How to Perform an Echocardiographic Assessment of Chagas Disease

Como eu Faço a Avaliação Ecocardiográfica da Doença de Chagas

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Introduction

Chagas disease has a heterogeneous pathology, and Chagas cardiomyopathy has high morbidity and mortality rates.[1] This infectious disease is characterized by three main pathological processes: inflammation, cell death, and fibrosis.[2] The distinguishing features of Chagas disease are the presence of fibrosis predominantly in the posterior and apical regions and involvement of the electrical conduction system in its pathogenesis.[3]

Echocardiography is the most frequently used imaging technique used for initial evaluation and follow-up of patients with Chagas disease. The indications for echocardiography in patients of this disease are shown in Chart 1.[3,4]

Echocardiographic evaluation

There were subtle changes in segmental contraction and cardiac chamber enlargement, with biventricular dysfunction at an advanced stage of the disease. Based on the presence and severity of echocardiographic changes associated with clinical data, Chagas disease can be classified into four stages (A to D) (Chart 2, adapted for Chagas disease).[5]

Changes in segmental contraction

A thorough examination is crucial because the identification of segmental changes, especially in the apical zone, is challenging. For instance, deep breathing and unconventional approaches, such as an intermediate cut between the apical four-and two-chamber views, have previously been used to identify small finger-shaped aneurysms located in the apical zone.[3] Apical aneurysms have different sizes and shapes (Figure 1) and are associated with thrombi, which are a frequent cause of cerebral embolism.[6] Echocardiographic contrast can be useful to confirm the unclear images for the presence of thrombi (Figure 2).[2,3]

Segmental changes, when present, can be used to identify individuals who are at risk of progressing to ventricular dysfunction and arrhythmias. These changes occur more commonly on the inferior and inferolateral walls (Figure 3) and in the apical segments described above. This pattern of involvement outside the coronary territory is a characteristic feature of Chagas cardiomyopathy.[7]

Left ventricular systolic function

One of the first indications of echocardiography assessed for Chagas heart disease is chamber size and left ventricular (LV) systolic function.[2]

Despite its high importance for the initial assessment of

Chart 1 – Indications for echocardiography in patients with Chagas heart disease.

Recommendation	Class of recommendation	Level of evidence
Initial evaluation of patients with positive serology for Chagas disease for diagnosis and risk stratification of cardiomyopathy	I	C
Patients with the indeterminate form of Chagas disease who presented with new electrocardiographic changes that were compatible with the development of cardiomyopathy	I	C
Patients with worsening of heart failure, syncope, and arrhythmic or thromboembolic events	I	C
Routine reevaluation in clinically stable patients without therapeutic changes	III	C

Keywords

Chagas Disease; Echocardiography; Prognosis; Diagnosis.

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Chart 2 – Clinical staging of Chagas Disease according to cardiac symptoms and their severity.

Stage	A	B1	B2	C	D
Clinical findings and complementary examinations	Absence of HF or structural cardiac damage on ECG and chest X-ray	Absence of HF, presence of ECG changes (arrhythmias or conduction disorders), and normal LV systolic function	LV systolic dysfunction but no HF symptoms	LV systolic dysfunction with current or previous HF symptoms	Refractory HF symptoms despite optimized drug therapy

HF, heart failure; ECG, electrocardiogram; LV, left ventricle.

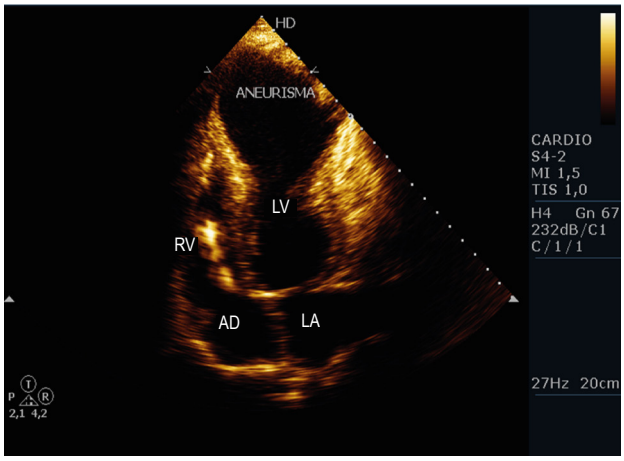


Figure 1 – *Presence of a typical and large ventricular apical aneurysm in a patient with Chagas disease. The other cardiac chambers were of normal size and a pacemaker lead is presented in the right chambers.*

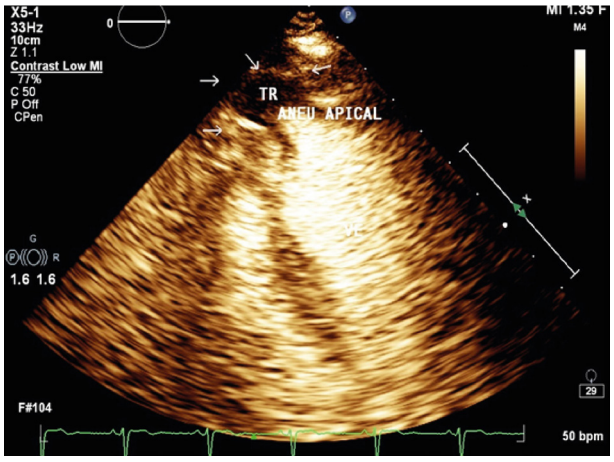


Figure 2 – *Use of echocardiographic contrast to improve the detection of a thrombus in an apical digitiform aneurysm. Non-opacification can be observed in the aneurysm.*

this cardiomyopathy, the M mode is not recommended for evaluating LV systolic dimension and function because of changes in geometry and segmentation. This analysis should be done using the Simpson method.[2]

The late onset of this cardiomyopathy presents diffuse LV hypokinesia, with enlargement of all cardiac chambers and a decrease in ejection fraction. The latter is the best predictor of mortality in this disease.[8] Secondary mitral and/or tricuspid regurgitation of varying severity might occur at this stage.[2]

Three-dimensional echocardiography

Similar to the other cardiomyopathies, three-dimensional echocardiography is superior to two-dimensional

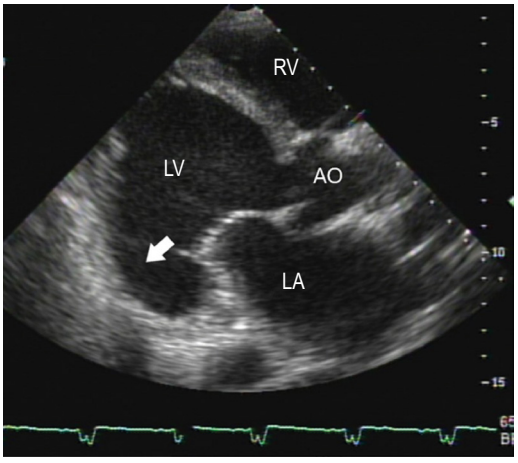
echocardiography for assessing ejection volume and fraction, especially in cases with suspected LV shortening (Figure 4).[3] Moreover, this technique is useful for analysis of apical segments and detection of thrombi (Figure 5). However, the limitations of three-dimensional echocardiography include low temporal resolution and dependence on the quality of transthoracic echocardiographic images.[9]

Diastolic function of the lv and la

The first distinguishing feature of the early stage of the disease is uncoordinated relaxation. With progression of the cardiomyopathy, the dysfunction pattern can evolve into a restrictive pattern.[3] Previous studies have shown that the E/e' ratio is associated with the levels of type B natriuretic peptide.[10] Another important factor is the assessment of the left atrial volume, which is associated with mortality that reinforces the importance of its analysis by echocardiography.[11,12]

Right ventricular dysfunction

Right ventricular (RV) systolic dysfunction can be attributed to LV systolic dysfunction or direct myocardial involvement with chronic myocarditis and fibrosis. The two classic factors strongly associated with the detection of RV systolic dysfunction in Chagas cardiomyopathy are the reduction of the s' wave of RV and



RV, right ventricle; LV, left ventricle; AO, aorta; LA, left atrium.

Figure 3 – *Changes in the segmental contraction in the inferolateral wall (arrow) associated with chamber enlargement.*

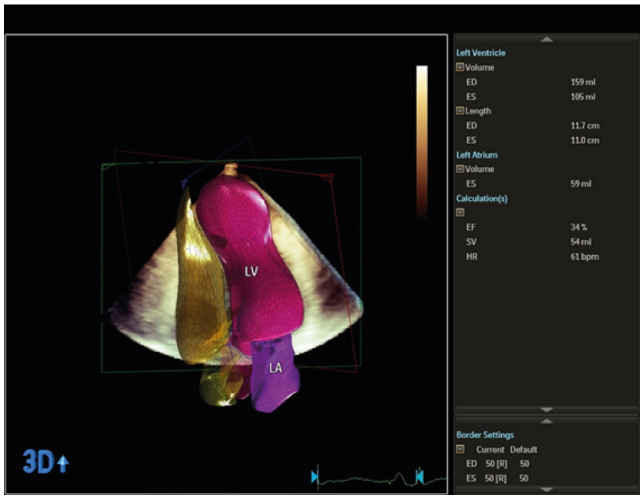


Figure 4 – *Assessment of ejection volume and fraction using three-dimensional echocardiography with semiautomatic detection of the margins in a patient with moderate systolic dysfunction and dyskinesia of the apical segments of all cardiac walls.*

the reduction of RV isovolumetric contraction time.[13,14] When present, RV systolic dysfunction leads to a reserved prognosis in these patients.[15] The assessment of this dysfunction is challenging because of the anatomical complexity of this chamber. However, new quantitative indexes, such as three-dimensional echocardiography and myocardial strain, are promising.[2,3]

Myocardial strain and speckle tracking (LV and RV)

Myocardial strain measurements, based on speckle tracking, constitute a vast and promising field of research on Chagas disease. Changes in segmental contraction might appear subtle when assessed visually, and the use of this technique allows a quantitative rather than qualitative assessment of these patients, especially those with the indeterminate form of the disease.[3] (Figure 6) Patients with no segmental contraction changes on the echocardiogram, but with fibrosis on magnetic resonance imaging (MRI), present changes in the global, radial, and circumferential strain, especially a decreased radial strain in the basal lower septal segment.[16] Decrease in the global longitudinal strain of the LV improves the prognosis of cardiac events and other parameters, such as ejection fraction.[17]

The RV strain has also gained prominence in Chagas cardiomyopathy, and the RV free wall strain is superior to other conventional parameters, such as MRI, that are used for assessment of RV systolic function.[18]

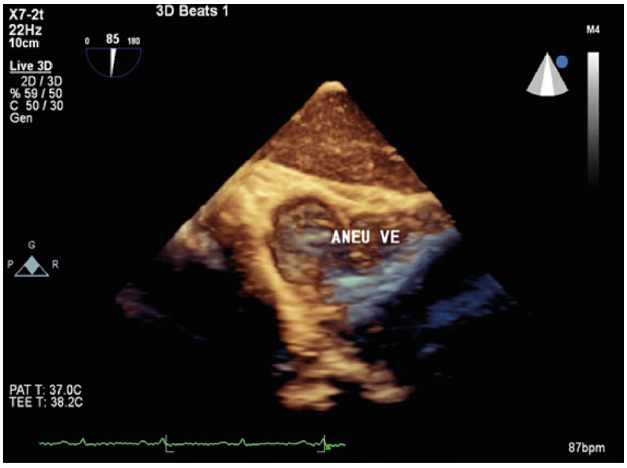


Figure 5 – *Three-dimensional transesophageal echocardiography revealing ventricular apical aneurysm associated with a thrombus.*

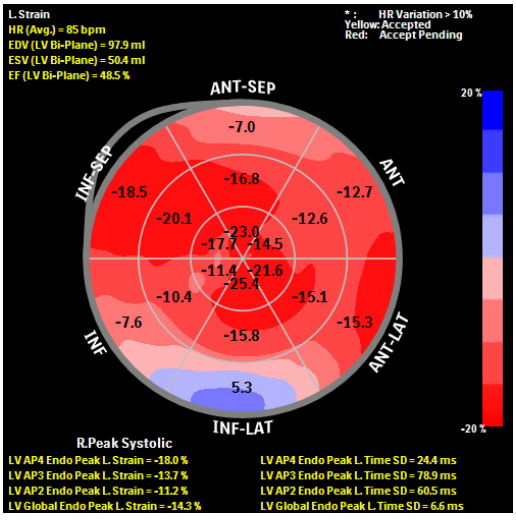


Figure 6 – *LV´s global longitudinal strain shows a reduction in its absolute value with marked involvement of the inferolateral wall.*

Stress echocardiography

Echocardiography under pharmacological stress can evaluate biphasic contractile responses in these patients, despite the absence of coronary artery disease.[19] Even using dobutamine, a drug with arrhythmogenic activity, echocardiography under pharmacological stress was safe, and changes in segmental contraction at rest were an independent predictor for the appearance of arrhythmias during the examination. Therefore, this technique is safe and recommended in cases of doubt about the concomitant presence of coronary disease.[20,21]

Conclusion

Despite the complexity of echocardiographic examination in Chagas heart disease, the use of systematization can help in correct diagnosis, staging, and prognosis in daily clinical practice.

Conflict of interest

The author have declared that they have no conflict of interest.

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