

STRUCTURAL AND FUNCTIONAL FEATURES OF THE LEFT VENTRICLE IN PATIENTS WITH HEART FAILURE IN ISCHEMIC HEART DISEASE AND THYROTOXICOSIS

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ABSTRACT

Goal. To determine the structural and functional features of the left ventricle in patients with chronic heart failure with coronary heart disease and thyrotoxicosis.

Materials and methods. 85 patients aged 58.3 ± 5.6 years were divided into 3 groups: the main group consisted of 25 patients with coronary heart disease (CHD), chronic heart failure (CHF) of functional classes II–III (FC) and thyrotoxicosis, the average age was 59.23 ± 3.81 ; the 1st comparison group consisted of 30 patients with CHD, HSN FC II-III, without thyroid pathology, average age – 57.6 ± 2.73 ; comparison group 2 – 30 patients with thyrotoxicosis without concomitant cardiovascular diseases (CVD), average age – 45.4 ± 3.51 . The structure and function of the thyroid gland were studied in all patients, and an echocardiographic (EchoCG) study was performed to assess the structural and functional parameters of the left ventricle (LV). **Results.** Pathological LV remodeling in patients of the main group is represented by two types: concentric LV hypertrophy (LVH) and eccentric LV hypertrophy (LVH), and LVH was more common than in patients without thyroid pathology with CHF on the background of coronary heart disease (84.0%, $p=0.01$). The contractility of the LV myocardium in patients of both groups with CHF was reduced, the values of the ejection fraction corresponded to the intermediate type of HF, there was no significant difference between the indicators ($p=0.1$). In the main The group of patients showed a significantly more pronounced decrease in the ratio of the blood flow rate of early LV diastolic filling and the maximum rate of atrial systole (E/A) – 0.63 and an increase in isovolumetric relaxation time (IVRT) – 84.69 ms compared with the indicators of patients with ischemic heart failure without thyroid pathology ($p=0.021$; $p=0.034$).

Conclusion. For patients with CHF on the background of coronary heart disease and thyrotoxicosis, the predominance of remodeling is characteristic LV by type of LVL (84.0% of cases), moderate decrease in LV contractility and more pronounced diastolic

dysfunction, which determines the structural and functional features of LV in patients with CHF in the presence of this comorbidity.

Keywords: left ventricle, thyrotoxicosis, chronic heart failure, coronary heart disease

INTRODUCTION

To date, the prevalence of thyroid diseases, including thyrotoxicosis, in the world and in Uzbekistan is quite high. It is known that in diseases associated with hyperthyroidism, the cardiovascular system becomes one of the main targets for thyroid hormones. Hypertrophy of the left ventricle (LV) on the background of thyrotoxicosis, followed by dilation of its cavity and myocardial dysfunction is a fairly common cause of chronic heart failure (CHF). There is no doubt about the fact, that the development of heart failure in coronary heart disease (CHD) and the risk of decompensation are also associated with progressive remodeling of the heart chambers. It is known that comorbid pathology is more common in patients of the middle and older age groups, and it is necessary to take into account the mutual influence of hyperthyroidism and diseases of the cardiovascular system, in particular coronary heart disease and arterial hypertension (AH), for the purpose of early diagnosis of CHF and optimization of therapy. However, currently there are no works in the literature that would define features of structural and functional changes of the heart in CHF on the background of coronary heart disease and thyrotoxicosis. The aim of the study was to determine the structural and functional features of the left ventricle in patients with chronic heart failure with coronary heart disease and thyrotoxicosis.

MATERIALS AND METHODS OF RESEARCH

85 patients (age 54.6 ± 4.8 years) were divided into 3 groups: the main group consisted of 25 patients with coronary heart disease, CHF II-III functional classes (FC) and thyrotoxicosis, the average age was 59.23 ± 3.81 ; the 1st comparison group consisted of 30 patients with coronary heart disease and CHF FC II-III, without thyroid pathology, the average age was 57.6 ± 2.73 ; the 2nd comparison group consisted of 30 patients with thyrotoxicosis without concomitant cardiovascular diseases (CVD), the average age was 45.4 ± 3.51 . The control group included 14 healthy volunteers (persons without signs of CVD and thyroid pathology), the average age – 57.87 ± 4.57 years. All patients signed an informed consent to participate in the study. Patients included in the study had thyrotoxicosis with diffuse goiter – Graves' disease in 100% of cases (the level of antibodies to the TSH receptor exceeded 1.5 U/l). For the first time, standard thyrostatic therapy (thiamazole) was She was assigned to the hospital. The study was conducted before the appointment of thyrostatics. Exclusion criteria from the study: other thyroid diseases with thyrotoxicosis syndrome (autoimmune thyroiditis, functional autonomy of the thyroid gland, iatrogenic thyrotoxicosis); myocardial

infarction or acute cerebrovascular accident less than 6 months ago; congenital and acquired heart defects; history of myocarditis and pericarditis; patients with implanted artificial drivers rhythm; diseases of other organs and systems in the decompensation stage; oncological diseases. Statistical processing and analysis of the obtained data were performed using the program STATISTICA 10.0 (StatSoft, USA). Qualitative values were presented in absolute numbers (n) and percentages (%), which were compared according to the criterion 2. Quantitative values, with a distribution close to normal, are given in the form of an average and standard deviation ($M \pm \sigma$), values with an abnormal distribution, it was represented as a median and quartiles (Me (Q1; Q3)). When comparing two groups on a quantitative basis, the Mann-Whitney criterion was used; comparison of several groups on quantitative and qualitative grounds was performed by the Kraskel-Wallis method. Differences in statistical values when comparing groups were recognized as significant at a significance level of $p < 0.017$.

THE RESULTS AND THEIR DISCUSSION

Heart rate (HR) and thyroid hormone levels in patients with thyrotoxicosis (main and 2nd comparison groups) did not differ significantly ($p=0.4$), but were significantly higher ($p_{1-3}=0.001$; $p_{1-3}=0.001$) than in the 1st comparison group, which It is probably caused by hyperactivation of the sympathetic nervous system under the influence of an excess of thyroid hormones. It should be noted that in patients of the main group and the 1st comparison group, there were no differences in the duration of coronary heart disease; the main proportion in both groups were patients with III FC of angina pectoris (72% and 70%, respectively). A comparative analysis of the clinical symptoms of CHF revealed no significant differences in the indicators of the Clinical Condition Assessment Scale (SHOCK) in patients of the main and 1st comparison groups (7.08 and 6.61 points, respectively, $p=0.3$), however, the distance traveled in 6 minutes in the main group turned out to be 1.2 times smaller (253.96 ± 16.88 m and 300.32 ± 19.12 m, respectively ($p=0.01$)), which indicates a lower exercise tolerance in comorbid patients with a combination of coronary heart disease, CHF and thyrotoxicosis.

Special attention is paid to the results Echocardiography of the left ventricle in patients of the compared groups. Analysis of the morphometric and volumetric characteristics of LV revealed significantly higher values in patients with a combination of coronary heart disease, CHF and thyrotoxicosis compared with those in patients with thyrotoxicosis without CVD (2nd comparison group): ICSR is 23.37% higher ($p_{3-4}=0.001$), ICDR is 23.05% higher ($p_{3-4}=0.02$), ICDO – by 23.91% ($p_{3-4}=0.001$), ICSO – by 81.64% ($p_{3-4}=0.001$). Modern ideas about the pathogenesis of LV remodeling play a leading role in this the process of activation of neurohumoral systems. It would be logical to assume that the structural and geometric

changes of LV in conditions of CHF of ischemic genesis in combination with thyrotoxicosis will be the most pronounced. However, when comparing linear and volumetric LV indices in patients with coronary heart disease and CHF on the background of thyrotoxicosis and in patients with coronary heart disease and CHF without thyroid pathology, it was found that in the main group ICDR, ICSO, and ICDO were significantly lower ($p_{2-4}=0.003$; $p_{2-4}=0.01$; $p_{2-4}=0.003$), which was probably due to increased cardiac output at against the background of the predominance of activity of the sympatho-adrenal system (SAS) in thyrotoxicosis.

The LV remodeling process also includes the formation of compensatory myocardial hypertrophy as an adaptation option to increased hemodynamic load. However, with prolonged, constant overloads of volume and/or pressure, this process acquires a pathological character and increases the risk of CVD and mortality in patients with coronary heart disease and arterialhypertension (AH). Represents the scientific The study of the geometric adaptation of the myocardium to changes in hemodynamics against the background of activation of the CAC, renin-angiotensin-aldosterone system (RAAS) in patients with hyperthyroidism in combination with coronary heart disease and CHF is of interest. In patients with thyrotoxicosis without CVD (comparison group 2), the parameters of IMLJ, TSSLJ and TMJ exceeded those in the control group ($p_{1-3}=0.01$; $p_{1-3}=0.03$; $p_{1-3}=0.01$), which indicates the initial signs of hypertrophyLV even with a duration of thyrotoxicosis less than 6 months and confirms the literature data on the development of myocardial remodeling in thyrotoxicosis against the background of predominance of activity of the sympathetic autonomic nervous system (NS).It should be noted that the formation of LV hypertrophy was influenced by the presence of arterial hypertension in patients of all compared groups. So, in patients of the 2nd comparison group (with thyrotoxicosis without CVD) symptomatic

Hypertension (first detected against the background of thyrotoxicosis) was observed in 70% of cases. An analysis of the frequency of hypertension in other groups showed that patients of the 1st comparison group (with coronary heart disease and CHF without hyperthyroidism) had in 66.7% of cases, in patients of the main group – in 92% of cases. Comparative analysis allows us to judge more pronounced signs of myocardial hypertrophy in patients of the main group compared with patients with thyrotoxicosis without CVD. Thus, LVMH by 61.67% ($p_{3-4}=0.0001$), TMJ by 23.51% ($p_{3-4}=0.001$) and TSLH by 26.67% ($p_{3-4}=0.001$) were higher than the results in patients of the 2nd comparison group. However, there was no significant difference between the corresponding indicators in the main group of patients and in patients of the 1st comparison group (with coronary heart disease and CHF without thyrotoxicosis). By the beginning of the study, patients of both groups already had diseases of the cardiovascular system, primarily coronary heart disease, hypertension in a high

percentage of cases, which led to the development of LV hypertrophy. The development of thyrotoxicosis in patients of the main group, despite the more pronounced activation of sympathetic NS in conditions of excessive secretion of thyroid hormones, did not lead to the progression of LV hypertrophy, which may be due to prolonged use of drugs (primarily RAAS blockers) that can slow down the development or cause regression of LV remodeling. It is noteworthy that, despite the absence of statistically significant differences between IMLJ and wall thickness (MZHP and ZSLJ), the index of relative LV wall thickness (IOTS) in patients with CHF on the background of coronary heart disease and thyrotoxicosis, it turned out to be significantly greater than in patients with Coronary heart disease and CHF without hyperthyroidism ($p=0.013$), which, apparently, is due to less CDR in patients of this group. An analysis of the types of LV remodeling in patients of the studied groups showed that in the group of patients with thyrotoxicosis without CVD (comparison group 2), 46.7% of cases were determined normal LV geometry, which is probably explained by the early diagnosis of the disease (thyroid pathology in the anamnesis – less than 6 months). Concentric LV remodeling (LVL), which, according to some researchers, is, an adaptive variant of changing the geometry of the myocardium in response to damage (afterload), according to others – the initial manifestations of the pathological process, gradually leading to concentric LV hypertrophy, was detected in this group in 30.0% of patients.

The share of KGLJ and eccentric hypertrophy LVH (EGLH) accounted for 13.3% and 10.0% respectively. Structural and functional changes in LV in patients of the main group and the 1st comparison group are represented by only two, prognostically the most unfavorable types: concentric and eccentric LV hypertrophy. It is known that LVH is associated with the highest risk of cardiovascular complication. Thus, in patients with CHF of ischemic genesis and thyrotoxicosis (the main group), this type of LV geometry was detected more often (84.0% of cases) compared with the result in patients with coronary heart disease and CHF (70.0% of cases, a tendency to reliability – $p=0.03$). At the same time, EGLH was significantly more common in patients of the 1st comparison group (in 30.0% of cases), almost 2 times higher than in individuals in the main group (16.0%, $p=0.01$). Of particular interest is the analysis of indicators characterizing the contractility of LV myocardium in patients of the studied groups. It is known that LV remodeling, especially with dilation of its cavity, leads to a decrease in myocardial contractility and, consequently, systolic dysfunction.

In our study, the values of impact volume (UO) and impact index (UI) did not significantly differ in the patients included in the study. However, the index of shock emission (PUV), characterizing the efficiency of the heart muscle, in patients of all groups turned out to be significantly lower than in the control group. Thus, in patients with thyrotoxicosis without CVD (comparison group 2), the result was 1.4 times lower

than the control ($p=0.001$), which is associated with a gradually increasing MMLF in conditions of hypersympathicotonia. In groups with CVD, myocardial hypertrophy was already maladaptive, resulting in there was a significant decrease in PUV: in the 1st comparison group - by 2.3 times ($p=0.0001$), in the main group – 2.2 times lower ($p=0.0001$) than in the control group. It is noteworthy that the values of PUV in the group of patients with coronary heart disease, CHF and thyrotoxicosis and in the group with coronary heart disease and CHF without thyroid pathology did not differ significantly ($p=1.00$). The results of comparative estimates of LV ejection fraction (LV) – the main parameter characterizing LV systolic function in patients of the studied groups. The higher LVEF value (67.0%) detected in people with thyrotoxicosis without CVD can be considered as the initial (hyperkinetic) stage of thyrotoxic heart disease. In both groups with CHF (the main group and the 1st comparison group), significantly lower LVEF values were noted and corresponded to the intermediate type of CHF. However, there were significant differences between the indicators in the group of patients with Coronary heart disease, CHF and thyrotoxicosis and in patients with coronary heart disease and CHF without thyroid pathology was not detected ($p=0.1$). The obtained values of myocardial stress (MS) in patients of the studied groups are of interest. The highest MS was found in patients with thyrotoxicosis without CVD: 13.61% more than in the control group ($p=0.001$), which is apparently due to a rapid increase in hemodynamic load on the myocardium in conditions of hyperthyroidism and, consequently, a rapid transition to maladaptation. It is important to emphasize that in patients of the 1st group In comparison with the main group, the values of MS were significantly lower compared with the result in patients with thyrotoxicosis without CVD, which is apparently due to gradual changes in the functional activity of cardiomyocytes during the development of coronary heart disease and CHF. In addition, as noted earlier, patients in these groups were already taking drugs at the time of inclusion in the study that help reduce the severity of LV remodeling. Currently, it is known that LV diastolic myocardial dysfunction appears much earlier than systolic, including in patients with thyrotoxicosis, which determines a decrease in exercise tolerance with a preserved LV ejection fraction (i.e., before the appearance of systolic dysfunction). Analysis of the parameters of the transmittal flow in patients of the studied groups revealed statistically significant signs of diastolic dysfunction in patients with coronary heart disease and CHF without thyroid pathology and in combination with thyrotoxicosis in the form of a decrease in the ratio of the blood flow rate of early diastolic LV filling and the maximum velocity of atrial systole (E/A) less than 1.0 and an increase in isovolumetric relaxation time (IVRT). So, in the main group of patients, the E/A ratio was 0.63, IVRT was 84.69 ms, which turned out to be significantly lower than in patients with coronary heart disease and CHF without thyroid pathology ($p=0.021$; $p=0.034$). In the group of patients with thyrotoxicosis

without CVD (comparison group 2), the ratio of E/A fluxes was 1.21, and the IVRT value was the lowest in comparison with the indicator in other groups, which indicates a shortening of relaxation time at the initial stages of thyrotoxic lesion of the LV myocardium.

CONCLUSIONS:

Thus, the results of the study made it possible to identify the features of LV remodeling in comorbid patients with HF on the background of coronary heart disease and thyrotoxicosis, which is important for optimizing therapy due to the prevalence of this combined pathology among elderly patients.

1. In patients with CHF on the background of coronary heart disease and thyrotoxicosis, linear and volumetric LV parameters were significantly lower than in patients with coronary heart disease and CHF in the absence of thyroid pathology, which is probably due to increased cardiac output in conditions of pronounced activation of CAC in thyrotoxicosis.
2. Pathological LV remodeling in patients of the main group is represented by two of the most prognostically unfavorable types – eccentric and concentric hypertrophy, and LVH was more common than in patients with coronary heart disease and CHF without thyrotoxicosis (in 84.0% of cases, $p=0.01$).
3. In patients with CHF and coronary heart disease of both groups, there was a deterioration in contractility LV myocardium, LV LV corresponded to an intermediate type of HF, and there was no significant difference between the indicators of the two groups. However, diastolic dysfunction was it is more pronounced in comorbid patients with CHF, Coronary heart disease and thyrotoxicosis.

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