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Ablation index in AF

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Since the landmark study by Haïssaguerre et al., catheter ablation targeting the pulmonary veins has become pivotal in managing paroxysmal atrial fibrillation [1]. The sustained durable electrical isolation of the pulmonary veins by creating atrial lesions remains the target of the procedure. Consequently, lesion assessment is the cornerstone of the same. Incomplete lesions can lead to reconnection of the veins and may predispose to flutter circuits that may paradoxically make the patient more symptomatic than before. Too much delivery of radiofrequency (or cryoenergy) into the atrial tissues carries the risk of collateral damage to the adjacent structures risking severe complications such as atrio-esophageal fistula [2].

The size of ablation lesions using an irrigated radiofrequency catheter is proportional to the contact force, power, and time delivered [3,4]. Each lesion created within the left atrium represents a choice made by the operator vis a vis the sufficiency of the same. Historically, the techniques and technology have been refined to maximize success, limit procedural time, and minimize complications. The advent of irrigated ablation catheters, intracardiac echocardiography, and contact force have been steps in this direction [5].

However, radiofrequency duration, power, and contact force to deliver the optimal lesion, and interlesional distance to avoid reconnection of the pulmonary veins has not been well-established. Traditional assessment of local lesion completeness has been based on assessing impedance fall during energy delivery, the change in the morphology of the bipolar electrogram, fractionation of the signal, or the development of double potentials [6–9]. Most electroanatomic mapping systems have provided visual graphical representation for the fall in local impedance due to the ablation lesion. However, the other parameters suffer from a lack of standardized representation and depend on operator assessment.

In this issue, Theis et al. examine the use of the Ablation Index (AI), a composite measure of force, power, and time along with

closely delivered lesions to maximize procedural success [10]. In this small sample, the authors demonstrate that the CLOSE protocol using an AI of 380 along the posterior wall and 480 along the anterior wall of the left atrium with an inter-lesion distance of < 5mm resulted in more durable pulmonary vein isolation and shorter procedural time.

Measures like the composite integral and other such values remain a challenging concept to use in clinical practice. They represent 'targets' to be achieved and perhaps oversimplify the energy delivery challenge to the atrial myocardium. They convey a sense of false security to the operator and attempt to 'automate' the complex decision-making process. These efforts are welcome to aid the electrophysiologist but need to be assessed critically considering their limitations. Tissue thickness and fiber orientation differ significantly throughout the left atrium [11]. Assuming similar characteristics even between contiguous lesions and using the same ablation index may not be the best approach. Too much unnecessary energy delivery, guided by such indices, can cause a steam pop resulting in pericardial effusion [12]. While this builds upon previous work, further refinement and assessment are necessary.

While a marker, additionally incorporating change in the amplitude of the local signal, catheter stability, catheter drift, high-resolution intra- or pre-operative imaging, or impedance, tailored the anatomical location to help create the perfect lesion with minimal risk is awaited, the authors should be commended for their work in this regard. It represents a worthwhile attempt to the electrophysiologist in one of the most challenging aspects of decision-making in day-to-day practice.

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Declaration of competing interest

None.

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