Editorial

Left atrial strain importance in atrial fibrillation screening process

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Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia among adults, with an estimated prevalence of 2–4% of the general population, and represents a critical health problem (1). It is significantly associated with high risk of stroke and heart failure (HF), and the development of AF is associated with unfavorable cardiovascular (CV) outcomes in several patient populations (1,2). Thus, early detection of AF is of critical importance for prevention and therapeutic purposes.

There is a close pathophysiological relationship between left atrium (LA) myopathy and the development of AF (3). Different biological processes leading to anatomical and structural atrial changes, particularly inflammatory processes and fibrosis, play a pivotal role in the pathogenesis of AF, by increasing the conduction heterogeneity of the atria, thereby providing the substrate for re-entry. Along with the structural and functional changes, LA myopathy is associated with alterations in calcium cycling, ion channels and gap junctions leading to electrophysiological remodeling (3). Concomitant autonomic nervous system remodeling with intrinsic cardiac nerve activities is observed. Such structural and functional derangement promotes a vicious cycle in which "AF begets AF", since calcium accumulation triggers adaptive and inflammatory responses eventually promoting myocyte apoptosis and accelerating atrial fibrosis.

There is no single imaging parameter that best defines atrial myopathy and different tools have been previously defined (4). Doppler measures, such as transmitral peak A wave velocity and tissue Doppler derived A' velocity, and volumetric measures, including LA ejection fraction (LAEF) and LA expansion index (LAEI), have been utilized. More recently, strain analysis by speckle tracking echocardiography has been utilized for evaluation of LA function by assessing myocardial deformation throughout the cardiac cycle with less load dependency compared to standard measures (4). Strain analysis enables the evaluation of LA reservoir and contractile functions. LA reservoir reflects the overall LA wall compliance and stiffness, whose impairment may eventually favor the onset of atrial arrhythmia. The loss of LA contraction, reflecting the intrinsic contractility of the chamber, may represent an early marker of a pro-arrhythmic substrate. Although delayed enhancement cardiac magnetic resonance (CMR) imaging is considered the 'gold standard' to assess the extent of atrial fibrosis, a reduced LA reservoir strain has been shown to well correlate with LA wall fibrosis on CMR in patients with AF (3). This has important clinical implications since pre-ablation fibrosis assessment is independently associated with increased risk of arrhythmia recurrence at follow-up (3).

In recent years these tools have been gradually adopted in clinical practice to enhance the selection of patients for appropriate therapeutic intervention including catheter and surgical ablation, and to predict AF recurrence.

The feasibility of LA strain assessment has been shown, both in patients with AF and sinus rhythm at the time of catheter ablation, as confirmed in a metanalysis showing the usefulness of LA strain to identify patients with high risk of AF recurrence, especially among those with paroxysmal AF (5). In particular, a LA strain <22.8% showed a higher incidence of AF recurrence one year after catheter ablation (5).

Assessment of LA function also provides incremental clinical value for patients treated with surgical AF ablation. This has several implications since patients undergoing surgical ablation tend to have advanced AF and atrial myopathy. A sub-analysis of the Atrial Fibrillation Ablation and Autonomic Modulation via Thoracoscopic Surgery (AFACT) trial revealed that among patients undergoing thoracoscopic pulmonary vein isolation, LA function was more impaired among those in AF at the time of the procedure compared to those in sinus rhythm and that reservoir function significantly predicted AF occurrence over one-year follow-up (6). The prognostic value was independent of cardiac rhythm at baseline. Assessment of LA function can also be useful to guide operative strategy in patients undergoing mitral valve surgery. In a recent cohort of patients undergoing surgical mitral valve repair for degenerative mitral regurgitation, all LA strain parameters including reservoir and contraction, but not LA volumes, were significantly associated with mid-to-late postoperative AF onset (7). Yet, international guidelines on mitral valve management do not include LA functional parameters to guide operative strategy. This current gap highlights the need to improve the care of these patients.

Recent data suggest that timely therapeutic intervention may attenuate the process of deleterious LA remodeling and potentially promote reverse LA remodeling with a consequent improvement in clinical symptoms and CV outcomes (3). Several studies demonstrated the potential benefits of catheter ablation on LA reverse remodeling. Despite ablation itself may result in increased LA fibrosis, performing the procedure has been shown to favor LA reverse remodeling over time. Recent data from the Catheter Ablation vs Antiarrhythmic Drug Therapy (CABANA) Imaging Substudy revealed that ablation patients underwent a greater degree of reverse structural remodeling than drug therapy patients (53% *vs.* 40%), and patients with more reverse remodeling had a lower risk of AF recurrence (8). Similarly, among patients undergoing radiofrequency (RF) surgical ablation, an improvement in LA function assessed by strain analysis was observed after restoration of sinus rhythm. In particular, a better systolic LA function during reservoir and contraction phase was observed after RF ablation compared to Cryothermy technique (9). A secondary analysis of the CASA-AF trial (catheter ablation *vs.* thoracoscopic surgical ablation in long standing persistent atrial fibrillation) assessed LA function improvement among patients with long-standing persistent AF undergoing catheter or surgical ablation. After 3 months, a recovery in LA contraction and an improvement in LA reservoir function were observed regardless of the procedure technique and were greater in patients who maintained sinus rhythm (10). Taken together these data highlights the need to incorporate LA imaging parameters in the therapeutic work-up of these patients.

Yet, clinical challenges to widespread the routinely application of LA function evaluation by strain analysis are related to the lacks a universal method of execution, disease-specific cut-off reference values and the standardization across inter-vendor packages. A more patient-oriented software utilization, better tailored to clinical needs is advocated. Future larger prospective trials are needed to overcome the limitations of retrospective studies investigating the clinical value of LA strain in the management of AF.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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