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CERTAIN CRITERIA OF RENAL AFFECTION IN CASE OF COPD.

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Abstract. *Chronic pulmonary problems belong to the group of leading diseases in modern society. Often the severity of the course and prognosis of chronic pathology of lungs are determined by extrapulmonary manifestations of the disease. Nephrological aspects of lung pathology are poorly studied.*

In this clinical research, we have examined 27 patients with COPD of the II-nd and III-rd stages of pulmonary insufficiency of the II-nd – III-rd degree. There were 20 (74%) males and 7 (26%) females. The average age of patients was 53 ± 3,7 years.

The severity of clinical picture in patients with COPD is increased while the progress of the pathological process occurs. The association of nephropathy at the early stages of its development does not worsen the clinical course. The diagnosis of microalbuminuria is the early marker of renal involvement in the pathological process.

The development of combined acidosis is distinctive for patients with COPD. Kidneys are actively involved in the compensation of these disorders by increasing the excretion of titrating acids, and at later stages the increased ammoniogenesis becomes evident.

Key words: *chronic obstructive pulmonary disease, nephropathy, microalbuminuria.*

In contemporary society, chronic pulmonary diseases are included in a group of leading diseases at the level of hypertension, ischemic heart disease, diabetes mellitus: over 30% for all other forms of human pathology. The World Health Organization refers COPD to the diseases having a high social burden. According to the prognosis for the period to 2020, made by the experts from the WHO, COPD will become one of the leading causes of death. [1, 2, 3]

The latest concept of medical science emphasizes not only on the efficiency of the processes of diagnosis and treatment, but also on the prevention of diseases. The severity of the course and the prognosis of chronic pneumopathies are frequently

determined by extrapulmonary manifestations of the disease. [3, 4] Therefore, preventive and treatment programs largely depend on comorbidities, against which they develop.

The presence of comorbidity modifies significantly the main clinical manifestations and requires the flexibility in determining therapeutic schemes. Deficient attention to extrapulmonary manifestations of diseases of the respiratory system and inadequate assessment of their impact cause diagnostic and therapeutic mistakes. In clinical studies an adverse prognosis has been demonstrated in combination of COPD with pathologies of the cardiovascular system, such as coronary heart disease, arrhythmia, hypertension. [3, 4, 5] This combination becomes particularly dangerous in case of the severe course of pneumopathy.

It is known that kidney is one of the main organs involved in maintaining the homeostasis of the organism. The state of renal functions, including the glomerular filtration mechanism, depends on the level of blood oxygenation. At the same time, bronchial obstruction, causing hypoxemia, is the pathophysiological basis of COPD. Renal hemodynamics, responding to changes in blood gas composition, is included in the mechanisms of the disease progression. In addition, the inflammatory process affects primarily the respiratory tracts and pulmonary parenchyma, but its systemic responses are manifested at certain stages of the disease: systemic oxidative stress, endothelial dysfunction, increased activity of pro-coagulating factors and others, also affecting the renal condition [4, 6, 7].

However, despite the importance and relevance, renal aspects of pulmonary pathologies are poorly studied. The least resolved issue includes the features of formation of changes in kidneys in case of chronic pulmonary diseases, the assessment of renal homeostatic functions.

Materials and Methods

In this clinical study, we have examined 82 patients who were hospitalized in the Pulmonology Department of Municipal Health Care Institution Regional Clinical Hospital – Center of Emergency Medical Care and Medicine of Catastrophes. They had the chronic obstructive pulmonary disease (COPD) of the II-nd and III-rd degrees

of severity, with the pulmonary insufficiency (PI) of the II-nd and III-rd degrees. There were 60 (74%) males and 22 (26%) females. The average age of patients was 53 ± 3,7 years (men – 54 ± 2,6 and women – 45 ± 3,7). The coronary heart disease and hypertension were the most frequent comorbidities.

All patients were divided into 3 groups :

I group – patients, diagnosed COPD of the II-nd degree, PI – the II-nd degree, totally 19 (24 %) patients, including 10 men and 9 women

II group – patients with COPD of the III-rd degree, PI – the II-nd degree, all together 41 (50%) patients, including 33 men and 8 women

III group – patients with COPD of the III-rd degree, PI – the III-rd degree, all together 22 (26%) patients, including 17 men and 5 women.

The physical examination and medical history were done for all patients in the in-patient department; they were undergone the following procedures: laboratory tests of clinical blood and urine analysis, biochemical blood tests (urea and creatinine levels), study of microalbuminuria (MAU) and proteinuria, determination of the external respiration function (ERF), study of indices of renal acid excretion – titrating acid excretion per day (E t.ac.), ammonium excretion per day (E_{NH4+}) and excretion of water ions (E_{H+}).

Mostly the patients of all groups complained of the cough associated with the discharge of poor amount of viscous sputum, asphyxia, tachycardia, dyspnea. The intensity and frequency of complaints depended directly on the stage of the disease and the degree of pulmonary insufficiency.

All patients participated in our research are smokers, but patients in group I have an average index – 15 pack/years, and patients from groups II-III – 30 pack/years.

The external examination has revealed acrocyanosis more in patients from groups II and III (11 cases), whereas only 5 cases was detected in the I-st group.

While examining the I-st group by auscultation, the rough respiration with solitary wheezing and whirring rales were heard over the entire surface of lungs, whereas in the patients from groups II and III, the rough respiration with multiple

wheezing and whirring cracklings were auscultatory heard over the entire surface of lungs.

No pathology was detected while auscultating the heart in patients of the I-st group, but in patients from groups II and III the cardiac examination revealed the occurrence of the accent of the second tone above the pulmonary artery in 80% of cases.

Results

While examining the functions of external respiration (FER) – in patients of the group I, it was found that respiratory volumes (RV) in men make on average (74 ± 3,7), and in women – (76 ± 2,9); FEV_1 in men is (65 ± 4,0), in women – (70 ± 1,3). At the same time in groups II and III, when examining the FER, it was found the significant deterioration of these indices – so RV in men make on average 43 (± 2,6), in women – (57 ± 1,4), and FEV_1 in men is (38 ± 2,2), in women – (49 ± 2,3).

In the study of MAU in patients from the group I, the test was positive in 10 cases – the MAU level was 0,03 g/L, and the level of creatinine in the urine was 2,2 mmol/L. The patients of the II-nd and the III-rd groups had the significantly higher MAU level – from 0,15 to 0,3 g/L, the level of creatinine – 17,7-26,5 mmol/L in 18 cases. Proteinuria was found only in 11 men from the group III and was on average 0,5 g/L.

Biochemical analysis of blood in patients from groups I and II (the II-nd group had only MAU) did not show any pathological changes. While in patients of the group III with microalbuminuria and proteinuria, the levels of urea and creatinine was a little higher than the physiological norm – 9,3 ± 0,7 mmol/L, and 126 ± 1,5 mmol/L.

According to creatinine clearance and depending on its level in the blood plasma, the glomerular filtration rate (GFR) in patients of the III-rd group was on average 62 ± 4,58 ml/min, corresponding to the second stage of chronic kidney disease (CKD), whereas in patients from I-st and II-nd groups the GFR had no pathological changes.

Therefore, we have found correlations between parameters FER, FEV_1 and MAU, indicating the presence of direct dependence of pathological changes in lungs and kidneys.

In addition, acid-base balance of blood was studied in all patients. The obtained data are presented in Table 1.

Table 1.

Indicators of acid-base status in patients with COPD (M ± m)

Groups / Indicators	I group	II group	III group
pH of blood	7,40±0,01	7,36±0,01	7,35±0,01
BE (mmol/L)	0,36±0,01	-4,04±1,09	-5,17±0,55*
pO_2 (mm Hg)	85,3±4,3	47,93±6,41	28,21±1,48*
pCO_2 (mm Hg)	39,2±0,15	38,23±3,79	47,48±47,48*

Comments: * - p<0.01

Taking into consideration the detected changes in kidneys and combined acidosis in patients from the III-rd group, an additional testing of acid renal excretory function was carried out. The obtained results are presented in Table 2.

Table 2.

Indicators of acid renal excretory function.

Groups / Indicators	I group	II group	III group
E t.ac. mmol/d	32,56±2,62	35,77±2,75	39,83±0,38
E_{NH4} mmol/d	75,84±5,21	77,62±7,17	87,77±1,09
E_{H+} mmol/d	110,314±5,11	113,39±4,25	127,70±1,35*

Comments: * - p<0.01

Thus, the involvement of renal tubules mechanisms into the process of compensation is distinctive for patients with COPD, who have acidosis as a result of ventilation disorders. The analysis of the data suggests that the excretion of titrating

acids is increased in patients with COPD of the III-rd degree. In patients with COPD, suffered from nephropathy, this index tends to increase, but the differences are not statistically significant. At the same time, the daily excretion of ammonium is statistically considerably increased throughout the entire period of the pathological process in the lungs, while the disease aggravates.

Analyzing the indices of the renal function of acid excretion in patients with COPD and nephropathy, their compensation abilities should been also regarded. The daily excretion of hydrogen ions in the patients from the third group was even higher than in other groups. This point indicates the high compensation abilities of kidneys. It is well known that in case of surgical removal of 5/6 – 7/8 of renal parenchyma, the supercompensation of hydrogen-ion excretion together with ammonium was observed. These phenomena suggest that so-called “intact or adaptive nephrons” have the ability to support the constant homeostasis of the organism, even if kidneys are wrinkled (M.Ratner, V.Serov, N.Tomylyna, 1977).

Hence, the analysis of all these indicators suggests that even in the most severe stages of COPD, the activity of acid-excretory function of kidneys is obvious and the involvement of renal mechanisms in the regulation of acid-base balance occurs.

Conclusions

Thus, our analysis suggests that the severity of the clinical picture in patients with COPD increases in the progression of the pathological process both in the case of isolated pulmonary affection, and in patients, suffered from COPD associated with nephropathy. Associated nephropathy at the early stages of its development does not worsen the clinical course. The diagnosis of microalbuminuria in the absence of other objective signs is the early index of renal involvement in the pathological process.

The malfunction of acid-base balance of the blood and the development of acidosis (first respiratory and later metabolic) are characteristic for patients with COPD. The role of kidneys in the regulation of acid-base balance of the blood in patients with COPD is the following: the first compensatory mechanism of the tubular apparatus is the increase of titrating acids, and at later stages the

augmentation of ammoniogenesis occurs. When comparing these parameters in patients with the isolated COPD and with the development of nephropathy, these indices were higher. This observation indicates the high compensation abilities of kidneys, and the possibility of “intact” nephrons to ensure compensatory functions in certain situations.

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