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THE CASE REPORT OF MYOCARDITIS CAUSED BY COVID-19

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Introduction. Myocarditis is known to occur in 5–25 % of COVID-19 cases and is associated with increased mortality. According to studies, even a mild course of COVID-19 is associated with a high risk of cardiovascular disease. Possible mechanisms of myocarditis are a combination of direct viral damage to the myocardium and the human immune response to the affected myocardium. Along with acute manifestations, as fulminant myocarditis, COVID-19 may also be associated with an increased risk of long-term cardiovascular complications. **Case report and discussion.** The article presents a case of myocarditis that developed five weeks after active coronavirus infection in patient I., 47 years old, Ukraine, Kyiv. She described such symptoms as palpitations, shortness of breath, fever, general malaise. According to magnetic resonance imaging (MRI) of the heart: signs of focal myocarditis; according to laboratory tests, an increase in the level of acute phase indicators; according to Holter monitoring of the electrocardiogram (HM ECG) – atrioventricular block of the II degree (Mobitz II). The patient was prescribed: eplerenone, bisoprolol fumarate, rivaroxaban, trimetazidine. After four months of treatment, the condition of the patient gradually improved. Positive dynamics was revealed according to HM ECG and MRI of the heart. Thus, the patient was diagnosed with long-term consequences of coronavirus infection – focal myocarditis. **Conclusions.** Coronavirus infection causes myocardial damage with the development of myocarditis. Myocarditis can develop both in the acute period of the disease and in the long term. Scientists and physicians should pay attention to the possible consequences of COVID-19 from the first contact with the patient, and conduct long-term follow-up of patients in the long term.

Key words: myocarditis; arrhythmias; COVID-19; myocardial fibrosis; SARS-CoV-2.

Despite the growing number of studies on the pathogenesis, diagnosis and treatment of COVID-19, many questions remain unexplored, especially regarding the cardiovascular complications of this pathology. It is known that myocarditis occurs in 5–25 % of cases and is associated with increased mortality. According to studies, even a mild course of COVID-19 is associated with a high risk of cardiovascular disease [1, 4, 6]. The understanding of the pathophysiology of the disease is still to be determined. There are several potential hypotheses: direct damage to cardiomyocytes by circulating virus due to binding to angiotensin-converting enzyme 2 receptor (ACE2), cytokine release syndrome due to unregulated T-helper response, leading to severe systemic inflammation, hypoxia, apoptosis of cardiomyocytes, and excessive activation of the autoimmune system with possible interferon-mediated hyperactivation of immune mechanisms [1, 5]. Myocarditis in patients with COVID-19 is more common in the acute period of the disease, along with fever, and is associated with increased cardiac biomarkers. Cytokine storm is considered to be the main pathophysiological mechanism of fulminant myocarditis caused by SARS-CoV-2. The clinical manifestations of SARS-CoV-2-associated myocarditis vary. Some patients may have mild symptoms such as fatigue and shortness of breath, while in others chest pain or a feeling of tightness in the chest during exercise are dominated [5, 6]. According to the modern data, myocarditis caused by COVID-19 is manifested in changes in the on the electrocardiogram (ECG), increased cardiac biomarkers and signs of heart failure. Usually, the first symptoms of myocarditis appear in patients with COVID-19 a few days after the onset of fever. This indicates myocardial injury caused by a viral infection. Along with myocarditis, which occurs in the active period of the disease – fulminant myocarditis, there are also myocar-

ditis, that develop in some weeks or even month after active disease. Such myocarditis are caused by severe systemic inflammation, which has a profound negative effect on the cardiovascular system. It is more common for patients with a history of cardiovascular disease, hyperlipidemia or impaired glucose metabolism. The article presents a case of myocarditis that developed five weeks after active SARS-CoV-2 infection.

Case report. The patient I. – a 47-year-old female without past medical history or co-morbidities, described symptoms of COVID-19 including fever, intense fatigue, myalgia, a body temperature at 37–38°C in September 2020. She isolated herself at home and took paracetamol, zinc, ascorbic acid without any diagnostic test. After three days, most symptoms resolved. After recovery, the patient continued to lead an active lifestyle, worked out in the gym. Five weeks later, in October 2020, she was admitted to the hospital. She had such complains: palpitations, mostly at night, accompanied by anxiety and fear of death, shortness of breath, periodic fever 37.2–37.5 C, malaise. The initial examination revealed, blood pressure at 120/70 mmHg, heart rate at 54–77 b. p. m. Leukocytes level was $14 \times 10^9/l$. All markers of serum inflammation were increased, C-reactive protein 345 mg/l, fibrinogen 9.5 g/l, procalcitonin 3 µg/l, and D-dimer 1700 ng/l. According to MRI: MRI signs of focal myocarditis, signs of active inflammatory process, focal non-ischemic myocardiofibrosis of the interventricular septum of mild degree (Fig. 1).

Fig. 1. MRI findings in patient with myocarditis caused by COVID-19 before treatment

According to monitoring ECG – arrhythmia, atrioventricular blockade of the II degree – Mobitz II (Fig. 2).

Fig. 2. Electrocardiogram in patient with myocarditis caused by COVID-19

The patient was prescribed treatment: bisoprolol 5 mg, eplerenone 25 mg, rivaroxaban 20 mg, trimethazedini 35mg twice a day. After four month of such therapy, the condition gradually improved: shortness of breath disappeared, the frequency and intensity of heart symptoms decreased (up to 1–2 in 10–12 days), body temperature normalized, and tolerance to physical activity increased. According to the ECG monitoring, the frequency of episodes of Mobitz II AV decreased. They appeared only at night, their duration decreased to 1.76 s. According to MRI: edema, inflammatory infiltration was not detected, myocardial contractility is normal, but focal non-ischemic myocardial fibrosis was present (Fig. 3).

Fig. 3. MRI findings in patient with myocarditis caused by COVID-19 after treatment

Discussion. The patient I. was diagnosed with long-term consequences of coronavirus infection – focal myocarditis, a new manifestation of –AV blockade II degree Mobitz II. The diagnosis was confirmed by MRI. Myocarditis was caused by the activation of immuno-inflammatory mechanisms. These cardio-vascular complications could develop in patient due to hypercoagulation and systemic inflammatory response, which may persist for a long period after active infection [1, 2, 4]. It's proved by elevation of levels of C-reactive protein, fibrinogen 9.5 g/l, and D-dimer. It can be assumed that the development of myocarditis was influenced by the intensive cardio workouts, which started immediately after recovery. It was reported about complications in professional athletes, which included sudden deaths due to cardiac arrhythmias. According to the survey of some groups of athletes in the United States, the incidence of myocarditis after COVID-19 is from 15 to 30–35 %. This is the basis for recommendations on the feasibility of limiting intense physical activity in the next 3–6 months after COVID-19 [4].

After four month of treatment, the condition of patient I. improved, but AV blockade and focal nonischemic myocardial fibrosis persisted. So, changes in the heart muscle are irreversible. After 6 months of observation the patient, complaints of periodic interruptions in the work of the heart and AV blockade persists on ECG. The patient M. needs long-term observation and supportive treatment and she needs to limit physical activity for next 3–6 months.

So, coronavirus infection causes myocardial injury which causes development of myocarditis even after mild disease. Usually patient develops myocarditis associated with COVID-19 within first week of infection but in some cases delayed responses can be seen. Scientists and clinicians should remember about possible myocardial injury and about necessity of long-term follow-up (8–12 month) of patients who have undergone COVID-19. Despite rapidly developing data and information, little is known about the incidence and outcomes of cardiovascular manifestations in COVID-19. While there are still insufficient large-scale, multicenter studies, approaches to treatment must be developed individually in each case.

Conclusions. 1. The potential mechanisms underlying myocardial damage in COVID-19 have not been fully studied. Alternative mechanisms include direct myocardial damage, hypoxia-induced immune response to infection, or a combination of these causes. 2. Manifestations of myocarditis are usually nonspecific, and ECG changes that may be absent may include ST-segment changes, new bundle branch blockade, QT prolongation, pseudoinfarction pattern, ventricular arrhythmia, or bradyarrhythmia with atrioventricular block. 3. Myocarditis usually occur during the active period of the disease, but long-term consequences are possible. Patients after active SARS-CoV-2 infection require dynamic monitoring of for 8–12 months after infection. Such patients should be recommended to limit intense physical activity for 3–6 months.

Conflict of interest. The authors declare no conflict of interest.

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КЛІНІЧНИЙ ВИПАДОК МІОКАРДИТУ, СПРИЧИНЕНОГО COVID-19

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Вступ. Відомо, що міокардит виникає у 5–25 % випадків COVID-19 та асоційован з підвищенням летальності. Можливими механізмами розвитку міокардиту вважають комбінацію прямого вірусного пошкодження міокарда та імунної відповіді людини на уражений вірусом міокард. Поряд з міокардитом, що виникає в активний період хвороби – фульмінантний міокардит, виявляють міокардит, що виникає в віддаленій термін. **Клінічний випадок та обговорення.** У статті представлено випадок міокардиту, який розвинувся через 5 тиж після активної ковідної інфекції у хворої І., 47 років, Україна, Київ. Турбували серцебиття, задишка, лихоманка, загальне нездужання. За даними магнітно-резонансної томографії (МРТ) серця – ознаки вогнищового міокардиту; за даними лабораторних обстежень – підвищення рівня гострофазових показників; за даними холтеровського моніторингу електрокардіограми (ХМ ЕКГ) – передсердно-шлуночкова блокада II ступеню (Мобітц II). Хвора отримувала лікування: еплеренон, біспрололу фуморат, ривароксабан, триметазидин. Впродовж 4 міс стан поступово покращився. Виявлена позитивна динаміка за даними ХМ ЕКГ та МРТ серця. Таким чином, у пацієнтки діагностовано довгострокові наслідки коронавірусної інфекції – вогнищевий міокардит. **Висновки.** Коронавірусна інфекція спричиняє ураження серцево-судинної системи з розвитком міокардиту. Міокардит може виникати як в гострий період хвороби, так і в віддаленому періоді, на що треба звертати увагу науковцям та клініцистам, починаючи з першого контакту з пацієнтом, та проводити довгострокове спостереження за хворими у віддаленому періоді, які перенесли COVID-19.

Ключові слова: COVID-19; міокардит; аритмія; міокардіофіброз.

КЛИНИЧЕСКИЙ СЛУЧАЙ МИОКАРДИТА, ВЫЗВАННОГО COVID-19

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Введение. Известно, что миокардит возникает в 5–25 % случаев COVID-19 и ассоциирован с повышением летальности. Возможным механизмом развития миокардита считают комбинацию прямого вирусного повреждения миокарда и иммунного ответа человека на поражённый вирусом миокард. Наряду с миокардитом, возникающим в активный период болезни (фульминантный миокардит), отмечается миокардит, возникающий в отдалённом периоде. **Клинический случай и обсуждение.** В статье представлен случай миокардита, развившийся через 5 нед после активной ковидной инфекции у больной И., 47 лет, Украина, Киев. Беспокоили сердцебиение, одышка, лихорадка, общее недомогание. По данным магнитно-резонансной томографии (МРТ) сердца – признаки очагового миокардита; по данным лабораторных исследований – повышение уровня острофазовых показателей; по данным холтеровского мониторирования электрокардиограммы (ХМ ЭКГ) – предсердно-желудочковая блокада II степени (Мобитц II). Больная получала лечение: эплеренон, бисопролол, фумарат, ривароксабан, триметазидин. В течение 4 мес состояние постепенно улучшилось. Выявлена положительная динамика по данным ХМ ЭКГ и МРТ сердца. Таким образом, у пациентки диагностированы отдалённые последствия коронавирусной инфекции – очаговый миокардит. **Выводы.** Коронавирусная инфекция вызывает поражение сердечно-сосудистой системы с развитием миокардита. Миокардит может возникать как в остром периоде болезни, так и отдалённом периоде, на что надо обращать внимание учёным и клиницистам, начиная с первого контакта с пациентом, и проводить наблюдение за больными, перенесшими COVID-19, в отдалённом периоде.

Ключевые слова: COVID-19; миокардит; аритмия; миокардиофиброз.