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CHANGE OF STRUCTURAL AND FUNCTIONAL HEART INDICATORS IN PATIENTS WITH DIABETES MELLITUS WITH DIASTOLIC HEART FAILURE

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Annotation
To study the structural and functional changes in the heart in patients with diabetes mellitus with diastolic heart failure. Doppler echocardiography is one of the most informative and accessible non-invasive methods for studying the structural and functional parameters of the heart.

Keywords: diabetes mellitus, diastolic, heart failure.

Introduction

Chronic heart failure (CHF) remains one of the most important problems for medical in many countries of the world. Recently, interest in diastolic heart failure has increased, as the number of patients in whom symptoms of decompensation develop against the background of preserved contractile function of the left ventricle has increased [2,16]. Recently, interest in diastolic heart failure has increased, as the number of patients has increased, in whom symptoms of decompensation develop against the background of preserved left ventricular function [1,2]. According to the Euro Heart Survay HF Study (2001), the number of patients with diastolic CHF is 30% [3]. The high prevalence of diastolic heart failure dictates the need for early diagnosis and the timely initiation of effective therapy. Difficulties in identifying diastolic CHF in patients with combined pathology are very great. This is due to the fact that minimal manifestations of diastolic heart failure are often "masked" behind the symptoms of the underlying disease (arterial hypertension and type 2 diabetes mellitus) and its complications. In turn, the success and effectiveness of treatment of diastolic chronic heart failure is determined by early and timely diagnosis of structural functional changes in the heart.

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Research Materials and Methods

A total of 82 patients with heart failure were examined, which were divided into three groups. Of these, 49 patients had type 2 diabetes mellitus in combination with primary arterial hypertension (type 2 diabetes mellitus + arterial hypertension) and constituted the main group. The second group of patients (17 people) had type 2 diabetes mellitus without arterial hypertension and the third group consisted of 16 patients. with arterial hypertension without diabetes mellitus. The age of the patients ranged from 40 to 68 years (mean age 52 years). According to the anamnesis, the average duration of arterial hypertension was 15 years, the duration of type 2 diabetes mellitus was 2 years . To objectify and more accurately determine the functional class of chronic heart failure, we used the clinical condition assessment scale modified by V.Yu. Mareeva (2000) [1] and a test for determining the distance of a 6-minute walk [1, 4]. The criteria for the inclusion of patients in the study were the following: the presence of diastolic heart failure, age from 35 to 70 years, the presence of sinus rhythm, the absence of ACE inhibitors and / or ß-blockers for 2 or more weeks. The following groups were examined as comparison groups: 12 patients with type 2 diabetes mellitus without arterial hypertension, aged 41 to 62 years (mean age 49 [5; 6] years), disease duration 1.5 years; 11 patients with arterial hypertension without diabetes mellitus aged 43 to 62 years (mean age 53), disease duration 14.5 years. The diagnosis of type 2 diabetes mellitus and the degree of compensation, carbohydrate metabolism was established according to the WHO recommendations and national standards for the diagnosis and treatment of diabetes mellitus (2002). Arterial hypertension was assessed according to the criteria of the GFCF (2004 and 2008). Diastolic chronic heart failure was diagnosed according to the recommendations of the Working Group of the European Society of Cardiology (2002).

At the initial stage of the study, a general clinical examination of patients was carried out, including: collection of complaints, anamnesis of the disease, study of the objective status, anthropometric data (calculation of body mass index, kg / m2), measurement of blood pressure was carried out according to the recommendations of the All-Russian Scientific Society of Cardiology according to the method of N.S. Korotkov under standard conditions (average of three measurements in a sitting position, after a 5-minute rest); standard laboratory and instrumental techniques (general blood and urine analysis, urine analysis for ketone bodies, biochemical blood analysis for glucose, urea, creatinine, bilirubin, transaminases; ECG, etc.). All patients underwent echocardiographic examination with Doppler ultrasonography in order to study the structural parameters of the heart, systolic and diastolic functions

of the heart. All patients were divided into three groups: group 1 consisted of patients with type 2 diabetes mellitus + AH, group 2 included patients with type 2 diabetes mellitus without arterial hypertension, and group 3 included patients with arterial hypertension without diabetes mellitus

Discussion of the Results

Comparison of the studied groups of patients by structural and functional parameters of the echocardiogram is presented in Table 1.

Table 1.Comparative characteristics of echocardiography parameters in the studied groups

Index	1st group (diabetes mellitus + hypertension) n = 49	2nd group (diabetes mellitus without hypertension) n = 17	Group 3 (Hypertension without diabetes mellitus) n = 16
E, m / s	0.61 ± 0.15	0.71 ± 0.16	0.68 ± 0.12
A, m / s	0.77 ± 0.16	0.65 ± 0.11	0.79 ± 0.18
E / A	0.78 ± 0.08	1.08 ± 0.29	0.87 ± 0.12
DTe, sec	0.215 ± 0.03	0.213 ± 0.04	0.213 ± 0.01
IVRT, sec	0.098 ± 0.05	0.082 ± 0.02	0.090 ± 0.07

When analyzing the EchoCG data, the most pronounced changes in the myocardium were observed in patients of the main group (type 2 diabetes mellitus in combination with AH). Patients of this group had significantly ($p < 0.05$) higher values of the end-diastolic volume of the left ventricle, end-systolic volume of the left ventricle, thickness of the interventricular septum in diastole, thickness of the posterior wall of the left ventricle in diastole, relative wall thickness of the left ventricle, the mass of the left ventricular myocardium, the mass index of the left ventricular myocardium, the average pressure in the pulmonary artery compared with patients in the comparison group (type 2 without AH). Also statistically significant ($p < 0.05$) higher values of LV dimensions in diastole, end-diastolic volume of the left ventricle, end-systolic volume of the left ventricle, mass of the left ventricular myocardium and mass index of the left ventricular myocardium, were obtained in the study group when comparing with the parameters of the comparison group (arterial hypertension without diabetes mellitus).

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In turn, in the control group of patients with arterial hypertension without diabetes mellitus, the above parameters were also statistically significantly ($p < 0.05$) higher than in patients with type 2 diabetes mellitus without arterial hypertension.

Obviously, these structural changes in the heart are primarily associated with the presence of arterial hypertension, which is considered one of the main triggering factors for activating myocardial remodeling processes, since changes in normotensive patients with type 2 diabetes mellitus were less pronounced.

Indicators of the contractile function of the left ventricular myocardium (contraction fraction, ejection fraction) in patients of the main group (type 2 diabetes mellitus + arterial hypertogy), as, indeed, in the rest of the study groups, were within the normal range, which once again confirms the high prevalence of CHF with preserved ejection fraction.

Table 3. Comparative characteristics of transmittal diastolic flow in the surveyed groups

Index	1st group	2nd group	Group 3
E, m / s	0.61 ± 0.16	0.71 ± 0.17	0.68 ± 0.14
A, m / s	0.77 ± 0.17	0.65 ± 0.10	0.79 ± 0.19
E / A	0.78 ± 0.09	1.08 ± 0.28	0.87 ± 0.11
DTe, sec	0.215 ± 0.02	0.213 ± 0.03	0.213 ± 0.01
IVRT, sec	0.098 ± 0.04	0.082 ± 0.01	0.090 ± 0.08

When analyzing the indicators of diastolic flows on the MC (table 2) and TC (table 3), the most pronounced changes in diastolic function were revealed in patients with combined pathology (main group)

Table 4 Comparative characteristics of the indicators of tricuspid diastolic flow in the surveyed groups

Index	1st group n = 49	2nd group n = 17	Group 3 n = 16
E, m / s	0.50 ± 0.13	0.57 ± 0.11	0.48 ± 0.12
A, m / s	0.62 ± 0.16	0.50 ± 0.083	0.46 ± 0.12
E / A	0.8 ± 0.08	1.14 ± 0.16	1.08 ± 0.26
DTe, sec	0.198 ± 0.01	0.194 ± 0.02	0.195 ± 0.01

The peak E, which characterizes early, passive diastolic filling of the left ventricle and right ventricle, and the E / A ratio were statistically significantly ($p < 0.05$) lower than in the control group.

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Statistically significant (p <0.05) were higher peak A, characterizing later, active diastolic filling of the left and right ventricles, isovolumetric relaxation time of the left ventricle (IVRT), deceleration time of peak E (DTe) and diastolic pressure of the left ventricle and right ventricle in end-diastole versus type 2 diabetes mellitus group without hypertension. There is also a statistically significant (p <0.05) difference in the E / A ratio of both the left and right ventricles between the main and control groups. These changes are consistent with literature data [7, 8, 2, 46, 9, 10, 11, 12, 13, 14] on the effect of arterial hypertension and diabetes mellitus on the development of diastolic dysfunction of the heart, followed by the formation of diastolic chronic heart failure.

When assessing the tricuspid diastolic blood flow, we noted that in patients with type 2 diabetes mellitus in combination with arterial hypertension, without pathology of the respiratory system, the diastolic function of the right ventricle is impaired along with the diastolic function of the left ventricle [16-20]. This once again confirms the close functional relationship between the left and right ventricles of the heart.

According to Echo-Doppler spectra, diastolic dysfunction of the left ventricle of the "hypertrophic" (first) type (according to the criteria: E / A < 1.0; DTe > 0.220 sec; IVRT > 0.094cek) was diagnosed in all examined patients of the main and control groups, and also in 11 out of 17 (68.9%) patients in the comparison group. “Restrictive” or the second type of diastolic dysfunction in the patients examined by us was not identified, as well as the “pseudonormal” or transitional type. The latter was excluded according to the criteria: E / A > 1.0 , but less than 2.0, an increase in the anterior-posterior size of the left atrium (37-43 mm), the presence of signs of hypertrophic remodeling of the left ventricle, and proposed by H. Feigenbaum (1999), V. NS. Vaizov, I.I. Fedosov (2001), Yu.V. Belousov, N.Yu. Demidova (2002) criterion for "violation of the closure function of the MC" (regurgitation of 1-2 tbsp.). Diastolic dysfunction of the right ventricle of the first type in the study group was observed in 29 of 49 (58.1%), in the control group in 9 of 16 (57.1%) patients and in 2 of 16 (10.3%) patients in the comparison group (type 2 diabetes mellitus without hypertension).

According to the classification of A. Oapai et al. type of myocardial remodeling normal geometry of the left ventricle was observed in 4 out of 49 (8.1%) patients in the main group, 12 out of 17 (75.8%) in the majority of patients in the control group (type 2 diabetes mellitus without arterial hypertension) and in 1 out of 16 (3.5%)) surveyed in the group of hypertension without diabetes. The next type of LV geometry, concentric remodeling, was found in 6 (7.1%) of the study group and in 2 (7.2%) patients of the comparison group. The main part of the altered LV geometry

consisted of the types of concentric LV hypertrophy in 40 (46.5%) and non-dilated eccentric LV hypertrophy in 33 (38, 3%) patients with concomitant pathology, in 18 of 28 (64.3%) and 7 (25%)) of the control group of arterial hypertension without diabetes mellitus, respectively (table 4).

Output

Thus, when analyzing the Echo-Doppler data, in patients with type 2 diabetes mellitus and arterial hypertension, more pronounced structural changes in the myocardium were observed, as well as violations of the diastolic function of the heart, compared with the control groups (type 2 diabetes mellitus without arterial hypertension and arterial hypertension without mellitus diabetes).

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