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ORIGINAL ARTICLE

Assessment of right atrial function with speckle tracking echocardiography after percutaneous closure of an atrial septal defect

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KEYWORDS
Congenital heart disease;
Right atrium;
Echocardiography;
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Abstract
Introduction: Speckle tracking echocardiography (STE) for two-dimensional (2D) strain analysis is a new tool to assess myocardial function. The aim of this study was to assess right atrial (RA) function using STE in patients with an atrial septal defect (ASD) before and one month after percutaneous closure.
Methods: We prospectively examined 32 consecutive patients (nine male, 23 female) who underwent percutaneous transcatheter closure of a secundum ASD between June 2013 and December 2015. Echocardiography was performed on admission, prior to cardiac catheterization and then one month after ASD closure. Peak global RA longitudinal strain was analyzed by 2D-STE.
Results: Patients' mean age was 34.6±8.2 years. The mean diameter of the occlusive devices was 18.5±7.5 mm. Right ventricular (RV) end-diastolic diameters were significantly increased but decreased significantly after ASD closure (43±5 vs. 38±4 mm, $p<0.05$). Left atrial (LA) diameters (40±8 vs. 37±6 mm, $p<0.05$) decreased significantly after the intervention, whereas left ventricular (LV) end-diastolic diameters (45±5 vs. 46±4 mm, NS) remained unchanged. Tricuspid annular plane systolic excursion increased significantly (17.6±5.4 vs. 22.3±8.1 mm, $p<0.05$). After closure of the defect, a significant increase was observed in longitudinal RA strain (26.5±9.6% vs. 35.3±10.5%, $p<0.001$).

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Conclusions: After percutaneous transcatheter closure of a secundum ASD, there was an increase in RA longitudinal strain. 2D-STE strain analysis appears to be helpful for the assessment of RA function and of response to correction of volume overload after percutaneous transcatheter closure of a secundum ASD.

PALAVRAS-CHAVE
Doença cardíaca congénita;
Aurícula direita;
Ecocardiografia;
Comunicação interauricular

Avaliação da função auricular direita por ecocardiograma com *speckle tracking* após encerramento percutâneo de comunicação interauricular

Resumo
Introdução: O *speckle tracking* por ecocardiograma (STE) ou a avaliação do *strain* em 2 D são novas ferramentas para a avaliação da função miocárdica. O objetivo deste estudo foi avaliar a função da aurícula direita (AD) com o uso de STE em doentes com comunicação interauricular antes e um mês após o encerramento percutâneo.
Métodos: Avaliamos prospetivamente 32 doentes consecutivos (nove homens, 23 mulheres) submetidos a encerramento percutâneo de comunicação interauricular (CIA) do tipo *ostium secundum*, entre junho de 2013 e dezembro de 2015. O ecocardiograma foi feito previamente ao procedimento e um mês após o encerramento da CIA. Foi avaliado o *strain* longitudinal global da AD (RALS) por 2D-STE.
Resultados: A idade média dos doentes foi de 34,6±8,2 anos. O diâmetro médio dos dispositivos empregados foi de 18,5±7,5 mm. Os diâmetros telediastólicos do ventrículo direito (VD) eram significativamente maiores e diminuíram após encerramento da CIA (43±5 *versus* 38±4 mm, p<0,05). O diâmetro da aurícula esquerda (AE) diminuiu significativamente após a intervenção (40±8 *versus* 37±6 mm, p<0,05), enquanto que o diâmetro telediastólico do ventrículo esquerdo permaneceu igual (45±5 *versus* 46±4 mm, NS). O TAPSE aumentou significativamente (17,6±5,4 *versus* 22,3±8,1 mm, p<0,05). Observamos ainda uma subida significativa do *strain* longitudinal da AD (26,5±9,6% *versus* 35,3±10,5%, p<0,001).
Conclusão: Após encerramento percutâneo de CIA *ostium secundum*, observou-se um aumento significativo do *strain* longitudinal global da AD.

Introduction

Atrial septal defect (ASD) accounts for 25-30% of congenital heart defects diagnosed during adulthood.[1] Ostium secundum ASD is the most common type, constituting 70% of all ASDs and 6-10% of all congenital heart defects. Left atrial (LA) and right atrial (RA) diameters and volumes are increased in ASD patients due to volume overload. ASDs cause a left-to-right shunt and chronic right chamber volume overload that can result in severe pulmonary hypertension and right heart failure. Secundum ASDs are centrally located and generally bounded by the superior and inferior limbic bands, which often makes these defects amenable to device closure.[2,3]

In the absence of fixed pulmonary hypertension, percutaneous ASD closure is associated with improvements in right ventricular dimensions, morphology and function and exercise physiology, and reverse right ventricular (RV) remodeling.[3] However, such adaptations can be incomplete or delayed in adult patients, and atrial changes post-ASD closure are poorly understood.[4]

New echocardiographic methods have been developed to quantify left and right ventricular function and are important for diagnostic and prognostic assessment in various cardiovascular diseases.[5,6] A new echocardiographic technique, two-dimensional (2D) speckle tracking echocardiography (STE), is capable of angle-independent tracking of myocardial deformation, enabling non-invasive and quantitative assessment of global and regional myocardial function.[7]

Myocardial STE measures tissue deformation within the myocardium expressed as a percentage change. Myocardial tissue lengthening and shortening give positive and negative strain values, respectively. Strain rate measures the local rate of myocardial deformation per time unit. The global strain or strain rate is calculated by computing deformation along the entire myocardial line length.[8,9] This new echocardiographic method is frequently used to assess left ventricular (LV) myocardial function, but has rarely been used to examine RA and RV myocardial function. Myocardial strain and strain rate can be used to investigate RA myocardial function during each phase of the cardiac cycle. Padeletti et al. showed that RA speckle tracking analysis is significantly correlated with systolic pulmonary artery pressure and pulmonary arterial hypertension secondary to LV systolic dysfunction. They also found that assessment of RA

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