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**MODERN DIRECTIONS AND  
MOVEMENTS IN SCIENCE**

Luxembourg, Luxembourg  
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annasvobodaprague@yahoo.com

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## MEDICINE AND PHARMACY

# Blood gas analysis in chronic obstructive pulmonary disease with pulmonary hypertension

**Kholov Gulomjon Akhmadovich<sup>1</sup>, Gadaev Abdigaffar Gadaevich<sup>2</sup>,  
Turakulov Rustam Ismatullaevich<sup>3</sup>**

<sup>1</sup> Researcher;  
*Bukhara State Medical Institute, Department of Faculty and Hospital Therapy;  
Republic of Uzbekistan*

<sup>2</sup> Professor of the Department of Internal Diseases № 3;  
*Tashkent Medical Academy, Doctor of Medical; Republic of Uzbekistan*

<sup>3</sup> Doctor of Medical, Senior Lecturer of the Department of Internal Diseases № 3;  
*Tashkent Medical Academy; Republic of Uzbekistan*

**Abstract.** This article discusses the course of pulmonary hypertension in chronic obstructive pulmonary disease, in particular the relationship between systolic pressure in the lungs and blood gases, as well as a comparative analysis of bosentan and sildenafil. The results of the study showed that in chronic obstructive pulmonary disease with pulmonary hypertension in stages II-III-IV of the disease, there are the following correlations in accordance with systolic pressure in the pulmonary artery, a positive relationship in the II degree with pCO<sub>2</sub> ( $r = 0.3$ ), ( $P < 0.03$ ), negative pO<sub>2</sub> ( $r = -0.3$ ,  $P < 0.02$ ), also grade III positive relationship with pCO<sub>2</sub> ( $r = 0.54$ ,  $P < 0.001$ ) and negative with pO<sub>2</sub> and sO<sub>2</sub> ( $r = -0.6$ ,  $P < 0.001$  and  $r =$  respectively).

**Keywords:** *chronic obstructive pulmonary disease, pulmonary hypertension, systolic pressure in the pulmonary artery.*

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Chronic obstructive pulmonary disease (COPD) is one of the most common diseases in the population, the pathogenesis of which is dominated by changes such as inflammation, endothelial dysfunction, oxidative processes, and hypoxia of the lungs and other organs.

According to a number of studies, the prevalence of OCD among the world population over 40 years old is 11.8% in men and 8.5% in women, respectively, with an average of 10.1% [1, 8]. This is one of the main diseases that requires going to the doctor, emergency departments and requires hospitalization .

Mortality from COPD ranks fourth among all diseases and

## MEDICINE AND PHARMACY

averages 4% [4, 5, 6, 9]. This is because it can lead to respiratory, pulmonary, and a number of other extrapulmonary systemic complications, including pulmonary hypertension (PH). Among them, OH is of particular clinical importance [3, 7, 8, 10]. The development of complications has a sharp negative impact on the quality of life of patients and has an important prognostic value [11, 12, 13].

**The purpose of the study:** to evaluate the effect of bosentan on blood gases in patients with chronic obstructive pulmonary disease with pulmonary hypertension.

**Materials and methods.** Under observation were 120 patients with pulmonary hypertension of mixed type, who were treated in a hospital. Their clinical and functional examinations were carried out in accordance with the recommendations of the latest international program [Eurasian Clinical Guidelines for the Diagnosis and Treatment of Pulmonary Hypertension (2019)].

The first group of our observation consisted of 40 patients with chronic obstructive pulmonary disease complicated by functional class II pulmonary hypertension, mean age  $53.05 \pm 2.65$  years. In the III functional class of chronic obstructive pulmonary disease complicated by pulmonary hypertension, the second group also included 40 patients with an average age of  $56.27 \pm 2.85$  years. Chronic obstructive pulmonary disease complicated by pulmonary hypertension, the third group consisted of 40 patients with functional class IV, mean age  $64.12 \pm 2.25$  years. In turn, each group was divided into two subgroups. Patients of the first subgroup with chronic obstructive pulmonary disease received bosentan 62.5 mg 2 times a day and eplerenone 100 mg 1 time per day based on the recommended complex treatment based on laboratory functional parameters. In the second subgroup of patients with chronic obstructive pulmonary disease, according to the general condition, the patient received sildenafil 50 mg 1 time per day and eplerenone 100 mg 1 time per day in the morning based on the recommended complex treatment based on laboratory functional parameters.

Echocardiography (ExoCG) was performed transthoracically using a Vivid S60N machine (NORWAY) with a 3.5 MHz transducer.

For statistical processing of the data obtained during the study, the computer program MS Excel (2007) was used. The arithmetic mean and standard deviation ( $M \pm m$ ) of the indicators were calculated. The significance of the difference between the compared groups was assessed by

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Student's t-test, where  $p < 0.05$

**Results and analysis.** A comparative study of blood gas parameters before and after treatment was carried out in 40 patients with pulmonary hypertension of functional class II (severity). In the group treated with bosentan and eplerenone, the acid-base state (pH) of the blood before and after treatment was  $7.37 \pm 0.02$  and  $7.43 \pm 0.02$ , respectively, and significantly differed from each other ( $R < 0.05$ ). In the group treated with sildenafil + eplerenone,  $7.38 \pm 0.01$  and  $7.42 \pm 0.01$ , respectively, the shifts were also significant ( $R < 0.05$ ). When comparing the differences between the two groups after treatment, they were not significantly different ( $R > 0.05$ ).

The partial pressure of carbon dioxide in the blood ranged from  $44.75 \pm 1.2$  mm Hg. up to  $40.7 \pm 1.2$  mm.r.st. in a small group treated with bosentan and eplerenone. decreased by 9.05% and there was a significant ( $R < 0.05$ ) change. In the second subgroup treated with sildenafil + eplerenone, these figures were  $44.9 \pm 1.72$  and  $42.6 \pm 1.72$  mm Hg. respectively, and decreased by 5.1%, but unlike the first subgroup, no significant ( $R > 0.05$ ) changes were recorded.

Although the changes in the two subgroups did not differ significantly from each other when comparing postoperative changes, it was found that the first subgroup treated with bosentan had a high tendency to reduce the partial pressure of blood  $pCO_2$ .

The partial pressure of oxygen in the blood increased by 21.37% and 19.0%, respectively, after treatment in both subgroups. At the same time, although the values were higher in the group receiving bosentan and eplerenone, they did not differ significantly ( $R > 0.05$ ) from the second group.

The level of blood saturation  $sO_2$  increased from  $94.38 \pm 0.58\%$  to  $97.88 \pm 0.58\%$  in a small group receiving the first bosentan + eplerenone against the background of standard treatment, the result was 3.73%, the results are significant ( $R < 0.001$ ). In the subgroup receiving the second combination of sildenafil + eplerenone, the indications were  $94.93 \pm 0.54\%$  and  $94.92 \pm 0.54\%$ , respectively, with only 0.01% positive results ( $R > 0.05$ ). It was reported that postoperative oxygen saturation in the two subgroups was highly reliable ( $P < 0.001$ ) compared with changes in patients treated with sildenafil in the bosentan group

Comparative analysis of blood gas parameters before and after treatment in 40 patients with functional class III

## MEDICINE AND PHARMACY

(severity) of pulmonary hypertension showed that in the subgroup treated with bosentan + eplerenone, sildenafil + eplerenone was received with a significant decrease in pH from  $7.39 \pm 0.001$  to  $7.35 \pm 0.01$  (0.54%;  $R < 0.05$ ), respectively, before and after treatment. decreased from  $7.4 \pm 0.01$  to  $7.39 \pm 0.01$  (0.13%;  $R > 0.05$ ), respectively, and the differences were not significant ( $R > 0.05$ ). This confirms that the best positive results can be obtained when prescribing bosentan and eplerenone against the background of standard pH therapy in patients with COPD functional class III pulmonary hypertension..

The partial pressure of carbon dioxide in the first subgroup before and after treatment was  $47.7 \pm 1.43$  mm, respectively. from the mercury column  $42.7 \pm 1.43$  mm. Hg confidence ( $R < 0.05$ ) decreased by 11.8%. In the second subgroup, these values were  $48.4 \pm 2.09$  mm. And decreased to  $47.4 \pm 2.09$  mm Hg. Art., ( $R > 0.05$ ). Comparison of postoperative differences between the two subgroups confirmed that the partial pressure of carbon dioxide in the subgroup treated with bosentan + eplerenone was significantly reduced ( $R < 0.05$ ) relative to the second subgroup

The partial pressure of oxygen in the first subgroup was  $69.65 \pm 2.03$  mm Hg. and there was an increase to  $91.65 \pm 1.38$  mm Hg. with a difference of 31.5% ( $R < 0.001$ ). In the second subgroup, these changes also amounted to  $67.95 \pm 2.03$  mm. With a subsequent increase to  $79.95 \pm 2.03$  mm Hg. , the difference was 17.6%, ( $R < 0.001$ ), but the indicators were significantly lower than in the first subgroup ( $R < 0.05$ ).

Thus, the observations showed significant positive changes in blood gas content in the first subgroup taking bosentan and eplerenone against the background of standard treatment, compared with the second subgroup receiving sildenafil and eplerenone in patients with COPD functional class III pulmonary hypertension.

The gas composition of the lungs was studied in 40 patients with functional class IV (severity) of pulmonary hypertension. The partial pressure of carbon dioxide in the first subgroup changed from  $49.89 \pm 1.63$  mm Hg. up to  $44.1 \pm 1.43$  mm Hg Art., with a significant decrease of 11.6% ( $R < 0.05$ ). In the second subgroup, these values were  $50.9 \pm 1.63$  mm. mercury column and  $48.09 \pm 2.09$  mm Hg. Art., decreased by 5.5%, but the differences after surgery and before treatment are not significant ( $R > 0.05$ ). When comparing the indicators after treatment of the first and second



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subgroups, positive changes in the first subgroup were higher than in the second subgroup, although the partial pressure of carbon dioxide did not differ significantly ( $R > 0.05$ ) compared to the second.

Changes in blood oxygen saturation levels were also high in the first subgroup. In particular, in the group treated with bosentan and eplerenone, it increased significantly ( $R < 0.001$ ) from  $81.15 \pm 0.51$  to  $96.15 \pm 0.51$ , i.e. by 15.6%. In the second subgroup, these values increased from  $80.75 \pm 0.46$  to  $93.75 \pm 0.46$  and amounted to 15.6% ( $R < 0.001$ ). When comparing the values of the two groups after treatment, the difference between the first and second subgroups was not significant ( $R > 0.05$ ).

Thus, the observations showed that the use of bosentan and eplerenone in patients with pulmonary hypertension according to functional class IV COPD against the background of its standard treatment significantly reduced the partial pressure of carbon dioxide in the blood compared to the group of patients taking sildenafil and eplerenone, and the partial pressure of oxygen changed equally. positive in both groups.

**Conclusion.** In chronic obstructive pulmonary disease with pulmonary hypertension in II-III-IV stages of the disease, in accordance with systolic pressure in the pulmonary artery, there is a positive relationship with  $pCO_2$  ( $r = 0.3$ ,  $P < 0.03$ ) and a negative relationship with  $pO_2$  ( $r = -0.3$ ,  $P < 0.02$ ), respectively, such a change at stage III of the disease is positive with  $pCO_2$  ( $r = 0.54$ ,  $P < 0.001$ ) and negative with  $pO_2$  and  $sO_2$  ( $r = -0.6$ ,  $P < 0.001$  and  $r = -0$ , respectively). There is also a tendency to maintain and strengthen these relationships in stage IV of the disease. This shows that changes in the gas composition of the blood are of great importance in the development of the process.

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