

## MEDICAL SCIENCES

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Kharkiv National Medical University*[DOI: 10.24411/2520-6990-2020-11890](https://doi.org/10.24411/2520-6990-2020-11890)**ZN BLOOD LEVEL AMONG CHILDREN ON THE BACKGROUND OF ACUTE BRONCHITIS AND UNDIFFERENTIATED CONNECTIVE TISSUE DYSPLASIA****Abstract.**

*Mechanisms of the development of wheezing have been remaining unclear until now. The average content of serum zinc is slightly reduced in comparison with the indices of the comparison group and varies between 11.83 and 15.82 μmol/L with an average of 14.21 μmol/L in the main group of patients ( $p < 0.01$ ).*

*Children of the main group are classified as sick with acute respiratory diseases 1.85 times more than in comparison group; the average content of serum zinc is significantly lower among children of the main group in comparison with the indicators of the comparison group ( $p = 0.01$ ). The level of serum zinc is significantly lower in boys ( $p = 0.001$ ) than in the examined girls.*

**Key words:** acute bronchitis, UCTD, Zn, children.

**Introduction.** Respiratory diseases over the past years remain the most common pathology in the child population [1,3].

Studying the features of the course and searching of new methods of treatment and rehabilitation of patients in this category is very relevant, considering the high prevalence of lower respiratory diseases.

In recent years, convincing data on the features of the course of a number of diseases against the background of undifferentiated connective tissue dysplasia (UCTD) have been obtained [2]. CTD is one of the most important and insufficiently explored problems [1]. Data on the prevalence of UCTD are very contradictory: from 26% to 86% in the population, which is due to various diagnostic approaches of clinicians.

The diagnosis of UCTD is complicated by the lack of an accurate determination of the nature and quantity of symptoms.

UCTD is a background pathology for the development of the respiratory system disorders and constitutes their constitutional basis. Currently, there is a need for a comprehensive study of this group of sick children. Most biochemical and molecular genetic diagnostic methods are laborious and require expensive equipment, therefore, clinical-anamnestic and functional research methods are the most accessible to conduct screening examinations of children [4]. It makes knowledge of clinical signs and diagnostic algorithms of UCTD to be specially important.

Respiratory organs are in the constant physical activity, as a result of which connective tissue proteins, collagen and elastin have different requirements than, for example, proteins of the liver or kidneys, namely these proteins determine the stability and compliance that are necessary to perform the main function of respiration – respiratory exchange [5,6]. The presence of UCTD in child is one of modifying factors contributing

to the peculiar course of bronchitis and wheezing episodes. Morphological changes in the bronchopulmonary system during UCTD lead to functional changes of muscular-cartilaginous frame of the tracheobronchial tree and alveolar tissue, making them too elastic, what adversely affect drainage function of the bronchi and stromal resistance of the alveoli [6,7].

Zinc (Zn) is a trace element that plays an important role in the immune system, from the skin barrier to the regulation of genes in lymphocytes [8]. There are conflicting data on the role of Zn in bronchopulmonary pathology in the literature. Some studies report data on a decrease in plasma Zn in AD and recurrent wheezing syndrome. Other studies do not show a statistically significant connection [9,10].

**Objective:** to improve the diagnosis of acute bronchitis in children on the background of UCTD taking into account Zn blood level.

**Materials and methods.** The study included 72 children aged from 2 to 5 years who were hospitalized to treat acute bronchitis or acute bronchitis complicated by wheezing syndrome with the aim to treat it or to clarify the diagnosis.

The following methods were used: clinical anamnestic, general clinical, physical research. Determination of zinc level in serum was carried out by the colorimetric method (IFCC) [11,12].

The level of stigmatization was taken into account (conditional indicator, including the total number of UCTD points, highlighting low (up to 12 points), medium (13-24 points) and high (more than 24 points) levels (using the table “Indicator value in assessment of the severity of connective tissue dysplasia”, T.I. Kadurina, L.N. Abbakumova, 2008), establishing the presence of UCTD [13].

**Results.** 72 hospitalized patients were examined in the course of our research. The average age of patients was 4.5 (3.0;5.0) years. Patients were divided into

2 groups. The 1<sup>st</sup> (main) group included 41 children with acute bronchitis complicated with wheezing syndrome, which proceeded against the background of UCTD - 22 children (1A group) and without signs of UCTD-19 children (1B group). The second (comparative) group consisted of 31 children with acute bronchitis (without bronchial obstructive symptoms), which proceeded against the background of UCTD - 16 children (group 2A) and without signs of UCTD - 15 children (2B group).

The severity of the disease, determined by the severity and duration of symptoms, was associated with the number of signs of UCTD. It was established during analyzing of clinical implications of simple bronchitis. Thus, febrile fever was recorded 2.6 times more often among children of 1A and 2A groups than in 1B and 2B groups (in 40.35 and 15.07% of cases, respectively;  $p < 0.001$ ), while the terms for normalizing body temperature were delayed for more than 5 days in 38.60% of patients with UCTD.

The characteristics of cough did not have significant differences except the long periods of prevalence of this symptom in patients with UCTD among children of both groups.

It was found that the category of children with acute respiratory diseases (5 or more times a year) included 7 patients from group I (65.8%), which is 1.85 times more than in the comparison group (11 children - 35.5 %) ( $p < 0.05$ ).

Normal zinc content is 10.0-18.0  $\mu\text{mol/L}$  in blood serum of children aged from 1 to 5 years.

Our results indicate that the content of serum zinc is slightly higher and ranges from 16.45-28.6  $\mu\text{mol/L}$  with an average of 17.91  $\mu\text{mol/L}$ , that is, it is at the upper norm limit, or exceeds the normal indicator in the comparison group. The average content of serum zinc is slightly reduced in comparison with the indices of the comparison group and varies between 11.83 and 15.82  $\mu\text{mol/L}$  with an average of 14.21  $\mu\text{mol/L}$  in the main group of patients. The trend is statistically significant ( $p < 0.01$ ).

A statistically significant difference was found between the level of blood zinc in boys (15.2[14.2;17.08]) and girls (11.67[11.45;14.71]) in the process of analyzing the obtained data on the level of blood zinc. The trend is statistically significant ( $p < 0.01$ ) (Table 1).

Table 1

**Mg levels in children with acute bronchitis (Me (Lq; Uq))**

Group	1A	1B	2A	2B
Zn, $\mu\text{mol/L}$	14,21 [12,19;13,20]*	16,39 [14,35;18,80]**	13,14 [11,45;15,71]*	17,90 [17,08;18,24]**

Note: \* $p = 0,014$ , \*\* $p = 0,01$ .

### Discussions.

Zn concentration is often used to evaluate inflammatory diseases[14]. In addition, many studies have reported that Zn deficiency can lead to a number of complications, including stunted growth, delayed wound healing, chronic diarrhea, and increased susceptibility to infections[15].

It can also upset the balance between T-helpers of the 1st and the 2nd type, which causes an increase in inflammation; the same mechanism was found in allergic hypersensitivity of the respiratory tract. However, in the process of our study, there was no direct correlation between serum IgE and plasma Zn levels.

During the data analyzing in some studies[16], a reduced Zn content of blood plasma was established with uncomplicated bronchitis and recurrent bronchitis with wheezing syndrome.

During the examination of 130 children from Ankara (65 children with recurrent wheezing(RW) and 65 children without manifestations of wheezing syndrome), the level of Zn in the hair ( $\mu\text{g/g}$ ) in the RW group was lower compared to the comparison group (162,43 $\pm$ 91.52 versus 236.38 $\pm$ 126.44,  $P < 0.001$ )[18].

During the examination of 592 children in north-eastern Brazil the positive and significant bond between low serum zinc level and RW was identified as a positive; children with reduced serum Zn level have almost 1.9-fold increase in RW prevalence rate (OR=1.9;95%CI 1.03-3.53)[17].

Literature data confirm a significant decrease in plasma Zn level among children with formed bronchial asthma (BA).

80 children with BA and checkup participated in the study (Nigeria). Serum Zn level was significantly reduced among children with BA 71.0 $\pm$ 30.3  $\mu\text{g/dL}$  versus 84.2 $\pm$ 31.7  $\mu\text{g/dL}$  ( $p = 0.008$ )[18].

However, in a number of works, such a connection has not been established [19, 20]. During the examination of children from Istanbul(73 children with RW and 75 children without manifestations of wheezing syndrome), the plasma Zn level among children RW was 0.70 $\pm$ 0.13 and 0,73 $\pm$ 0.15 among children in the comparison group ( $P < 0.187$ ).

During the examination of children from urban and rural areas of Saudi Arabia, there were also no statistically significant differences between blood plasma Zn levels among children with wheezing syndrome (114 people) 14.2 $\pm$ 2.2 mg and among children of the control group (202 people) 14.7 $\pm$ 2.3 ( $p < 0.09$ )[20].

According to the literature, the level of blood zinc should decrease under the influence of the severity of the main disease. Our data do not contradict the world literature and indeed have reliable difference between blood zinc levels among children of the main group (patients had significant indicators of a longer course of the disease, and clinical symptoms (cough, fever) were more expressed and stored for a longer time) than among children of the comparison group. Also, children of the main group 1.85 times had 5 or more acute respiratory diseases per year than children from the comparison group. Although the level of blood zinc in both groups remained within the normal range, however, in children of the comparison group, the level of

blood zinc was significantly higher than in children of the main group ( $p < 0.05$ ).

#### Conclusions.

1. Children of the main group (patients with acute bronchitis complicated with wheezing syndrome) are classified as sick with acute respiratory diseases (5 or more times a year) 1.85 times more than in comparison group.

2. The average content of serum zinc is significantly lower among children of the main group in comparison with the indicators of the comparison group ( $p = 0.01$ ). The level of serum zinc is significantly lower in boys ( $p = 0.001$ ) than in the examined girls.

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