Features of immunological and nonspecific reactivity of the organism, clinical flow of chronic obstructive bronchitis based on the estimation of quality and quantitative composition of microelements (me) in the blood

Características de la reactividad inmunológica y no específica del organismo, flujo clínico de la bronquitis obstructiva crónica basada en la estimación de la calidad y la composición cuantitativa de los microelamentos en la sangre

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Abstract

The paper analyzes the features of the immunological and non-specific reactivity of the organism, clinical flow of chronic obstructive bronchitis based on the estimation of quality and quantitative composition of microelements (ME) in the blood. The observed changes in microelements, humoral immunity, and neutrophil activity indicate the active participation of microelements in the pathological process. The increase in the level of individual microelements reflects the high protective ability of the patient. Therefore, pathogenically justified in the prevention of exacerbation of chronic obstructive bronchitis is therapy with elements.

Keywords: residential areas, anthropotechnological pollution, changes in the microelement composition of blood, heavy metals, lead, reduction of resistance, chronicity of pathological processes, chronic obstructive bronchitis.

Resumen

El artículo analiza las características de la reactividad inmunológica y no específica del organismo, el flujo clínico de la bronquitis obstructiva crónica en función de la estimación de la calidad y la composición cuantitativa de los microelementos (EM) en la sangre. Los cambios observados en los microelementos, la inmunidad humoral y la actividad de los neutrófilos indican la participación activa de los microelementos en el proceso patológico. El aumento en el nivel de los microelementos individuales refleja la alta capacidad protectora del paciente. Por lo tanto, patogénicamente justificado en la prevención de la exacerbación de la bronquitis obstructiva crónica es la terapia con bioelementos.

Palabras clave: Áreas residenciales, contaminación antropotecnológica, cambios en la composición de microelementos de la sangre, metales pesados, plomo, reducción de la resistencia, cronicidad de procesos patológicos, bronquitis crónica obstructiva.

Introduction

The relevance of the research topic: All living things are 99% of the 12 most common elements, some of them (iron, iodine, copper, zinc, cobalt, chromium, molybdenum, nickel, vanadium, selenium, manganese, arsenic, fluorine, silicon, lithium) are considered essential, i.e. vital. Four others (cadmium, lead, tin, rubidium) are relatively essential trace elements[1,2].

The assimilation of vital trace elements by the body begins in the oral cavity, which is greatly enhanced in the stomach, reaching the highest intensity in the small intestine. Copper absorption is peculiar, which takes place 52% in the stomach, 21% in the duodenum 12, the rest in the jejunum. Copper is excreted mainly from the bile.

Homeostatic control over the normative content of cationic microelements in the body (zinc, iron, manganese, and copper) is carried out by the liver and gastrointestinal tract, and anionic microelements (chromium, selenium, molybdenum, iodine) - by the stomach. They are mainly excreted by the kidneys. The exchange of microelements in the body is influenced by developmental features, infections, and stress, the functional state of the endocrine organs, the presence of antagonistic ligands and competing pollutants, and the complex effect of adverse production and environmental hygiene factors[3].

Trace elements that cause intoxication of the organism are a component of anthropogenic environmental pollution[4]. Normally, they are not present in the body. According to the World Health Organization, about 35% of diseases may be associated with environmental hygienic and occupational risk factors. In the complex of factors affecting health at working age, occupational risks play an important role: from 20 to 40% of work losses are due to diseases directly or indirectly associated with unsatisfactory working conditions[5,6]. However, the microelement composition of blood in persons working in hazardous conditions and living in unfavorable ecological and hygienic residential areas remains unexplored. Approaches to detoxification and the normalization of the micronutrient composition of the patient's body are not developed[7].

Industrial cities are an extreme habitat zone, the entire biosphere of which is contaminated with salts of heavy metals of industrial origin[10-12]. The main sources are metallurgical production, industrial waste incineration, high traffic density. Determination of elevated concentrations of trace elements in the human body often indicates a pathogenic effect of the ecological and hygienic environment on its health[13,14] and dictates the need to develop comprehensive preventive measures. The full content of essential elements and the minimum, not threatening to disrupt the adaptation mechanisms of the body, the presence of toxic and conditionally-toxic elements is one of the most important components of the normal functioning of the body.

One of the effective ways to maintain health is the early diagnosis of borderline conditions and the implementation of preventive measures. In this case, an adequate diagnosis of microelements is very important, primarily due to the accurate quantitative determination of microelements in human indicator bio-substrates.

Intensive pollution of the environment, caused by emissions of industrial enterprises and exhaust gases of motor vehicles, affects the intake of trace elements in the human body[15]. The state of non-specific and immunological reactivity, the occurrence and course of various pathological conditions are influenced by the quantitative and qualitative composition of microelements in the body[16].

In the literature, the role of trace elements in the formation of the organism's immunological reactivity in chronic bronchopulmonary diseases has been studied sufficiently.

The works concerning the influence of the chronic inflammatory process in the bronchi on the blood content of trace elements are rare and mainly concern the study of iron and copper.

Based on the importance of copper in the maturation of proteins in the connective tissue, the connection of lead and zinc with intracellular and plasma proteins (globulins), the participation of iron and manganese in redox processes, the content of twelve trace elements (iron, honey, zinc, calcium, manganese, magnesium, silicon, aluminum, phosphorus, lead, titanium, silver) in the blood of patients with chronic pulmonary pathologies.

Objective: analysis of the features of the immunological and nonspecific reactivity of the organism, the severity of the clinical course of chronic obstructive bronchitis based on the qualitative and quantitative composition of trace elements in the blood of the population.

Methods of Research

Surveyed 122 patients (66 women, 56 men) chronic obstructive pulmonary disease, aged 21 to 60 years, with disease duration from 1 year to 20 years. The content of microelements was studied in all patients by the method of emission spectral analysis, the functional activity of B-lymphocytes (IgA, IgG, IgM) according to Mancini, and the nonspecific reactivity according to the NBT-test. The control was the blood of 83 donors.

The Main Results of the Study: In the whole blood and erythrocytes of the patients (when compared with the control), regardless of their sex, an increase of 2.5 times the manganese level was detected, and the content of iron and copper was higher only in the blood (1.3 and 1.5 times, respectively).

The increase in iron, copper, manganese, silicon - the elements responsible for tissue respiration, the immunobiological reactivity of the organism, is a manifestation of the protective-compensatory reaction of the organism. The concentration of magnesium, zinc, phosphorus, and silver in them was reduced by 20, 35, 40, 20, 13%, respectively, which worsened the enzymatic processes in the tissues. In the blood of patients with chronic obstructive bronchitis, there is a violation of the iron content. So, in 56.26% of persons, it was elevated, in 43.75% - decreased. Moreover, in the dynamics was not observed stability in the level of iron, such changes violate the oxidative and enzymatic processes, contribute to the development of hypoxia sluggish forms of the disease.

The degree of reduction for many elements depended on the age of the process. In patients under 5 years of illness, the content of magnesium, calcium, aluminum, zinc, phosphorus in erythrocytes was below the norm by an average of 25%, from 5 to 10 years of illness - by 32%.

The results of the study of immunoglobulins in the blood and non-specific reactivity of patients with the chronic obstructive pulmonary disease were analyzed taking into account the particular clinical course of the disease and the content of microelements in the blood (Table 1).

From the presented data it follows that the content of immunoglobulins of different classes varies with different concentrations of trace elements in the blood. Thus, against the background of increased iron content in the blood and a decrease in manganese, copper, lead, and zinc, LgA values tended to normalize, and IgG increased. With a decrease in manganese, a decrease in LGM was observed.

Against the background of reduced iron content in the blood (Table 2), the level of LgA was reduced almost 2 times and did not depend on the level of other microelements (P <0.5). IgG activity is almost not changed when the trace elements fluctuate. The level of IgM varied with the concentration of trace elements, which creates conditions for the further progression of the process. Observed changes in microelements and humoral immunity indicate that in patients with chronic obstructive bronchitis, microelements are actively involved in the pathological process. Changes in the level of trace elements in the blood lead to an imbalance in their organs and tissues, an increased release of biologically active substances and a decrease in the body's immunological reactivity. These disorders play a role in the pathological genesis of the torpid inflammatory process in the bronchopulmonary apparatus.

Significant changes were revealed when studying the effect of trace elements on the nonspecific resistance of the organism (see Table 2).

Table 1. The ratio of microelements, immunoglobulins, and NBT-test in patients with chronic obstructive bronchitis with elevated blood lead (M ± n)

The level of microelements	The content of immunoglobulins (g / l)			Neutrophil activity (NBT-test in%
	IgA	IgG	Ig M	
Manganese				
Increased	1,79 ± 0,7	9,47 ± 1,0	1,35 ±0,5	24,38 ±1,3
Reduced	3,17 ±0,9	11,54 ± 0,8	0,74 ± 0,9	33,0 ± 1,8
Calcium				
Increased	1,99 ±0,7	10,16 ±0,9	1,08 ± 0,6	36,31 ± 1,4
Reduced	1,99 ± 0,4	9,64 ± 0,8	1,28 ±0,8	24,49 ±1,4
Copper				
Increased	1,79 ±05	9,82 ± 0,7	1,15 ± 0,6	35,12 ±1,2
Reduced	2,21 ± 0,4	10,39 ±0,5	1,17 ±0,5	25,21 ±1,6
Zinc				
Increased	1,48 ± 0,8	9,70 ±0,3	1,05 ±0,5	29,64 ± 1,2
Reduced	2,26 ± 0,3	9,95 ± 0,4	1,31 ±0,5	25,52 ±1,2
Control	3,32 ± 0,3	8,2 ±0,6	1,1 ± 0,6	11,2 ± 1,5

Table 2. The ratio of microelements, immunoglobulins, and NBT-test in patients with the chronic obstructive pulmonary disease with reduced blood lead (M ± n)

The level of microelements	The content of immunoglobulins (g / l)			Neutrophil activity (NBT-test in%
	IgA	IgG	IgM	
Manganese				
Increased	1,27 ±0,3	8,22 ± 0,4	1,40 ±0,1	25,4 ± 1,8
Reduced	1,30 ±0,3	9,67 ± 0,8	0,60 ±0,1	28,54 ±1,1
Calcium				
Increased	1,57 ±0,7	8,5 ±0,6	0,33 ± 0,2	31,15 1,3
Reduced	1,27 ±0,5	8,31 ± 06	1,37 ±0,5	23,63 ± 1,1
Copper				
Increased	1,20 ±0,4	9,33 ± 1,0	1,47 ±05	23,33 ±1,1
Reduced	1,32 ±0,1	8,36 ± 0,9	1,11 ±0,7	26,51 ± 1,3
Zinc				
Increased	1,57 ±0,6	8,51 ± 0,9	0,4 ±0,1	36,18 ± 1,6
Reduced	1,25 ±0,4	7,65 ± 1,1	1,41 ±0,7	24,47 ± 1,5
Control	3,32 ± 0,6	8,2 ±0,6	1,1 ±0,6	11,2 ±1,5

All patients had an increase in activity (NBT-test) of neutrophils. However, the increase in the NBT - test was more significant with a decrease in manganese, an increase in calcium, zinc, copper, which indicates the significance of their influence on the factors of nonspecific protection. At the same time, an increase in the activity of neutrophils and bio-elements in the blood can be regarded as a favorable sign, reflecting the high protective ability of the patient's body.

The study of the concentration of microelements in the blood of patients with chronic obstructive bronchitis in the dynamics of the process showed that bio-elements are not normalized by the end of treatment and remain reduced for a long time (2-3 months). Perhaps this is due to the sluggish nature of the inflammatory process in the bronchi, which does not stop after treatment for the exacerbation of the disease.

This is reflected in the clinical course of chronic obstructive bronchitis. In patients with reduced levels of calcium, copper, zinc, more persistent clinical signs of the disease (dry rales, persistent obstruction and shortness of breath, difficulty in expectoration of sputum, weakness), a protracted process, difficult to treat, were observed.

Thus, the data obtained indicate that long-lasting for many years' antigenic irritation, which occurs in patients with chronic obstructive bronchitis, leads to a decrease in the function of B-lymphocytes (Ig A and Ig M blood, which is caused, apparently, by changing the concentration of trace elements.

A favorable prognostic sign is a simultaneous increase in the level of copper, zinc, calcium and non-specific reactivity of the organism.

The quantitative changes of microelements established by us, their connection with the immunological reactivity of the patient's body must be taken into account in the treatment and prevention of exacerbation of the chronic obstructive pulmonary disease.

Discussion

The study of the influence of chemical pollutants entering the human body from the external environment on human health and the course of various diseases is one of the urgent problems of modern medicine.

In the scientific work of individual authors, Attention is drawn to the fact of the association of the prevalence of chronic obstructive pulmonary diseases with the biogeochemical conditions of the human environment.

The immune status of patients with exacerbation of chronic obstructive pulmonary disease in an imbalance of zinc and copper hemostasis is characterized by a pronounced inhibition of T-cell functions and phagocytosis, an imbalance in the expression of activation markers on lymphocytes - CD 25, CD 71, HLA - DR, CD 95. Decrease T cell function, for which a clear correlation is shown with an increase in the copper/zinc index, can be considered as one of the immunopathogenetic links of chronic obstructive pulmonary disease under conditions of natural zinc deficiency, determining the adverse clinical course of this disease. The results of our study showed that, against the background of elevated levels of iron in the blood and a decrease in manganese, copper, and zinc, LgA values tended to normalize, IgG increased. With a decrease in manganese, a decrease in lgM was observed.

Against the background of reduced iron content in the blood (Table 2), the level of LgA was reduced almost 2 times and did not depend on the level of other trace elements ($P < 0.5$). IgG activity almost did not change with fluctuations of me. The level of IgM varied with the concentration of trace elements, which creates conditions for the further progression of the process. The observed changes in microelements and humoral immunity indicate that in patients with chronic obstructive bronchitis, microelements are actively involved in the pathological process. Thus, the quantitative changes of microelements, as well as their connection with the immunological reactivity of the patient's body, must be taken into account in the treatment and prevention of exacerbation of the chronic obstructive pulmonary disease.

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