



Posterior wall isolation using a novel radiofrequency ablation catheter—an addition to our atrial fibrillation armamentarium

Anvi Raina¹ · Abhishek Deshmukh¹

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Abbreviations

| | |
|-----|--------------------------|
| AF | Atrial fibrillation |
| PV | Pulmonary vein |
| PVI | Pulmonary vein isolation |
| PW | Posterior wall |
| PWI | Posterior wall isolation |
| RF | Radiofrequency |

1 The rationale for posterior wall isolation

Atrial fibrillation (AF) remains the most common arrhythmia plaguing patients worldwide. Despite the remarkable advances in catheter ablation, achieving long-term success in patients with non-paroxysmal AF remains challenging. The left atrial posterior wall (PW) has recently gained traction as an additional target to improve AF ablation outcomes in this cohort. Embryologically, the pulmonary veins (PVs) unite to form a common antrum that joins the left atrial appendage (remnant of the primordial left atrium) and the area around the mitral annulus to form the left atrium [1]. The PW and PVs are histologically indistinguishable, representing an amalgam of atrial myocardium and primary venous components [1]. This, along with other factors like heterogenous fiber orientation, frequent fibrosis, and cellular properties which make the PW susceptible to misfiring, as mentioned by the authors [2] became the impetus to consider posterior wall isolation (PWI) as an adjunct to pulmonary vein isolation (PVI) in AF ablation. Several approaches have been conceived to isolate the PW, including endocardial box

isolation, single ring isolation, debulking, and hybrid surgical and endocardial ablation.

2 Anatomic complexity and emerging approaches

The PW is heterogeneous in its thickness which makes transmural lesions more complex; the wall is thickest along the superior margin of the septopulmonary bundle near the roof and becomes thinner inferiorly [3]. Adipose tissue separating the muscle bundles is also more common superiorly than inferiorly and can have an insulating effect which makes creating transmural lesions along the superior edge of the PW more difficult [3]. Moreover, the sinoatrial nodal artery, when branching from the left circumflex (40% of cases), courses along the roof of the left atrium, can serve as a heat sink during radiofrequency (RF) ablation or be inadvertently damaged during ablation [2]. Most importantly, the esophagus lies directly posterior to the PW, and extensive ablation in this area raises concern for the catastrophic complication of atri-esophageal fistula. A less severe issue of gastric hypomotility from injury to the esophageal plexus can also occur. A successful PWI approach must walk the tightrope in balancing these efficacy and safety concerns.

Two randomized control trials [4, 5] lent credence to this mechanistic plausibility of PW being an AF trigger by showing a decrease in recurrences in the PWI plus PVI arm compared to the PVI alone arm. However, two more recent randomized clinical trials have shown no benefit of the technique [6, 7]. One consideration for the failure of these studies to show benefit is that the PW represents an anatomically complex area to ablate marred by frequent reconnections and patchy ablation. Hence, the intention for the clinical trials has been noble; it does appear that the durable ablation failed the trial rather than the trial showing ablation is not effective.

PWI techniques like “box” or single-ring lesions are associated with residual conduction gaps and scar-related

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✉ Abhishek Deshmukh
Deshmukh.Abhishek@mayo.edu

¹ Department of Cardiovascular Medicine, Mayo Clinic College of Medicine, 200 First Street SW, Rochester, MN 55905, USA

re-entrant arrhythmias. In contrast, the CONVERGE trial showed increased freedom from all-atrial arrhythmias using a hybrid endocardial and surgical ablation approach compared to endocardial ablation only (67.7% vs. 50.0%; $p=0.036$) [8]. This result likely stems from the ease of access to the PW during surgery and more robust homogenization. However, this outcome improvement was somewhat offset by a higher complication rate in the hybrid arm compared to the endocardial ablation arm (7.8% versus 0%, $p=0.053$). Therefore, an approach that combines the efficacy of hybrid ablation with the safety of endocardial ablation could represent a breakthrough in this space.

3 Novel radiofrequency ablation catheter for posterior wall isolation

In this edition of the Journal of Interventional Cardiac Electrophysiology, Del Monte et al. investigate the feasibility of PWI using a novel radiofrequency catheter that enables a “single-shot delivery” in a small but impressive study [2]. Although comprised of 32 patients, the study protocol is comprehensive, and the authors augment their findings by comparing acute efficacy and safety endpoints with a cryoablation arm. The 28-mm Heliostar™ catheter (Biosense Webster, CA, USA) is balloon-based with ten gold-plated, irrigated electrodes. The catheter appears to be easily maneuverable and compliant and delivers larger surface area lesions allowing for PW homogenization with fewer applications. The authors show the feasibility of PWI using the novel catheter in 100% of treated patients without needing touch-up RF applications. PWI using RF required fewer applications and a drastically shorter procedural time than cryoablation. Impressively, the primary safety endpoint was not observed in the RF arm. We also applaud the authors for implementing a robust esophageal temperature monitoring protocol. No atrioesophageal fistulas were reported in the entire cohort, and no thermal lesions were seen on esophageal endoscopy in the four patients in whom the temperature reached 41 °C or above. Of the patients who completed 6-month follow-up, 73% were free from atrial tachyarrhythmias, and 83% of patients who underwent redo procedures had persistent PWI indicating robust ablation with the catheter.

4 Significant unknowns and future directions

The authors need to be congratulated on completing this intriguing study and adding a potentially valuable tool to our AF ablation armamentarium. While the study was

comprehensive and well executed, several important questions remain unanswered, and limitations must be acknowledged. Of course, all the caveats of a single-center, non-randomized study with a smaller sample size apply. Secondly, the authors provide some long-term data for the RF arm, but the cryoablation arm was followed only acutely. Therefore, long-term freedom from AF comparative analysis between the two arms is not feasible. Regardless, the presence of durable PWI in most patients with recurrences who underwent redo procedures is very impressive.

Similarly, the safety profile in this early study is encouraging, but a more extensive study is needed given the low incidence of atrioesophageal fistulas and other complications during AF ablation. The implications of concomitant ganglionated plexi ablation during posterior wall homogenization should also be investigated. Lastly, considering the recent negative PWI trials [6, 7], long-term randomized data and comparative analysis with PVI alone and other PWI techniques are needed to break the clinical equipoise and clarify the role of PWI as an adjunct procedure in AF ablation.

References

1. Ho SY, Sanchez-Quintana D, Cabrera JA, Anderson RH. Anatomy of the left atrium: implications for radiofrequency ablation of atrial fibrillation. *J Cardiovasc Electrophysiol.* 1999;10(11):1525–33.
2. Del Monte A, Chierchia GB, Della Rocca DG, Pannone L, Sorgente A, Bala G, Monaco C, Mouram S, Capulzini Cremonini L, Audiat C, Praet J, Ramak R, Overeinder I, Ströker E, Sieira J, La Meir M, Brugada P, Sarkozy A, de Asmundis C, Almorad A. Posterior wall isolation via a multi-electrode radiofrequency balloon catheter: feasibility, technical considerations, endoscopic findings and comparison with cryoballoon technologies. *J Interv Card Electrophysiol.* 2023.
3. Clarke JD, Piccini JP, Friedman DJ. The role of posterior wall isolation in catheter ablation of persistent atrial fibrillation. *J Cardiovasc Electrophysiol.* 2021;32(9):2567–76.
4. Ahn J, Shin DG, Han SJ, Lim HE. Does isolation of the left atrial posterior wall using cryoballoon ablation improve clinical outcomes in patients with persistent atrial fibrillation? A prospective randomized controlled trial. *Europace.* 2022;24(7):1093–101.
5. Aryana A, Allen SL, Pujara DK, Bowers MR, O’Neill PG, Yamauchi Y, Shigeta T, Vierra EC, Okishige K, Natale A. Concomitant pulmonary vein and posterior wall isolation using cryoballoon with adjunct radiofrequency in persistent atrial fibrillation. *JACC Clin Electrophysiol.* 2021;7(2):187–96.
6. Kistler PM, Chieng D, Sugumar H, Ling LH, Segan L, Azzopardi S, Al-Kaisey A, Parameswaran R, Anderson RD, Hawson J, Prabhu S, Voskoboinik A, Wong G, Morton JB, Pathik B, McLellan AJ, Lee G, Wong M, Finch S, Pathak RK, Raja DC, Sterns L, Ginks M, Reid CM, Sanders P, Kalman

- JM. Effect of catheter ablation using pulmonary vein isolation with vs without posterior left atrial wall isolation on atrial arrhythmia recurrence in patients with persistent atrial fibrillation: the CAPLA randomized clinical trial. *JAMA*. 2023;329(2):127–35.
7. Lee JM, Shim J, Park J, Yu HT, Kim TH, Park JK, Uhm JS, Kim JB, Joung B, Lee MH, Kim YH, Pak HN. The electrical isolation of the left atrial posterior wall in catheter ablation of persistent atrial fibrillation. *JACC Clin Electrophysiol*. 2019;5(11):1253–61.
 8. DeLurgio DB, Crossen KJ, Gill J, Blauth C, Oza SR, Magnano AR, Mostovych MA, Halkos ME, Tschopp DR, Kerendi F, Taigen TL, Shults CC, Shah MH, Rajendra AB, Osorio J, Silver JS, Hook BG, Gilligan DM, Calkins H. Hybrid convergent procedure for the treatment of persistent and long-standing persistent atrial fibrillation: results of CONVERGE clinical trial. *Circ Arrhythm Electrophysiol*. 2020;13(12):e009288.

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