

Restoring sinus rhythm in a patient with atrial flutter and left ventricular assist device: does it really matter?



Fatima M. Ezzeddine, MD,^{*} Nathaniel E. Davis, MD,[†] Andrew N. Rosenbaum, MD,^{*} Ammar M. Killu, MBBS^{*}

From the ^{*}Department of Cardiovascular Medicine, Mayo Clinic, Rochester, Minnesota, and [†]Department of Internal Medicine, Mayo Clinic, Rochester, Minnesota.

Introduction

An increasing number of patients with advanced heart failure are having left ventricular assistance devices (LVADs) implanted as destination therapy. Atrial arrhythmias are common in patients with LVADs and are associated with increased mortality rates.¹ There are limited data regarding optimal management strategies in patients with LVADs and atrial arrhythmias. Herein, we present the case of a patient with LVAD and atrial flutter who underwent catheter ablation and reflect on the outcomes of the ablation procedure.

Case Report

A 79-year-old male patient with chemotherapy-induced severe non-ischemic cardiomyopathy underwent a HeartMate 3 LVAD (Abbott) implantation as destination therapy. Other medical history was notable for ventricular tachycardia and appropriate implantable cardioverter-defibrillator shocks, hypertension, and paroxysmal atrial fibrillation. At the time of LVAD implantation, he underwent pulmonary vein isolation using radiofrequency ablation and left atrial appendage exclusion with an AtriClip device (40 mm; AtriCure). Twenty months later, he developed symptomatic atrial flutter manifesting as marked impairment in exertional capacity and quality of life correlating with increased burden of atrial arrhythmias on his implantable cardioverter-defibrillator device interrogations in addition to reduced LVAD pump flow to 2.3–2.8 L/min. He was loaded with amiodarone and was successfully cardioverted with symptom resolution and improvement in LVAD pump flow to 3.1–3.2 L/min. A month later, the patient had recurrent symptomatic atrial arrhythmias, despite being on amiodarone. As such, he was referred for catheter ablation.

On preablation cardiac workup, device interrogation showed a 96.4% burden of atrial flutter with ventricular rates

WHAT WE LEARNED FROM THIS CASE

- Atrial arrhythmias are common in patients with left ventricular assist devices (LVADs).
- Restoration of sinus rhythm can improve quality of life and optimize the hemodynamics and functionality of LVADs.
- Catheter ablation is safe and effective in patients with LVADs and typical atrial flutter.

ranging between 70 and 110 beats/min. Surface electrocardiogram showed a regular rhythm with variable atrioventricular (AV) conduction (Figure 1A). The ventricular rate was 78 beats/min. P-wave morphology was positive in lead V1 and biphasic in the inferior leads with an initial negative deflection followed by a positive deflection. After discussion of management options, the patient elected to proceed with atrial flutter ablation alone. He did not wish to undergo left atrial ablation unless the critical isthmus for the atrial flutter was felt to be left-sided.

The patient presented to the electrophysiology laboratory in his clinical flutter. The coronary sinus catheter showed a cycle length of 340 ms with proximal-to-distal activation. Electroanatomic mapping of the right atrium was done using a multielectrode catheter, OctaRay (CARTO system version 7.2; Biosense Webster). Activation mapping of the right atrium was suggestive of a counterclockwise cavotricuspid isthmus-dependent flutter, which was confirmed with entrainment maneuvers (Figure 1B). A subeustachian cavotricuspid isthmus line of ablation was performed, anchoring the tricuspid valve annulus to the inferior vena cava. The flutter terminated during ablation (Figure 1C). Bidirectional block across the line was confirmed using differential pacing. Immediately following restoration of sinus rhythm, the LVAD pump flow increased from 2.6 to 3 L/min. Postablation, the patient had dramatic symptomatic improvement. Several months later, device interrogation showed no evidence of atrial arrhythmias, off antiarrhythmic drug therapy.

KEYWORDS Atrial flutter; Atrial fibrillation; Catheter ablation; Hemodynamics; Left ventricular assist device (Heart Rhythm 0² 2024;5:421–423)

Address reprint requests and correspondence: Dr Fatima M. Ezzeddine, Mayo Clinic, 200 First Street SW, Rochester, MN 55905, USA. E-mail address: ezzeddine.fatima@mayo.edu.

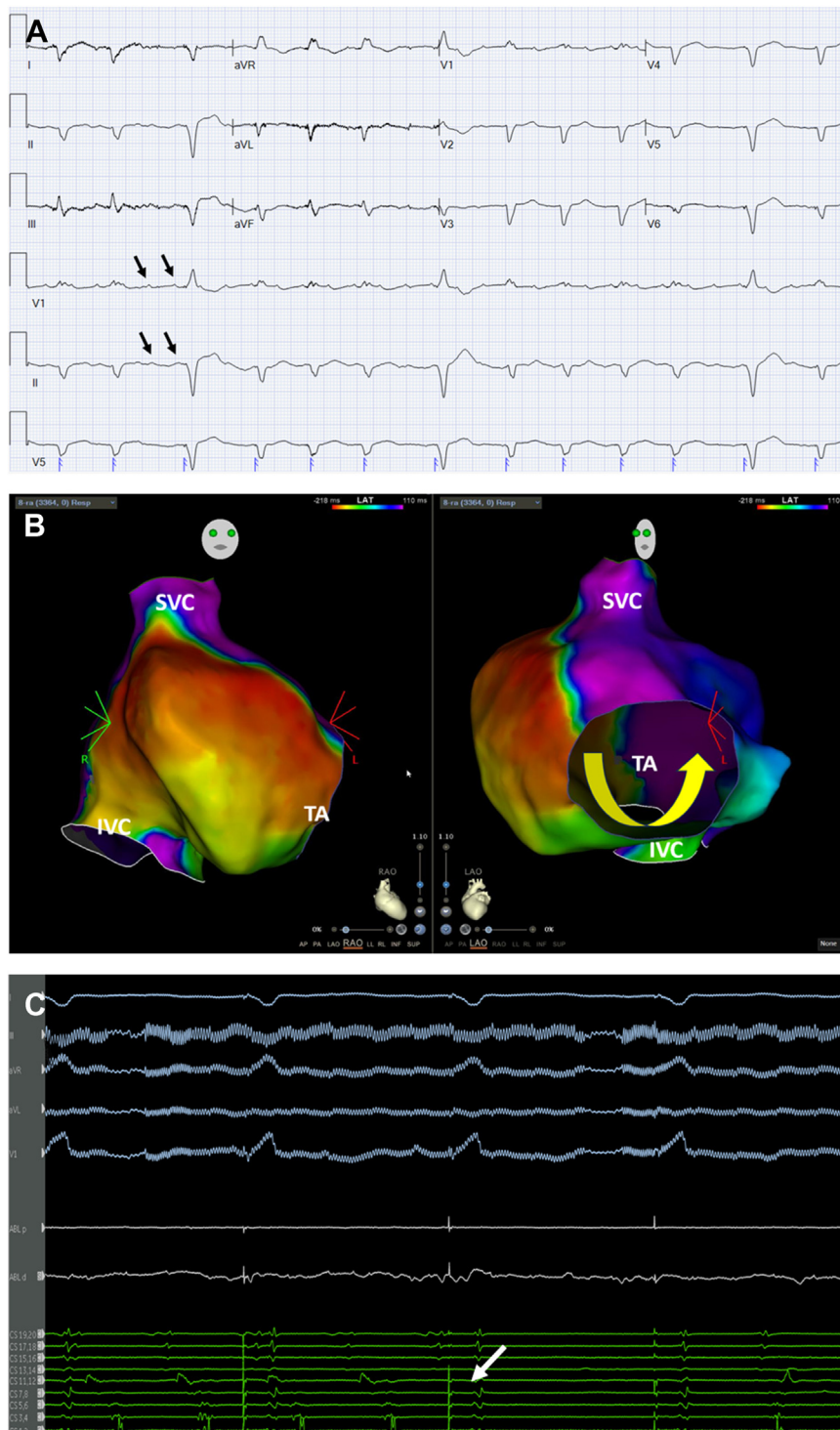


Figure 1 A: Surface 12 lead electrocardiogram (with low-pass filter set at 40 Hz) showing atrial flutter with variable atrioventricular conduction. The black arrows highlight the flutter waves. B: A 3-dimensional electroanatomic propagation map (CARTO system) of the right atrium showing typical atrial flutter, confirmed with entrainment maneuvers. Note the counterclockwise activation pattern around the tricuspid annulus (TA). C: Intracardiac electrograms showing tachycardia termination during ablation (white arrow) with restoration of sinus rhythm. IVC = inferior vena cava; LAO = left anterior oblique; RAO = right anterior oblique; SVC = superior vena cava.

Discussion

As more patients receive LVADs as destination therapy, optimization of their device hemodynamics becomes paramount. Furthermore, due to the high rates of morbidity and mortality,

optimization of quality of life is also important in these patients.² Atrial arrhythmias are common in patients with LVADs and can affect both LVAD hemodynamics and quality of life. Atrial arrhythmias contribute to worsening pump

failure due to several reasons, including loss of atrial contractility and loss of AV synchrony. In the presence of right ventricular dysfunction or failure, they are also much less hemodynamically tolerated.

Management of atrial arrhythmias in patients with LVADs is complex and should be individualized.¹ This case demonstrates successful restoration of sinus rhythm and AV synchrony via catheter ablation in a patient with LVAD and typical atrial flutter, which translated into symptomatic improvement and improvement in the LVAD hemodynamics. This is important, as maintenance of appropriate hemodynamic output of ventricular assistance devices has been shown to significantly lower rates of hospital readmission and heart failure exacerbation.³

There is a paucity of data comparing options for rhythm control in patients with LVADs and atrial arrhythmias. In patients with LVADs and typical atrial flutter, catheter ablation has been shown to be safe and effective,⁴ similar to our case. On the other hand, in patients with LVADs and atrial fibrillation, the data are limited, and the concern about iatrogenic atrial septal defects compromising hemodynamics should be approached with caution. In a large retrospective study including patients with LVADs and atrial arrhythmias by Noll and colleagues,⁵ atrial arrhythmias were not associated with increased mortality, thromboembolism, or bleeding, and among patients with paroxysmal or persistent atrial fibrillation, rhythm control measures were not associated with improved outcomes. However, it is worth noting that nearly all patients with atrial fibrillation included in the study were treated with antiarrhythmic drugs, and none of them had catheter ablation.

Conclusion

This case demonstrates successful restoration of sinus rhythm and AV synchrony in a patient with LVAD and typical atrial flutter using catheter ablation with immediate improvement in LVAD hemodynamics post-ablation. The long-term outcomes of rhythm control in patients with LVADs and atrial arrhythmias remain unknown.

Funding Sources: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Disclosures: The authors have no conflicts to disclose.

Authorship: All authors attest they meet the current ICMJE criteria for authorship.

Patient Consent: The patient provided consent for publication of the submitted article and accompanying images.

References

1. Gopinathannair R, Cornwell WK, Dukes JW, et al. Device therapy and arrhythmia management in left ventricular assist device recipients: a scientific statement from the American Heart Association. *Circulation* 2019;139:e967–e989.
2. Mehra MR, Nayak A, Morris AA, et al. Prediction of survival after implantation of a fully magnetically levitated left ventricular assist device. *J Am Coll Cardiol HF* 2022;10:948–959.
3. Imamura T, Narang N. Implication of hemodynamic assessment during durable left ventricular assist device support. *Medicina (Kaunas)* 2020;56:413.
4. Hottigoudar RU, Deam AG, Birks EJ, McCants KC, Slaughter MS, Gopinathannair R. Catheter ablation of atrial flutter in patients with left ventricular assist device improves symptoms of right heart failure. *Congest Heart Fail* 2013;19:165–171.
5. Noll AE, Adewumi J, Amuthan R, et al. Atrial tachyarrhythmias among patients with left ventricular assist devices: prevalence, clinical outcomes, and impact of rhythm control strategies. *J Am Coll Cardiol EP* 2019;5:459–466.