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ANALYSIS OF THE INFLUENCE OF POSTCOVID SYNDROME ON DIFFERENT ORGANS AND SYSTEMS

Djumaeva Nasiba Sobirovna, Shodieva Dilafruz Abdusalolovna
Samarkand State Medical University, Republic of Uzbekistan, Samarkand

ПОСТКОВИД СИНДРОМИНИНГ ТУРЛИ АЪЗО ВА ТИЗИМЛАРГА ТАЪСИРИНИ ТАҲЛИЛ ҚИЛИШ

Джумаева Насиба Собировна, Шодиева Дилафруз Абдужалоловна
Самарқанд давлат тиббиёт университети, Ўзбекистон Республикаси, Самарқанд ш.

АНАЛИЗ ВЛИЯНИЯ ПОСТКОВИДНОГО СИНДРОМА НА РАЗЛИЧНЫЕ ОРГАНЫ И СИСТЕМЫ

Джумаева Насиба Собировна, Шодиева Дилафруз Абдужалоловна
Самаркандский государственный медицинский университет, Республика Узбекистан, г. Самарканд

e-mail: djumayeva.nasiba1986@gmail.com

Резюме. COVID-19 ўткир даври диагностика ва давosi етарли даражада ривожланганлигига қарамай, касалликдан кейинги оқибатлар тўғрисидаги бирламчи маълумотлар фақатгина илмий адабиётларда кўрилмоқда. Ўткир COVID-19 ўтказилгандан кейинги турли туман ҳолатларни Жаҳон соғлиқни сақлаш ташкилоти томонидан “Постковид ҳолатлар” (ПКХ) терминини ишлатиш таклиф этилди. Соғлиқни сақлашнинг бирламчи бўғинида бу борада нисбатан кам миқдордаги тадқиқотлар ўтказилган, жуда кам ишлар фақат постковид синдромига бағишланган. Халқаро журналларда чоп этилган мақолаларни таҳлил қилиш ва протоколлар натижаларига кўра, ПКХ турли тизимли, юрак қон-томир, ошқозон-ичак, неврологик ва руҳий ўзгариш белгилари билан характерланади. Бугунги кунда ПКХ кенг қирралиги ҳақидаги мавжуд тадқиқотларнинг ёритилиши камлиги мазкур муаммонинг долзарблигини белгилайди. Соғлиқни сақлаш тизимида ПКХ нинг давosi ва профилактикасига оптимал ёндашувни аниқлаш учун қўшимча текширувлар ўтказиш лозимлигини кўрсатади.

Калит сўзлар: COVID-19, постковид синдроми, постковид ҳолатлар, COVID-19 оқибатлари.

Abstract. Although the diagnosis and treatment of the acute phase of COVID-19 is well developed, primary data on the consequences are found only in the scientific literature. The World Health Organization (WHO) has suggested using the term post-COVID-19 (PCS) for various conditions after experiencing COVID-19. Relatively little research has been done in this area in the primary health care sector, and very little research has focused solely on post-COVID syndrome. According to the analysis of articles published in international journals and the results of the protocols, PCS is characterized by various systemic, cardiovascular, gastrointestinal, neurological and psychological changes. The lack of coverage of existing studies of the universality of PCS to date underlines the urgency of this problem. Indicates the need for more research to determine the optimal approach to the treatment and prevention of PCS in the healthcare system.

Key words: COVID-19, post-COVID syndrome, post-COVID states, consequences of COVID-19.

The first case of the new coronavirus infection (COVID-19) in our republic officially registered in March 2020. As of January 20, 2022, there have been 200 million confirmed cases of COVID-19 worldwide [1]. For a long time, the study of the acute period of COVID-19 has been the main topic, however, the accumulated data during these years has shown that not only the study of the clinical signs of the acute period and the sub-acute period of the infection, but also their analysis is of great importance. An effective approach to the therapy of COVID-19 is an important factor for determining the subsequent post-covid condition in individual groups of patients [3, 4]. In mid-2021, data began to emerge on the short- and long-term outcomes of those who experienced COVID-19. Today, this problem is called "post-covid conditions" (ПКХ). Early data from COVID-19 analyzed residual complications such as fatigue, dyspnea, chest pain, cognitive impairment, arthralgia, and reduced quality of life

[1]. These consequences can lead to the production of inflammatory cytokines and cell damage as a persistent response of the immune system.[8,9]

Polymorbid residual complications or signs arising after the disease of COVID-19 are observed with the manifestation of one or another symptom or syndrome predominance. With this in mind, we decided to analyze the post-covid syndrome, which occurs after infection with the new coronavirus, based on the collected scientific sources.

The purpose of the study: Analysis and study of the post-covid syndrome in patients with COVID-19 by organ and system.

The term "Long COVID" is the first it appeared from May to June 2020, and the patient's symptoms did not disappear for several weeks after the laboratory recovery. In the literature, other words besides the term "Long COVID". *post COVID syndrome* (postcovid syndrome (PKS)), *Post-Acute Sequelae of SARS-CoV-2 infection* (Effects of acute

coronavirus) also began to be used. The term "Post-COVID condition" was proposed by the World Health Organization (WHO). ("post-covid cases"), revised in MKB-10. It was included in the international classification of diseases. In patients with PKH, the symptoms observed during the acute period of the disease may persist for a long time or new symptoms may appear. Meanwhile, markers of acute inflammation may be within the normal range, and a polymerase chain reaction (PCR) test for SARS-CoV-2 may be negative [7]. Due to the increasing number of patients with various complaints after undergoing the disease of COVID-19, it became clear that there is a need for clinical recommendations and guidelines for the treatment and diagnosis of PKH. For the first time, such a document was a temporary guide issued by the British National Institute for Health and Care Excellence (NICE) in December 2020. Depending on the period of the disease, the following classification was proposed [8]:

1. Acute COVID-19 - symptoms observed for < 4 weeks;
2. Prolonged symptomatic COVID-19 - symptoms persist for 4-12 weeks;
3. Post-covid syndrome symptoms are symptoms lasting > 12 weeks.

These symptoms can appear, disappear, and damage more and more systems and organs. According to reviews of data collected in the literature [9], dozens of different symptoms are identified in PKH, among which pain in the back of the chest, shortness of breath, tachycardia, pain in the head, muscles and joints, rapid fatigue, paraosmia and paragesia, profuse sweating and hair loss are relatively common. It seems that clinical signs are observed in all organs and systems, and the data are not sufficient to define PKH phenotypes.

The main pathophysiological mechanisms of acute COVID-19 are:

- *Direct toxic effect of the virus;
- *Damage of vascular endothelium;
- * Violation of immune control and stimulation of strong inflammatory process;
- * Observation of hypercoagulation and subsequent microthrombosis;
- * Angiotensin- converting enzyme malfunction.

PKH in intensive care patients, especially in patients with a severe form, includes microvascular thrombosis and ischemia, as well as brain stem damage and metabolic changes. Peripheral and central nerve damage may be persistent, and tissue regeneration may be very slow or absent. Damage to the brain stem can have long-term consequences [1]. Thus, this article reviews the epidemiological, clinical, and pathophysiological aspects of various organs and systems in PKH.

Respiratory system. Simple respiratory disorders have been identified in some cases after COVID-19. Sometimes cases ranging from respiratory failure to artificial lung ventilation (SOV) are observed. As a result, a fibrotic process develops in the lungs. Also, it was found that shortness of breath was the most common persistent symptom during 60-100 days of follow-up in 42-66% of patients with COVID-19 compared to those with acute respiratory distress syndrome (ARDS) of other etiologies. Chinese colleagues have shown that 50% of patients with COVID-19 have at least one pathological pattern in the chest, more like a "tinted window" phenomenon, according to computed tomography results [1,4]. Reticuloendothelial changes and bronchiectasis are the second most common symptom after the "tinted window" phenomenon [1,8]. In the development of clinical manifestations in the disease of COVID-19, micro- and macrothrombosis of pulmonary vessels also plays an important role. This sign is observed in 20-30% of patients [1,7]. Procoagulant changes in hemostasis in patients with a severe form of the disease require the use of long-acting anticoagulants. In many patients, even after recovery, there is a long persistence of cough without sputum. In PKH, it is based on inflammation of the persistent esophageal nerve endings. The basis of reflex cough of unclear etiology is the increased sensitivity of the larynx. Currently, the use of antifibrotic therapy to prevent the development of pulmonary fibrosis after transmission of COVID-19 is being conducted in a clinical trial. [2], but it will take some time to draw conclusions about the need for such tools.

Cardiovascular system. Long-term residual effects on the cardiovascular system can occur with COVID-19. The most common symptoms in PKH are recurrent arrhythmias and cardiac decompensation [2,3]. After the acute period of the disease, along with arrhythmia, chest pain is observed in 20% of patients [2,8]. 5% of patients remain up to 6 months. 9% of patients complain of a strong heartbeat [1,4]. Currently, the development of chronic myocarditis and post-covid myocarditis is widely discussed. In studies conducted in porters who had mild and asymptomatic COVID-19 ($n = 26$), myocarditis was detected in 15% of cardiac magnetic resonance imaging, and myocarditis was observed in 30.8% of participants with previous heart changes [2,3]. Preliminary data suggest that 60% of patients have persistent myocarditis > 2 months after illness [3]. Thrombosis of large and small coronary vessels is one of the main damaging mechanisms in COVID-19. The specific treatment for this condition remains an open question and will require further follow-up of those who transmit COVID-19.

Nervous system. Neurological symptoms are the most characteristic symptoms of PKH. Patients

are mainly bothered by weakness and weakness (58%), headache (44%), taste and smell disturbances (46%) [1,4]. Observation of anosmia and ageusia is more characteristic of those who passed the acute period of the disease without obvious symptoms and without fever [9]. In women, recovery of sense of smell lasts 4-6 weeks after the disease, 2.5 times less than in others, and the consequences worsen with age. Full recovery of taste and smell is observed in 11.7% of patients on average in 1 week, in 26% of patients in 1-2 weeks, in 26.5% of patients in 2-4 weeks, in 35.8% of cases more than 4 weeks [2]. Headaches are often migraine-like in nature, sensitive to conventional analgesics [3,4] and persist for up to 6 months after the onset of the disease [3,4]. Some of the patients have cognitive problems - disordered thinking, attention and memory disorders. Cognitive impairment is often observed in hospitalized patients [9]. Cognitive impairment occurs in < 80% of patients 4 months after hospital discharge (they have difficulty retaining more information in memory). Due to the neurotropic nature of SARS-CoV-2, during the acute course and recurrence of the disease, it has the characteristic of damaging various structures of the central and peripheral nervous system, which leads to the appearance of psychological or neurological symptoms in patients.

Mental disorder. Persistent psychiatric disorders in those with COVID-19 may be associated with psychological factors and neurobiological injury [8,9]. Recent studies in the United Kingdom show that 2-3 months after the onset of COVID-19, individuals in a control group more frequently reported moderate to severe depressive symptoms [1,2]. According to the studies of Italian authors, in patients who recovered from the disease of COVID-19 - stress state (28%), depression (31%), restlessness (42%), insomnia (40%) was observed [3,4]. These cases are more common in hospitalized patients. 73% of patients who underwent ORDS at discharge from the hospital, and 47% of cases for a certain period of time. [8,9,10].

Separation system. In a study conducted by a number of Chinese researchers, 35% of patients had a decrease in glomerular filtration rate 6 months after the onset of COVID-19, but in the acute period, the parameters were normal in these patients [1,4].

Endocrine system. Obesity is considered to be the main prognostic factor of severe course of the acute phase of COVID-19. Recently published data have shown that obesity is also a risk factor in the origin of PKH [1,2,3]. Patients with impaired carbohydrate metabolism may develop or decompensate diabetes following COVID-19. [1,3], including the development of diabetic ketoacidosis and hyperosmolar diabetic coma, leading to the use of high doses of insulin. According to the results of a systematic review and meta-analysis, an increase in

the probability of the occurrence of type 1 and type 2 diabetes during PKH was mentioned. [3,6]. Of course, before this disease, patients may also develop impaired glucose tolerance. Many researchers argue that autoimmune diseases develop as a result of excessive activation of the immune system during the acute period of COVID-19 (autoimmune thyroiditis, Graves' disease) [7,8,9]. Endocrine at the end of March 2021 published an analysis of the literature on the increase in the number of cases of subacute and chronic thyroiditis against the background of COVID-19 [6,7,10].

Skin changes. Skin changes were detected in 50% of patients during the acute period of the disease [6,9]. Almost 25% of patients experience extensive hair loss after COVID-19. Hair loss is caused by stress or severe infectious process. This process is associated with the acceleration of the transition of hair follicles from the phase of active growth to the phase of rest.

Also, taking into account the presence of autoimmune mechanisms in the pathogenesis of COVID-19, we cannot rule out the development of systemic diseases during the recovery period [4,6].

Summary. The collection of clinical data on post-covid syndrome in patients in the post-pandemic period shows that disorders involving organs and systems are observed in the post-disease period. The world will have to live with this problem for decades to come. It is necessary to carry out a large number of studies and researches in this regard, to fully classify, diagnose, prevent and treat PKH.

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АНАЛИЗ ВЛИЯНИЯ ПОСТКОВИДНОГО СИНДРОМА НА РАЗЛИЧНЫЕ ОРГАНЫ И СИСТЕМЫ

Джумаева Н.С., Шодиева Д.А.

Резюме. Хотя диагностика и лечение острой фазы COVID-19 достаточно разработаны, первичные данные о последствиях встречаются только в научной литературе. Всемирная организация здравоохранения (ВОЗ) предложила использовать термин «постковидное состояние» (ПКС) для различных состояний после перенесенного COVID-19. Относительно мало исследований было проведено в этой области в секторе первичной медико-санитарной помощи, и очень мало исследований было посвящено исключительно постковидному синдрому. Согласно анализу статей, опубликованных в международных журналах и результатам протоколов, ПКС характеризуется различными системными, сердечно-сосудистыми, желудочно-кишечными, неврологическими и психологическими изменениями. Отсутствие освещения существующих исследований универсальности ПКС на сегодняшний день подчеркивает актуальность этой проблемы. Указывает на необходимость проведения дополнительных исследований для определения оптимального подхода к лечению и профилактике ПКС в системе здравоохранения.

Ключевые слова: COVID-19, постковидный синдром, постковидные состояния, последствия COVID-19.