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Evaluation of Geometric Parameters of the Heart in Patients with Hypertension According to Standard Echocardiography

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The heart is the most important target organ in arterial hypertension (AG). In recent years, a huge number of studies and publications have been devoted to this problem. The most characteristic sign of changes in the heart muscle in arterial hypertension is left ventricular hypertrophy. The presence of left ventricular hypertrophy, in turn, has a significant impact on the course and prognosis of the disease. According to D. Levy et al. [1] left ventricular hypertrophy is detected in 20-90% of patients, depending on the severity and duration of hypertension. LVH is associated with a high risk of developing cardiovascular complications and is therefore a determining factor in the development of chronic heart failure.[2,3].

Although hypertrophy of the heart walls is an adequate response to systolic tension of the walls of the left ventricle, an increase in the volume of circulating blood, total peripheral resistance, etc., but this process is not perfect. This is manifested in the disproportionate growth of individual cardiomyocytes, disorganization of the left ventricular muscle fibers, which is accompanied by a decrease in the elasticity and contractility of the myocardium, that is, remodeling of the heart [4,5].

The aim of our study was to investigate the morphological and functional state of the heart in patients with arterial hypertension.

The examined patients with arterial hypertension, depending on the presence of signs of chronic heart failure, were divided into three groups. At the same time, group 1 consisted of 62 (43.7%) patients without signs of chronic heart failure, and group 2 included patients with symptoms of heart failure. 80 (56,3%). They complained of shortness of breath, rapid fatigue, and palpitations during daily physical activity. The third group was the control group of comparison. In patients with arterial hypertension, a more pronounced structural and geometric rearrangement of the left ventricle was observed in comparison with the control group of healthy individuals. In patients with signs of chronic heart failure, the change in the geometry of the heart was expressed by a more significant increase in the linear dimensions of the left atrium and the walls of the left ventricle. These changes, taking into account the increase in the mass of the left ventricular myocardium and the index of relative wall thickness, indicate the presence of more pronounced heart remodeling in patients of this group. (Table 1). However, there were no significant differences in the indicators of end-systolic and end-diastolic volumes, as well as the ejection fraction. This fact indicates that the remodeling of the left ventricle does not go beyond the adaptive changes aimed at maintaining the functional state of the heart.

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Structural and functional parameters of the left ventricle in patients with arterial hypertension, depending on the presence of possible symptoms of chronic heart failure

table 1

Indicator	Controlgroup n=20	Group 1 n=62	Group 2 n=80
Heartrate (inminutes)	68,3±6,1	68,9±9,3	66,8±9,5
Leftatrium	3,2±0,37	3,6±0,35	3,8±0,47
Relativewallthicknessindex	0,38±0,05	0,47±0,09	0,51±0,07
Myocardialmass	90,6±15,8	106,8±20,6	122,5±31,5
End-diastolicvolume	59,7±10,4	58,0±16,6	37,0±8,0
Course-systolicvolume	22,3±4,6	21,3±9,3	22,0±6,4
Impactvolume	38,6±8,2	40,5±5,9	
Ejectionfraction(%)	64,2±5,6	64,9±5,5	63,2±7,2
Thickness of the interventricular septum in the diastole	0,98±0,12	1,17±0,21	1,29±0,20
Thickness of the posterior wall of the left ventricle in diastole	0,84±0,09	1,02±0,17	1,09±0,20

The results obtained indicate that LV hypertrophy in patients with hypertension was aimed at restraining the growth of diastolic myocardial stress, thereby slowing or preventing the development of CHF.

In the analyzed groups, we distributed geometric models of the left ventricle (Table 2).

Distribution of geometric models of the left ventricle in patients with arterial hypertension, depending on the presence of possible symptoms of CHF.

Table 2.

Typeof LV remodeling	Group 1 (п=62)	Group 2 (п=80)
Normal	29 (46,8%)	21 (26,25%)
Concentricremodeling	19 (30,6%)	10 (12,5%)
Concentrichypertrophy	14 (22,6%)	45 (56,25%)
Eccentrichypertrophy	-	4 (5%)

In patients of the second group (with signs of heart failure), remodeling of the left ventricle was revealed. At the same time, concentric hypertrophy of the left ventricle was observed. And in patients of the 1st group (without signs of heart failure), the normal geometry of the heart was revealed. It was noted that eccentric left ventricular hypertrophy accompanied the symptoms of chronic heart failure in patients with hypertension. It should be assumed that patients with arterial hypertension with concentric or eccentric LV hypertrophy significantly more often showed clinical signs of chronic heart failure.

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We also studied the structural and functional parameters of the right heart (Table 3). According to the data obtained, the right ventricular free wall thickness in the right ventricle in diastole and the level of mean pressure in the pulmonary artery were higher in patients with arterial hypertension, and the diameter of the inferior vena cava was lower compared to the control group.

Structural and functional parameters of the right ventricle, depending on the presence of signs of heart failure in patients with arterial hypertension.

table 3

Indicator	Controlgroup n =20	Group 1 n =62	Group 2 n =80
Rightatrium (ml / m)	46,5±9,4	41,4±9,6	47,8±12,6
The thickness of the free wall of the pancreas in the diastole (cm)	0,37±0,07	0,42±0,12	0,48±0,11
Diameter of the pancreas in the diastole (cm)	2,8±0,43	2,8±0,42	3,0±0,38
Diameter of the inferior vena cava (cm)	2,0±0,23	1,8±0,21	1,8±0,27
Mean pulmonary artery pressure (mmHg)	2,1±0,25	29,2±9,8	32,1±12,3

In patients with signs of heart failure, compared with group 1, an increase in the thickness of the free wall of the pancreas and an increase in the average pressure in the pulmonary artery were revealed. However, there were no significant differences in the volume parameters of the right atrium and the end-diastolic diameter of the pancreas between the three groups.

Thus, in arterial hypertension, there is a structural remodeling of the left ventricle. It is more pronounced in patients with clinical signs of chronic heart failure. At the same time, concentric hypertrophy of the left ventricle is most often noted. It should be assumed that the remodeling of the heart in this case is adaptive in nature while maintaining diastolic myocardial stress. The absence of significant differences in the indicator of diastolic myocardial stress between the control group and patients with arterial hypertension indicates that not all patients with the above complaints actually have chronic heart failure. Perhaps, in some patients, these symptoms are not associated with heart damage. (for example: physical inactivity, obesity, lack of fitness). This is proved by the indicators of the structural state of the right ventricle. However, the mean pulmonary artery pressure was significantly higher in patients with arterial hypertension with clinical complaints corresponding to signs of chronic heart failure.

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