show the tachycardia in the donor heart. The red tracings represent the ablation catheter positioned in the recipient right atrium. A paced and captured beat in the recipient atrium pulled in and reset the tachycardia in both donor and recipient atria.

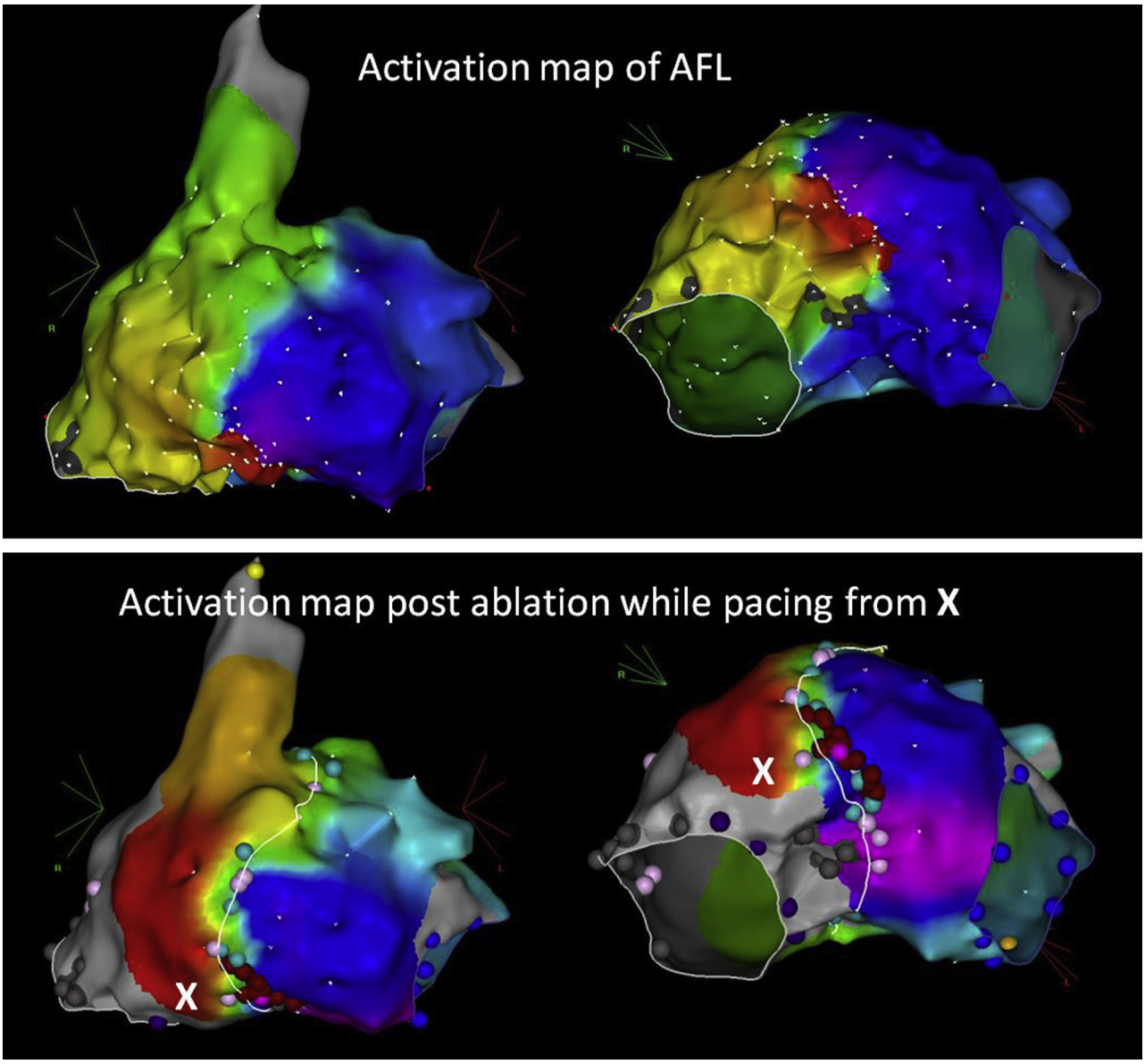

Figure 3 The 3D electroanatomic maps show the activation map (upper) of the atrial tachycardia in the right anterior oblique and caudal views and the block across the inferolateral connection of the atrioatrial anastomosis line (*marked in white*) after ablation. Red dots = ablation lesions; gray dots = nonexcitable scar with voltage below 0.1 mV; pink and light blue dots = double potentials with and without fractionation used as guide to localize anastomosis line; dark blue dots = tricuspid annulus signals with both atrial and ventricular signals.

lower ischemic time, the biatrial technique is known to cause more atrial arrhythmias and sinus node dysfunction with subsequent need for pacing.[2]

Atrial fibrillation is uncommon in heart transplant patients owing to pulmonary vein isolation and denervation of the heart.[3] ATs appear to be the most common arrhythmias after heart transplantation.[1,4] They can present early after transplantation and could be associated with allograft rejection. Late-presenting ATs are often a result of surgical arrhythmogenic substrate as opposed to an inflammatory process that occurs during the more acute postoperative period or immunologic rejection.[5] They can be microreentrant, macroreentrant, or focal, originating in the donor or recipient atrium. They most frequently occur at or around surgical incisions, anastomosis lines, and areas of low voltage and are often effectively treated with ablation.[4]

In patients with biatrial anastomosis, atrial-to-atrial electrical conduction through the anastomosis line after heart transplantation can occur. Atrioatrial connections were first recognized in 1983 and then first demonstrated in 1994.[3] There have been case reports of unidirectional or bidirectional conduction between the atrial tissues, with an atrial flutter originating in either the recipient's remnant atrium conducting to the donor atrium or vice versa. One case report has previously described double atrioatrial connections.[3] However, the reported AT was in the recipient atrium and conducting to the recipient one. Our case is unique and is a first because the AT circuit included both the recipient and donor atria through 2 atrioatrial connections. Ablating 1 of

the 2 connections terminated the tachycardia in both the donor and recipient atria. We chose not to ablate the second connection to keep mechanical association and synchrony between the donor and recipient atrium.

Our working diagnosis after 3D mapping was a macroreentry circuit including both donor and recipient atria and using 2 atrioatrial connections. The differential diagnosis included microreentrant or focal AT next to the anastomotic line in the recipient atrium propagating to the donor atrium through an atrioatrial connection. We could not perform full entrainment on the AT because it was easily terminated with pacing from either the donor or recipient atrium. However, the fact that we bracketed all the cycle length of the tachycardia and that we could induce, terminate, and reset the tachycardia with a single paced beat from both the donor and recipient atria strongly suggested a macroreentrant mechanism.

Conclusion

This unique and first-of-its kind case highlights the fact that multiple atrioatrial connections through the biatrial anastomosis line can sustain a recipient-donor AT in heart transplant recipients.

Appendix

Supplementary data

Supplementary data associated with this article can be found in the online version at https://10.1016/j.hrcr.2020.08.024.

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