Study of the state of the bronchopulmonary system and adaptation reserves in patients with chronic obstructive pulmonary disease using electropunctural vegetative resonance test

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Determination of the adaptation reserves of the human body is an important part of the functional diagnosis of chronic diseases. It is known that with an exacerbation of a chronic disease, including an exacerbation of chronic obstructive pulmonary disease (COPD), there is a decrease in adaptation reserves and a change in the functioning of systems that provide homeostasis [1, 2, 3]. COPD progression is associated with the development of exacerbations of the disease [4, 5, 6]. Spirography does not always help to determine the deterioration of the course of COPD, and therefore, to adjust the therapy [6, 7, 8]. General symptoms reflecting changes in adaptive reserves are rarely taken into account [9, 10, 11]. It seems relevant to develop diagnostic technologies for restorative medicine,
allowing a comprehensive assessment of both the functional status of the bronchopulmonary system and the general adaptive reserves of the body. The aim of the study is to develop an easily accessible method for assessing the functional state of the bronchopulmonary system in patients with chronic obstructive pulmonary disease, taking into account the stage of the disease and the body's adaptation reserves.

Materials and research methods

A total of 197 people were examined, among them 154 patients with chronic obstructive pulmonary disease in the acute phase, who were undergoing inpatient treatment. Diagnostic monitoring was performed in 40 patients with mild COPD, in 54 with moderate COPD, and in 60 with severe COPD. The risk group included 22 people without clinical manifestations of COPD, but with changes in the respiratory organs according to EP ART, unfavorable history, and risk factors. The control group consisted of 21 conditionally healthy volunteers aged 36 to 41 years, non-smokers, without allergic diseases, COPD risk factors, without chronic processes in the bronchopulmonary and cardiovascular systems, without X-ray changes in the chest organs.

To verify the diagnosis of COPD, the International Classification of Diseases X revision (ICD-10) prepared by WHO (Geneva 1992), definitions of the All-Russian Research Institute of Pulmonology, WHO epidemiological criteria, data of the International Consensus and the National Program for the Diagnosis and Treatment of COPD, 2009 were used. According to the global strategy for diagnosis and treatment and prophylaxis of COPD (2008) [12], the stages of the disease are determined depending on the level of decrease in the forced exit volume in the first second (FEV1), on the ratio of forced expiratory volume in the first second to forced vital capacity (FEV1 / FVC) (Table 1). Stage I - mild COPD - is characterized by mild airflow limitation (FEV1 / FVC <0.70; FEV1 ≥ 80% of due). Chronic cough symptoms and sputum production may be present, but not always. At this stage, the person is usually not aware that their lung function is impaired. Stage II - moderate COPD - characterized by a decrease in airflow velocity (FEV1 / FVC <0.70; 50% ≤ FEV1 <80% of the expected values) with shortness of breath, which usually develops during exercise, as well as cough and production sputum. At this stage, patients usually seek medical attention because of chronic respiratory symptoms or an exacerbation of the disease. Stage III - severe COPD - is characterized by a further decrease in air flow rate (FEV1 / FVC <0.70; 30% ≤ FEV1 <50% of the proper values), increased shortness of breath, decreased ability to exercise, fatigue and recurrent exacerbations, which are almost always affect the patient's quality of life. Stage II - moderate COPD - characterized by a decrease in airflow velocity (FEV1 / FVC <0.70; 50% ≤ FEV1 <80% of the expected values) with shortness of breath, which usually develops during exercise, as well as cough and production sputum. At this stage, patients usually seek medical attention because of chronic respiratory symptoms or an exacerbation of the disease. Stage III - severe COPD - is characterized by a further decrease in air flow rate (FEV1 / FVC <0.70; 30% ≤ FEV1 <50% of the proper values), increased shortness of breath, decreased ability to exercise, fatigue and recurrent exacerbations, which are almost always affect the patient's quality of life. Stage II - moderate COPD - characterized by a decrease in airflow velocity (FEV1 / FVC <0.70; 50% ≤ FEV1 <80% of the expected values) with shortness of breath, which usually develops during exercise, as well as cough and production sputum. At this stage, patients usually seek medical attention because of chronic respiratory symptoms or an exacerbation of the disease. Stage III - severe COPD - is characterized by a further decrease in air flow rate (FEV1 / FVC <0.70; 30% ≤ FEV1 <50% of the proper values), increased shortness of breath, decreased ability to exercise, fatigue and recurrent exacerbations, which are almost always affect the patient's quality of life. 80% of the expected values) with shortness of breath, which, as a rule, develops during exercise, as well as cough and sputum production. At this stage, patients usually seek medical attention because of chronic respiratory symptoms or an exacerbation of the disease. Stage III - severe COPD - is characterized by a further decrease in air flow rate (FEV1 / FVC <0.70; 30% ≤ FEV1 <50% of the proper values), increased shortness of breath, decreased ability to exercise, fatigue and recurrent exacerbations, which are almost always affect the patient's quality of life. 80% of the expected values) with shortness of breath, which, as a rule, develops during exercise, as well as cough and sputum production. At this stage, patients usually seek medical attention because of chronic respiratory symptoms or an exacerbation of the disease. Stage III - severe COPD - is characterized by a further decrease in air flow rate (FEV1 / FVC <0.70; 30% ≤ FEV1 <50% of the proper values), increased shortness of breath, decreased ability to exercise, fatigue and recurrent exacerbations, which are almost always affect the patient's quality of life.

Table 1

Spirometric classification of the severity of COPD,

based on post-bronchodilatory FEV1

COPD stage	Clinic, spirometry data
Stage 1	FEV1 / FVC <0.7% FEV1 ≥
Mild COPD	80% of due
	The presence or absence of chronic symptoms (cough, sputum)
Stage 2	FEV1 / FVC <0.7%
COPD moderate	50% ≤ FEV1 ≤ 80% of due
gravity	The presence or absence of chronic symptoms (cough, sputum)
Stage 3	FEV1 / FVC <0.7%
Severe COPD	30% ≤ FEV1 ≤ 50% of the expected presence or absence of chronic symptoms (cough, sputum, shortness of breath)
Note. FEV1 - forced expiratory volume in the first second; FVC - forced vital capacity of the lungs.	

During the examination, a questionnaire survey, a physical examination were used, the results of a general blood test, adaptation reserves, an X-ray examination of the chest organs, fibrobronchoscopy, ART EP, and a statistical analysis of the materials obtained were evaluated.

The function of external respiration was investigated on a computer-assisted spirograph "Spirotest" (Russia), with registration of pulmonary volumes: VC - vital capacity of the lungs, FVC - forced vital capacity of the lungs, FEV1 - forced expiratory volume in the first second, the ratio of forced expiratory volume in the first second to forced vital capacity of the lungs (FEV1 / FVC); speed indicators: POS - peak expiratory flow rate, MOS25, MOS50, MOS75 - maximum volumetric flow rates of the curve at points corresponding to 25%, 50%, 75% FVC.

EP VRT was carried out on the HSC (hardware-software complex) "IMEDIS-EXPERT" (developed by LLC "CIMS IMEDIS", Moscow), 14 tests were analyzed.

The adaptation reserves were determined by the leukocyte blood count (the method of Garkavi, Ukolova, Kvakina). The adaptation reserves were differentiated as good, satisfactory, and unsatisfactory [1, 2].

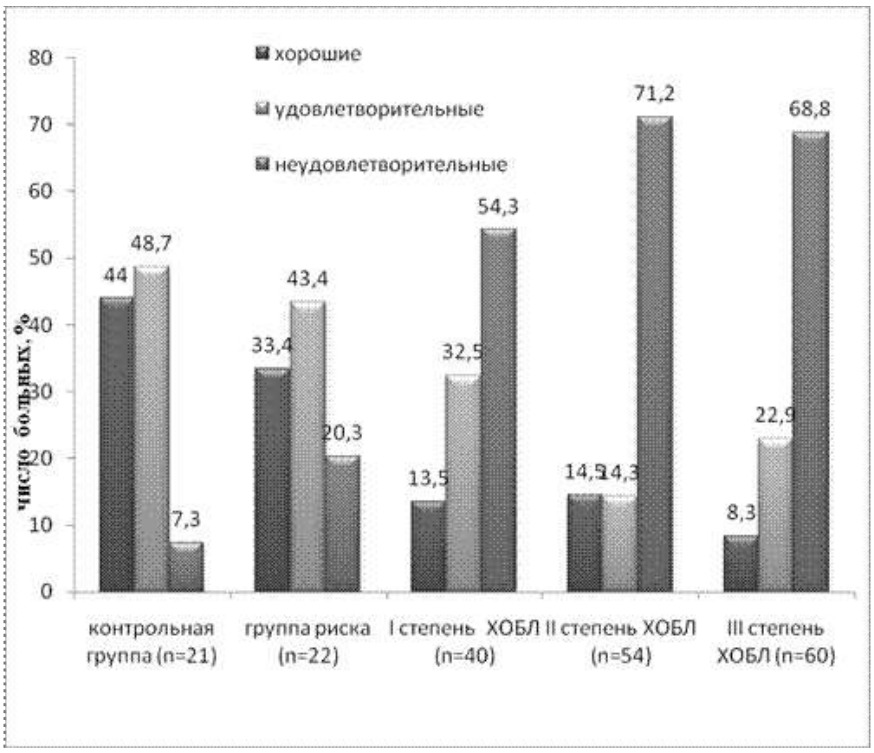
Results and its discussion

When assessing the adaptive capabilities according to the leukocyte formula, a significant decrease in the reserves of adaptation ($p < 0.05$) was revealed in comparison with the control group in patients with moderate and severe COPD. In these patients, an unsatisfactory state of adaptation was recorded in 36 (78.3%) and 53 (88.3%) people, respectively. In patients with stage I COPD, satisfactory adaptation reserves were determined in 38 (95.0%) cases, while no good adaptation reserves were recorded, in contrast to patients with moderate and severe COPD.

Differences in adaptation reserves between the risk group and the control group are not significant ($p > 0.05$), although there is a tendency to an increase in the number of surveyed in the risk group with unsatisfactory adaptation reserves 4 (20.3%) compared with the control group - 2 (7.3%), and a decrease in the number of cases with good adaptation reserves. That is, there is a significant decrease in the number of cases with good adaptation reserves from the healthy group to the patient group ($p < 0.005$).

Thus, the analysis of the obtained data showed that the determination of adaptation reserves by the leukocyte formula does not allow distinguishing the severity of COPD (Fig. 1).

There are no significant differences in adaptation reserves in patients with mild, moderate and severe COPD. There is a significant decrease in the number of cases with good adaptation reserves. The "adaptation reserves" index of the ART EP had close ($r > 0.7$) correlations with the adaptation reserves determined by the leukocyte formula both in the entire study group ($n = 197$) and when ranking by subgroups.



Rice. one.Adaptation reserves in patients with COPD, depending on the severity (according to the method of Garkavi, Ukolova, Kvakina)

The studies carried out have shown that EP ART tests differ depending on the stage of the disease (Table 2). Among the 14 analyzed tests, organopreparations of the bronchi and lungs, morphological tests of the bronchi and lungs, biological indices of the bronchi and lungs can be used to determine the stage of COPD.

The choice of ART EP indicators for determining the stage of COPD is based on the data of multivariate analysis [13]. This statistical method made it possible to identify the parameters of ART EP, which have the highest diagnostic value. After the rotation of factors in space, the varimax method was used to select variables (indicators of ERT EP) with loads 0.7 and more. [fourteen]. The results of factorial analysis have something in common with the cross-correlation of EP values of ART and spirography. When ranking a group of patients with COPD by severity, high and medium correlations exist between volumetric-speed indicators of spirography and EP ART tests: "organopreparations of the bronchi and lungs", "BI of the bronchi and lungs".

table 2

Electro-acupuncture classification of COPD severity

COPD stage	Indicators of EP ART
I. Mild COPD	- OP br D6 - OP l D6 - Normal condition of the bronchi - Normal lung condition - BI < sixteen
II. Moderate COPD	- OP br D10 or D12 - OP l D10, D3 - Chr. Inflammation. bronchi - Chr. Inflammation. lungs - BI < 17
III. Severe COPD	- Bronchi D3, etc. (more than 3) - Light D3 and others (more than 3) - Chr. Inflammation. bronchi - Chr. Inflammation. lungs - Lung sclerosis - Fibrosis of the bronchi - BI ≥ 17
Note. OP br- organopreparation of the bronchi, OP l - organopreparation of the lungs, inflammation of the chronology. bronchial tubes - chronic inflammation of the bronchi, inflammation of the chr. lungs - chronic pneumonia, BI- biological indices of the lungs and bronchi.	

Thus, on the basis of the experimental studies, a new method for determining the severity of the disease and the adaptation reserves of the body in patients with COPD was proposed - an electropuncture vegetative resonance test. The use of this method will allow an objective assessment of the adaptive capabilities of the body and the stage of COPD in cases where the use of spirography is difficult. The method can be used for diagnostics at the stages of outpatient, inpatient, sanatorium-resort treatment and does not require much time and special conditions.

Conclusions:

1. No significant differences were found in determining the adaptation reserves by leukocyte formula in patients with chronic obstructive pulmonary disease, depending on the stage of the disease.

2. Conducted cross-correlation analysis between indicators of electropuncture vegetative resonance test, spirography data and adaptation reserves shows the possibility of using the electropunctural vegetative resonance test as an independent method for assessing the state of the bronchopulmonary system in chronic obstructive pulmonary disease.

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