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# Echocardiographic Assessment of Left Atrial Mechanics: Are We Ready for Daily Clinical Use?

Ines Paola Monte, MD [1,*]

[1]Department of Medical and Pediatric Sciences, University of Catania, Catania, Italy

*Corresponding author: Ines Paola Monte, Department of Medical and Pediatric Sciences, University of Catania, Catania, Italy. Tel/Fax: +39-0953792743, E-mail: inemonte@unict.it

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## *Dear Editor,*

Atrial function is important for the maintenance of ventricular performance in that it actively modulates its filling through three cardiac functions: reservoir function during ventricular systole, early diastolic phase as it works like a conduit, and in end-diastole as it has a pumping function. The left atrium (LA), which is directly exposed to the diastolic pressure of the left ventricle (LV) when the mitral valve is open, initially tends to reduce its elastic properties due to the thin structure of its walls and then dilate with increasing pressure. Therefore, the structural and functional remodeling of the LA reflects a range of pathophysiological changes in response to specific stresses.

The advances in echocardiography have improved our knowledge of the functional role of the LA in cardiovascular diseases, starting from the information about the shape and size of the atrium obtained by M-mode and the measurements of the areas and volumes obtained by two-dimensional images leading to the LA function via the Doppler analysis of the transmitral and pulmonary veins flow and the tissue Doppler assessment of the LA myocardial velocities. And now, three-dimensional methods for the clinical and quantitative analysis of the LA can be deemed a future direction for echocardiography.

The evaluation of the LA deformation parameters is a promising approach for the analysis of phasic LA function, derived from the application of Doppler tissue imaging or speckle tracking echocardiography. Strain and strain rate (SR) imaging allows an excellent assessment of the atrial deformation profile during a cardiac cycle. Recent studies have shown the considerable feasibility and reproducibility (1-3) and the prognostic value of the LA analysis for long-term cardiovascular outcome events such as atrial fibrillation, stroke, congestive heart failure, and cardiovascular death (3-5). Atrial SR reduction reveals diastolic heart failure earlier and more accurately than other diastolic dysfunction conventional parameters, ventricular mass, and atrial volume modifications. In patients with diabetes and/or hypertension, with a preserved left ventricular ejection fraction (LVEF), atrial global and longitudinal strain gradually reduces before organic changes and diastolic dysfunction occur. Moreover, in the end stage of heart failure, the reduction in the longitudinal atrial strain correlates with an increase in ventricular filling pressures and with an increase in pulmonary capillary wedge pressure more accurately than the E/E' ratio (5, 6).

Hypertension modifies atrial dynamics significantly. The pathophysiology of the LA dysfunction in hypertensive heart disease is ascribed to the LA's chronic exposure to high ventricular pressure during diastole, resulting in a rise in the LA pressure and a reduction in the reservoir and conduit functions. In early hypertensive heart disease, LA stretching causes a temporary increase in the LA pump function, which is required to maintain adequate ventricular filling. When compliance is lost and rigidity is increased, LA contractility can be reduced. Therefore, the three phases of atrial dysfunction may exist from the beginning of hypertensive disease, according on its stage (7, 8).

Sahebjam et al. (9), in a work published in the Archives of Cardiovascular Imaging, remark that in individuals with a normal value of the LA size, the effect of hypertension on the LA function, expressed by deformation parameters, does not depend on age, sex, heart rate, LA volume, LV mass index, and LVEF. After adjustment for other related factors, the heart rate is shown to be independently correlated with reduced myocardial deformation parameters. Kokubu et al. (10) reported that the LA strain and SR values were lower in patients with hypertension when compared with normal subjects and that treatment with renin-angiotensin system (RAS) inhibitors appeared to preserve the LA reservoir function in the hypertensive patients without a dilated LA.

The Sahebjam and Kokubu data suggest that SR imaging can detect LA dysfunction early in hypertensive patients and that it is useful for the assessment of a possible beneficial effect of therapy with RAS inhibitors or even beta-blockers (9, 10).

The clinical significance of the LA size and function is now well known. The study of the deformation parameters of the LA is considered to be a promising tool for clinical practice in terms of both diagnosis and therapeutic decision-making. However, the usefulness of the evaluation of the atrial mechanical function requires other studies similar to those carried out by Sahebjam et al. (9) to recognize the natural history of atrial remodeling, degree of the reversibility of mechanics with different therapy, and prognostic impact of such changes on outcomes.

Currently, the lack of standardization in image acquisition, software application on images, and data analysis is the main technical limitation to further larger multicenter studies and to the daily clinical application of the assessment of the LA mechanics.

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