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 precise⁸ 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.\textsuperscript{15} 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
eye disease in cardiac AL amyloidosis, since if untreated,
median survival after the onset of heart failure is only six
months,\textsuperscript{15} but modern treatments can lead to prolonged
remission and extend survival by many years.\textsuperscript{16}

The article by Nemes et al. published in this issue of the
Journal\textsuperscript{17} 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
fracture 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
coeexisting 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. Pro-
gressive improvements in image quality, and particularly
in algorithms for automated interpretation and analysis of
information specially designed for atrial assessment, repre-
sent 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 impor-
tant 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 correla-
tion 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 assess-
ment of myocardial strain and the superior geometrical
representation of 3D imaging. Although it has some limi-
tations, 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.

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