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ASSESSMENT OF THE CLINICAL CONDITION OF PATIENTS IN THE EARLY REHABILITATION PERIOD OF COVID-19

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Abstract

Purpose of the study: assessment of the functional status of patients with postcoid syndrome using the PCFS scale and determination of its relationship with the severity of damage to the pulmonary parenchyma and cardiac changes.

Material and research methods. The study included 281 patients with clinical manifestations of postcoid syndrome (main group) and 20 patients who had undergone COVID-19, in whom the infection ended in complete recovery (comparison group). All patients underwent an assessment of the functional status of patients after suffering COVID-19 was carried out using the PCFS method - Post-COVID-19 Functional Status (<https://osf.io/qgpdv/>), electrocardiographic (ECG) and echocardiographic (EchoCG) studies.

Research results. In the main group of patients, the average score of the questionnaire was 13.34 ± 0.83 points. There were 13 patients (4.63%) in patients with postcoid syndrome who determined a violation of their functional status; 1 point was 13 people (4.63%), 2 points - 90 people (32.03%), 3 points - 117 people (41.64%), 4 points - 61 people (21.71%). In the comparison group, patients who underwent COVID-19 rated their functional status violations due to infection at 0 points. It was determined that the groups significantly differed in the volume of lung damage at the peak of infection ($p < 0.05$), while by the early rehabilitation period the differences were leveled. Patients of the main group with different severity of postcoid syndrome according to PCFS did not differ in terms of the volume of lesions of the pulmonary parenchyma and the value of saturation. According to the results of ECG examination, cardiac arrhythmias were recorded significantly more often in patients in the main group than in the comparison group (66.19% and 25%, chi square 13.3, $p < 0.001$). The results of the echocardiography of the study found that in the patients of the main group, compared with the comparison group, there was a significantly greater size of the LV and RV of the heart ($p < 0.05$), a lower LVEF ($p < 0.01$) and a higher value of the mean pressure in the PA ($p < 0.05$). Patients with a higher PCFS score are characterized by large sizes of both ventricles ($p < 0.05$ significant difference for LV and $p < 0.01$ for RV) and low LV ejection fraction ($p < 0.001$). The value of LVEF in patients of the main group strongly negatively correlated with the PCFS score ($r = -0.73$, $p < 0.01$), which indicates a significant

contribution of cardiovascular syndrome to a decrease in the functional status of patients who underwent COVID-19.

Conclusion. The PCFS scale is an effective, simple and quick way of identifying patients with postcoid syndrome in the early resilience period. The severity of PCFS did not depend on the lesion of the pulmonary parenchyma. The low functional status of patients is associated with a more pronounced violation of the structural and functional state of the myocardium.

Keywords. COVID-19, PCFS, rehabilitation, postcoid

Introduction. To date, it has been clearly shown that COVID-19 can have a serious impact on physical, cognitive, mental and social health, including in patients with mild disease [1]. Articles appear in the literature describing the phenomenon of symptoms or various complaints lasting more than 3-4 weeks and reported by patients who have had SARS-CoV-2 infection. These conditions have received "long COVID" and "postcoid syndrome" [2,3]. Patients with persisting symptoms of COVID-19, as well as those with post-coccygeal syndrome, need timely rehabilitation, which can prevent the development of long-term complications. Clinical experience around the world has shown that the earlier patients received help, the more effective it was [4, 5,6]. According to experts, given the heterogeneity of COVID-19 in terms of clinical and radiological manifestations, it is extremely important to have a simple tool to track the course of symptoms and their impact on the functional state of patients, that is, a scale that can measure the consequences of the disease beyond such outcomes. like mortality. With the sheer number of COVID-19 patients requiring follow-up, a simple and reproducible tool will help guide the prudent use of medical resources [7, 8].

Purpose of the study: assessment of the functional status of patients with postcoid syndrome using the PCFS scale and determination of its relationship with the severity of damage to the pulmonary parenchyma and cardiac changes.

Material and research methods. There were 281 patients under observation, with the presence of clinical manifestations of postcoid syndrome. Inclusion criteria were: 1) virologically confirmed no earlier than 30 and later 7 days prior to inclusion in the COVID-19 study; 2) negative result of the PCR test for SARS-CoV-19 at the time of inclusion in the study. We also examined 20 patients who underwent COVID-19 at the same time (SG - comparison group), in whom the infection ended in full recovery (there are no pathological symptoms and signs that appeared in the acute period or after it and are not explained by other possible reasons). The main group and the comparison group were comparable in age (49.48 ± 12.54 and 49.10 ± 12.61 years, respectively).

All patients underwent electrocardiographic (ECG) and echocardiographic (EchoCG) studies. The ECG was performed on an automatic 6-channel electrocardiograph, in a horizontal position, in the morning, after 10 minutes of rest. EchoCG was performed on an ultrasound scanner equipped with a sector transducer with a frequency of 5-7.5 MHz. The study was carried out according to the standard technique, lying on the left side and on the back, according to the recommendations of the American Sonographic Association. Multislice computed tomography (MSCT)

of the chest was performed on a tomograph using 128 slices, according to the standard technique.

The assessment of the functional status of patients after suffering COVID-19 was carried out using the PCFS method - Post-COVID-19 Functional Status (<https://osf.io/qgpdv/>). This method uses a questionnaire completed by the patient himself or a form filled out by the doctor in the process of interviewing the patient. In the case of both options, a point assessment of the functional status of patients who underwent COVID-19 was determined [2]. For the study, the questionnaire was translated into Russian and adapted for use in the Republic of Uzbekistan. The PCFS assesses the functional limitations of the quality of life, including lifestyle, sports, professional and social activities during the last week. Symptoms that limit functional status include shortness of breath, pain, weakness, fatigue, memory impairment, depression, and anxiety. In the case of applying 2 variants of assessment, the higher score is used.

Statistical processing. All data obtained in the course of the study were entered into Excell summary tables. Intergroup comparison was performed using paired and unpaired Student's t test. In the case of nonparametric signs, the intergroup difference in the frequency distribution was assessed using the Chi-square table test and confirmation of its reliability according to the tables depending on the number of degrees of freedom.

Research results and their discussion. All patients included in the study underwent the PCFS test, which reflects the severity of the functional disorder of patients associated with a previous viral infection. In the main group of patients, the average score of the questionnaire was 13.34 ± 0.83 points. There were 13 patients (4.63%) in patients with postcoid syndrome who determined a violation of their functional status; 1 point was 13 people (4.63%), 2 points - 90 people (32.03%), 3 points - 117 people (41.64%), 4 points - 61 people (21.71%). The small number of patients who rated their condition disorders at 1 point is probably due to the method of recruiting patients - patients hospitalized due to poor health were included. 1 point according to the PCFS method indicates a slight limitation of daily activity, which does not motivate the patient to go to a rehabilitation hospital. In almost a third of patients in the main group (90 people), the functional status was rated at 2 points, that is, a state that allows you to independently perform the main types of activity, but at the same time, forcing you to avoid certain types of activities or perform them intermittently, including due to pain, depression or anxiety. The largest number of patients (117 people) scored 3 points, which means restrictions on daily activity due to symptoms associated with the previous infection, but not requiring assistance in self-care. 61 people rated their condition at 4 points, which indicates a significant limitation of the patient's daily activity due to symptoms associated with the previous infection and the patient needs help in self-care.

In the comparison group, patients who underwent COVID-19 assessed violations of their functional status in connection with the infection at 0 points, which means that they have no restrictions on activity and complaints associated with the previous infection, including pain, anxiety, depression.

The choice of this method for assessing the functional status of patients is due to the convenience of reproducibility and validity. Thus, studies involving 1939 people with symptoms associated with coronavirus infection, approximately three months after illness, demonstrated the constructive validity of the PCFS (Post-COVID-19 Functional Status) scale. The authors note that the main advantage of the scale is its ease of use and suggest using it when referring to expert (outpatient) clinics or rehabilitation programs [9].

Our study showed that among 281 patients included in the study, lesions of the pulmonary parenchyma during the acute course of COVID-19 in an infectious diseases hospital were found in 279 patients. Including, 87 patients (30.96%) were diagnosed with a lesion of 5-25% (CT-1), in 94 patients (33.45%), in 69 patients (24.56%) - 50-75% (CT -3) and in 29 patients (10.32%) - more than 75% (CT-4). In the comparison group, CT revealed lung damage during hospitalization in an infectious diseases hospital in 16 patients (80%), while in 9 patients (45%) the lesion was 5-25% (CT-1), in 5 patients (25%) - 25-50% (CT-2) and in 2 patients (10%) - 50-75% (CT-3). In the period of early rehabilitation, the patients underwent control MSCT. In both groups of patients who underwent COVID-19, there was a significant decrease in the average volume of pulmonary parenchyma lesions, however, in the comparison group, the relative dynamics of MSCT was significantly greater than in patients of the main group ($-51.65 \pm 26.63\%$ versus $-6.51 \pm 16.16\%$, respectively, $p < 0.001$). In the main group of 279 patients with lung lesions in the acute period of infection, 229 (82.08%) showed no significant MSCT dynamics, while in the comparison group of 16 patients, no dynamics was observed in only 1 patient (6.29%, chi square = 48.54, $p < 0.001$). The absence of MSCT dynamics after the eradication of the virus was regarded as a tendency to fibro-formation.

In the course of this study, we compared the severity of lesions of the pulmonary parenchyma in patients of the main group with different severity of postcoid syndrome according to PCFS (Table 1). It was determined that the groups significantly differed in the volume of lung damage at the peak of infection ($p < 0.05$), while by the early rehabilitation period the differences were leveled. Saturation values also did not differ in patients with PCFS scores 1-2 and 3-4. This finding shows that the volume of lung damage does not play a decisive role in the development of postcoid syndrome, probably other pathogenetic mechanisms are more involved.

Table 1

Comparative characteristics of the volume of lesions of the pulmonary parenchyma in patients with postcoid syndrome according to MSCT data, depending on the functional status

Index	wed PCFS 4-3CT	wed PCFS 1-2CT
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Lung lesion volume according to MSCT data, infectious period,%	46,94±23,45	40,21±24,37*
Lung lesion volume according to MSCT data, early rehabilitation period,%	43,29±22,62	38,42±24,24
Saturation,%	92,35±5,08	93,21±4,92

Note: * - significance of differences between groups according to the PCFS test. One character - $p < 0.05$.

The study of changes in the cardiovascular side in patients with skovidny syndrome showed that 255 patients (90.75%) of the main group had signs of cardiovascular pathology according to ECG and EchoCG data. According to the results of ECG examination, cardiac arrhythmias were recorded significantly more often in patients in the main group than in the comparison group (66.19% and 25%, chi square 13.3, $p < 0.001$). The results of the echocardiography of the study found that in the patients of the main group, who showed clinical signs of postcoïd syndrome, compared with the comparison group, there was a significantly greater size of the LV and RV of the heart ($p < 0.05$), a smaller LVEF ($p < 0.01$) and higher value of avg pressure in the aircraft ($p < 0.05$). In general, in 81 patients of the main group (28.83%), LVEF was below the reference norm of 55%. 77 patients (27.40%) had moderate pulmonary hypertension.

In the course of the study, a comparison was made of patients in the main group, distributed depending on the severity of functional disorders (Table 2). The comparison showed that patients with a higher PCFS score (significant limitation of daily activity due to symptoms associated with the previous infection and the need for assistance in self-care) have larger sizes of both ventricles ($p < 0.05$ significant difference for the LV and $p < 0.01$ for RV) and low LVEF ($p < 0.001$).

When conducting a correlation analysis, it was found that the value of LVEF in patients of the main group strongly negatively correlated with the PCFS score ($r = -0.73$, $p < 0.01$), which indicates a significant contribution of cardiovascular syndrome to a decrease in the functional status of patients who underwent COVID-19.

table 2

EchoCG characteristics of patients in the main group, depending on the severity of violations of the functional status of patients

Index	wed PCFS 4-3 (n=178)	wed PCFS 1-2 (n=103)
KDR LV, mm	53,08±7,22	51,42±4,32*
KDR PZh, mm	27,47±6,11	25,58±4,37**

LP, mm	37,54±5,37	37,28±5,40
LVEF,%	52,63±5,37	65,40±4,48***
srRLA, mm Hg	18,25±4,21	17,59±3,94

Note: * - the reliability of the difference between the groups according to the severity of the disease. One sign - $p < 0.05$, two signs - $p < 0.01$, three signs - $p < 0.001$

According to the literature, the types of cardiovascular disorders vary widely: arrhythmias, myocardial injury and myocarditis, heart failure (HF) and cardiomyopathy, acute coronary syndrome (ACS) and myocardial infarction (MI), cardiogenic shock and cardiac arrest, venous thromboembolism [10, 11,12]. Etiopathogenetic factors of cardiac arrhythmia and conduction disorders in COVID-19 can be hypoxia, hyperthermia, agitation, hypercatecholaminemia, electrolyte and metabolic disorders, myocardial damage, myocardial ischemia / infarction and, finally, side effects of drugs [12,13]. A viral infection can provoke decompensation of chronic heart failure (CHF). According to a Chinese study, the incidence of HF in deaths from COVID-19 was 52%, and among survivors - 12% ($p < 0.0001$), the incidence of new cases of HF in hospitalized with COVID-19 averaged 23% [14]. Acute HF against a background of viral infection is obviously a consequence of previous systolic dysfunction, ARDS, and de novo cardiovascular pathology (acute myocardial ischemia, MI, tachyarrhythmias, myocarditis or cardiomyopathies) [15]. In a study by E. Argulian et al. found that dilatation of the right ventricle, detected by echocardiography (EchoCG), is associated with a high risk of hospital death in patients with COVID-19. Pulmonary hypertension developing in COVID-19 due to damage to the lungs and hypoxia or due to thromboembolism of the pulmonary arteries increases the load on the right ventricle, leading to damage to cardiomyocytes [16].

Conclusion. The PCFS scale is an effective, simple and quick way of identifying patients with postcoid syndrome in the early resilience period. The severity of PCFS did not depend on the lesion of the pulmonary parenchyma. Low functional status of patients (PCFS score of 3-4 points is associated with a more pronounced violation of the structural and functional state of the myocardium (decrease in LVEF, increase in the size of the ventricles of the heart).

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