Further Insight into the Technique and Outcomes of “Curative” Catheter Ablation of Atrial Fibrillation

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During the past decade, catheter ablation of atrial fibrillation (AF) has emerged as an important treatment option for patients with symptomatic AF refractory to ≥1 antiarrhythmic agents. Electric isolation of the pulmonary vein musculature (PVI) has been identified as the primary end point for both catheter- and surgical-based AF ablation procedures. \(^{1}\) What is less clear is whether the addition of “linear lesions” or ablation of atrial sites demonstrating complex atrial electrograms improves outcome for patients with paroxysmal, persistent, or long-standing persistent AF. \(^{2,3}\) This issue remains an area of active discussion, debate, and investigation.

In this issue of *Circulation: Arrhythmia and Electrophysiology*, Gaita et al \(^{2}\) report the results of a prospective single-center randomized study of 204 patients who underwent catheter ablation for treatment of paroxysmal or persistent/permanent AF. Patients were stratified according to whether they had paroxysmal \((n=125)\) or persistent/permanent \((n=79)\) AF and were then randomized in a 2:1 fashion to undergo PVI alone or PVI combined with a “roof line” and a “left mitral line.” Follow-up visits that included an ECG, 24-hour Holter, and an echocardiogram were set up at 1, 3, 6, 12, 18, 24, and 30 months and then every year thereafter. If a patient experienced symptoms between follow-up visits, an event monitor was prescribed. A recurrence was defined as a symptomatic or asymptomatic episode of AF or atrial flutter lasting ≥30 seconds after a 2-month blanking period. Patients who developed a recurrence after the blanking period were offered a repeat ablation procedure. The outcome of ablation was evaluated at 12 months of follow-up and at completion of the study. Each patient was followed for a minimum of 3 years. Among the 125 patients with paroxysmal AF, the single-procedure success rate at 12 months was 46% with PVI alone versus 53% for PVI plus lines. With the addition of repeat ablation procedures and longer-term follow-up, the overall success rate was 34% for PVI alone versus 66% for PVI plus lines. Major complications included pericardial tamponade and transient ischemic attacks in 2 patients each. The authors drew 4 conclusions from their study: (1) success at 12 months cannot be considered permanent success; (2) \(\approx 50\%\) of patients undergoing AF ablation will need a second procedure; (3) AF ablation is more effective in paroxysmal AF than in persistent/permanent AF; and (4) PVI plus lines is a more effective ablation strategy than PVI alone.

This study is a welcome addition to the literature on AF ablation and I commend the authors for the considerable effort required to complete this ambitious trial. In writing this editorial, I am charged with helping to interpret the results of this study in the context of both my own experience with catheter ablation as well as the considerable body of previously published literature on AF ablation. I would like to offer the following thoughts for your consideration. First, it has been well established for many years that catheter ablation of AF is more effective in patients with paroxysmal AF when compared with those patients with persistent AF. It is reassuring, therefore, that this study confirmed this long-standing belief with an overall combined efficacy of an ablation strategy involving up to 2 ablation procedures of 70% for patients with paroxysmal AF and 56% for patients with persistent/permanent AF. Second, the early hope of AF ablation being a “curative” procedure continues to be shattered by the harsh reality that early and late recurrences of AF after a several-month blanking period do in fact occur, and these recurrences are observed even in patients who are AF free at 12 months of follow-up. The results of the study by Fiorenzo et al \(^{2}\) are consistent with my own published experience and also the experience reported by the increasing number of centers that have had the fortitude to examine and publish their long-term results of AF ablation. \(^{4,8}\) It is because of the recognition of the reality of late recurrences of AF that the HRS/EHRA/ECAS consensus document on AF ablation encourages that the term “cure” not be used in conjunction with AF ablation. \(^{1}\) It is also because of the recognition of the reality of late recurrences of AF that this consensus document concluded that a decision regarding discontinuation of warfarin after AF ablation should be based on the CHADS stroke risk score rather than the apparent efficacy of the AF ablation procedure. \(^{9}\) Third, the results of this study support the concept that PV isolation is the cornerstone of AF ablation. What is much less clear is whether the addition a roof line and a mitral line should be routinely combined with circumferential PV isolation procedures for treatment of patients with paroxysmal AF, persistent AF, or both. And, if they are used, should they be used as an initial ablation strategy or reserved for repeat AF ablation procedures? It is my opinion that the jury is still out on this issue. My sentiments reflect the fact that the addition of lines results in the destruction of a greater.

The opinions expressed in this article are not necessarily those of the editors or of the American Heart Association.

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*Circ Arrhythmia Electrophysiol* is available at http://circcep.ahajournals.org
DOI: 10.1161/CIRCEP.108.819417
proportion of the atrial myocardium. The long-term adverse consequences of this more aggressive ablation strategy have not been well defined. Furthermore, it must be recognized that this was a small single-center trial with all of the limitations that accompany such a study. Although the follow-up protocol appeared to be strict, the authors do not provide data on patient compliance with this protocol. This was also not a blinded study. The 2:1 randomization scheme suggests that the authors believed that the linear ablation strategy was preferable. We are also provided with no information on AF burden. A 40-second recurrence of AF detected on a Holter monitor, although classified as a failure in this study, may be a very acceptable outcome of AF ablation in a patient with long-standing persistent AF. Although the authors made an effort to describe their patient population, they failed to provide a careful description of the 79 patients with persistent AF. In the introduction, they use the term “persistent/permanent AF.” It is unclear to me what this term means. The American College of Cardiology/American Heart Association/European Society of Cardiology AF guidelines define a patient as having permanent AF when a decision has been made to not attempt restoration of sinus rhythm. Then why are these patients undergoing AF ablation? It is for this reason that the HRS/EHRA/ECAS consensus document has recommended that the term “persistent AF” no longer be used in conjunction with AF ablation procedures. Recognizing the importance of the duration of time that a patient has been in continuous AF in determining the outcome of AF ablation, this consensus document proposed the term “long-standing persistent AF,” defined as AF that has been continuously present for at ≥12 months, be used to describe a subset of patients with persistent AF. Finally, it is my opinion that before the AF ablation community can conclude that linear ablation should become a routine part of AF ablation strategies, further research is needed. One important unanswered question regards the efficacy of permanent electric isolation of the PVs. This study, consistent with all studies before it, has reported that recurrence of PV conduction was observed in 100% of patients who failed an initial AF ablation procedure and underwent a repeat procedure. The question that emerges in my mind concerns what the efficacy of the AF ablation procedure would have been if more time had been spent isolating the PVs initially and searching for and treating early recurrence of conduction. We have previously reported that recovery of PV conduction occurs commonly within the first 30 minutes of PV isolation and that 33% of patients with isolated PVs at 30 minutes demonstrate recovery at 60 minutes. Another important issue that needs to be resolved is that if we conclude that PV isolation alone is an insufficient strategy for AF ablation, which adjunctive strategy is best? Should we be isolating veins and ablating complex fractionated atrial electrograms, should we be isolating veins and ablating autonomic ganglia, or should we be isolating veins and creating linear lesions, as suggested in this study? It is clear that much more research is needed to clarify the many unanswered questions concerning AF ablation. Those involved in this field are grateful to Fiorenzo et al and all of those who are working hard to improve the techniques and outcomes of AF ablation. I remain certain that some day catheter ablation of AF will become a very routine standard procedure. And what will we be working on then?

Disclosures
Within the past 2 years, Dr Calkins has consulted for Ablation Frontiers, Biosense Webster, ProRhythm, and Sonofi Adventis. He has received honoraria for speaking from St Jude Medical, Medtronic, Boston Scientific, and Biosense Webster. He has received research support and/or participated in clinical trials with Ablation Frontiers, Biosense Webster, Boston Scientific, Medtronic, and St Jude Medical.

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Circ Arrhythm Electrophysiol. 2008;1:238-239
doi: 10.1161/CIRCEP.108.819417

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