Ablation for Persistent Atrial Fibrillation
Pulmonary Vein Isolation Plus What?*

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It was evident early in the experience of catheter ablation for atrial fibrillation (AF) that pulmonary vein (PV) isolation at the level of the venous ostium was ineffective for patients with recurrent persistent or long-standing persistent AF (1). Although electrical PV isolation at the level of the antrum (PVAI) is a better approach for such patients, PVAI alone leaves considerable room for improvement. Strategies that have been developed beyond PVAI to improve the results for persistent AF involve PVAI plus additional ablation: isolation of other thoracic veins, linear atrial ablation, targeting of complex fractionated electrograms, and are commonly done in a stepwise fashion (2,3). However, recent studies such as the STAR AF 2 (Substrate and Trigger Ablation for Reduction of Atrial Fibrillation Part 2) trial (4) have called into question the value of additional ablation beyond PVAI, which adds time to the procedure, adds little benefit, and is associated with a 5-year, single-procedure success rate of only 20% (5).

Newer strategies to ablate persistent AF beyond PVAI alone can be placed in 2 strategic categories: approaches that are more selective, such as the identification and targeting of sites that are critical to the AF substrate, and approaches that are more extensive. The Focal Impulse and Rotor Modulation (FIRM) mapping system (Topera, Menlo Park, California) (6) is an example of an invasive technique to identify rotors responsible for AF perpetuation, and the combination of panoramic body surface electrical data with anatomical data obtained from imaging scans (CardioInsight, Cleveland, Ohio) (7) is an example of a noninvasive technique. These approaches continue to be refined.

The goal of more extensive approaches is debulking as much of the substrate as possible, including the left atrial (LA) septum, posterior LA, and left atrial appendage (LAA). Examples that have been published and are under further development include ablation of the entire posterior LA using standard point-by-point radiofrequency (RF) ablation (8), use of a set of multielectrode catheters and duty-cycled RF energy to ablate the LA septum and sites associated with high-frequency activity (9), and the convergent hybrid procedure that couples PVAI with minimally invasive surgical epicardial RF ablation of the posterior LA (10).

Although the PVs and posterior LA have received most of the attention as sites of AF triggers and substrate, the LAA may also have a role in some patients with persistent AF. Electrical isolation of the LAA would be a logical goal, but using point-by-point focal endocardial RF lesions to isolate the LAA is technically difficult. Furthermore, if the LAA is electrically isolated, but still communicating with the LA, there is a theoretical risk of clot formation and embolism from the potential loss of LAA systole.

The LARIAT suture delivery device (SentreHEART, Redwood City, California) is a suture snare catheter that is Food and Drug Administration approved for soft tissue closure and has been used to ligate the LAA with the objective of stroke reduction in patients with AF and contraindications to oral anticoagulation (11). The procedure requires combined transseptal and pericardial access and is effective at LAA closure. A potential added benefit of the LARIAT procedure, which is not shared by LAA plug devices, is that it results in electrical isolation of the LAA (12). A previous study showed that LAA ligation reduces AF burden in patients, on the basis of pacemaker diagnostics (13). In this issue of JACC: Clinical
Electrophysiology, Lakkireddy et al. (14) report their attempt to capitalize on the ability of LAA ligation to electrically isolate the LAA in patients with persistent AF. Lakkireddy et al. (13) from multiple centers offered the LARIAT procedure to patients referred for catheter ablation for persistent AF who had no contraindications to undergo the LARIAT procedure, such as previous cardiac surgery. Patients underwent a screening computed tomography scan of the LAA to determine whether the anatomy was suitable for the LARIAT procedure. After excluding 18 patients who were not eligible to undergo the LARIAT procedure on the basis of their LAA anatomy, 69 patients underwent LAA ligation followed by catheter ablation at least 30 days later. The outcome of these 69 patients was compared with the outcome of an age-matched historical control group. Impressively, the primary outcome of freedom from atrial tachycardia/AF at 1 year, off antiarrhythmic drugs, after a single ablation procedure was significantly higher in the LARIAT group (65% vs. 39%; p = 0.002). There was no difference in extra-PVAI ablation in both LARIAT and control groups (45% vs. 52%). In addition, only 16% of patients in the LARIAT group underwent a repeat ablation procedure compared with 33% in the control group (p = 0.018). The LARIAT procedure added a major complication rate of 5%. The study itself is limited by its use of a historical control, and the endpoint of re-do ablation rate is confounded by the fact that patients in the LARIAT group underwent at least 2 procedures before considering a repeat procedure and may have been less likely to agree to a repeat procedure. The combined procedure itself also has limitations. These include the safety of the LARIAT procedure and the need for 2 sequential staged procedures rather than a single procedure.

Single-center series have reported high LAA closure rates and low complication rates. However, multicenter series have shown a 9% rate of major bleeding and 5% rate of tamponade (15). It has been argued that the high complication rate reported in the multicenter series was due to operator inexperience and the use of obsolete techniques (16). It is true that newer techniques such as the use of a micropuncture needle to access the pericardial space have likely reduced the risk of the LARIAT procedure. However, many of the potential complications such as the development of delayed pericardial effusions, thrombus formation at the endocardial site of closure, and delayed LAA leaks may be inherent to the procedure regardless of operator experience and the use of a micropuncture needle (17). Nonetheless, with time and experience, the safety and efficacy of the technique will likely improve.

The question remains regarding the best ablation procedure for persistent AF: PVAI plus what? Given recent data challenging the stepwise ablation approach, and recent studies challenging the foundation of more selective approaches such as the FIRM mapping system (18), extensive debulking approaches such as the convergent procedure and ligation of the LAA appear to be strong candidates for further clinical investigation.

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REFERENCES


KEY WORDS atrial fibrillation, catheter ablation, left atrial appendage, ligation