Monitoring of Heart Rhythm Changes After Myocardial Infarction According to the Data of Heart Echocardiography in Outpatient Conditions

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ABSTRACT

Myocardial infarction is one of the most important socio-economic problems in the world due to high mortality and disability of the population. Patients who have had myocardial infarction are at increased risk, their life expectancy is half as long, and the incidence of cardiovascular complications and death is significantly higher than in people of the same age without myocardial infarction. The study included 45 men aged 40 to 60 years (49.2±2.5 years) who were admitted to the cardio intensive care unit with a diagnosis of ACS with further transformation into AMI with a Q wave (20 bx) or without a Q wave (20 b -X). The control group consisted of 35 practically healthy men aged 35 to 60 years (47.9±2.5 years). Upon admission to the hospital, patients received standard therapy: for ACS without ST segment elevation - antiplatelet agents (aspirin), anticoagulants (heparin), beta-blockers, ACE inhibitors, nitrates, potassium preparations. In ACS with ST segment elevation, patients underwent thrombolytic therapy for 6 hours , in addition to the generally accepted standard therapy.

Keywords: myocardial infarction, chronic heart failure, coronary heart disease, acute heart failure, ejection fraction, end-systolic and end-diastolic volumes

Relevance: According to the literature data of recent years, the authors of the studies say that after myocardial infarction, the number and size of cardiomyocytes change , both in damaged and intact areas of the left ventricle. There is a restructuring of the interstitial component of the myocardium, causing a modification of the anatomy of the heart - the development of hypertrophy and dilatation of the left ventricle. These processes are extended in time and lead to its dysfunction . This pathogenetic process is called remodeling , and it is he, and not contractile dysfunction, that underlies the onset and progression of heart failure .

Echocardiography is a useful tool for risk stratification and prognosis after acute myocardial infarction. It has been shown that many traditional echocardiographic parameters can be used to obtain prognostic information , such as volumes and ejection fraction of the left ventricle, wall motion index, left atrial volume and the presence of mitral regurgitation . Development of methods of tissue dopplerography and " speckle tracking " led to the emergence of new prognostic parameters such as strain, strain rate, and left ventricular dyssynchrony . Contrast echocardiography allows assessment of myocardial perfusion and microvascular integrity and provides valuable information on myocardial viability, closely related to prognosis. Stress echocardiography can detect ischemia and viable myocardium, dopplerography of the coronary arteries - to assess the reserve of coronary blood flow, and finally, three-dimensional echocardiography provides optimal information about the volume, function and sphericity of the left ventricle, which are also important parameters of long-term prognosis [2].

Although LVEF is widely used to characterize LV function, its prognostic value after MI is still under investigation. On the one hand, low LVEF may be due to reduced contractile function due to extensive myocardial injury or residual ischemia; on the other hand, it is a consequence of LV dilatation caused by the spread of the infarct zone and stretching of the cicatricial area of the myocardium. In addition, the assessment of LVEF in the early stages of MI may be incorrect due to the presence of stunned myocardium. There is an opinion that LV end-systolic (ESV) and end-diastolic volume (EDV) may be more important predictors of prognosis than LVEF [1, 4].

In patients with AMI , Doppler echocardiography can provide reliable information on diastolic function, in particular, on the type of LV filling [3].

It has been shown that the restrictive type of LV filling in patients with AMI is a powerful independent predictor of late LV dilatation and cardiovascular mortality [5, 7]. In the Nijland study F , et al [6] shortened early filling deceleration time (peak E) has been described as the best predictor of CV mortality in patients hospitalized for AMI. The one-year survival rate in patients without restrictive filling type (the ratio of peak early diastolic filling velocity (E) and peak late filling velocity (A) was ≤1 or between 1 and 2, and deceleration time >140 ms) was 100%, and in the group with restrictive filling (E / A ratio ≥2 or between 1 and 2, and deceleration time ≤140ms) only 50%. Also , the 3-year survival rates were 100% and 22%, respectively. In addition to a higher mortality rate, patients after AMI with a restrictive filling type have a higher risk of developing CHF. Within 1 year of follow-up after AMI, CHF was detected in 71% of hospitalized patients with a restrictive type of filling, and in 21% of patients, progression of CHF was the reason for rehospitalization. Cerisano G , et al . [8] performed a Doppler assessment of LV diastolic function in 104 patients three days after AMI. The survival rate at a mean follow-up of 32 months in patients with restrictive LV filling was 79% (delay time ≤130 ms) versus 97% in patients without restrictive type (delay time >130 ms; p = 0.003). Multivariate analysis showed that, in addition to age, restrictive LV filling was an independent predictor of poor CV-free survival.

The aim of the study was to study changes in heart rate variability in patients with acute coronary syndrome (ACS) with ST elevation with the transition to acute myocardial infarction (AMI) according to echocardiography .

Materials and research methods. The study included 45 men aged 40 to 60 years (49.2±2.5 years) who were admitted to the cardio intensive care unit with a diagnosis of ACS with further transformation into AMI with a Q wave (20 bx) or without a Q wave (20 b -X). The control group consisted of 35 practically healthy men aged 35 to 60 years (47.9±2.5 years). During the day, the subjects were monitored for heart rate variability (HRV) using a Holter ECG monitoring system. The diagnosis was established on the basis of the characteristic clinic of the disease, ECG data, determination of necrozatroponin biomarkers . I , CK-MB, EchoCG (determination of hypokinesis zones). HRV temporal indicators were studied: SDNN , ms - standard deviation of RR intervals, rMSSD , ms - root-mean-square difference between the duration of neighboring sinus intervals RR , SDANN , ms - standard deviation of mean RR calculated over short (5-minute) intervals, SDNN ind , ms - average of 5-

minute standard deviations of RR intervals, pNN 50 (%) - percentage representation of episodes of differences in successive RR intervals by more than 50 ms. Upon admission to the hospital, patients received standard therapy: for ACS without ST segment elevation - antiplatelet agents (aspirin), anticoagulants (heparin), beta-blockers, ACE inhibitors, nitrates, potassium preparations. In ACS with ST segment elevation within 6 hours, patients received thrombolytic therapy, in addition to the generally accepted standard therapy . Intracardiac hemodynamics and the state of diastolic function of the left ventricle (LV) were assessed according to Echo-KG and Doppler-EchoCG performed on the Mindray machine (China) in accordance with the recommendation of the American Association of Echocardiography.

Results. In the study group, according to the results of echocardiography , the ejection fraction (EF) was 46.1±11%, end-systolic size (ESD) 4.3±1.02 cm, end-diastolic size (EDS) 5.7±1 cm, volumes (EDV)– 160.7±66 ml, CSR– 90.5±48cm. 72.3% had left ventricular diastolic dysfunction (LVDD). 82% had left ventricular hypertrophy (LVH), myocardial index was– 189 ±70 g/m ^{2} . In the group of patients with coronary artery disease in combination with PICS, AH was found to be EF– 46±9%, EFR– 4.4±1 cm, EDR– 5.8±1 cm, EDV– 161±69 ml, ESD– 90±52 cm, LVDD 43.5%. LVH was found in 55.8% of patients , while the LV IMM was– - 189±72 g/m ^{2} . 3.7±0.9 cm, EDV– 137±51.6 ml, ESV– 67±34 cm, LVDD was detected in 73%. LVH was established in 88% of cases, LV IMM– 161 ± 43.6 g/m ^{2}. In the group of patients with coronary artery disease, without PICS, AH in anamnesis, EF was– 55.5 ± 9%, cavity sizes (ECD, EC) 5.3 ± 0.8 cm and 3.7±0.8 cm, respectively, the dimensions of the cavities were 132±56 ml and 61±32.7 ml. LVH was found in 80.6% of cases, LV BMI was 167±70 g/m ^{2} . Most often, atrial fibrillation occurred in the group of patients with coronary artery disease in combination with PICS, AH.

Comparison of the data obtained allows us to state that all temporal indicators of HRV in patients with AMI were significantly lower than in the control group (with AMI, a pathological decrease in HRV is observed, which indicates an increase in the tone of the sympathetic division of the autonomic nervous system and a significant decrease in vagal influences on heart rate. HRV parameters in patients depended on the type of AMI. Thus, in patients with transmural AMI, HRV indices were lower than in patients with non-transmural AMI. Experimental and clinical studies have shown the important role of the autonomic nervous system in the development of arrhythmias. A decrease in HRV is a consequence of an imbalance in the sympathetic and parasympathetic regulation of cardiac activity with a predominance of sympathetic influences on the heart, which increases the electrical instability of the myocardium, creating conditions for the occurrence of ventricular arrhythmias. It has been established that a decrease in HRV in patients with AMI is associated with an increased risk of sustained ventricular tachycardia and sudden cardiac death.

The risk of SCD, according to the literature, also increases in patients with changes in the geometry of the heart (dilation, cardiac hypertrophy) with any pathology of the heart (usually organic). Correlation analysis carried out between HRV and cardiac echogeometry showed that there is a negative relationship between LVMI and SDNN (r =0.36, P<0.05), LVMI and SDANN (r =-0.38, P<0.05), EDV and SDNN (r =-0.37, P<0.05), EDV and SD A NN (r =-0.39, P<0.05), EDV and SDNN ind , ms (r = -0.33, P<0.05), EF and SDNN (r = -0.32, P<0.05), EF and SD A NN (r = -0.38, P<0.05), FIR and SDNN (r = -0.31, P<0.05). From the above results, it can be seen that the deterioration of HRV parameters is more typical for patients with pronounced changes in the echogeometry of the heart in the form of dilatation of the heart cavities with the phenomena of diastolic and systolic myocardial dysfunction, which are typical for patients with AMI with a Q wave .

Conclusion. Thus, the data of the correlation analysis suggests that with severe organic pathology of the heart, there is a significant improvement in HRV indicators, which contributes to the timely diagnosis and prevention of the development of cardiovascular catastrophes .

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