

DIAGNOSTIC CRITERIA FOR CORONAVIRUS INFECTION IN CARDIOVASCULAR DISEASES AND PROTECTING PERSONNEL FROM INFECTION

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✓ Resume

Given the risk of cardiovascular complications in COVID-19, including exacerbation of pre-existing heart disease, acute myocardial injury, and drug-related cardiac arrhythmias, echocardiography (EchoCG) is one of the main diagnostic methods for evaluating patients with suspected infection or confirmed disease.

Conducting bedside echocardiography, which may be of diagnostic value if myocarditis is suspected as one of the manifestations of heart damage in coronavirus infection.

Key words: coronavirus infection, cardiovascular system, echocardiography, ultrasound examination, myocarditis.

КРИТЕРИИ ДИАГНОСТИКИ КОРОНАВИРУСНОЙ ИНФЕКЦИИ ПРИ СЕРДЕЧНО-СОСУДИСТЫХ ЗАБОЛЕВАНИЯХ И ЗАЩИТА ПЕРСОНАЛА ОТ ИНФЕКЦИИ

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✓ Резюме

Учитывая риск сердечно-сосудистых осложнений при COVID-19, включая обострение ранее существовавшего сердечного заболевания, острое повреждение миокарда и сердечные аритмии, связанные с приемом лекарств, эхокардиография (ЭхоКГ) является одним из основных диагностических методов для оценки пациентов с подозрением на инфекцию или подтвержденной инфекцией. болезнь.

Проведение прикроватной эхокардиографии, которая может иметь диагностическое значение при подозрении на миокардит как одно из проявлений поражения сердца при коронавирусной инфекции.

Ключевые слова: коронавирусная инфекция, сердечно-сосудистая система, эхокардиография, ультразвуковое исследование, миокардит.

KARDIYOVASKULYAR KASALLIKLARDA KORONAVIRUS INFEKTSIYASINI TASHXISLASH MEZONLARI VA XODIMLARNI INFEKTSIYADAN HIMOYA QILISH

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✓ Rezyume

COVID-19da yurak-qon tomir asoratlari, shu jumladan ilgari mavjud bo'lgan yurak kasalliklari, miokardning o'tkir shikastlanishi va giyohvandlik bilan bog'liq yurak ritmining buzilishi xavfini hisobga olgan holda, ekokardiyografi (EchoCG) infeksiyaga shubha qilingan yoki tasdiqlangan bemorlarni baholashning asosiy diagnostik usullaridan biridir. infeksiya. ... kasallik.

Koronavirus infeksiyasida yurak shikastlanishining namoyon bo'lishidan biri sifatida gumon qilinadigan bo'lsa, diagnostik ahamiyatga ega bo'lgan yotoq yonida ekokardiyografiya o'tkazish.

Kalit so'zlar: koronavirus infeksiyasi, yurak-qon tomir tizimi, ekokardiyografiya, ultratovush tekshiruvi, miokardit.

Relevance

The beginning of the 21st century went down in the history of world virology as a period of rethinking the ecological characteristics of coronaviruses and their epidemic potential. The SARS-CoV outbreak of Severe Acute

Respiratory Syndrome (SARS) initially demonstrated that coronaviruses can cause not only mild to moderate acute respiratory infections (ARI), but also severe primary viral pneumonia (up to fatal): according to the World

Health Organization (WHO), from 01.11.2002 to 31.07.2003 the mortality rate in the world was 9.6% (774/8096), while imported cases were registered in 29 countries (667 cases and 89 deaths) [1-3,7 -11,12]. The natural reservoir of SARS-CoV is bats (bats, microchiropters), which transmit the infection without clinical manifestations, but excrete the virus in saliva, urine and feces. Direct human infection by bats is possible, but most often they first infect small wild mammals, widely used for food in Southeast Asia, and from them - human infection.

The SARS outbreak has spurred active research on coronaviruses in bats, mainly in Asia. However, the next time coronaviruses showed their epidemic potential, at first glance, in an unexpected place - on the Arabian Peninsula, known for its arid landscapes. However, it should be borne in mind that the western part of this peninsula is in the monsoon zone, and the southwestern slopes of the El-Asir mountains are mainly covered with tropical forests; in addition, the central part of the peninsula is also often not a lifeless desert, covered with many islets of oases and water. Under these conditions, the populations of bats in Arabia are quite numerous and represent a natural reservoir of MERS-CoV, discovered in June-September 2012 when decoding fatal viral pneumonia in humans. The intermediate host of MERS-CoV, the one-humped camel (*Camelus dromedarius*), was unexpected. According to the WHO, at the beginning of 2020, mortality from MERS-CoV, including cases imported to 27 countries of the world, was 34.4% (866/2519) [1,3,7,8,13]. The turning point of 2019/2020 It went down in history as an outbreak of COVID-19 (coronavirus disease 2019), which was assigned the status of an emergency of international importance by WHO, and from March 11, 2020 - the status of a pandemic.

SARS-CoV-2 (Severe Acute Respiratory Syndrome, Coronavirus 2) is a new strain of coronavirus identified at the end of 2019 and causing a dangerous infectious disease - Coronavirus 2019 disease, as they say, COVID-19, is a single strand RNA virus. The main routes of transmission of the virus: airborne, dusty, contact. The fecal-oral route is being investigated for its feasibility and importance given the confirmed excretion of viable virus in feces. Transmission from sick people and asymptomatic carriers is possible [4,5,6]. Infection of host cells via angiotensin-converting enzyme receptor 2 (ACE2) receptor exopeptidase. ACE2 expression was found in lung tissue (type II alveolocytes), myocardium, kidneys, endothelium, intestinal

epithelium, which determines the likelihood of multiple organ damage and the risk associated with unwanted outcomes. The SARS-CoV-2 virus is not only the causative agent of pneumonia, but also causes serious systemic consequences [14,15]. Patients with cardiovascular diseases and risk factors for cardiovascular complications, such as male gender, old age, diabetes mellitus, arterial hypertension and obesity, were identified as particularly vulnerable groups with an increased risk of severe course, complications and fatalities. outcomes for new coronavirus infection COVID-19 [16]. In addition, a significant proportion of patients develop COVID-associated myocardial injury, which significantly increases the risk of in-hospital mortality [17]. In addition to arterial and venous thrombotic complications, manifested as acute coronary syndrome and venous thromboembolism, myocarditis plays an important role in patients with acute heart failure [18, 19]. This viral infection is often relatively easy to carry, but a high risk of complications is typical for some population groups (elderly people, people with chronic diseases, weakened immunity and, possibly, pregnant women) [15]. Given the risk of cardiovascular complications in COVID-19, including exacerbation of pre-existing heart disease, acute myocardial injury [20], and echocardiography is one of the main diagnostic methods for examining patients with suspected infection or confirmed disease. Any infectious process can provoke the development of acute chronic cardiovascular diseases (CVD) and exacerbations. Having only CVD is not associated with a higher risk of contracting coronavirus, but is associated with a higher risk of infectious complications. Elderly patients with underlying medical conditions are more likely to be infected with SARS-CoV-2, especially if they have hypertension, coronary artery disease (CAD), and diabetes mellitus (DM).

HA and diabetes mellitus are the most common (up to 30%) comorbidities in COVID-19, especially in patients over 60 years of age. Patients with severe COVID-19 in the intensive care unit have a higher mortality rate among patients with cardiovascular disease. With an average mortality of 2.9% with a diagnosis of COVID-19, with high blood pressure, it was 11%, with diabetes - 6.5%, with cardiovascular diseases - 21.5%.

In COVID-19, myocardial damage (diagnosed based on an increase in the level of highly sensitive troponin I), acute heart damage (27.2% of cases), shock (8.7%) and arrhythmias (56.7%), the percentage of thrombus formation in the heart

chambers (7 %), most patients with these complications required intensive therapy. It is argued that a higher prevalence of CVD in elderly and senile patients (according to recent reports) leads to functional disorders of the immune system, which leads to an increase in the level of ACE-2.

Cardiovascular disease can be diagnosed in 47% of patients who die from COVID-19 infection.

Possible mechanisms:

1. Destabilization of existing cardiovascular diseases.

2. Chronic damage to the cardiovascular system

3 acute heart damage

4. Cardiotoxicity of antiviral drugs.

A) ACE2 signaling pathways involved in the cascade of cardiac lesions (decreased expression of ACE2, dysregulation of the renin-angiotensin system);

B) Pathological systemic inflammatory response, which manifests itself as a "cytokine storm" caused by an imbalance in the response of T-helper types 1 and 2, leads to multiple organ failure, including damage to the cardiovascular system;

C) Respiratory dysfunction with hypoxia (oxidative stress, intracellular acidosis and mitochondrial damage), leading to damage to cardiomyocytes;

D) an imbalance between increased metabolic needs and a decrease in heart reserve;

E) the risk of rupture of an atherosclerotic plaque due to viral inflammation;

E) the risk of thrombotic complications (for example, stent thrombosis) due to the procoagulant and prothrombogenic effects of systemic inflammation;

G) damage to microvessels due to hypoperfusion, increased vascular permeability, angiospasm, direct damaging effect of the virus on the endothelium of the coronary arteries.

It is unclear whether the risk of cardiovascular complications continues in the long term. A 12-year follow-up of patients with SARS-CoV infection showed changes in lipid metabolism compared to patients who did not have a history of this infection. Given that SARS-CoV-2 has a similar structure to SARS-CoV, this new virus can also cause metabolic disorders, which requires evaluation in the management of patients

with COVID-19. Mortality is often determined by damage to other organs (eg, the lungs). An interdisciplinary approach to the management of severe cases and long-term follow-up of recovered patients is required.

Despite all the measures taken with coronavirus, critical hemodynamic disturbances occur in patients in the cardiovascular system. Serious hemodynamic disorders in patients with COVID-19 can include:

- the result of a heart injury (first developed as a complication of COVID-19 or decompensation of chronic heart failure) (Fig. 3);

- the result of the development of a pronounced systemic inflammatory reaction (often called "cytokine storm"), which, given the infectious origin, should be classified as septic shock.

Depending on the hemodynamic profile, heart damage from COVID-19 can manifest as cardiogenic shock (PAC) or cardiogenic pulmonary edema (COL).

Severe hemodynamic disturbances are indications for hospitalization in the intensive care unit (ICU) with the mandatory carrying out of the following diagnostic procedures:

- ECG, EchoCG and chest x-ray;

- monitoring of the patient's condition - ECG, pulse oximetry, blood pressure measurement;

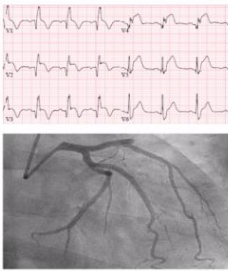
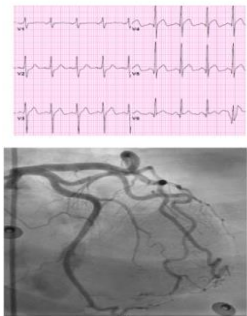
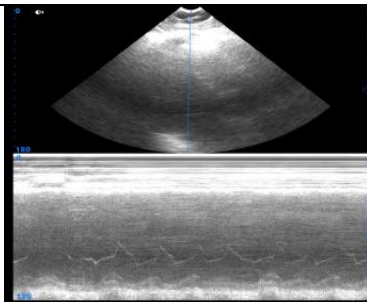
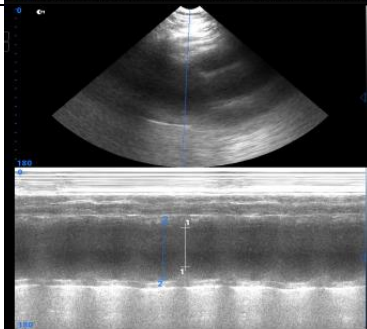
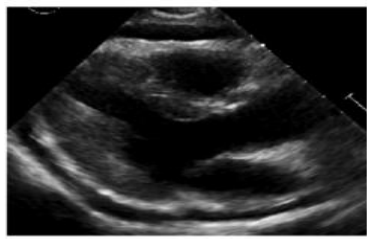

- the panel of laboratory tests should include: clinical blood test, general urine analysis, blood electrolytes (potassium, sodium), total protein and albumin, creatinine and urea, ALT, AST, total bilirubin, lactate, NT-proBNP, troponin, coagulogram (fibrinogen, APTV, PTI, INR). It is imperative to perform an analysis of the gas composition of arterial blood and blood from a catheter located in the central vein (SvO₂) with the possibility of analyzing indicators of the acid-base state (ACS).

These basic laboratory and instrumental studies will determine the cause of critical hemodynamic disorders and begin differentiated intensive therapy.

Arterial catheterization with invasive continuous blood pressure measurement

is recommended (if technically feasible and trained).

Catheterize the central vein (subclavian or jugular) and measure central venous pressure (CVP).

№	Critical violations	ECG and coronary readings	ECHOKG changes
1.	Acute coronary syndrome with ST-segment elevation and coronary syndrome without ST-segment elevation		
2.	Acute myocardial injury without vascular atherosclerosis a) myocarditis b) stress cardiomyopathy		
3.	Arrhythmias		
4.	Heart failure		
5.	Pericardial effusion		
6.	Thromboembolic complications		

The main task for bed echocardiography in a new coronavirus infection is to assess:

1. global and regional contractile function of the LV and right ventricle (RV) (qualitatively);
2. the size of the heart chambers (dilatation of the chambers);
3. the presence of fluid in the pericardial cavity and in the pleural cavities;
4. presence of mitral regurgitation (qualitatively);
5. the presence of additional formations in the cavities and structure of the heart (blood clots);
6. volumetric status (diameter of the inferior vena cava);
7. Ultrasound profile of the lungs.

High-speed and temporary parameters of the high-amplitude reflected signals of the movement will help to reveal early dysfunction of a myocardium at that stage of its development when traditional DExoKG indicators don't change yet. The high-speed indicators of the high-amplitude reflected movementsignals easily are registered by means of usual filtering wave doppler sonography in this connection the technique is available to broad diagnostic practice [23].

Damage to the tissue of the heart or lungs leads to the activation of the innate immune

response with the release of pro-inflammatory cytokines, as well as to the activation of the adaptive mechanisms of the autoimmune type. In patients with myocarditis, echocardiography is not the method of choice for diagnosing specific myocardial injury. However, on the basis of clinical and laboratory data, allowing to suspect the presence of a new coronavirus infection, the following pathological changes should be determined in a patient when performing an EchoCG study:

- regional violations of LV contractility (yes / no);
- a) regional violations of RV contractility (yes / no);
- b) decrease in the amplitude of movement of the mitral and tricuspid rings (MAPSE and TAPSE) (yes / no);
- c) LV dilatation (yes / no);
- d) RV dilatation (yes / no);
- i) significant mitral regurgitation (yes / no);
- f) significant tricuspid regurgitation (yes / no);
- j) the presence of pathological hyperechoic echoes in the cavity of the ventricles attached to areas of the myocardium with impaired regional contraction - presumably a thrombus (yes / no).



Picture 1. The figure shows small blood clots and hyperechoic overlays on the valve leaflets.



Figure 2. Hyperechoic overlays on the interventricular septum (a) and papillary muscles of the MV (b) associated with dilatation of the right ventricle and expansion of the interventricular septum, which is consistent with increased pressure in the right heart.

To study the role of respiratory viral infections in the formation of staning of the left atrium and its early diagnosis. 157 patients were examined, average age - 39.5 ± 4.8 years, men 98 people (63%), women 59 people (37%). All subjects were divided into 3 groups: 1 group — persons who had a mild form of myocarditis (n = 63); Group 2 - people who have had a complicated form of myocarditis (n = 75); Group 3 - persons who had a complicated form of myocarditis (n = 19) [22] .

We recommend a cautious attitude towards COVID-19 patients who come to the doctor for the first time with complaints of palpitations and chest tightness, taking into account the assessment of the associated respiratory symptoms (fever and cough) and the epidemiological history.

With complaints of arrhythmia, palpitations, pain and discomfort in the region of the heart, episodes of weakness and dizziness, fainting occurs.

Before starting treatment with azithromycin, chloroquine / hydroxychloroquine, lopinavir + ritonavir - estimate the duration of the QT interval, corrected by Bazett's formula (QTc), it should not exceed 480 ms; further monitoring every 5 days or when complaints appear. Daily ECG recording for severe COVID-19.

In view of the above, medical personnel should, whenever possible, print electrocardiograms from the internal monitor to minimize contamination of the equipment. It is very important for all medical personnel to wash their hands thoroughly and frequently. Standard protection methods include washing hands with warm water for at least 30 seconds, then disinfecting the hands with antiseptic solutions and wearing gloves. Additional precautions include a specialized suit, a second set of gloves, a hat, a face mask and protective eye mask, and overshoes.

The local application of each component of personal protective equipment in hospitals may vary depending on the level or type of risk. In some institutions, the practice of covering sensors and machine consoles with a special protective film with the possibility of quick replacement is adopted. It is advisable to refrain from

synchronizing ultrasound and ECG in such conditions [21].

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