



ORIGINAL ARTICLE

M-mode apical systolic excursion: A new and simple method to evaluate global left ventricular longitudinal strain



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KEYWORDS

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Abstract

Introduction: Since M-mode measurements can assess deformation of specific regions of the left ventricle, we hypothesized that M-mode measurements like M-mode apical systolic excursion (MMASE) and mitral annular plane systolic excursion (MAPSE) may be correlated with left ventricular longitudinal strain (LVLS).

Methods: All subjects of the study underwent a full echocardiographic evaluation and MMASE and MAPSE measurement. Three-dimensional wall motion tracking (3D-WMT) was performed.

Results: Thirty-one patients were evaluated. Significant correlations between MAPSE and LVLS (-0.372 ; $p=0.04$) and between MMASE and LVLS (-0.398 ; $p=0.027$) were found. LVLS was linearly related to MAPSE and MMASE (in mm) as follows: $ST=-10.6-0.4 * MAPSE$ ($r^2=0.14$) and $ST=-13.1-0.5 * MMASE$ ($r^2=0.16$).

Conclusions: Our results demonstrate that simpler and faster methods than strain based on complex speckle analysis can also have a role in predicting subclinical left ventricular systolic dysfunction.

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PALAVRAS-CHAVE

Ecocardiograma
Modo-M;
Strain longitudinal;
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tracking

Excursão sistólica apical em Modo-M: um método novo e simples para avaliação do strain longitudinal global do ventrículo esquerdo

Resumo

Introdução: Uma vez que as medições em Modo-M podem determinar a deformação de regiões específicas do ventrículo esquerdo, neste trabalho é colocada a hipótese de que medidas como a excursão sistólica apical em modo-M (MMASE) e a MAPSE podem ser correlacionadas com o Strain Longitudinal do Ventrículo Esquerdo (SLVE).

Métodos: Todos os indivíduos do estudo foram submetidos a uma avaliação ecocardiográfica completa, à medição da MMASE e da MAPSE. Foi ainda realizado o 3D-wall motion tracking (3D-WMT).

Resultados: Foram avaliados 31 pacientes, tendo sido obtida uma correlação estatisticamente significativa entre a MAPSE e o SLVE (-0.372 ; $p=0.04$) e entre a MMASE e o SLVE (-0.398 ; $p=0.027$). Estas medidas apresentaram uma correlação linear: $ST = -10,6 - 0,4 * MAPSE$ ($r^2=0.14$) and $ST = -13,1 - 0,5 * MMASE$ ($r^2=0,16$).

Conclusão: Os nossos resultados demonstram que métodos mais simples e rápidos que o strain podem também ser úteis na determinação da disfunção subclínica sistólica do ventrículo esquerdo.

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List of abbreviations

3D-WMT	three-dimensional wall motion tracking
LV	left ventricular
LVLS	global left ventricular longitudinal strain
MAPSE	mitral annular plane systolic excursion
MMASE	M-mode apical systolic excursion

Introduction

Cardiac echocardiography has evolved and new methods have been developed to assess left ventricular (LV) mechanics. One of these techniques is three-dimensional wall motion tracking (3D-WMT), which enables assessment of global LV longitudinal strain (LVLS), radial and circumferential strain simultaneously. It has been described as a reliable parameter that is less dependent on loading conditions¹ and allows the measurement of left ventricular mechanics.

Theoretically, M-mode measurements can assess deformation of specific LV regions, so it is to be expected that the study of different regions of the myocardium will allow global LV deformation to be predicted. Mitral annular plane systolic excursion (MAPSE) is a parameter used to assess left ventricular longitudinal function,² and has been recently correlated with LVLS, as an early predictor of systolic dysfunction.³

Our goal is to assess whether M-mode apical systolic excursion (MMASE) and MAPSE could be correlated with LVLS.

Methods

Consecutive patients aged >18 years with preserved LV systolic function and a good acoustic window were recruited.

All subjects underwent a full echocardiographic evaluation. MAPSE was measured in 4-chamber view with an M-mode cursor positioned through the mitral annulus, close to the lateral wall. MMASE was calculated by subtracting the distance between the apical line in M-mode in end-diastole and in end-systole. These distances were measured in 4-chamber view with the left ventricle centered in the scanning sector and the M-mode cursor positioned through the apex. The distance between the apical line and the mitral valve was measured in end-diastole and end-systole, as shown in Figure 1.

Three-dimensional wall motion tracking (3D-WMT) was performed with an Artida system and a PST-25SX probe. Global LVLS, radial strain, circumferential strain and area tracking were determined. Statistical analysis was performed using SPSS version 20.0.

Results

Thirty-one patients were enrolled (mean age 60.1 ± 21.0 years; 54.8% men). Eighteen (58%) patients were hypertensive, eight (25.8%) had dyslipidemia, and two (6.5%) had diabetes.

In terms of two-dimensional echocardiographic parameters, mean LV ejection fraction was $65 \pm 9\%$, mean LV diastolic diameter 44.8 ± 6.9 mm, mean MAPSE 16.7 ± 2.7 mm and mean MMASE 8.6 ± 2.4 mm. On 3D-WMT analysis, mean LVLS of -17.3 ± 2.4 , mean LV radial strain of 29.1 ± 7.8 and mean LV circumferential strain of -28.2 ± 7.3 were observed.

Analysis of the dataset showed statistically significant correlations between MAPSE and LVLS (-0.372 ; $p=0.04$) and between MMASE and LVLS (-0.398 ; $p=0.027$), as shown in Table 1. This association was slightly stronger for MMASE. There was no significant statistical correlation between these two parameters and LV ejection fraction or

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