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STUDYING THE PARAMETERS OF MICROELEMENTS IN THE BLOOD OF CHILDREN WITH COMMUNITY-ACCOMPANIED PNEUMONIA

Shamsieva E.R.
Tashkent Medical Academy

ABSTRACT

Community-acquired pneumonia (CAP) is an actual problem for pediatric practice. In recent years, there has been an increase in the incidence of CAP in children, and mortality from this disease remains relatively high. In real practice, especially in outpatient settings, early diagnosis and rational therapy of pneumonia in children are serious problems [1, 4, 8]. Meanwhile, over the past decades, a large amount of factual material has been accumulated on the significance of microelements for the human and animal organisms. Based on these data, copper, cobalt, zinc, selenium and other trace elements (14 in total) were identified as essential. Numerous clinical and experimental works are devoted to the study of the characteristics of metabolism and the significance of microelements in various pathological conditions [3,5,6]. The data of clinical studies on the microelement composition of the blood in children with acute pneumonia are not numerous and contradictory, meanwhile, in acute pneumonia, due to toxemia and impaired external respiration, compensatory-adaptive shifts occur in the homeostasis system, in particular, the content of microelements, as factors involved in oxygen transport, tissue respiration, detoxification and repair processes [7].

PURPOSE OF THE STUDY

The study of some indicators of the microelement composition and activity of blood metal enzymes in acute community-acquired pneumonia in school-age children.

MATERIAL AND METHODS

The microelement composition of the blood was studied in 25 children suffering from acute community-acquired pneumonia. Sick children were divided into 2 groups: the 1st group consisted of 10 children with uncomplicated pneumonia and the 2nd group of 15 children with complicated pneumonia. Determination of vital trace elements of copper, cobalt, zinc, selenium in the blood was carried out by the neutron activation method. The content of glutathione peroxidase was determined by the Revin method modified by O.V. Siveren et al. The index of carbonic hydrase in the blood was studied according to the modified method of Ventda.

RESULTS AND DISCUSSION

As can be seen from table No. 1, at the height of the disease with pneumonia, an increase in the content of copper in the blood of patients with pneumonia was noted, which amounted to 19.5 ± 0.4 μg/g. This increase was significant ($P<0.001$) compared with healthy children. When studying the content of cobalt in the blood of this group of patients, an increase in its content was also stated in comparison with the data of the group of patients; an increase in its content was also stated in comparison with the data of healthy 0.0246±0.001 ($P<0.001$). Similar data were obtained by us in relation to the level of zinc in the blood, on average, its content in the blood was 31.4±0.4 μg/g, the significance of the difference ($P<0.001$). In this group of examined

patients, an increase in the concentration of selenium in the blood (0.92±0.05 μg/g) (P<0.001) was also revealed. In almost all patients, an increase in the level of copper in the blood (28.2±0.5 μg/g) was noted upon admission. The difference in comparison with the indicators of healthy people is significant (P<0.001). We noted a similar picture when studying the content of cobalt in the blood (0.292±0.001 μg/g). The difference compared to the control group is significant (P<0.001). The concentration of zinc in the blood also underwent changes. Its content was much higher (34.6±0.3 μg/g) than in healthy children (P<0.001). This group of patients had hyperselenemia. If in patients its content averaged 0.98±0.04, then in healthy children it was much lower (0.66±0.04 μg/g) (P<0.001).

Considering the close relationship between zinc metabolism and the activity of the zinc-containing enzyme carbonic hydrase, selenium and the selenium-containing enzyme glutathione peroxidase, as well as their participation in redox processes, we considered it appropriate to trace the dynamics of their activity in the child's body (Table 2).

Table 1. Microelement composition of blood in acute uncomplicated and complicated community-acquired pneumonia

trace elements (μg/g)	**Healthy**	**Sick**	**P**
Copper	11,1±0,4	19,5±0,4 28,2±0,5	<0,001 <0,001
Cobalt	0,0176±0,001	0,0246±0,001 0,0292±0,001	<0,001 <0,001
Zinc	23,4±0,6	31,4±0,4 34,6±0,001	<0,001 <0,001
Selenium	0,66±0,03	0,92±0,05 0,982±0,001	<0,001 <0,001

Note: P - Reliability of differences in indicators in patients with respect to healthy indicators. In the numerator are indicators in patients with uncomplicated pneumonia, in denominators are indicators in patients with complicated pneumonia.

In uncomplicated pneumonia (Table 2), the activity of glutathione peroxidase and carbonic acidase increased, and averaged 28.1±0.6 units. and 1.7±0.04 units. against the norm 19.6±0.82 units. and 0.68±0.03 units. In complicated pneumonia, an increase in the activity of these enzymes was noted, which amounted to (32.2±0.7 units and 2.2±0.04 units, respectively). Thus, the study of the microelement composition of the blood and the activity of metalloenzymes revealed significant changes in acute pneumonia in children. These changes were expressed in an increase in the content of copper, levels of cobalt, zinc and selenium in the blood. Along with this, an increase in the activity of the enzyme carbonic hydrase and glutathione peroxidase in the blood was noted.

Table 2. Activity of metalloenzymes in acute uncomplicated and complicated community-acquired pneumonia

Metalloenzymes (unit)	Healthy	Sick	P
Glutathione peroxidase	19,6±0,82	28,1±0,6 32,2±0,7	<0,001
Carbonhydrase	0,68±0,03	1,7±0,04 2,2±0,04	<0,001

Note: R - Reliability of indicators in patients in relation to indicators of healthy people. In the numerator are indicators in patients with uncomplicated pneumonia, in denominators are indicators in patients with complicated pneumonia.

The changes depended on the severity of the process. The most pronounced changes were found in a complicated form of pneumonia with respiratory failure, an increase in the content of microelements and the activity of metalloenzymes in the blood with profound disorders of tissue respiration is apparently of an adaptive-compensatory nature, aimed at improving gas exchange between blood and tissues, as well as stimulating cellular respiration. Along with this, a direct pattern was revealed between the content of the trace element selenium, the activity of glutathione peroxidase, and zinc with carbonic hydrase metathalloenzyme.

CONCLUSIONS

The detection of changes in the microelement composition in the body of children is obviously associated with disturbances in oxidative enzyme systems, which include specific metal components. The established facts of violations of the microelement composition of the blood and the activity of the metalloenzymes glutathione peroxidase and carbonic hydrase in the blood dictate the need for corrective, pathogenetically substantiated therapy.

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