Editorial

2D and 3D Echocardiography to Assess Reverse Remodeling after CRT: What is its Real Application? Did 3D Echocardiography Improve 2D Echo Evaluation?

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Cardiac Resynchronization Therapy (CRT) has proven effective when combined with treatment with conventional drugs in patients refractory to medical treatment, with severe ventricular dysfunction, conduction disturbances, dyssynchrony and chronic heart failure (CHF) functional class III and IV[1].

Several studies have shown that CRT significantly improves symptoms, exercise tolerance and quality of life. However, 20% to 30% of patients do not improve with CRT. The probable cause of failure is the fact that mechanical dyssynchrony is not always related to electrical dyssynchrony, and the greater the mechanical dyssynchrony, the better the response to TRC[2].

The echocardiographic markers that indicate patient improvement with CRT are: increased heart rate, decreased degree of mitral regurgitation, reduction of ventricular remodeling and reduction of intraventricular delay.

Technological progress of equipment allows carrying out a more accurate assessment of left ventricular reverse remodeling, whose importance has been demonstrated by studies in the literature with increasing frequency. Since the initial studies of volumes by the M-mode, two-dimensional mode, and more recently by 3D echo, as done in this study, much has been learned in this field[3].

Real-Time Three-Dimensional Echocardiogram (RT3DE) represents a new technique to identify patients with CHF who may or may not be considered for CRT quantifying LV function and its dyssynchrony.

The software application used by current RT3DE devices helps the correction of edges, thus providing a more accurate RT3DE. Only markedly increased left ventricle diameters make it difficult to capture the image at full volume. In this study, the correlations of volumes and left ventricle ejection fraction were excellent between 2D and 3D modes. Only the mass calculated by the 3D was superior to 2D echo. The semi-automatic measure of the endocardial surface by the RT3DE is fast, accurate and reproducible of volumes, reported in the literature as superior to the volumes calculated by 2DECHO[4], which differs from that observed in this study, which showed no superiority of 3DECHO for the calculation of volumes[3].

Large studies that validate RT3DE definitively have not been undertaken yet. The RT3DE can assist in choosing the best location for the implantation of the pacemaker (PM) and monitor the patient[5].

Zhang et al[6] studied 13 patients after CRT and showed that the shutdown of PM determined asynchrony, increased volumes and decreased ejection fraction, indicating the importance of this analysis in selecting patients for CRT and predicting favorable responses.

In a recent review on this issue, Auger et al[7] studied 166 patients after CRT with Doppler tissue imaging (TSI) and RT3DE (real-time 3D echo), showed that the response to CRT was positive in 86.3% of patients when the two methods showed the presence of dyssynchrony, and the response was negative in 97% of patients when either method showed no dyssynchrony. They concluded that the evaluation of dyssynchrony allows a more accurate prediction of response to CRT when both methods are consistent.

Waggoner et al[8] report that invasive studies have shown significant improvement in systolic function and reverse remodeling after CRT (up to three months) in more than 20%, and end-diastolic pressure did not change, as well as relaxation indices.

The accurate determination of LV volumes and ejection fraction has important clinical implications for patients with cardiovascular disease due to their correlation with prognosis and mortality, which is usually done with 2DECHO[4]. The possibility that the RT3DE can fill the limitations inherent in 2D echo for estimating the volumes online without geometric reconstruction was the reason for the study presented. The 2D ECHO usually underestimates LV volumes compared with cardiac magnetic resonance imaging (MRI). The disparity between the ECO and CMRI is because the ECHO measures the endocardial edges at the tips of the trabeculae and the CMRI, at the base of the trabeculae, and it ignores the longitudinal shortening[4].

Keywords

Cardiac resynchronization therapy; echocardiography/methods; ventricular dysfunction, left; heart failure.

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This study evaluated 24 patients with CHF with indication for CRT. As mentioned in the study, the CMRI considered a reference method for measuring ventricular volumes was not used to compare 2DECHO with 3DECHO, but it has been done in other studies reported in the literature. The LV reverse remodeling is very important in long-term prognosis, making it a marker of clinical improvement, as reported in the literature and in this study.

We should highlight the innovative aspect of this article, allowing its use with great precision for the evaluation of volumes and ejection fraction, an important tool in the pre and post-implantation of PM where the 3D Echo becomes a great help to understand what is happening in terms of function, since ejection fraction does not change significantly (always below 30%), but clinical improvement is evident. Reverse remodeling has been shown to be of great importance and a better prognostic predictor of survival than the functional class. The ECHO has become an important technique in determining the correct candidate to benefit from CRT.

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References

1. Yu CM, Bax JJ, Monaghan M, Nihoyannopoulos P. Echocardiographic evaluation of cardiac dyssynchrony for predicting a favorable response to cardiac resynchronization therapy. Heart. 2004;90(Suppl. 6):vi17-22.
2. Nesser HJ, Sugeng L, Corsi C, Weinert L, Niel J, Ebner C, et al. Volumetric analysis of regional left ventricular function with real-time three-dimensional echocardiography: validation by magnetic resonance and clinical utility testing. Heart. 2007;93(5):572-8.
3. Hotta VT, Martinelli Filho M, Mady C, Mathias Jr W, Vieira MLC. Comparação entre a ecocardiografia 2D e 3D na avaliação do remodelamento reverso após TRC. Arq Bras Cardiol. 2011;97(2):111-21.
4. Jacobs LD, Salgo IS, Goonewardena S, Weinert L, Coon P, Bardo D, et al. Rapid online quantification of left ventricular volume from real-time three-dimensional echocardiographic data. Eur Heart J. 2006;27(4):460-8.
5. Agler DA, Adams DB, Waggoner AD. Cardiac resynchronization therapy and the emerging role of echocardiography (part 2): the comprehensive examination. J Am Soc Echocardiogr. 2007;20(1):76-90.
6. Zhang Q, Yu CM, Fung JW, Zhang Y, Chan YS, Chan HC, et al. Assessment of the effect of cardiac resynchronization therapy on intraventricular mechanical synchronicity by regional volumetric changes. Am J Cardiol. 2005;95(1):126-9.
7. Auger D, Bertini M, Marsan NA, Hoke U, Ewe SH, Thijssen J, et al. Prediction of response to cardiac resynchronization therapy combining two different three-dimensional analyses of left ventricular dyssynchrony. Am J Cardiol. 2011;108(5):711-7.
8. Waggoner AD, Agler DA, Adams DB. Cardiac resynchronization therapy and the emerging role of echocardiography (part 1): indications and results from current studies. J Am Soc Echocardiogr. 2007;20(1):70-5.