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Remodeling of the left ventricle development of paroxysmal arrhythmias

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ABSTRACT: Aim of investigation: to study features of rhythm disturbance at the stanning of the left atrium in a group of people with hypertension.
On the base of the Cardiology dispensary there carried out a retrospective survey of 85 ambulatory cards of patients between 30 and 56 years old with hypertension as well as irregular heartbeats. Surveys have been continued for 3 years. For the evolution of the geometric model of the left ventricle was used classification (normal geometry of LV, concentric remodeling of LV- Finite diastolic size of LV, eccentric hypertrophy of LV, concentric hypertrophy of LV).
Patients are separated into two groups: 1 group - There are patients with hypertension but without irregular heartbeats. 2group - there are patients with both hypertonic diseases as well as irregular heartbeats. Consequently, it was detected that majority of the first group has a variation of LV by concentric type. Nevertheless, concentric hypertrophy of LV had revealed a great part of the second group, where patients suffered hypertension and disturbance of rhythm
Hypertension-induced heart damage leads to morpho-functional remodeling, in spite of that it changes the electrophysiological features of cardiac cells. The important thing to detect irregular rhythm is the existing heart's structural pathology, called a stanning of LA.

KEYWORDS: irregular heartbeats, hypertonic disease, remodeling of LV, stanning of LA.

INTRODUCTION

Changes in the heart that occur with arterial hypertension are the cause of the development of cardiac arrhythmias of ventricular extrasystoles (VE), tachycardia, and atrial fibrillation (AF). Of particular importance for the development of tachycardia, VE, and AF belongs to structural changes of the atria such as "deafness" or stunning of the myocardium [3,4]. A natural consequence of arterial hypertension (AH) is the formation of left ventricle hypertrophy (LVH), which leads to an increase in the rigidity of the left ventricle (LV) and a deterioration of its diastolic relaxation, which leads to LV diastolic dysfunction [1,2].

G.K. Moe and co-authors concluded that any increase in the size of the left atrium (LA) increases the likelihood of developing various rhythm disturbances [13]. And in 1986 M.S. Kushakovsky described dilation of the left atrium as a prerequisite for the inevitability of atrial fibrillation [4,5]. It is known that atrial myocardial dystrophy, followed by their "primary" and "secondary" (retrograde) expansion, creates a substrate for sinus rhythm disorders (RD). However, earlier, in 1949, E. Phillip and S. Levin reported on the possibility of developing tachycardia paroxysms, and atrial fibrillation (AF) in people who do not have any heart diseases other than tachyarrhythmia itself [10,15,17,19].
It is known that in hypertension, remodeling of the left ventricle (LV) develops, including the processes of hypertrophy and dilation, changes in geometry and violations of its systolic and diastolic functions [6,12,13,15]. Structural changes of the LV are accompanied by LA overload and its dilation, which, in turn, is a factor predisposing to the development of rhythm disturbances. On the other hand, this rhythm disturbance itself causes LA dilation [7,8,9]. However, recent research data suggest that a more accurate marker of structural

remodeling of LA is the LA volume index (LAVI) [10, 11, 13,18,20].

In 1989, W.Manning et al. they demonstrated in their studies that in most patients with a persistent form of AF, after the restoration of the sinus rhythm, the phenomenon of temporary mechanical dysfunction of the LA was observed, characterized by the authors as the phenomenon of "stunning" or "stanning" [14,13,15]. And in subsequent studies by other authors, the phenomenon of suppression of the function of the LA and its ear was confirmed [4,14, 15, 16,19,20].

In the mosaic lesion of the myocardium there are areas without signs of mechanical activity, but with preserved basic physiological functions. Deviation from this ideal geometry dictates the need for early application of diagnostic methods for the "sleeping", "stunned" myocardium of the left atrium.

Aim of investigation: to study the features of cardiac arrhythmia during left atrium stanning at the early stages of left ventricular remodeling in patients with hypertension.

MATERIALS AND METHODS

On the basis of the regional cardiology dispensary, a retrospective study of 85 outpatient records of patients with hypertension and rhythm disorders aged 30 to 56 years (average age 40.2 ± 2.7 years) was performed. The observation period was 6 months. Patients complained of palpitations, periodic discomfort behind the sternum, a feeling of lack of air, destabilization of blood pressure. SU, ultrasound examination (ECHOCG) was performed.

Standard ECHOCG examination with determination of the mass index of the left ventricle, as well as the relative thickness of the posterior wall the left ventricle and interventricular septum allows us to characterize the geometry of the left ventricle, diffuse thickening of the myocardial walls due to interstitial edema, the size of the left atrium, the volume of the left atrium, peak rates of early and late diastolic flows. When assessing the geometric structure of the LV in the B-mode, the thickness of the anterior, septum, posterior and lateral walls of the LV was measured in the diastole from the parasternal access along the short axis at the level of the MV flaps and papillary muscles. The antero-posterior size of the papillary muscles was determined from the position of the short LV axis in the parasternal projection. In the M-mode, the thickness of the interventricular septum and the posterior wall of the LV was measured in the diastole, EDS and ESS of the LV, anterior-posterior LA size, in 4 projections, 2 projections.

In order to diagnose remodeling of the left ventricle (LV), the mass of the myocardium, the mass index of the myocardium, the index of relative wall thickness were determined. To evaluate the geometric model of LV, the classification was used (normal LV geometry, concentric remodeling of the left ventricle - EDS of LV, concentric LV hypertrophy- eccentric LV hypertrophy).

The patients were divided into 2 groups: group 1 - control group (n=38) with hypertension without cardiac arrhythmia. The duration of hypertension was 4,794±2.31 years, in group 2 (n=47) with hypertension with cardiac arrhythmia – tachycardia, AF, VE, and ventricular repolarization disorder. The duration of hypertension in this group was 5,920±3.21 years. In the presented group, during the study, we identified the following variants of cardiac arrhythmia: tachycardia - 10 (21%), frequent ventricular monotopic extrasystole-18 (38%), polytopic -6 (13%), atrial fibrillation - 13 (28%).

Statistical processing of the obtained results was carried out using the statistical package "Statisticav.6.0» . The arithmetic mean (M) and the error of the mean (m) were calculated. The normality of the sample distribution was estimated by the Kolmogorov–Smirnov criterion. The reliability of the differences between the values was determined using the Student's t-test for the normal distribution of the trait, and for the distribution of a trait other than normal - using the nonparametric Mann–Whitney method. For the analysis of qualitative features, the exact Fisher criterion and $\chi 2$ were used. The differences were considered significant at $p<0.05$.

RESULTS AND DISCUSSION

Indicators of systolic (SBP) and diastolic blood pressure (DBP) in patients in group 2 were relatively higher, i.e. by 8.7% and 12.7% ($p < 0.05$), in relation to patients in group 1 of the study.

Currently, we have identified normal LV myocardial hypertrophy in group 1 in 3.1%, and in group 2 at 4.8%. Geometry changes among patients with hypertension without cardiac arrhythmia were detected in the largest number of patients with concentric myocardial remodeling – 21.9%.

In the group of patients with hypertension and heart rhythm disorders, persons with concentric LV hypertrophy dominated 39% (n=16), and concentric remodeling was observed in 29.3% (n=12). Eccentric hypertrophy 21.9% (n=9).

In the diagnosis of left ventricular hypertrophy (LVH) in patients with arterial hypertension (AH), echocardiography (EchoCG) is considered to be the main method today. The role of electrocardiography (ECG) has decreased somewhat recently.

Table 1

Hemodynamic parameters in the examined persons

№	Study groups	Group 1 hypertension I degree without heart rhythm disturbance n=38	Group 2 hypertension I degree with cardiac arrhythmia n =47
1	EDS, mm	53,202±3,340	54,432±4,286
2	ESS, mm	32,142±4,400	36,152±5,340
3	EDV , ml	118,020±12,730	128,126±10,643*
4	ESV , ml	31,711±16,786	36,786±18,412
5	Interventricular septum, mm	11,074±1,224	12,2400±3,033
6	Posterior flap of the left ventricle, mm	10,348±2,330	12,029±2,785
7	LAV (ml)	41,711±16,654	46,786±18,321
8	LA on the long axis	4,161±3,340	4,712±3,230
9	EF of LV, %	63,256±9,372	58,468±6,282*
10	Myocardial mass of LV	213,136±6,467	285,115±5,128**
11	Left ventricular myocardial mass index, gr/m²	98,297±9,088	168,125±7,550**
12	SBP	124,210±6,210	134,424±11,400*
13	DBP	83,860±6,120	94,125±8,240*

Note: *p<0.05,**p<0.05 reliability of differences between groups

However, due to the general availability, technological simplicity, the speed of obtaining information and the possibility of parallel assessment of the state of coronary circulation, this method cannot be "pushed aside".

In our studies, according to ECHOCG data, significant changes were only in EDV, EF, myocardial mass of LV and left ventricular myocardial mass index. EDV indicators by 9%, myocardial mass of LV by 34% and left ventricular myocardial mass index by 71% were higher in the group of patients with HD 1 st. and cardiac arrhythmia, LVEF index was 9% lower in relation to patients with HD 1 st. without cardiac arrhythmia.

In the study, data were obtained where, in persons with HD of 1 art. without cardiac arrhythmia, in 35% of cases, an excess of the thickness of the interventricular septum of more than 11 mm was determined, and there was also a slight change in the left atrium – 21%.

In 45% of the subjects, changes were observed in both the posterior and interventricular septum – the change in the volume of the left atrium was moderate in 19%. In 20% of cases, the LVP and the posterior wall of the left ventricle remained unchanged. In patients with HD of 1 art. with cardiac arrhythmia in 42% of cases, the thickness of the interventricular septum exceeded the norm in 12%, where cardiac arrhythmias were often accompanied – the volume of the left atrium exceeded the norm in 38% of cases. In 49 % , changes were observed in the LV and in the posterior wall of the LV .

When analyzing the results of DMBP in individuals with HD 1 st without cardiac arrhythmia, SBP normotension was registered in 22 individuals (68.7%), stable hypertension SBP was detected in 6 (18.7%), labile hyperten-

sion in 2 (6.3%) individuals, labile hypotension SBP was detected in 2 (6.3%) individuals.

According to the degree of decrease in SBP at night, "dipper" persons made up 11 (42.3%) people, "non-dippers" - 4 (15.8%) persons. According to the degree of reduction of DBP, "dippers" accounted for 9 (34.6%) patients, persons with excessive reduction of DBP ("over-dipper") – 2 (7.6%) persons.

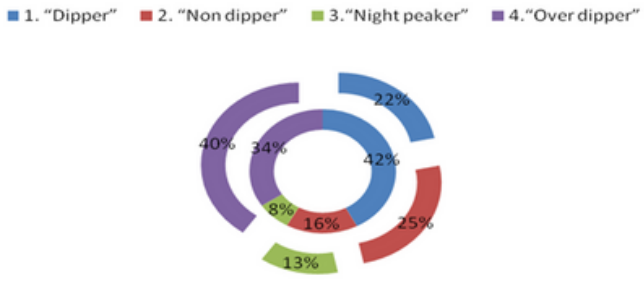
In individuals with HD 1 st with cardiac arrhythmia of the SBP group, normotension was registered in 7 individuals (17.1%), stable hypertension of SBP was detected in 21, which was 51.2%, labile – in 13 (31.7%) individuals.

In persons with HD 1 st with a violation of the heart rhythm of the group with a sufficient decrease in SBP during sleep ("dipper") there were 8 (21.7%) persons, patients with insufficient reduction of SBP ("non-dipper") – 2 (5.2%), with nocturnal hypertension – 1 (2.6%) patient. According to the degree of reduction of DBP at night, "dipper" persons accounted for 8 (21.7%) patients, "non-dipper" persons - 3 (7.8%) patients.

In individuals from the general groups, SBP normotension was registered in 29 individuals (39.7%), stable hypertension SBP was detected in 27, which was 37.0%, labile – in 15 (20.5%) individuals, labile hypotension SBP was detected in 2 (2.8%) individuals.

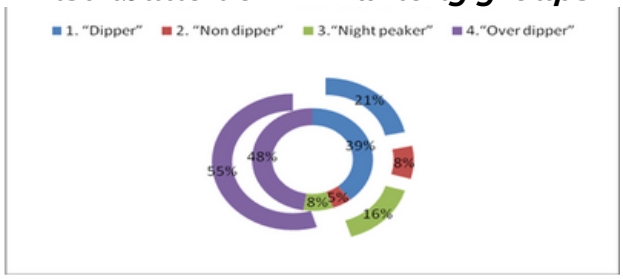
According to the degree of decrease in SBP, "dippers" accounted for 41 (56%) patients, "non-dippers" – 28 (40%) patients, "night pickers" - 5 (5.2%) patients.

Distribution of SBP among groups



According to the degree of reduction of DBP, "dippers" accounted for 44 (61%) persons, "non-dippers" and "over-dippers" -13 (18%) and 8 (21%) persons, respectively.

Distribution of DBP among groups



CONCLUSION

Thus, the approach to assessing LV diastolic dysfunction should be comprehensive, including the study of the contractile and pumping functions of the myocardium, which in hypertension is manifested by remodeling of the left ventricle and left atrium stanning, but also by changes in the electrophysiological properties of cardiomyocytes. Ultrasound methods used to assess left ventricular diastolic dysfunction in patients with concentric hypertrophy and left atrial stanning allow stratifying the risk of atrial fibrillation.

Violation of the daily blood pressure profile by the type without a bucket is manifested already at the earliest stages and was more common in patients of group 2. Insufficient nocturnal decrease in blood pressure occurs due to the phenomenon of increased activity of the sympathetic nervous system at night.

Hypertension is a significant, potentially modifiable risk factor for cardiac arrhythmia leading to remodeling "deafness" - stunning left atrial myocardium.

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