

**COMPARISON OF THE INFORMATIVENESS OF THE 6-MINUTE STEP TEST
AND THE SIT AND STAND UP TEST IN PATIENTS WHO HAVE SURVIVED
(COVID-19)**

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Abstract: On February 11, 2020, the World Health Organization assigned an official name to the infection caused by the new coronavirus — COVID-19 (“Coronavirus disease 2019”) [1]. On February 11, 2020, the International Committee on Taxonomy of Viruses assigned its own name to the causative agent of the COVID-19 infection — SARS-CoV-2. COVID-19-associated pulmonary vascular disease is a complex set of interrelated pathophysiological processes associated with dysfunction of the vascular endothelium. Reduced exercise tolerance (TE) is one of the key symptoms observed in patients with bronchopulmonary diseases such as chronic obstructive pulmonary disease (COPD) and asthma.[7] TE reflects the functional capabilities of the body under physical activity and can serve as an indicator of disease progression. Evaluation of TE is an important aspect of clinical practice, allowing physicians to monitor the patient's condition and the effectiveness of therapy.[7] A 6-minute walk test is widely used in clinical practice, providing a simple and accessible way to determine the level of physical endurance.

This test involves assessing the distance covered by the patient in six minutes, which allows obtaining quantitative data on his functional capabilities. This method has several advantages: it can be performed on an outpatient basis, requires minimal equipment and is easily reproducible, which makes it an indispensable tool for physicians. In addition, the results of the 6-minute walk test can be compared with other clinical parameters, such as spirometry parameters and assessment of the patients' quality of life. This allows for a more complete picture of the patient's health status and appropriate adjustments to the treatment process. It is important to note that systematic assessment of the 6-minute walk test by means of this test contributes not only to diagnosis, but also to determining the prognosis of the disease course, which in turn improves treatment outcomes and the patients' quality of life. In conclusion, the 6-minute walk test is a reliable and simple method for assessing exercise tolerance, which is especially important for patients with bronchopulmonary diseases. A decrease in the 6-minute walk test not only indicates a deterioration in the patient's condition, but also serves as an important indicator for prescribing adequate therapy and assessing its effectiveness. a 6-minute walk test, and its dynamics over 6 months [2]. The 6-MST is a standardized [5] and well-studied method [4], but one of its significant drawbacks is the need for a straight, closed at both ends, free corridor of 15 to 50 m in length [4, 9], which is not feasible in all situations. In this regard, in recent years, a search has been conducted for alternative methods of stress testing that would offer the patient's usual physical activity (PE), but would not require large spaces. Several such tests have been borrowed from other areas of medicine. Thus, the "Stand up and go" test and the walking test are used to assess mobility and the risk of falls in elderly patients [1], the 30-second test (30-ST) "Sit and stand up" is used in patients with neurological diseases, including those who have suffered a stroke [1], with pathology of the musculoskeletal system [1], and also

to assess the condition of the muscles of the lower extremities [3]. The use of these tests is actively studied in pulmonary patients with COPD. Thus, it has been shown that the time spent on the Stand and Go test is associated with worsening health over the next year, and the number of repetitions of the 1-minute Sit and Stand test predicts mortality over 2 years [1]. Two modifications of the 30-ST Sit and Stand have been described with different testing durations (from 30 sec to 3 min), counting the number of repeated standing up and sitting down on a chair (repetitions) performed by the patient during the specified time, a fixed number of repetitions (5–10), and counting the time spent on completing this task [4]. In patients with COPD, when performing the 30-ST Sit and Stand, shortness of breath increased to a greater extent and the pulse rate increased compared to those when performing the 30-ST Sit and Stand with 5 repetitions [5]. The threshold value of 30-ST "Sit and stand" for patients with COPD, correlating with an unfavorable outcome, is defined as 21.5 repetitions [5]. In many chronic bronchopulmonary diseases, in particular ILD, data on the possibilities of using non-laboratory stress tests, other than the 6-MShT, are very scarce. Thus, a single clinical study has been published, according to the results of which desaturation against the background of exercise in a large group of patients with various ILDs was assessed in the 1-minute "Sit and Stand" test [6]. Good comparability of the results of the 1-minute "Sit and Stand" test and the 6-MShT was shown, however, restrictive disorders of pulmonary function were not observed in the patients who took part in this study. The aim of the study was to compare the results of performing the 30-ST "Sit and Stand" and the 6-MShT in patients with ILDs with restrictive disorders of pulmonary function.

The aim of the work was to compare the results of the 30-second test (30-ST) "Sit and stand" and the 6-MST in patients with interstitial lung diseases (ILD) with restrictive disorders of pulmonary function.

A cross-sectional, non-randomized, open comparative study consecutively included patients with ILD (n = 25: 11 men, 14 women). Eleven patients were former smokers, 14 had never smoked. Exercise testing. The 6-MST was performed according to the standards of the American Thoracic Society (ATS) and the European Respiratory Society (ERS) [9] in a 23-m corridor. If the patient had a pulmonary function test scheduled for the same day, pulmonary function tests were performed first, followed by exercise tests. Before exercise testing, pulse rate and SpO₂ were measured using a pulse oximeter and the severity of dyspnea using the Borg scale. The patient was given detailed instructions, and communication with him during testing was limited to standard phrases only. Pulse oximetry was performed continuously throughout the testing. Immediately after finishing walking, the pulse rate, SpO₂, and dyspnea severity were recorded. If the patient made stops during walking, the pulse rate and SpO₂ values were also recorded at the time of stops. The lowest SpO₂ value and the highest pulse rate recorded during PE were included in the analysis. The 30-ST "Sit and Stand" was performed on the same day as the 6-MST, no earlier than 30 min after completing the 6-MST. The patient sat on a 46 cm high chair placed against the wall for greater stability. Before testing, as before the 6-MST, the pulse rate, SpO₂, and dyspnea severity according to the Borg scale were measured. Then, without using his hands (with his arms crossed on his chest), the patient stood up from the chair within 30 s and sat back down with the maximum possible frequency (Fig. 1). After 30 s, the number of repetitions performed was counted and the pulse rate, SpO₂ and dyspnea severity were measured again. Desaturation was defined as a decrease in SpO₂ at the end of any exercise

test by $> 4\%$ of the initial value, or $< 90\%$ [4]. In each exercise test, the difference between the final and initial pulse rate (Δ pulse), dyspnea according to the Borg scale (Δ Borg) and SpO₂ (Δ SpO₂) was calculated. At the end of the exercise tests, the patient was asked: "Which type of physical activity – getting up from a chair or walking along the corridor – was more difficult to tolerate due to respiratory symptoms?"

Spirometry was performed in 24 patients (96%), body plethysmography in 20 (80%), and DLCO study in 16 (64%). A decrease in TLC $< 80\%$ predicted, corresponding to restrictive disorders of pulmonary function, was detected in 15 of 20 patients. Obstructive disorders of pulmonary ventilation were detected in 1 of 24 patients. In 9 of 24, the indicators of bronchial patency and lung volumes were within normal limits. Load testing. 6-MShT and 30-ST "Sit and Stand" were performed by all patients included in the study.

According to the study by J.Briand et al., the frequency of desaturation during the 1-minute Sit-and-Stand test and 6-MST, and the number of repetitions during the 30-ST Sit-and-Stand test correlated with the distance covered by the patient in 6 minutes [16], however, the duration of the Sit-and-Stand test in the work [16] was longer than in the present study, and in patients with ILD, restrictive pulmonary ventilation disorders were generally not observed (FVC – $85 \pm 19\%$ vol.), in contrast to the patients who participated in the present study, in whom FVC was $72.2 \pm 18.9\%$ vol. Thus, the discrepancy in the results may also be associated with differences in the characteristics of the patients. The results of the 30-ST "Sit and Stand" were studied mainly in patients with COPD with systemic manifestations of the disease, primarily skeletal muscle dysfunction caused not only by chronic hypoxemia, but also by systemic inflammation. In patients with fibrosing ILD, systemic inflammation is absent or minimally expressed, so skeletal muscles suffer to a lesser extent than in COPD. Therefore, it is possible that in ILD, higher skeletal muscle exercise, including lower limb muscles, is required to identify TFN limitations. It is possible that increasing the test duration from 30 sec to 1 min will increase its diagnostic and prognostic significance.

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