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Spectrum of Fatty Acids in Condensate of Children with Acute Pneumonia

Key words: *fatty acids, expirate, condensate, lipid metabolism, pulmonary surfactant system.*

Annotation: *The article contains the results of the research in Biochemistry concerning fatty acids in the condensate in children with acute pneumonia.*

In the general structure of morbidity the diseases of the respiratory tract are common among children. In the Trans-Baikal region it is due to a number of environmental factors including air saturation by various oxidants which significantly affects the blood barrier.

The adaptation to the low temperature conditions is accompanied by tension of all functional systems of the child's body including the intensification of lipid metabolism. It is known that lipid peroxidation processes are required for normal metabolism. They move from the compensatory and adaptive phase to the stage of pathophysiological changes with the destruction of the cell membrane due to the exposure of the extreme environmental factors. The structural and functional disorganization of surface-active agents of the lungs resulting from the activation of non-controlled chain processes of radical formation with the subsequent development of antioxidant deficiency syndrome plays an important role in the pathogenesis of bronchopulmonary diseases. Therefore the study of pulmonary surfactant system in children living in conditions of peroxide stress is very important.

Nowadays the use of new methods in health-technology research of the respiratory system especially in children is expanding. In vivo study of pulmonary surfactant system was carried out in the condensate of vapor exhaled air using a non-invasive method. It was established that expirate obtained from healthy and sick children and adolescents reflects the state of the pulmonary surfactant system .

Materials and methods. We have examined 31 children aged 7 to 14 years with acute pneumonia. Among them 13 children (41.9%) had complications (subgroup B), and 18 (58.1%) hadn't any complications (subgroup A). In patients with complicated forms some more physical manifestations of lung intoxications and cardiovascular disorders were observed. X-ray examination revealed a predominant right-sided localization of the inflammatory focus in the lung tissue (61.3%). The infiltration of the lung in the phase of the disease had polysegmental and lobe character in both forms.

The control group consisted of 50 healthy children and adolescents in the same age group who were treated in hospital for about vascular dystonia and neurotic states. Fatty acid content of the total lipids in the exhaled moisture and in serum of the blood was studied.

Results and discussion. The ratio of the main classes of fatty acids (FA) in the blood serum of patients with acute pneumonia in class A was as follows: the value of saturated FA was 36.54% against 36.48% (control), monoenic FA – 34.93% against 27.20% (control) and polyene FA – 27.53% against 36.34% (control). The amount of indefinite fatty acids was 62.46% against 63.54% (control).

We have found the following distribution of the main families of fatty acids in the blood of the patients with complicated form of pneumonia (subgroup B). The level of saturated FA was 45.39% concerning 39.25% (control); monoenic FA – 35.04% against 28.76% (control) and polyene FA – 19.57% against 32.00% (control). The amount of polyunsaturated FA was 54.61% against 60.76% (control).

In patients with complicated forms of pneumonia the amount of fatty acids was increased by 15.6%, monoenic FA was increased by 28.4% ($p < 0.05$) and 21.8% ($p < 0.05$) in the subgroups A and B. The amount of polyene FA was reduced to 75.8% ($p < 0.01$) and 61.2% ($p < 0.001$) in the control group. The content of palmitate significantly increasing in the blood of patients with complicated form of pneumonia was the main contribution to the pool of saturated FA. In the parallel subgroup various directions of shifts (slight decrease of palmitic acid and increase of stearic acid) helped to keep the total volume of the FA family. The basis of monoenic fatty acids pool consisted a significant increase in the number of C18:1. In the subgroup A the increase of palmitooleinat was noticed. In patients with complicated forms of pneumonia the proportion of polyunsaturated fatty acids was decreased due to significant reduction in the quantities of all registered unsaturated compounds: linoleic acid was reduced by 1.4 times; linolenic one – by 1.6 times and arachidonic acid – by 6.4 times. The absence of specific complications contributed to the multi-direction in concentrations of the given acids: linoleate and arachidonat were decreased by 1.3 times and 1.9 times respectively, and linolenoat was increased by 3.1 times.

Careful analysis of the main fatty acid families in the condensate of vapor exhaled air in children with uncomplicated forms of pneumoniaia showed that saturated FA consisted 61.86% against 68.51% (control), monoenic FA – 17.72% against 12.40% (control) and polyunsaturated fatty acids – 20.42% against 19.09% (control). The amount of unsaturated fatty acids has increased to 38.14% compared to 31.49 % (control).

The general picture of the main fatty acid classes in the condensate of vapor exhaled air in children of subgroup B was as follows: the content of saturated fatty acids was 67.65% compared to 70.16% (control), monoenic FA – 19.96% against 13.74% (control) and polyunsaturated FA – 12.39% against 16.10% (control). The amount of unsaturated FA was 32.35% compared to 29.84% (control).

The detailed characterization of variations in the content of saturated FA of expirate in patients of subgroup A showed the decreasing trend in C14:0, C15:0 and C17:0 with the relative rise of palmitate and fall of stearate in 3.3 times. Similar changes were observed in persons of parallel subgroup. The total volume of unsaturated FA was decreased to 90.3% in subgroup A and to 96.4% in subgroup B. In the structure of monoenic FA there were no any special features. Their number increased in both groups at 42.9% and 45.3% respectively. The level of the polyene FA family remained unchanged compared to the control children in subgroup A due to the increase of C18:2 and C18:3 against reduction of C20:4 to 2.3 times. In complicated pneumonia the deviations from the normal values in the content of C18:2 was not recorded, but there was some decrease of C18:3 and the maximum fall of C20: 4 (4.9 times).

Conclusions. Thus the research confirms the dependence of lipid metabolism in the body and in surfactants of the lungs. The complicated pneumonic process causes the maximal lack of polyene fatty acids in the blood and lung tissue.

The non-invasive method to define the state of the system is informative for estimation of metabolic function of the respiratory apparatus. The application of this simple and available method in pediatric inpatient and outpatient clinics allows to use expirate at early stage of diagnostics and to reveal the effectiveness of membrane stabilizers in treatment.