



ORIGINAL ARTICLE

Right atrial deformation analysis in isolated left ventricular noncompaction – insights from the three-dimensional speckle tracking echocardiographic MAGYAR-Path Study



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Received 8 January 2016; accepted 5 April 2016
Available online 5 September 2016

KEYWORDS

Echocardiography;
Function;
Right atrium;
Speckle-tracking;
Strain;
Three-dimensional

Abstract

Objective: Isolated left ventricular noncompaction (ILVNC) is a rare cardiomyopathy characterized by a prominent trabecular meshwork and deep intertrabecular recesses. The present study aimed to examine right atrial (RA) volumes, volume-based functional properties and strains by three-dimensional speckle-tracking echocardiography (3DSTE) in ILVNC patients.

Methods: The study group consisted of 13 patients with ILVNC (mean age: 54.6±14.1 years, six male) and 23 healthy age- and gender-matched volunteers (mean age: 50.4±12.4 years, 10 male), who served as normal controls. Complete two-dimensional Doppler echocardiography and 3DSTE were performed in all cases.

Results: Increased systolic maximum (58.2±15.3 ml vs. 40.5±11.8 ml, p=0.0004) and diastolic pre-atrial contraction (39.6±16.1 ml vs. 28.2±9.2 ml, p=0.01) and minimum (46.2±17.5 ml vs. 34.6±11.6 ml, p=0.02) RA volumes were detected in ILVNC patients. Only total (18.6±8.5 ml vs. 12.2±5.9 ml, p=0.01) and passive (12.0±13.3 vs. 5.9±3.7 ml, p=0.05) RA stroke volumes, representing features of RA reservoir and conduit phases, were increased in ILVNC; active RA stroke volume and all emptying fractions did not differ between ILVNC patients and matched controls. Moreover, global, mean segmental and regional peak strains and strains at atrial contraction showed no differences between ILVNC patients and controls.

Conclusions: 3DSTE-derived volumetric analysis confirmed increased cyclic RA volumes in ILVNC. Only mild RA functional alterations were demonstrated in ILVNC.

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PALAVRAS-CHAVE

Ecocardiografia;
 Função;
 Aurícula direita;
Speckle-tracking;
 Strain;
 Tridimensional

Análise da mecânica auricular direita por estudo ecocardiográfico de *speckle-tracking* tridimensional, no ventrículo esquerdo não compactado isolado – estudo MAGYAR-Path

Resumo

Objetivo: A miocardiopatia não compactada isolada do ventrículo esquerdo (NCIVE) foi apresentada como uma miocardiopatia rara, caracterizada por uma trabeculação proeminente e por profundos recessos trabeculares na cavidade ventricular. Este estudo tem como objetivo examinar os volumes da aurícula direita (AD) e a mecânica auricular direita por ecocardiografia tridimensional de *speckle-tracking* nos doentes com NCIVE.

Métodos: O grupo de estudo é composto por 13 doentes com NCIVE (idade média: $54,6 \pm 14,1$ anos, seis homens) e 23 voluntários saudáveis com idade e género correspondentes (idade média: $50,4 \pm 12,4$ anos, homens) que são controlos normais. Foram realizadas em todos os casos ecocardiografia Doppler bidimensional e ecocardiografia tridimensional de *speckle-tracking*.

Resultados: Foi detetado nos doentes com NCIVE um aumento do volume da AD na fase sistólica ($58,2 \pm 15,3$ ml versus $40,5 \pm 11,8$ ml, $p = 0,0004$), na fase de contração diastólica pré-auricular ($39,6 \pm 16,1$ ml versus $28,2 \pm 9,2$ ml, $p = 0,01$) e na fase diastólica final ($46,2 \pm 17,5$ ml versus $34,6 \pm 11,6$ ml, $p = 0,02$). Apenas o volume da fase de reservatório ($18,6 \pm 8,5$ ml versus $12,2 \pm 5,9$ ml, $p = 0,01$) e da fase de condução da AD ($12,0 \pm 13,3$ versus $5,9 \pm 3,7$ ml, $p = 0,05$) foram superiores no grupo NCIVE em comparação com o grupo de controlos. O volume de ejeção da aurícula direita foi semelhante entre ambos os grupos. Os grupos foram também homogéneos relativamente ao *strain* e ao *strain rate* da AD nas diferentes fases do ciclo cardíaco.

Conclusão: A análise volumétrica detetada pela ecocardiografia tridimensional de *speckle-tracking* confirmou o aumento cíclico dos volumes da AD na NCIVE. Apenas alterações funcionais suaves da AD podem ser demonstradas na NCIVE.

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Introduction

Isolated left ventricular noncompaction (ILVNC) is a rare cardiomyopathy characterized by a prominent trabecular meshwork and deep intertrabecular recesses.¹⁻³ The disorder seems to occur because of an arrest of the normal compaction process in myocardial development during the first trimester. The classic triad of ILVNC-related complications are heart failure, arrhythmias, and systemic embolic events. Although the usual site of involvement is the left ventricle (LV), the right ventricle (or both) are also affected in some cases.^{4,5} Due to atrioventricular interactions, left atrial (LA) function may show alterations, as has been demonstrated in ILVNC.⁶ However, no clinical studies on right atrial (RA) function have been performed in series of patients with ILVNC. Therefore, the present study aimed to examine RA volumes, volume-based functional properties and strains by three-dimensional (3D) *speckle-tracking* echocardiography (STE) in ILVNC patients.

Methods**Study population**

The study population consisted of 13 patients with ILVNC from the Cardiology Center of the University of Szeged, Hungary, and 23 age- and gender-matched healthy

volunteers, who served as normal controls. All patients and controls were in sinus rhythm and all were examined by two-dimensional Doppler echocardiography and 3DSTE. The echocardiographic diagnostic criteria for ILVNC of Jenni et al.¹ were used:

- (1) Segmental and excessive thickening of the LV wall with a two-layered structure, consisting of a thin, compacted epicardial layer and a thicker, noncompact layer. The latter has a characteristic appearance with numerous prominent trabeculations (meshwork) and deep intertrabecular recesses. LV thickening is predominant in the apical, mid-lateral, and mid-inferior walls.
- (2) A noncompact/compact myocardial thickness ratio >2 measured at maximal thickness in end-systole in parasternal short-axis view.
- (3) Evidence of deeply perfused intertrabecular recesses communicating with the LV cavity by color Doppler echocardiography.
- (4) Coexisting cardiac anomalies are absent.

The present work is part of the Motion Analysis of the heart and Great vessels by three-dimensional *speckle-tracking* echocardiography in Pathological cases (MAGYAR-Path) Study ('Magyar' means 'Hungarian' in the Hungarian language), which aims to examine the diagnostic and prognostic significance of 3DSTE-derived parameters in

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