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ORIGINAL ARTICLE

Comparison of left and right atrial appendages anatomy and function in patients with mitral stenosis and sinus rhythm

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KEYWORDS

Left atrial appendage;
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Abstract *Background:* The left atrial appendage (LAA) has been considered a relatively significant portion of the cardiac anatomy. Transesophageal echocardiography (TEE) is a technique that makes clear imaging of the LAA possible, so that its shape and function can be assessed. Tissue Doppler imaging (TDI) was used recently for the assessment of the contractile function of the left atrial appendage (LAA) and right atrial appendage (RAA).

Patients and methods: Forty-three patients with pure mitral stenosis (MS) in sinus rhythm were compared to 12 normal individuals only patients with mild and severe mitral stenosis were included. Patients with moderate mitral stenosis were excluded. A transthoracic and a transesophageal echo were performed in all patients. We assessed the LAA anatomy (neck width, length, area). Assessment of LAA function was done by the recording of LAA emptying velocity. Pulsed-wave tissue Doppler imaging (TDI) was positioned at the tip of the LAA and the tip of the RAA to obtain atrial peak systolic (Sm) and diastolic myocardial velocities.

Results: Patients with MS (severe and mild) had a larger left atrial diameter and area than the control {50.5 ± 3.8 & 46.2 ± 4.5 vs 35.4 ± 1.8, and 31.2 ± 3.3 & 26 ± 2.3 vs 19.9 ± 1.4} *P*-value 0.0001 & 0.0001, respectively and patients with MS (severe and mild) had a higher PASP than the control {50.9 ± 10.5 & 30 ± 7 vs 25.2 ± 1.6} *P*-value 0.0001. TEE data of patients with MS (severe and mild) had a larger left atrial appendage length, base, and area than the control {(49.8 ± 6.38 & 42 ± 2.5 vs 37.8 ± 2.2), (27.7 ± 3.8 & 23.2 ± 3.1 vs 18 ± 2.5), and (7.6 ± 0.6 & 6.5 ± 0.5 vs 4.6 ± 0.7} *P*-value 0.0001. Patients with MS (severe and mild) had a significant decrease in atrial peak systolic flow velocities (S wave) than the control (16.1 ± 3.7 & 26.5 ± 0.7 vs 70 ± 13), *P*-value 0.0001.Also patients with MS (severe and mild) had significant decrease in atrial peak systolic myocardial velocities (Sm wave) of the LAA compared with the control

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(6.1 ± 1.7 & 12.6 ± 0.3 vs 18.8 ± 1.9), *P*-value 0.0001. (TDI) flow of the RAA myocardial velocity, patients with mitral stenosis (severe and mild) had a significant decrease in atrial peak systolic myocardial velocities (Sm wave) of the RAA compared with the control (16.5 ± 2.9 & 17.7 ± 1.6 vs 20.1 ± 2.6), *P*-value 0.0001. SEC was detected in the LAA in 17 patients of the 43 patients with mitral stenosis which represents 39.5% of the patients. All patients with SEC were with severe MS. Patients with SEC had a significant increase in Fc, mean transmitral gradient, PASP, Sm LAA, Sm RAA, LAA area and peak S velocity LAA than patients without SEC. No patient had SEC in the RAA cavity.

Conclusion: LAA and RAA dysfunction occurred in patients with MS and sinus rhythm due to increase of atrial afterload presented by a decrease in atrial myocardial velocities.

1. Introduction

Trans-esophageal echocardiography (TEE) is a moderately invasive technique that has been shown to have a higher accuracy in identifying abnormal lesions in patients with cardio embolic strokes. These include abnormalities of the left atrium (LA) and right atrium (RA) and appendages.[1] The left atrial appendage (LAA) is an important anatomical region, given its association with atrial tachyarrhythmias and thrombi.[2,3] Recent reports have described the development of technologies for therapy delivery for this region.[4,5] A detailed understanding of the LAA anatomy may facilitate such endeavors.[6] The appendages are the cardiac structures that remain difficult to examine thoroughly by trans- thoracic echo (TTE). However, TEE allows for superior imaging of both LAA and right atrial appendage (RAA).[7,8] The incidence of thromboembolism remains high in patients with mitral stenosis (MS). LAA is a potential site for the development of thrombus and LAA dysfunction is an independent predictor of thromboembolism.[9] Among the factors related to the presence of thrombi in the LAA are its dilation and decrease in contractility with the ensuing blood stasis, manifested by SEC and low flow velocities[10,11] in the TEE. Several authors have analyzed this contractile dysfunction of the LAA[12,13], but little attention has been paid to the RAA. This is probably due to its location, which makes it difficult to visualize with monoplane transducers, while it is almost impossible to assess with transthoracic echo. In the RAA, the prevalence of thrombi and their embolic complications are lower than in the LAA.[14]

2. The aim of the study

The aim of the study was to evaluate anatomical and functional parameters of LAA and RAA in patients with MS and sinus rhythm.

3. Patients and methods

The current study included 43 patients with pure mitral stenosis (MS) who were still in sinus rhythm. It was carried out in the Cardiology department, El Minia University Hospital, during the period from January 2007 to January 2011 and compared them to 12 normal subjects. Five were healthy volunteers and 7 underwent TEE due to suspicion of congenital heart disease. All patients signed the informed consent. Only patients with mild (mitral valve area > 1.5 cm^2) and severe (mitral valve area < 1 cm^2) mitral stenosis were included. Patients with moderate mitral stenosis were excluded to explore the differences in both extremes of the whole spectrum of the disease. A TTE and TEE were performed in all patients. Patients were divided into 3 groups: group 1 (19 patients with severe MS, 16 women, 3 men, mean age: 40.1 ± 10.2 years), group 2 (24 patients with mild MS, 20 women, 4 men, mean age: 34.8 ± 11.9 years), and group 3 (12 normal individuals, 10 women, 2 men mean age: 41.9 ± 12.8 years).

3.1. Echocardiographic studies

Both TTE and TEE studies were done. All patients were subjected to TTE examination using Doppler echocardiography unit (GE, Norway, vivid 3 Expert) with a 2.5–3.5 MHz transducer. Patients were examined in the left lateral decubitus position. The mitral valve area (MVA) was measured by continuous wave Doppler on mitral valve at apical four chamber view using the pressure half-time method in cm^2 and by 2D planimetry method. The mean pulmonary artery pressure was estimated from pulmonary acceleration time of the pulmonary blood flow. The LA and RA were visualized for the presence of thrombus and SEC. LA dimension, LVEDD, and ESD and EF% were measured and calculated from para-sternal M-mode recordings according to standard criteria.[15]

3.2. TEE study

All patients were studied in the conscious & fasting state using 10% lidocaine spray and viscous lidocaine gel for posterior pharyngeal anesthesia. Sedation (midazolam Hydrochloride) was given only when needed and no atropine was administered. The procedure was performed with continuous monitoring of ECG and oxygen saturation using a multi-plane TEE probe 8T of the same machine. The TEE probe was inserted with the subject lying in the right lateral position. The TEE examination was done stressing on the following specific measurements:

- The LAA images were visualized at 0° and the RAA at 130° according to the standard recommendations[16,17] to facilitate anatomic assessment and to obtain pulsed Doppler flow velocity profiles immediately within the appendage base with the transducer tip in the mid-esophagus. We assessed the LAA anatomy (neck width, length, area) (Fig. 1). The LAA neck width was measured as a line drawn from the limbus of the confluence of the left upper pulmonary vein and the LAA to the outermost portion of