

EDITORIAL COMMENT

New Ablation Technology Keeps Getting Cooler*



Dominik Beer, DO,^a Ronald D. Berger, MD, PhD^{a,b}

Pulmonary vein isolation (PVI) is an effective and widely accepted strategy for the treatment of patients with paroxysmal atrial fibrillation (PAF).^{1,2} Radiofrequency and nitrous oxide cryoablation energy are well-validated modalities with excellent efficacy in patients with PAF; however, success rates in patients with persistent atrial fibrillation (PsAF) remain low.^{3,4} Recently, promising prospective data have emerged in support of a PVI plus posterior wall isolation approach at index procedure in patients with PsAF.⁵ Worck et al⁵ demonstrated a 75% freedom from AF at 6 months in a PsAF cohort despite the finding that only 46% of patients had durable posterior wall isolation at 6 months. These findings signal that durable posterior wall isolation in addition to PVI may be of benefit in a PsAF population and highlights the need for technological expansion in this arena.

Much of ablation technology development has been limited by the physical constraints of a percutaneous form factor. For years, surgeons have benefited from liquid nitrogen-cooled ablation catheters that can reach significantly lower temperatures (-196°C) than contemporary percutaneous cryoablation systems using nitrous oxide (-89°C). The Adagio Medical ultra-low temperature cryoablation (ULTC) system surmounts this limitation by

pressurizing nitrogen refrigerant to “near-critical” pressure where it behaves like a liquid vapor and cools to its boiling point of -196°C . In its low-viscosity liquid-vapor state, the liquid nitrogen is rapidly circulated from the console to the 11-cm cooling element on the distal end of the stylet-driven ablation catheter.⁶ Preshaped endoluminal stylets may then be used to guide the ablation catheter and perform “single-shot” PVI, posterior wall isolation, as well as other linear lesions such as cavotricuspid isthmus ablation. To protect the esophagus from collateral damage, an esophageal warming balloon is used.⁷

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In this issue of *JACC: Clinical Electrophysiology*, De Potter et al⁸ report the results of their first-in-man study of the effectiveness and safety of ULTC ablation. Seventy-eight of 79 enrolled patients with symptomatic drug-refractory AF underwent first-time ablation. Those patients with PAF underwent PVI alone, whereas those patients with PsAF underwent PVI plus posterior wall isolation, mitral isthmus ablation, and/or cavotricuspid isthmus ablation at the discretion of the operator. All patients were followed for safety outcomes, a cryomapping cohort of 65 patients was followed for effectiveness outcomes, and no control group was used. A favorably low complication rate of 1.5%, all related to non-permanent phrenic nerve palsy, was observed; although, as the investigators mention, subclinical cerebrovascular and esophageal injuries were not assessed. Freedom from clinical AF at 12 months was observed in 82.6% of the cryomapping cohort overall and an impressive 85.9% in the PsAF subset therein. Implantable loop recorders were not used to assess efficacy in this study. These findings are consistent with another recent report of the same ULTC system. Tohoku et al⁷ performed PVI and cavotricuspid

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From the ^aDivision of Cardiology, Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland, USA; and the ^bDepartment of Biomedical Engineering, Johns Hopkins University, Baltimore, Maryland, USA.

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isthmus ablation in 27 patients with PAF or PsAF, and similarly found a 6-month recurrence-free rate of 84%, and just a single complication of transient phrenic nerve palsy.

The results of the current study,⁸ including the low complication rate and high freedom from clinical AF at 12 months, particularly in the PsAF group, invigorate our enthusiasm for ablation in this difficult patient population. We thank the investigators for presenting their findings with this promising technology. We look forward to the results of currently ongoing European postmarket studies as well as the recently paused and now resumed iCLAS for Persistent Atrial Fibrillation (NCT04061603) US IDE study. Reports from these larger cohorts will be essential in

establishing the ultimate safety of this technology, the durability of the cryoablative lesions it produces, and the clinical efficacy of the ablation strategy based on this novel system.

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ADDRESS FOR CORRESPONDENCE: Dr Ronald D. Berger, Division of Cardiology, Department of Medicine, Johns Hopkins University School of Medicine, Johns Hopkins Hospital, Halsted 570, 600 North Wolfe Street, Baltimore, Maryland 21287-0409, USA. E-mail: rberger@jhmi.edu.

REFERENCES

1. Calkins H, Reynolds MR, Spector P, et al. Treatment of atrial fibrillation with antiarrhythmic drugs or radiofrequency ablation: two systematic literature reviews and meta-analyses. *Circ Arrhythm Electrophysiol*. 2009;2:349–361.
2. January CT, Wann LS, Calkins H, et al. 2019 AHA/ACC/HRS focused update of the 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *J Am Coll Cardiol*. 2019;74:104–132.
3. Mansour M, Calkins H, Osorio J, et al. Persistent atrial fibrillation ablation with contact force-sensing catheter: the prospective multicenter PRECEPT trial. *Clin Electrophysiol*. 2020;6:958–969.
4. Su WW, Reddy VY, Bhasin K, et al. Cryoballoon ablation of pulmonary veins for persistent atrial fibrillation: results from the multicenter STOP persistent AF trial. *Heart Rhythm*. 2020;17:1841–1847.
5. Worck R, Sørensen SK, Johannessen A, Ruwald M, Haugdal M, Hansen J. Posterior wall isolation in persistent atrial fibrillation feasibility, safety, durability and efficacy. *J Cardiovasc Electrophysiol*. Published online May 22, 2022. <https://doi.org/10.1111/jce.15556>
6. Littrup PJ, Babkin A. Evolving concepts: near-critical cooling-based technologies. In: Bredikis A, Wilber D, eds. *Cryoablation of Cardiac Arrhythmias*. Elsevier; 2011:107–115.
7. Tohoku S, Schmidt B, Bordignon S, Chen S, Bologna F, Julian Chun K. Initial clinical experience of pulmonary vein isolation using the ultra-low temperature cryoablation catheter for patients with atrial fibrillation. *J Cardiovasc Electrophysiol*. 2022;33:1371–1379.
8. De Potter T, Klaver M, Babkin A, et al. Ultra-low temperature cryoablation for atrial fibrillation: primary outcomes for efficacy and safety: the Cryocure-2 study. *J Am Coll Cardiol EP*. 2022;8:1034–1039.

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