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Interdependence of Obstructive Changes in the Coronary Arteries and Clinical Manifestations of Heart Failure in Patients Who Have Suffered Myocardial Infarction

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In patients who have suffered a myocardial infarction (MI), heart failure (HF) is caused by a decrease in the pumping function of the heart when a significant portion of the myocardium is activated from contraction. Impairment of the pumping function of the left ventricle of the heart without clinical signs of HF or with minimal, as well as with its pronounced manifestations, on Our opinion should be considered in the aspect of hemodynamic supply to the left ventricles (LV). The New York Heart Association has developed a classification of heart failure into class IV (Stages). At the same time, identifying circulatory decompensation taking into account clinical and angiographic signs is important for assessing the condition of patients and selecting drug therapy. And also when developing indications for surgical correction of this complication.

The purpose of this work is to identify the interdependence of obstructive changes in the coronary arteries and clinical manifestations of heart failure in patients who have suffered an MI, to clarify a set of signs that make it possible to distinguish between compensated and decompensated stages of heart failure, using multifactorial discriminant analysis using a computer.

Material and methods .

We observed 154 patients with coronary artery disease (men) who had suffered an MI, including 91 patients in the subacute stage of MI and 63 with post-infarction cardiosclerosis.

In the group of patients with subacute stage of myocardial infarction, the average age was 46.8+(-)6.9 years, and in patients with post-infarction cardiosclerosis - 47.5+(-)*.3 years. Patients in the subacute stage of MI were examined at the 4th week from the onset of the disease, and patients with post-infarction cardiosclerosis were examined in the period from 2 months to 10 years after MI. All patients underwent polypositional Coronagraphy using the M method. D. Judkins and also left ventriculography. When analyzing coronograms , the degree of obstruction of the coronary arteries was taken into account according to the classification of Yu.S. Petrosyan and L.S. Zergerman , the number of affected coronary arteries and the total severity in units according to the method presented in work V. Kaltenbach and W. D. Bussuman , angiographic morphology of the coronary arteries was based on the classification of J. A. Ambrose. Identification of an “ infarct-related ” coronary artery was determined by selecting the most affected vessel, corresponding to the location of the previous MI predicted by ECG and two-

dimensional echocardiography. Patients with equivalent lesions of the two main branches of the coronary arteries were not included in this analysis. Along with angiographic methods, non-invasive ones were also used: ECG in conventional leads, a complex echocardiographic study using the MK-600 ATL device (USA), a bicycle ergometer test was carried out in 33 (36.2%) patients in the subacute stage of myocardial infarction and in 27 (42.8%) patients with post-infarction cardiosclerosis on a 380-V device from Rodly-Electric (USA). The patients underwent a complex of clinical, diagnostic and biochemical studies, adopted at the Center for Emergency Cardiology of the Russian Research Center for Emergency Medicine, Samarkand branch. The diagnosis of IHD was established taking into account the classification criteria

Diagnosis of HF was carried out taking into account the classification New York Heart Association. At the same time, at **the 1st stage** , the distribution of indicators of intracardiac hemodynamics and contractility of the left ventricle of the heart, as well as clinical signs of circulatory decompensation (shortness of breath, palpitations, congestive wheezing in the lungs, etc.) were obtained using descriptive statistics. **At the 2nd stage,** according to the data of univariate analysis, a preliminary selection of patients was carried out according to the classes of heart failure.

At the 3rd stage, stepwise discriminant analysis was used to identify possible differences between the selected groups of patients.

Stage I of HF was established in 60 (38.9%) patients, stage II in 48 (31.1%) and stage 1 in 46 (29.8%). The patients received complex treatment, including long-acting nitrates (nitrosorbide 60-320 mg/ day , sustak forte 6.4 mg 4-8 times a day), beta-adrenergic receptor blockers (propranolol 40-320 mg), calcium antagonists (corinfar 30-120 mg/ day , finoptin 160-400 mg/ day). The combination of anti- anginal drugs included nitrates and beta-blockers, nitrates, beta-blockers and calcium antagonists. In this case, the effectiveness of therapy was assessed according to the following gradation:

1 - stable, 2 - unstable, 3 - absent.

It should be noted that this group of drugs, along with the antiangial effect, stabilizes hemodynamics. Data about patients was encoded using a special program and entered into a personal computer from Sora-501 (Taiwan). The material was processed using the statistical software package SPSS (USA).

Results and discussion

The study revealed a parallelism between the functional state of the LV and the stages of HF (table), which depended on the location of the MI, as well as the number of affected LV segments. High stages of HF were observed mainly in patients with scar changes along the anterior wall of the LV **Table 1.**

Indicators of intracardiac hemodynamics and contractility of the left ventricle of the heart at various stages of HF in patients who have had an MI

Index	Stage of heart failure		
	1 （n=60）	1I （n=48）	III （n=46）
End diastolic pressure, mm Hg. Art.	7.9±0.2	11.2±0.9*	18.2±1.2 *
End diastolic volume, ml/m?	65.2±2.8	78.0±4.0*	1 03.0±3.6*
End systolic volume, ml/m2	20.7±1.3	33.0±1.8*	57.8±3.3 *
Stroke volume, ml/m?	44.5±1.2	45.0±2.2	45.0±2.2
Ejection fraction, %	68.2±0.8	57.6±0.5*	43.6±1.0 *
Asynergy, arb. units	1.2±0.2	3.2±0.5*	3.2±0.5*

Note : *

* - significant differences in indicators with stage I of heart failure, * - significant differences

between stages II and III
High stages of HF were observed mainly in patients with scar changes along the anterior wall of the LV ($p<0.001$). Similar results were obtained by other authors.

In patients with damage to 1 segment of the LV, there were practically no clinical manifestations HF, but when more than 2 segments of the LV are affected, they are usually detected more often. At the same time, according to the literature, there are patients in whom a significant part of the myocardium is affected, and the LV ejection fraction remains within normal limits.

According to our data, in patients who suffered an MI with a large number of affected segments, end-diastolic pressure and LV volumetric characteristics were significantly increased , and the LV ejection fraction and the rate of shortening of circular fibers were decreased. Asynergia was significantly more severe in patients with a larger number of affected segments

LV (Table 2).

The stages of HF depended on the territory of the " infarct-related " coronary artery. At the same time, damage to the " infarct-related " LAD was mainly observed in groups with stage III HF ($p<0.001$). Occlusion of the " infarct-related " coronary artery was more often detected in patients with stage III HF ($p<0.001$). The study did not reveal any dependence of HF stages on the number of affected coronary arteries ($p>0.248$). In patients who underwent MI, the frequency of collateral anastomoses did not depend on the stages of HF ($p>0.431$). Analysis of the angiographic morphology of obstructive changes in the coronary arteries showed that concentric stenoses were more often detected in stage I HF ($p <0.003$). Eccentric stenoses of type 2 and (or) irregular shape were significantly more often detected in patients with stages II and III of HF ($p <0.001$). According to the literature, eccentric stenoses of type 2 and/or irregular shape are hemodynamically more significant in relation to coronary blood flow.

At the same time, deterioration of coronary blood flow also reduces LV contractility.

• Clinical signs of HF were mainly dyspnea and tachycardia.

Analysis of electrocardiographic changes depending on the stages of HF showed characteristic changes characteristic of post-MI. In this case, the QS wave reflected the localization of the MI. Depression of the ST segment along the anterior wall was observed in 52 (33, /) patients, and elevation - in 6 (5.0%) patients. ST segment elevation was detected in 14 (9.0%) patients along the posterior wall of the LV, biphasic wave I was detected in 36 (22.3%) patients along the anterior wall and in 14 (9.0%) patients along the posterior wall of the LV. T wave inversion was observed in 37 (24.0%) along the anterior wall, 6 (3.8%) along the lateral wall, and 11 (7.1%) along the posterior wall of the LV. These signs were observed only in patients with stages II and II heart failure.

Changes in the final part of the ventricular ECG complex in the form of depression or elevation of the ST segment more than 2 mm from the isoelectric line in combination with a change in the T wave, on the one hand, suggest ischemic changes in the myocardium, and on the other, its overload caused by a violation of intracardiac hemodynamics and contractility of the LV of the heart [14, 17, 18). In our opinion, both of these reasons can lead to changes in the final part of the ventricular ECG complex.

Table 2 Indicators of intracardiac hemodynamics and LV contractility depending on the number of affected segments in patients who suffered an MI

Index	Number of affected LV segments			
	1 （n=43）	2 (n=50)	3 （n=30）	4 (n= 31)
Final diast. Dav.m. m, rt. Art.	8.7±2.7	10.0±84.6	15.5±2.9	16.6±5.7
Final syst. Dove. m. m, rt. Art	65.2±8.1	71.4±14.6	96.2±7.1	100.2±2 3.6

Stroke volume, ml/m?	41,43,9	30.0±1 4.2	47.3±3.9	49.2±8.7
Fraction emission %	63.4±8.3	57.9±1.5	50.8±3.1	49.2±1 2 .0
Asynergy, conventional unit .	1.6±1.4	1.7±2.0	4.8±2.6	5.3±2.5

Note : Significant differences in p indicators: *-2-3, **-1-3, ***1-4, *****2-4

Cardiac rhythm disturbances were detected in 23 (14.9%) and conduction disturbances in 58 (37.6%) patients. At the same time, arrhythmias were mainly detected in patients with stage III heart failure. According to the literature, the detection of arrhythmias increases significantly with the use of Holter monitoring.

A comprehensive echocardiographic study revealed LV aneurysm in 45 (29.2%) patients, and papillary muscle dysfunction in 20 (12.9%) patients. Regurgitation of blood into the cavity of the left atrium was detected in 14 (9.0%) patients. According to the literature and our clinic, dysfunction of the papillary muscles with regurgitation of blood into the cavity of the left atrium contributes to the development of severe heart failure.

In 21 (13.6%) patients with stage III HF, its clinical signs were identified: congestive wheezing in the lungs, distribution of liver boundaries according to Kurlov, disturbances in the electrolyte balance of blood plasma, increased venous pressure, and decreased daily diuresis. According to the literature, these signs indicate circulatory decompensation. X-ray examination in these patients revealed an increase in the pulmonary pattern. The results of clinical angiographic studies have established a number of common and different signs at certain stages of heart failure.

Using multifactorial discriminant analysis using a computer, we clarified the complex of clinical and angiographic signs that allow us to distinguish between compensated and decompensated stages of blood circulation:

1) the appearance of congestive wheezing in the lungs ($p < <0.001$); 2) disturbance of the electrolyte composition of blood plasma ($p<0.001$); 3) heart rhythm disturbance ($p<0.001$); 4) high obstruction of the LAD of the left coronary artery ($p <0.001$); 5) LV ejection fraction is less than 50% ($p<0.001$).

To determine the weight value of each of these features, it would be possible to determine their sensitivity, but we did not set such tasks.

In patients who suffered a MI with stage III HF, exercise tolerance according to the bicycle energy test was lower, which is consistent with literature data. Moreover, the higher the total severity of coronary artery damage, the lower the exercise tolerance was ($p <0.001$).

The results of the study established the dependence of the clinical manifestations of post-infarction angina on the stage of HF. At the same time, in patients with more severe forms of post-infarction angina, stage III HF was more often observed ($p <0.001$).

Antiangial therapy was more successful in patients with stage I HF ($p<0.001$). An unstable effect and/or its absence was significantly more often observed in patients with stage III HF ($p <0.001$). The results of the study are the interdependence of obstructive changes in the coronary arteries, the functional state of the left ventricle and the stages of HF.

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