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Study of Psychoemotional Status in Patients with Pulmonary Hypertension and the Effects of Complex Therapy in Patients with Chronic Obstructive Pulmonary Disease

Tilloeva Sh. Sh
Bukhara State Medical Institute, Republic, Uzbekistan, Bukhara

Abstract: The state of central hemodynamics, endothelial function and external respiration in patients with chronic obstructive pulmonary disease in a comorbid state were studied and the impact of complex therapy was assessed. In the dynamics of the complex treatment, including resonance therapy (RT) against the background of basic therapy, a significant improvement in microcirculation and the degree of recovery of endothelial function disorders was established. In these patients, there was a significant increase in VC and blood oxygen saturation - SaO2.

Keywords: chronic obstructive pulmonary disease, peak flow, hypertension, hypoxic pulmonary vasoconstriction, endothelium, rehabilitation therapy.

According to the World Health Organization, chronic obstructive pulmonary disease (COPD) with the presence of chronic pulmonary heart disease (CHP) is considered a medical and social problem due to its widespread prevalence and high mortality rate [1,2].

In recent years, Uzbekistan has seen an increase in the prevalence and mortality from lung diseases complicated by chronic cor pulmonale. To optimize early diagnosis, adequate prevention and treatment of CHL, it is necessary to clarify the factors leading to its development and aggravating its course [6,10].

vasoconstriction of the vessels of the pulmonary circulation occurs , leading to hypertrophy, dilatation and failure of the right ventricle (RV) of the heart. But the question of what pathogenetic mechanisms underlie these changes in COPD has not yet been resolved. According to most researchers, in patients with chronic lung diseases, the leading factor in the development of changes in hemodynamics and disturbances in the diastolic function of the right ventricle of the heart are disturbances in the ventilation capacity of the lungs, hypoxia and endothelial dysfunction [3,4,5,6]. With prolonged hypoxia and an affective state in patients with COPD, endothelial function (EF), which promotes vascular relaxation, is significantly reduced, which can cause constriction of pulmonary vessels, the occurrence of pulmonary hypertension and right ventricular hypertrophy (RVH) of the heart. When studying peripheral blood flow disorders in patients with chronic obstructive pulmonary disease, great importance is paid to the vasoregulatory function of the vascular endothelium. The role of EF in the pathogenesis of pulmonary hypertension (PH) has been studied mainly in patients with primary pulmonary hypertension. There are very few studies devoted to the study of changes in endothelial regulation of vascular tone during secondary PH in patients with COPD [7]. It has now become obvious that neuropsychic factors have a negative impact on the state of internal organs through the autonomic nervous system [8].

Of course, prevention and treatment of patients with COPD complicated by cor pulmonale should be early, comprehensive, rational, individual and multi-stage [9].

Significant advances in the treatment of chronic heart disease in recent years are associated with calcium antagonists, which significantly improve survival and life prognosis in patients with chronic heart failure.

At the same time, it is important to search for alternative non-drug methods for the treatment of chronic pulmonary disease that can directly influence the pathogenetic mechanisms of the development of complications of COPD. One of these methods of therapy at the stage of exacerbation of CHL may be ozone therapy , used against the background of basic treatment. The results of clinical studies on the use of ozone therapy in patients with coronary heart disease, hypertension, bronchial asthma with associated disorders of carbohydrate metabolism, chronic obstructive pulmonary disease, indicate its positive effects: metabolic, bioenergetic, membrane stabilizing, anti-inflammatory, bronchodilator effects [11,12].

Purpose of the study. To study the state of diastolic function of the pancreas, pulmonary hemodynamics and vasoregulatory function of the endothelium of peripheral vessels in patients with chronic pulmonary heart disease in the dynamics of complex treatment.

Material and research methods. We examined 53 patients with COPD (age 49.7±2.8 years, disease experience 10.7±2.9 years), in whom the disease was complicated by the development of PH with a mean pulmonary arterial pressure (PAP) level of more than 25 мм.p.p . Art . Also examined 40 patients with COPD (age 56.9±2.6 years, disease experience 16.8±3.7 years), in whom the disease was complicated by prostate cancer, and 20 healthy individuals (HL).

Patients by treatment method were randomized and divided into 3 subgroups, respectively: subgroup A - 14 patients with COPD with PH (1a) and 17 patients with COPD with PH (2a) received basic therapy (BT) according to the international GOLD recommendations (2006); subgroup B - 12 patients with COPD with PH (1b) and 17 patients with COPD with PH (2b) against the background of BT received amlodipine (A) at a dose of 5-10 mg per day and ozone therapy (OT); subgroup B - 14 patients with COPD with PH (1c) and 19 patients with COPD with PH (2c), in whom basic therapy was combined with OT. Ozone therapy was carried out in the form of intravenous administration of ozonated saline solution (1000 μg/l), daily, for a course of 10 infusions. In the structure of basic therapy, patients took: β - agonists + anticholinergic inhaler, antileukotrienes, methylxanthines, β -agonists, glucocorticosteroids. Also, all patients took 1 capsule of immunohelp capsules. 3 times a day, chest massage, breathing exercises. The effectiveness of treatment regimens was assessed over time on the 10th day of therapy.

The psycho-emotional status of patients was assessed on the basis of psychological testing using the Spielberger test for identifying reactive anxiety (RT) and trait anxiety (PT). Vegetative status was determined using the parameter - tension index (TI).

Endothelium dependent vasodilation (EDVD) was assessed using Dopplerography of the brachial artery (BA) using a Toshiba ultrasound system SSH 60 A , (Japan) in constant wave mode. The maximum systolic blood flow velocity (MSV, m/s) and the vascular circulatory resistance index (VCI, units) were measured in response to a compression test (CT).

Doppler echocardiographic examination was performed using a Shimadzu 500 A ultrasound system (Japan) according to the Hatle method L. , Angelsen B. _ (1985), with assessment of diastolic function indicators: ratio of early and late diastolic filling (E/A), isovolumic relaxation time (IVR, m/s), deceleration time of the maximum speed of early diastolic filling (IZ, m/s), atrial fraction filling (FPN, %). The level of mean pulmonary arterial pressure was assessed and the level of stable metabolites of nitric oxide (SMNO) in blood plasma was determined.

The ventilation capacity of the lungs (VCA) was determined by assessing the volume of forced expiration in 1 second ($FEV_{1,}$%) , vital capacity (FVC, %) and Tiffno index (FEV_1/FVC, %) .

The results were processed using the Excel software package using Student's t -test. Differences between the studied parameters were considered significant at $p < 0.05$.

Research results. The results of the study showed that in patients with COPD complicated by CHL, there is an imbalance in the levels of stable metabolites of nitric oxide (S_{MNO}) in the blood plasma and a decrease in the ability of VA vessels to active endothelium-dependent vasodilation . Thus, analysis of the results of tests with reactive hyperemia showed that in patients with CHL, the maximum systolic blood flow velocity is significantly reduced and correlates with the severity of the disease. In patients with COPD complicated by chronic pulmonary arterial disease, MVR indices in response to CP are reduced compared to the indices of healthy individuals, by 32.9 and 19.2%, respectively, and ICI is increased by 38.6 and 28.0%. In parallel with the deterioration of VSL and endothelium-dependent vasodilation (EDVD), diastolic dysfunction of the RV heart is observed. In this case, dysfunction of the right ventricle has a positive correlation with the level of S_{MNO} ($r = 0.32$, $p < 0.05$).

The dominance of anxious affect in the personality structure is confirmed by the results of psychometric analysis using the Spielberger method using the reactive anxiety and personal anxiety scale. All patients with COPD were found to have high anxiety as a stable personality trait. According to the Spielberger scale, a significant increase in personal anxiety by 38.6 and 32.5% and especially reactive anxiety by 40.4 and 38.2% was revealed in patients with COPD with prostate cancer and PH. The data we obtained in the subgroup of patients with COPD complicated with PH showed that the level of reactive anxiety, the level of personal anxiety and the tension index were higher compared to patients with COPD complicated with PH.

It should be noted that in patients with COPD complicated by CHL, changes in the structure of the filling of the pancreas in diastole were significantly expressed. The decrease in filling rates in early diastole that we discovered is associated with impaired relaxation of the hypertrophied myocardium of the right ventricle of the heart, as a result of which the decrease in intraventricular filling slows down and FRF increases.

The studies assessed the level of S_{MNO} and cardiorespiratory parameters and diastolic function of the right ventricle of the heart in patients with COPD complicated by chronic cor pulmonale in the dynamics of various treatment regimens. During therapy using ozone therapy , also amlodipine and ozone therapy against the background of BT in patients with COPD complicated by CHL, a decrease in LBP , DD, and an increase was noted S_{MNO} and endothelium dependent vasodilation .

During therapy with amlodipine and ozone therapy in patients with COPD complicated by RPG and PH, a significant decrease in indicators was noted: the time of isovolumic relaxation, by 9.7% and 10.5%, respectively, the time of deceleration of the maximum rate of early diastolic filling - by 6.6% and 7.3%, atrial filling fractions - by 11.8% and 13.9%, LAPmean - by 13.1 and 15.7%. During the therapy, the E /A ratio increased, respectively, by 11.5% and 12.4% ($p <0.05$) and an increase S_{MNO} by 9.7% and 10.6%. The maximum systolic velocity after the compression test increased by 6.7% and 7.6% ($p<0.05$). A decrease in the vascular circulatory resistance index was determined - by 6.9% and 7.2% ($p <0.05$). There were positive changes in parameters i.e. diastolic function of the right ventricle. Affective symptoms decreased : RT by 5.1%, RT by 7.1%.

Ozone therapy against the background of BT in patients with COPD complicated by RPG and PH led to a decrease in the following indicators: the time of isovolumic relaxation, respectively, by 4.6% and 5.1%, the time of deceleration of the maximum rate of early diastolic filling - by 3.8% and 4.1% , atrial filling fractions - by 8.3% and 9.9%, LAPmean - by 8.7% and 9.5% ($p <0.05$). The ratio of early and late diastolic filling increased, respectively, by 7.7% and 8.3% ($p <0.05$) and an increase S_{MNO} by 6.1% and 8.1%. An increase in maximum systolic velocity after a compression test was found to increase by 5.9% and 5.2% and a decrease in the vascular circulatory resistance index by 6.2% and 6.7% ($p<0.05$). Affective symptoms decreased : RT by 4.8%, RT by 5.4%

The data obtained allowed us to state a more pronounced improvement in the parameters of S_{MNO} , EDV, VSL, diastolic function of the RV heart and affective symptoms in the dynamics of complex therapy regimens using amlodipine and ozone therapy in patients with COPD with PH, compared with patients with COPD complicated by RH.

A similar condition was observed in the group of patients receiving ozone therapy , however, in general, the improvement in all indicators was less pronounced than when using ozone therapy with amlodipine . The study confirmed the vasodilating effect of ozone therapy and amlodipine , which was manifested by a decrease in pulmonary arterial pressure and an improvement in the diastolic function of the RV heart.

The basic therapy regimens had no effect on changes in the diastolic function of the RV heart and the level of mean pulmonary arterial pressure .

Discussion. Studies have shown that before treatment, an increase in affective symptoms, a decrease in VSL, S_{MNO} and changes in the ability of vessels to actively vasodilate are parallel to disturbances in the structure of filling of the pancreas in diastole. These changes are significantly pronounced in patients with COPD with PH compared with the indicators in patients with COPD with PH. Mutual aggravation and progression of disorders of peripheral and central hemodynamics is based on the commonality of some links in pathogenesis: the development of disturbances in VSL and the level of S_{MNO} , pulmonary -cardiac microcirculation and pulmonary hypertension and [13,14]. The progression of PH and the development of chronic cor pulmonale in patients with COPD are closely related to the development of endothelial dysfunction, which should be taken into account when developing a treatment plan for this category of patients [8,15]. We noted an improvement in the parameters of right ventricular diastolic function , mean pulmonary arterial pressure , S_{MNO} , EDVD and affective symptoms in patients with COPD complicated by CHL, occurring after complex treatment using ozone therapy and amlopidine against the background of BT.

Conclusions.

1. The most pronounced decrease in the content of stable metabolites of nitric oxide, endothelium-dependent vasodilation , affective symptoms are observed in patients with COPD with RPG comparing COPD with PH . In this case, dysfunction of the right ventricle has a positive correlation with the level of S_{MNO} ($r = 0.32$, $p < 0.05$).
2. Ozone therapy and amlodipine combined with BT significantly correct levels S_{MNO} improves endothelium-dependent vasodilation and diastolic function of the right ventricle of the heart, reduces the level of mean pulmonary arterial pressure and affective symptoms in patients with COPD complicated by CHL .

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