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Consequences of Cyanobacterial Toxicity and Their Residues in an Organism

ABSTRACT

As a purpose there has been the study of water content with a «flowering» phenomenon, falling into the centralized water system from surface reservoirs and its effect on FAS-ligand content and anticardiolipin antibodies in blood of parturient women and newborns' cord blood from two cities

of the Kharkov region Bogodukhov (the artesian water-supply) and Chuguev (the water intake from Seversky Donets), they being characterized by prolonged «flowering» of the surface. We have found some facts indicating the negative effect of cyanobacteria and their metabolites contained in drinking water and organism as well.

Keywords: water; cyanobacteria; FAS-ligand; anticardiolipin antibodies; parturient woman; newborn.

INTRODUCTION

Reservoirs of Ukraine are mainly polluted by nitrogen compounds, petroleum products, heavy metals. Nowadays the leading suppliers of nitric compounds are dark blue-green algae, or cyanobacterias which are more than 2000 kinds. Thus ecologists notice that the reservoirs where these algae reproduce themselves, other ecological factors are not so important [1, 2, 4, 5].

In Ukraine in many settlements water intake is carried out from the open reservoirs with the phenomena of «water-flowering», that is numerous of reproducing themselves cyanobacterias. The degree influence of the consumption of running water having residues of cyanobacterias on human's health, including parturients has been estimated according to recommendations of Scientific Research Institute of problems of ecology (Kharkov). For this purpose the groups of habitants of two cities of the Kharkov area have been studied – Bogodukhov (artesian water-supply) and Chuguev (water intake from Seversky Donets, where



the long-time «flowering» of water is observed).

Comparative analysis of the data from the histories of births of obstetrician departments of Bogodukhov and Chuguev central district hospitals for the period 2000–2004 years have been conducted. Anaemia of pregnant, diseases of thyroid, frequent spontaneous abortions and premature births, the anomalies during delivery are more frequent, higher index of perinatal mortality are more frequently diagnosed in Chugueve, relative by big number of children with mass of body less than 1999 g are registrated in Chuguev in comparison with Bogodukhov, and number of newborns with body mass more than 3500 g is less in Chuguev. The detailed analysis of peculiarities of pregnancy duration and results of labors in central district hospitals of these two towns for some years is published [8].

Clinical and experimental researches have established, which have been conducted by us before, that levels of some hormones (estradiol, estriol, progesterone, prolactin) in blood of parturients are reliably substantially decreased in women, residents of the settlement with a water-supply from the open reservoir (Chuguev) [7], and also the increase of levels of urea, kreatinine, aminotransferases are observed in this group, which testify the activation of catabolism of proteins, and intensification of the processes of lipids and proteins oxidization against weakening of antioxidant processes activity [6], that indicates the development of oxidizing stress, which is possible as the result of chronic action of cyanobacterias and their metabolites, entering organism with water.

The purpose of the research was the study of influence of consumption of water, entering centralized water system from the open reservoirs with the phenomena of «flowering». Content of FAS-ligand and anticardiolipin antibodies in blood of parturients and umbilical cord blood of newborns has been studied.

MATERIALS AND METHODS

Venous blood of woman in childbirths was taken for research coming for delivery in 34 cases in Bogodukhov central district hospital and in 29 cases in Chuguev central district hospital. Umbilical cord blood in the same cases was taken at the cut of umbilical cord.

For the exception of negative influence of chlorinates water product on an organism,



including biochemical indexes of blood, in Chuguev water used for preparation of food was settled.

Content of FAS-ligand and anticardiolipin antibodies determined in blood by immunological method. Statistical information is processed by the methods of variation and cross-correlation analyses.

RESULTS AND DISCUSSION

Possible reason of previously found by us the increase of proteins catabolism is activation of apoptosis in connection with the toxic loading. For the estimation of level of apoptosis we studied content of FAS-ligand in blood of woman in childbirths. FAS-ligand or CD95-L is a membranous protein, known as a «factor of death», contacts with a FAS-receptor and induces cell death [3].

The sharp increase of level of FAS-ligand content is established in blood of Chuguev habitants ($6,97 \pm 0,47$ pg/ml, $p < 0,001$) as compared to the level of physiological norm ($0,89 \pm 0,06$ pg/ml) and the level of Bogodukhov habitants ($0,95 \pm 0,04$ pg/ml), that is one of integral indexes, testifying the state of chronic intoxication, that means sevenfold increase content in blood of apoptosis marker.

Anticardiolipin antibodies are antibodies to the cellular membranes phospholipids. A certain level of autoantibodies to cardiolipin is present in blood of healthy people, but at its increase develops qualitatively new condition in hemostasis system. These bodies co-operate with the phospholipids of thrombocytes membranes and endothelial cells of vessels, causing their destruction and assisting in thromboses and thromboembolism development.

Growth of concentration of antibodies is sensitive and specific laboratory test, characterizing the risk of thromboembolic complications origin. Death of fetus, abortion, placental separation, oligotrophy and fetus hypoxia at pregnancy due to the thromboembolic damages of trophoblast and placentas are possible [3].

The study of content of anticardiolipin antibodies in blood serum of parturients showed, that their content in woman in childbirths from Bogodukhov corresponds a physiological norm (index of reaction $0,64 \pm 0,03$ at a norm up to 1,0), in parturients from Chuguev was noted considerable increase of antibodies concentration ($1,69 \pm 0,11$). Increased level of anticardiolipin antibodies for Chuguev habitants can be explained by impossibility of rapid and complete utilization of forming wreckages of the own died in the result of apoptosis cells due to, at first, sharp apoptosis activation and, secondary, weakening of phagocytic possibilities in organism. There is start of autoimmune reactions against died cells proteins. It should be noted that antibodies are absent in parturients from Bogodukhov in 45% cases. However antibodies are present in 100% cases in woman in childbirths from Chuguev, in a number of cases index of reaction is higher than 2,0. It is characteristic, that content of antibodies is higher in those parturients which have the higher FAS-ligand level. It is evident, that antibodies formation is not only to cardiolipin but also to the proteins of many other organs, including kidneys, liver, epithelium of mucous membrane of gastrointestinal tract etc.

Moreover, it is established that FAS-ligand content in umbilical cord blood newborns from Bogodukhov corresponds to physiological norm ($1,34 \pm 0,09$ pg/ml, in a control group – $1,29 \pm 0,11$), antibodies to cardiolipin are absent in 100% of cases. FAS-ligand content is increased in umbilical cord blood of newborns from Chuguev ($2,01 \pm 0,14$ pg/ml), in 30% of cases antibodies to cardiolipin are found (reaction index is $1,48 \pm 0,07$). A characteristic feature is that antibodies are present in umbilical cord blood in the cases when and the highest indices of antibodies content are in maternal blood.

COCNLUSIONS

The hemoanalysis of woman in childbirths using different drinking-water showed that increasing of toxic compounds content in an organism, oxidizing stress results to multifold apoptosis intensification found by us in woman in childbirths from Chuguev. It is possibly, that apoptosis activation is associated with the direct action of bioactive substances of algae, because it is found in experimental researches, that they have expressed cytotoxic action.

Oxidizing stress causes tension in immune system state, that, in the end, results in autoimmune processes development (significant increase of antibodies content to cardiolipin has been revealed in our researches).

The levels of content of the studied indexes in umbilical cord blood showed, that toxic action of bioactive substances of algae on a fetus is less expressed, than on the mother's organism, that is related with protective role of placenta. The barrier function of placenta reduces the «level» of damaging factor, however, metabolic violations in an organism of newborn take place, that can become reason of



functional violations in future.

Thus, the data indicating negative influence on an organism of cyanobacterias and them metabolites contained in drinking-water have been found.

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