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Editorial

What Is Better Predictor of Late Recurrence after Radiofrequency Catheter Ablation for Atrial Fibrillation?

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▸ See the article "Electrical Remodeling of Left Atrium Is a Better Predictor for Recurrence Than Structural Remodeling in Atrial Fibrillation Patients Undergoing Radiofrequency Catheter Ablation" in volume 52 on page 368.

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There are several risk factors to predict clinical outcomes in patients with atrial fibrillation (AF) after radiofrequency ablation (RFCA) including AF burden, type of AF.[1] However, In fact, it is known that the degree of anatomical and electrical remodeling is more important to predict the prognosis of AF after RFCA.[2] There are several mechanism of atrial fibrosis that cause atrial arrhythmias including abnormal trigger, automatic activity and predisposing conduction delay for reentry circuit.[3] In real world practice, low-voltage bipolar mapping might provide lots of information to cardiac electrophysiologists about the atrial substrate, under limited availability of fibrotic substrate imaging. However, the association between low-voltage bipolar mapping and outcomes of AF after RFCA is unclear. There have been reported about various ranges of low voltage values in atrium, however, the tissue with underlying atrial fibrosis usually shows lower voltage values <0.5 mV in sinus rhythm (SR). Thus, the low-voltage mapping using <0.5 mV values can be an attractive surrogate marker for fibrotic tissue and atrial substrate imaging.[2] In addition, previous study reported that the left atrium (LA) continued structural and functional remodeling even though after RFCA, and the LA volume index obtained by 3D echocardiography was also helpful in the prediction of long term outcomes after RFCA.[4] However, the predictive value of low voltage area (LVA) for long term clinical outcome after RFCA as compared to conventional 2D-LA diameter is not fully evaluated.[5]

In this issue of *Korean Circulation Journal*, Kim et al.[6] compared the predictive value of LA electrical (low voltage zone, LVZ) versus structural remodeling (LA diameter) for long term clinical outcome after RFCA. The authors also provided LA surface area value measured with 3D mapping system, which could also reflect LA dimension and structural remodeling. In this issue, the authors found that the LVZ volume in LA was associated with late recurrence (LR) after RFCA significantly and proposed that those electrical remodeling area (LVZ) might be more reliable predictor for LR compared to simple structural dimension (2D-LA diameter) in this study.

Conflict of Interest
The authors have no financial conflicts of interest.

Data Sharing Statement
The data generated in this study is available from the corresponding author upon reasonable request.

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The substrate mapping using Voltage map in the atrium is a well-known approach and commonly performed during RFCA for AF with ablation or multielectrode mapping catheters. These substrate mapping in patients with AF would depend on dynamic components, such as cycle length and wave-front direction. Therefore, in real-world practice, it may be necessary to adjust the voltage scale to identify voltage gradients in an individualized way. Velocity-dependent changes occurred in all LA region, but direction-dependent changes were highly localized, especially confined to posterior wall of LA. Therefore, the extent to which potential substrate regions at short cycle length or with tunable wave-front propagation are important for substrate ablation approaches requires further study.[7]

Previous study reported that additional LVZ-guided ablation and LA mass reduction is better than non-substrate guided ablation for long term clinical outcome (LR) after RFCA. And in SR patients after RFCA, reverse remodeling occurred in LA regardless of the extent of RFCA.[8]

However, while the term low voltage is representative of fibrosis tissue in myocardium, the two terms have fundamentally different meanings and lower voltage amplitude cannot be used to quantify myocardial tissue fibrosis. AF itself can generates lower amplitude fragmented electrograms due to heterogeneous tissue properties. However, those low voltage during AF may not represent fibrosis but may be due to underlying tissue electrical refractoriness associated with the short AF cycle-length. And the lower amplitude electrogram in AF may be due to various simultaneous fibrillatory wavelets with multiple propagation directions, because the bipolar voltage amplitude during electrophysiologic study depends on the direction of wave-front activation.[3] In addition, the presence of fibrosis does not necessarily indicate increased incidence of arrhythmia. In contrast, restorative fibrosis replaces dead cardiomyocytes, disrupting electrical continuity, and results in slowing conduction velocity or discontinuing conduction.[9]

The issue that Kim et al.[6] reported is a valuable study that addresses a potentially more reliable tools for prediction of AF late recurrence after RFCA using electrical remodeling parameters, such as LVZ, compared to conventional LA enlargement. And the authors should be commended for the challenge of correlating low voltage values with underlying fibrosis and seeking to find a more reliable paradigm for predicting long-term outcomes after RFCA. However, the information obtained from the voltage map is a bit complicated, and the result of current study should be interpreted cautiously. A multiple modality comparison about low voltage area in AF, such as with late gadolinium enhanced cardiac magnetic resonance imaging should be performed to validate reliable voltage cut-off values to find fibrotic and arrhythmogenic substrates in AF that enable clinicians to use a voltage-guided ablation strategy.[10] Furthermore, larger and more comprehensive studies are needed to clarify the scope of a reliable technique for which bipolar voltage mapping in AF can detect abnormal LA myocardium.

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