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CLINICAL MANIFESTATIONS OF HEART FAILURE IN PATIENTS WITH OBSTRUCTIVE CHANGES IN THE CORONARY ARTERIES IN PATIENTS WHO HAVE HAD MYOCARDIAL INFARCTION

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КЛИНИЧЕСКИЕ ПРОЯВЛЕНИЯ СЕРДЕЧНОЙ НЕДОСТАТОЧНОСТИ У БОЛЬНЫХ, ПЕРЕНЕСШИХ ИНФАРКТ МИОКАРДА, С ОБСТРУКТИВНЫМИ ИЗМЕНЕНИЯМИ КОРОНАРНЫХ АРТЕРИЙ

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MIOKARD INFARKTI VA KORONAR ARTERIYALARDA OBSTRUKTIV O'ZGARISHLAR BO'LGAN BEMORLARDA YURAK YETISHMOVCHILIGINING KLINIK KO'RINISHLARI

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Цель: *выявление взаимозависимости обструктивных изменений в коронарных артериях и клинических проявлений сердечной недостаточности у пациентов, перенесших инфаркт миокарда, а также уточнение признаков, позволяющих различать компенсированную и декомпенсированную стадии сердечной недостаточности, используя многофакторный дискриминантный анализ с помощью компьютера.* ***Материал и методы:*** *под наблюдением были 154 мужчин с ишемической болезнью сердца, перенесших инфаркт миокарда, в том числе 91 пациент в подострой стадии инфаркта (ср. возраст 46,8±6,9 года) и 63 – с постинфарктным кардиосклерозом (ср. возраст 47,5±0,3 года). Пациенты в подострой стадии инфаркта миокарда обследовались на 4-й неделе с начала заболевания, а пациенты с постинфарктным кардиосклерозом – в период от 2-х месяцев до 10 лет после инфаркта.* ***Результаты:*** *установлена зависимость клинических проявлений постинфарктной стенокардии от стадии сердечной недостаточности. В то же время у пациентов с более тяжелыми формами постинфарктной стенокардии чаще наблюдалась III стадия сердечной недостаточности (p<0,001). Антиангиальная терапия была более успешной у пациентов с I стадией сердечной недостаточности (p<0,001). Нестабильный эффект и/или его отсутствие значительно чаще наблюдались у пациентов с III стадией сердечной недостаточности (p<0,001).* ***Выводы:*** *полученные результаты свидетельствуют о взаимозависимости обструктивных изменений в коронарных артериях, функционального состояния левого желудочка и стадии сердечной недостаточности.*

Ключевые слова*: инфаркт миокарда, клиническое течение, молодые пациенты, реваскуляризация миокарда.*

Maqsad: *miokard infarktidan keyingi bemorlarda koronar arteriyalardagi obstruktiv o'zgarishlar va yurak yetishmovchiligining klinik ko'rinishlari o'rtasidagi bog'liqlikni aniqlash, shuningdek, kompyuter yordamida ko'p o'zgaruvchan diskriminant tahlil yordamida yurak yetishmovchiligining kompensatsiyalangan va dekompensatsiyalangan bosqichlarini farqlash imkonini beruvchi xususiyatlarni aniqlash.* ***Materiallar va usullar:*** *tadqiqotga miokard infarktini boshdan kechirgan koronar arteriya kasalligi bilan og'rigan 154 erkak, jumladan, miokard infarktining subakut bosqichidagi 91 bemor (o'rtacha yoshi 46,8±6,9 yosh) va infarktdan keyingi kardioskleroz bilan og'rigan 63 bemor (o'rtacha yoshi 47,5±0,3 yosh) kiritilgan. Miokard infarktining subakut bosqichidagi bemorlar kasallik boshlanganidan 4-haftada, infarktdan keyingi kardioskleroz bilan og'rigan bemorlar esa infarktdan keyingi 2 oydan 10 yilgacha bo'lgan davrda tekshirildi.* ***Natijalar:*** *infarktdan keyingi stenokardiyaning klinik ko'rinishlari va yurak yetishmovchiligi bosqichi o'rtasidagi bog'liqlik aniqlandi. Shu bilan birga, III bosqichdagi yurak yetishmovchiligi infarktdan keyingi stenokardiyaning og'irroq shakllari bo'lgan bemorlarda ko'proq kuzatilgan (p<0,001). Antianginal terapiya I bosqichdagi yurak yetishmovchiligi bo'lgan bemorlarda muvaffaqiyatliroq bo'lgan (p<0,001). III bosqichdagi yurak yetishmovchiligi bo'lgan bemorlarda beqaror ta'sir va/yoki uning yo'qligi sezilarli darajada ko'proq kuzatilgan (p<0,001).* ***Xulosa:*** *olingan natijalar koronar arteriyalardagi obstruktiv o'zgarishlar, chap qorinchaning funktsional holati va yurak yetishmovchiligi bosqichi o'rtasidagi o'zaro bog'liqlikni ko'rsatadi.*

Kalit so'zlar*: miokard infarkti, klinik kechishi, yosh bemorlar, miokard revaskulyarizatsiyasi.*

Ischemic heart disease remains one of the leading causes of morbidity and mortality worldwide. Despite advances in reperfusion therapy and secondary prevention, myocardial infarction continues to be associated with high rates of structural and functional myocardial remodeling, which largely determine long-term prognosis.

The subacute stage of myocardial infarction and the period of post-infarction cardiosclerosis represent consecutive phases of the same pathological process, characterized by different degrees of coronary artery involvement, myocardial damage, and compensatory mechanisms. At these stages, coronary artery morphology and the severity of atherosclerotic lesions play a key role in the development of left ventricular dysfunction, residual ischemia, and recurrent cardiovascular events.

Coronary angiography remains the reference method for assessing the extent and nature of coronary artery lesions in patients with ischemic heart disease. Quantitative assessment of coronary artery obstruction, the number of affected vessels, and angiographic morphology allows a more accurate evaluation of the severity of coronary atherosclerosis and identification of the infarct-related artery. These parameters are essential for understanding the mechanisms of myocardial injury and for stratifying cardiovascular risk.

At the same time, comprehensive evaluation of patients with myocardial infarction requires the combined use of invasive and non-invasive diagnostic methods, including electrocardiography, echocardiography, and exercise testing, which provide complementary information on myocardial function and ischemic burden.

The aim of the present study was to assess the angiographic characteristics of coronary artery lesions and their relationship with clinical and instrumental findings in patients at the subacute stage of myocardial infarction and in those with post-infarction cardiosclerosis.

Purpose of the study

To identify the relationship between obstructive changes in the coronary arteries and clinical manifesta-

tions of heart failure in patients who have had myocardial infarction, as well as to clarify the features that allow us to distinguish between compensated and decompensated stages of heart failure using computer-aided multivariate discriminant analysis.

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 study group, patients with subacute myocardial infarction (MI) had a mean age of 46.8±6.9 years, while patients with post-infarction cardiosclerosis had a mean age of 47.5±8.3 years. Patients with subacute MI were examined 4 weeks after the onset of the disease. Patients with post-infarction cardiosclerosis were examined at different time points ranging from 2 months to 10 years after MI. All patients underwent selective coronary angiography performed by the Judkins technique in multiple projections, as well as left ventriculography. When analyzing coronary angiograms, the degree of coronary artery stenosis was assessed according to the classification of Yu.S. Petrosyan and L.S. Zergerman. The number of affected coronary arteries and the total severity score were evaluated using the method described by V. Kaltenbach and W.D. Bussmann. Angiographic morphology of coronary lesions was classified according to the J.A. Ambrose classification.

The infarct-related artery was identified as the coronary vessel with the most significant lesion corresponding to the localization of the previous myocardial infarction, as determined by electrocardiography and two-dimensional echocardiography. Patients with equivalent significant lesions of two major coronary arteries were excluded from this analysis. In addition to invasive methods, non-invasive diagnostic studies were performed, including standard 12-lead electrocardiography and comprehensive echocardiographic examination using the MK-600 ATL system (USA). Bicycle exercise testing was carried out in 33 patients (36.2%) with subacute MI and in 27 patients (42.8%) with post-infarction cardiosclerosis using a Rodly-Electric ergometer (USA). All patients underwent a comprehensive clinical, laboratory and biochemical evaluation according to the diagnostic protocols adopted at the Center for Emergency Cardiology of the Samarkand branch of the Russian Research Center for Emergency Medicine. The diagnosis of ischemic heart disease was established in accordance with accepted classification criteria [3,4,6,9].

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) [1,2,4,5] The combination of antianginal 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 1), 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		
	I, n=60	II, n=48	III, n=46
End diastolic pressure, mm Hg. Art.	7.9±0.2	11.2±0.9a	18.2±1.2b
End diastolic volume, ml/m2	65.2±2.8	78.0±4.0a	103.0±3.6b
End systolic volume, ml/m2	20.7±1.3	33.0±1.8a	57.8±3.3b
Stroke volume, ml/m2	44.5±1.2	45.0±2.2	45.0±2.2
Ejection fraction, %	68.2±0.8	57.6±0.5a	43.6±1.0b
Asynergy, arb. units	1.2±0.2	3.2±0.5a	3.2±0.5a

Note. a – significant differences – compared with stage I heart failure; b – 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 [1,3,4,8].

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 [6-9].

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 [1,4,10].

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. In our opinion, both of these reasons can lead to changes in the final part of the ventricular ECG complex (Table 2).

Table 2

Indicators of intracardiac hemodynamics and LV contractility depending on the number of affected LV segments in patients after myocardial infarction

Parameter	1 segment, n=43	2 segments, n=50	3 segments, n=30	4 segments, n=31
Final diastolic pressure, mmHg	8.7±2.7	10.0±4.6	15.5±2.9*	16.6±5.7*
Final systolic pressure, mmHg	65.2±8.1	71.4±14.6	96.2±7.1*	100.2±23.6*
Stroke volume, ml/m^2	41.4±3.9	30.0±4.2	47.3±3.9*	49.2±8.7*
Ejection fraction, %	63.4±8.3	57.9±11.5	50.8±3.1*	49.2±12.0*
Asynergy index, arb. units	1.6±1.4	1.7±2.0	4.8±2.6*	5.3±2.5*

Note. * – p<0.05 compared with patients with 1 affected LV segment.

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 [1,2,4,6].

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 [1,2,4,5].

Using multifactorial discriminant analysis using a computer, we clarified the complex of clinical and angiographic signs that allow us to distinguish between com-

pensated 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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Objective: *To identify the relationship between obstructive changes in the coronary arteries and clinical manifestations of heart failure in patients after myocardial infarction, as well as to clarify the features that allow us to distinguish between compensated and decompensated stages of heart failure using computer-aided multivariate discriminant analysis.* ***Material and methods:*** *The study included 154 men with coronary artery disease who had suffered myocardial infarction, including 91 patients in the subacute stage of myocardial infarction (mean age 46.8±6.9 years) and 63 with post-infarction cardiosclerosis (mean age 47.5±0.3 years). Patients in the subacute stage of myocardial infarction were examined at the 4th week from the onset of the disease, and patients with post-infarction cardiosclerosis – in the period from 2 months to 10 years after the infarction.* ***Results:*** *A relationship between the clinical manifestations of post-infarction angina and the stage of heart failure was established. At the same time, stage III heart failure was more often observed in patients with more severe forms of post-infarction angina (p<0.001). Antianginal therapy was more successful in patients with stage I heart failure (p<0.001). An unstable effect and/or its absence were significantly more often observed in patients with stage III heart failure (p<0.001).* ***Conclusions:*** *The obtained results indicate an interdependence between obstructive changes in the coronary arteries, the functional state of the left ventricle, and the stage of heart failure.*

Key words*: myocardial infarction, clinical course, young patients, myocardial revascularization.*

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