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DIAGNOSIS OF HEART DYSFUNCTION IN PATIENTS WITH COVID-19

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Abstract. Respiratory support and rehabilitation tactics undoubtedly remain the main challenge in COVID-19. Nevertheless, COVID-19 has unpredictable effects on the cardiovascular system, the consequences of which can be unfavorable not only in the acute period of the disease, but also during the rehabilitation period. Unfortunately, respiratory failure, the main manifestation of the disease, with which medical personnel fights, often distracts from cardiac disorders in patients, which inevitably leads to undermining the timely diagnosis and treatment of cardiovascular diseases.With a massive admission of patients during a pandemic, these problems are also due to the lack of narrow specialists and the inability to routinely use diagnostic methods.

Key words: COVID-19; the cardiovascular system; rehabilitation

Introduction. In patients with cardiovascular disease (CVD), special vigilance should be exercised against the background of COVID-19 infection, paying equal attention not only to the treatment of infection, but also to the control of risk factors for cardiovascular disease. CVD patients with COVID-19 are at high risk of destabilization due to a combination of stressors, systemic infection, and inflammation. Early studies have shown that people with comorbid conditions such as hypertension, diabetes mellitus suffer increased morbidity and mortality from COVID-19 [3,6]. At the same time, mortality from COVID-19 increases up to five times in people with CVD [7]. Clinical and laboratory symptoms of heart damage are detected with COVID-19 quite often; some patients have experienced chest pain and palpitations even in the absence of typical respiratory symptoms [2]. The most common cardiac manifestations of infection are cardiac arrhythmias and myocardial damage [4,5]. In patients admitted to intensive care units, arrhythmias were detected in 16.7% to 44.4% of cases [4,5].

Purpose of the study: development and implementation in practice of optimal rehabilitation schemes for COVID-19 aimed at reducing the hospital period through effective treatment of CVD and prevention of complications.

Materials and methods. In the Specialized Clinic of Zangiota No. 1 and Zangiota No. 2, schemes for managing patients with CVD have been put into practice for the treatment of patients with coronavirus infection. Based on the analysis of the frequency and structure of cardiac manifestations, as well as the treatment of patients with COVID-19, guidelines have been developed. In the algorithms for diagnosing CVD (Table 1), the following are distinguished: clinical, instrumental, laboratory diagnostics, available in specialized clinics.

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Table 1

ALGORITHMS FOR CVD DIAGNOSIS IN COVID-19

CLINICAL DIAGNOSIS:
Detection of symptoms: IHD, acute coronary syndrome (ACS), myocardial infarction (MI), AH, hypertensive crisis, arrhythmia, myocarditis, acute cardiovascular failure, chronic heart failure (CHF)
INSTRUMENTAL DIAGNOSIS
Measurement of blood pressure (BP) in order to detect hypertension and / or hypertensive crisis: • If necessary, daily monitoring of blood pressure (taking into account the influence of stress factors) **ECG in 12 leads:** • Analysis of the S-T segment, T wave, Q-T interval • Signs of ischemia and damage in the myocardium • Cardiac arrhythmias, Q-T prolongation → 24-hour ECG monitoring to detect life-threatening arrhythmias **Echocardiography**: • Identification of disorders of systolic and diastolic dysfunction • Local contractility disorders • Dilatation of the chambers of the heart • Signs of pericarditis
LABORATORY DIAGNOSIS
With clinical and ECG signs of ACS, MI, myocarditis: 1. markers of myocardial damage: troponin 2. lipid profile 3. C reactive protein (CRP)*
Differential Diagnosis: * Infectious damage to the heart by coronavirus can also lead to clinical manifestations suggestive of a heart attack. ● Patients with COVID-19, in the absence of myocardial injury, may present with symptoms mimicking cardiovascular disease, including chest pain, dyspnea, and shock.

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Identification of CVD allows timely medical rehabilitation of patients. The developed algorithms (Table 2) on the specifics of the use of drugs can not only improve the condition of patients, but also make it possible to prevent possible cardiovascular complications.

Table 2

ALGORITHMS FOR THERAPEUTIC REHABILITATION OF CVD PATIENTS WITH COVID-19

Patients with stable CVD are advised to continue treatment with previously taken cardiac drugs. At the same time, taking into account possible changes in hemodynamics and hemostasis, a differentiated approach to the choice of drugs: - if against the background of anticoagulants in patients with hypertension, there is a decrease in blood pressure, it is necessary to individually adjust the dose of antihypertensive drugs;
Given the possible side effects of statins (rhabdomyolysis, elevated liver enzymes), it is advisable to refrain from using them during the acute period of COVID-19.
Hypertension management should be in line with current guidelines during the COVID-19* pandemic. *According to the ESC experts, there are no data on the adverse effects of ACE inhibitors and angiotensin receptor blockers on the course of COVID-19 and it is recommended to continue taking them. Four drug classes: beta-blockers, calcium antagonists, ACE inhibitors, and angiotensin receptor blockers can be used to treat hypertension in COVID-19 patients.
When prescribing antiviral therapy: • (lopinavir / ritonavir) conduct an ECG, with an assessment of the P-Q interval, taking into account the possibility of its lengthening. In patients with AV blockade, lopinavir/ritonavir is not recommended. • Hydroxychloroquine, ECG monitoring is recommended to assess the Q-T interval, especially when taken with azithromycin. In case of Q-T prolongation by more than 60 ms from the initial one, decide on the issue of discontinuing the drug.
With the development of tachyarrhythmias (atrial fibrillation / flutter): beta-blockers in the absence of heart failure (HF) and / or shock.

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In the presence of HF or borderline/low blood pressure, amiodarone is the drug of choice..

According to these algorithms, patients were examined with a confirmed diagnosis of COVID-19 with pneumonia, hospitalized in the intensive care and resuscitation departments of the Zangiota Specialized Clinic No. 2 for the treatment of patients with coronavirus infection. An echocardiographic study was conducted in 54 patients diagnosed with COVID-19 who were subsequently admitted to intensive care units, 2 patients were excluded from the study due to poor visualization of the heart during echocardiography. 46 patients were on non-invasive ventilation (NIV) and 6 on invasive ventilation (ALV). Clinical characteristics of patients, taking into account laboratory and ECG parameters, are shown in Table 3. Concomitant diseases occurred in 92% of patients, the most common comorbid background was arterial hypertension (AH) in 75%, coronary heart disease (CHD) in 46%, diabetes mellitus (DM) 37%, obesity 37%, etc.

Table 3

Clinical characteristics of the studied patients

Parameters	Number of patients (n=52)
Average age	46,3±12,4
Number of men, n (%)	32 (62%)
Number of women, n (%)	20 (38%)
AG, n (%)	39 (75%)
IHD, n (%)	24 (46%)
DM, n (%)	19 (37%)
Obesity, n (%)	19 (37%)
chronic kidney disease, n (%)	6 (11%)
Chronic obstructive pulmonary disease, n (%)	4 (7%)
Oncology, n (%)	1 (2%)
C-reactive protein, mg/dL	50,7±4,4
D-dimer, ng/ml	1376,3±206,3
Ferritin, ng/ml	275,5±28,4
Interleukin-6, pg/ml	39,4±6,7
Albumin, g/l	33,5±0,7
Heart rate, avg.	85±18
Sinus rhythm, n (%)	48 (92%)
Atrial fibrillation, n (%)	4 (8%)
Blockade of the right leg of the bundle of His, n (%)	9 (17%)

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Blockade of the left leg of the bundle of His, n (%)	2 (4%)
S-T segment elevation, n (%)	2 (4%)
S-T segment depression, n (%)	14 (27%)
T wave inversion, n (%)	27 (52%)
Q-Tc, ms	417,2±48,1

Treatment and respiratory support of patients was carried out according to temporary recommendations for the management of patients infected with coronavirus infection [1]. During the echocardiography, the averaged indicators of three cardiac cycles were calculated. All data measured and calculated by formulas were divided into groups characterizing the structure, systolic and diastolic functions of the left and right ventricles. RV parameters were assessed in the apical 4-chamber position: end-systolic and diastolic dimensions, movement of the tricuspid ring. Flow in the outflow tract of the pancreas and in the pulmonary artery (PA) was assessed in the parasternal position along the short axis at the level of the PA trunk. The flow acceleration time (AT) in the pulmonary artery and the ejection time (ET) were estimated, and the average pressure in the PA was determined from the AT/ET ratio.

Echocardiographic results

Evaluation of LVDD in patients with concomitant CAD and preserved EF (n=16) was carried out according to the algorithm for diagnosing normal diastolic function and diastolic dysfunction. Analysis according to this algorithm revealed the presence of LVDD in 14 out of 16 patients with coronary artery disease. In all 16 patients, the E/e´>14 ratio and an increase in the rate of tricuspid regurgitation over 2.8 m/s were revealed. In 12 patients, an increase in the index of the volume of the left atrium (LA) >34 ml/m2 was noted. Analysis of LVDD in patients with coronary artery disease with reduced EF (n=8) showed an increase in pressure in the LA and LVDD of II and III degrees in 6 patients, in 2 patients, the degree of LVDD could not be determined due to insufficient criteria.

The size of the pancreas was increased in 22 patients (42%). Evaluation of pulmonary blood flow showed a decrease in AT in all patients.

In patients with a severe course of the disease, including those on mechanical ventilation, a significant decrease in AT was observed, which indicated an increase in afterload on the pancreas. In 23% of patients, clinical worsening of the disease was observed, and repeated echocardiography showed further worsening of RV parameters, probably associated with an increase in pressure in the pulmonary artery.

The severity of RV diastolic dysfunction in patients with COVID-19 was associated with elevated levels of D-dimer, C reactive protein (CRP), and Interleukin-6 (Table 2).

Table 2

Indicators of RV diastolic function, pulmonary flow and correlation between D-dimer, CRP in patients with COVID-19

Parameter	D-dimer, r	SRP, r	IL-6
E′/A′ average	0,69	0,53	0,614
DT, мс	0,24	0,16	0,312
AT, мс	0,576	0,49	0,542
Avg. pressure in PA	0,613	0,54	0,718
EDS RV	0,21	0,26	0,47
ESS RV	0,15	0,51	0,62

Note: E′/A′ - the ratio of the speed of early and late diastolic movement of the tricuspid valve ring; DT - time to slow down the rate of early filling of the pancreas; AT - acceleration time of the pulmonary flow; EDS RV - end-diastolic size of the RV; ESS RV - end-systolic size of the RV.

Conclusion. In contrast to LV functional parameters, all parameters of RV hemodynamics were worse in patients with COVID-19, especially those with elevated levels of IL-6 and D-dimer, against the background of a worsening clinical course of the disease. Echocardiography with the determination of the function of the pancreas and indicators of pulmonary hypertension will effectively carry out dynamic monitoring of the course of the disease and may be of decisive importance in determining timely treatment. The key to successful cardiological rehabilitation in the context of coronavirus infection is the timely diagnosis of CVD and targeted therapeutic rehabilitation based on the compatibility of drugs and their side effects. An important component is the differential diagnosis of infectious myocardial damage and exacerbation of existing CVD / respiratory failure. The use of the above algorithms will significantly reduce the frequency of cardiac manifestations, which also helps to reduce the length of stay in the hospital and the cost of treatment.

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