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EDITORIAL COMMENT

Assessment of left atrial function by three-dimensional speckle-tracking in cardiomyopathies: A step forward?☆

Avaliação da função auricular esquerda por speckle-tracking 3D nas miocardiopatias: um passo em frente?

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The main role of the left atrium (LA) is to modulate left ventricular filling through its three phasic functions: reservoir, passive conduit, and active contraction. Assessment of left atrial strain is feasible and can be used to categorize diastolic dysfunction.[1] Structural and functional analysis of the LA can reveal a wide range of pathophysiological alterations occurring in response to specific stresses. In particular, the LA is exposed directly to the diastolic pressure of the left ventricle (LV) when the mitral valve opens, which, due to its thin walls, tends to reduce its elasticity, eventually resulting in dilatation as the pressure increases.[2]

Left atrial dimensions and function have been analyzed in the context of various cardiovascular disease and have been shown to be strong prognostic markers in different clinical conditions.[3] A review article by Vieira et al. highlighted the clinical importance of studying the LA using two-dimensional strain analysis.[4] A large number of studies have been published demonstrating the feasibility and reproducibility of speckle-tracking echocardiography (STE) for the assessment of myocardial strain, and this is now a major focus of research in echocardiography.[5] However, the resulting indices of atrial function depend on hemodynamic conditions and are based on geometric assumptions.[6,7]

Three-dimensional (3D) echocardiography allied with STE is a novel technique that has proved useful for assessing the volumes and functional properties of all the cardiac chambers. It enables characterization of the different phases of left atrial function without being based on geometric assumptions and is therefore more precise[8] and reproducible.[9] Studies have shown that in hypertrophic cardiomyopathy left atrial strain is reduced compared to healthy controls and to patients with hypertrophy secondary to hypertension.[10,11]

There have, however, been few studies using 3D-STE, particularly in patients with amyloidosis. Cardiac amyloidosis results from the deposition of amyloid in the heart. The most common form of presentation in western countries is restrictive cardiomyopathy, which mimics hypertrophic cardiomyopathy in around 5% of cases.[12–14] The echocardiogram usually shows concentric thickening of the LV, often associated with right ventricular thickening, and the ventricular wall may appear more echogenic due to amyloid deposition.[15] The most common clinical manifestations are heart failure and arrhythmias. It is important to consider cardiac amyloidosis as part of a systemic disease rather than as an isolated condition. Cardiac involvement in amyloidosis was seen until recently as a rare manifestation, often only diagnosed at autopsy, and considered untreatable when diagnosed during life. However, the last decade has seen

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significant advances in both diagnosis and treatment of cardiac amyloidosis, along with the recognition that it is more prevalent than previously thought.[16] Recent progress in advanced imaging techniques such as cardiac magnetic resonance and echocardiography has enabled significant advances in the ability to diagnose the disease.

There is widespread recognition of the importance of early diagnosis in cardiac AL amyloidosis, since if untreated, median survival after the onset of heart failure is only six months,[17] but modern treatments can lead to prolonged remission and extend survival by many years.[18]

The article by Nemes et al. published in this issue of the *Journal*[19] compares echocardiographic signs of left atrial dysfunction in three groups (16 patients with AL cardiac amyloidosis, 20 patients with hypertrophic cardiomyopathy, and 16 healthy controls) in the context of the MAGYAR-Path Study. The article highlights the advantages of 3D-STE in the assessment of LA function, as demonstrated in previous studies; what is new is the comparison of patients with AL cardiac amyloidosis and with hypertrophic cardiomyopathy. The results show different patterns of atrial dysfunction, with impairment of the reservoir phase in both diseases but significant impairment of the contractile phase only in cardiac amyloidosis, with reduced active atrial emptying fraction and contraction. The study's discussion points out the limitations of the technique, including its relatively low temporal and spatial resolution, the effects of age on left atrial functional parameters, and the potential influence of coexisting mitral valve regurgitation.

There are, moreover, considerable challenges in the use of 3D-STE, including the anatomical complexity of the LA, with its thin and non-uniform walls, which reduces the quantity of speckles, and its close relationship with other structures such as the pulmonary veins and atrial appendage, which tends to produce artifacts. This makes it difficult to divide the LA into 16 segments, the usual model for the LV. While 3D-STE is able to assess the entire LA in a single cardiac cycle, its anatomical heterogeneity can affect regional strain analysis.

3D-STE is already more than just a research method or a promising tool for left ventricular assessment. Progressive improvements in image quality, and particularly in algorithms for automated interpretation and analysis of information specially designed for atrial assessment, represent important advances and in the future should lead to inclusion of the technique in clinical practice for studying left atrial function.

Further 3D-STE studies of atrial function, including larger patient populations with different age-groups and involving other conditions, including cardiotoxicity, may add important information to what is known of the technique's considerable diagnostic value. Possible links between the different atrial strain parameters obtained by 3D-STE and arrhythmic risk in patients with cardiomyopathy may also be the subject of future research. Comparison of assessment of left atrial function by 3D-STE with other imaging modalities, particularly cardiac magnetic resonance, and their correlation with biomarkers, could provide important evidence in support of its clinical value.

Finally, the LA plays an important part in the clinical expression and prognosis of cardiac disease, particularly the cardiomyopathies. Echocardiography, as a non-invasive method, has made increasingly important contributions to the quantitative analysis of left atrial function. 3D-STE brings together the advantages of angle-independent assessment of myocardial strain and the superior geometrical representation of 3D imaging. Although it has some limitations, it provides information that enables detection of patterns of functional remodeling in early stages of the disease, before anatomical alterations, which is of clinical value. The study by Nemes et al. shows that application of 3D-STE to left atrial assessment is a step forward, since it provides useful information with potential clinical importance, particularly in a disease in which it has high prognostic impact.

Conflicts of interest

The author has no conflicts of interest to declare.

References

1. Singh A, Addetia K, Maffessanti F, et al. LA strain categorization of LV diastolic dysfunction. JACC Cardiovasc Imaging. 2017;10:735–43.
2. Cameli M, Lisi M, Righini FM, et al. Novel echocardiographic techniques to assess left atrial size, anatomy and function. Cardiovasc Ultrasound. 2012;10:4.
3. Leung DY, Boyd A, Ng AA, et al. Echocardiographic evaluation of left atrial size and function: current understanding, pathophysiologic correlates, and prognostic implications. Am Heart J. 2008;156:1056–64.
4. Vieira MJ, Teixeira R, Gonçalves L, et al. Left atrial mechanics: echocardiographic assessment and clinical implications. J Am Soc Echocardiogr. 2014;27:463–78.
5. Saraiva RM, Demirkol S, Buakhamsri A, et al. Left atrial strain measured by two-dimensional speckle tracking represents a new tool to evaluate left atrial function. J Am Soc Echocardiogr. 2010;23:172–80.
6. Mochizuki A, Yuda S, Oi Y. Assessment of left atrial deformation and synchrony by three-dimensional speckle-tracking echocardiography: comparative studies in healthy subjects and patients with atrial fibrillation. J Am Soc Echocardiogr. 2013;26:165–74.
7. Badano LP, Miglioranza MH, Mihăilă S. Left atrial volumes and function by three-dimensional echocardiography: reference values, accuracy, reproducibility, and comparison with two-dimensional echocardiographic measurements. Circ Cardiovasc Imaging. 2016;9.
8. Mor-Avi V, Yodwut C, Jenkins C, et al. Real-time 3D echocardiographic quantification of left atrial volume: multicenter study for validation with CMR. JACC Cardiovasc Imaging. 2012;5:769–77.
9. Jenkins C, Bricknell K, Marwick TH. Use of real-time three-dimensional echocardiography to measure left atrial volume: comparison with other echocardiographic techniques. J Am Soc Echocardiogr. 2005;18:991–7.
10. Paraskevaidis IA, Panou F, Papadopoulos C, et al. Evaluation of left atrial longitudinal function in patients with hypertrophic cardiomyopathy: a tissue Doppler imaging and two-dimensional strain study. Heart. 2009;95:483–9.
11. Eshoo S, Semsarian C, Ross DL, et al. Comparison of left atrial phasic function in hypertrophic cardiomyopathy versus systemic hypertension using strain rate imaging. Am J Cardiol. 2011;107:290–6.
12. Philippakis AA, Falk RH. Cardiac amyloidosis mimicking hypertrophic cardiomyopathy with obstruction: treatment with disopyramide. Circulation. 2012;125:1821–4.

13. Fernandes A, Caetano F, Almeida I, et al. Diagnostic approach to cardiac amyloidosis: a case report. Rev Port Cardiol. 2016;35, 305.e1-7.
14. Falk RH. Diagnosis and management of the cardiac amyloidoses. Circulation. 2005;112:2047–60.
15. Fonseca C, Ceia F, Nogueira JS. Myocardiopathy caused by Portuguese-type familial amyloidotic polyneuropathy. Sequential morphologic and functional study of 60 patients. Rev Port Cardiol. 1991;10:909–16.
16. Falk RH, Alexander KM, Liao R, et al. AL (light-chain) cardiac amyloidosis: a review of diagnosis and therapy. J Am Coll Cardiol. 2016;68:1323–4.
17. Kyle RA, Linos A, Beard CM, et al. Incidence and natural history of primary systemic amyloidosis in Olmsted County, Minnesota, 1950 through 1989. Blood. 1992;79:1817–22.
18. Comenzo RL. Out, out – making amyloid's candle briefer. N Engl J Med. 2015;373:1167–9.
19. Nemes A, Földeák D, Domsik P, et al. Left atrial dysfunction in light-chain cardiac amyloidosis and hypertrophic cardiomyopathy – a comparative three-dimensional speckle-tracking echocardiographic analysis from the MAGYAR-Path Study. Rev Port Cardiol. 2017;36:905–13.