

EFFECTS OF CELLULAR IMMUNITY IN CONDITIONS OF SURPLUS SUPPLY OF STRONTIUM WITH CONSUMED WATER

Zaytseva N.V., Dianova D.G., Dolgykh O.V.

Federal state institution of science «Federal scientific center of medical-prevention technologies of managing risks to health of population», Perm, e-mail: root@fcrisk.ru

Anthropogenic pollution of environment leads to emergence of immune system malfunction among children. Using the method of flowing cytometry and immune-ferment analysis, we have studied alterations in indexes of immune system among children who consume water with increased contents of strontium. It has been established that expression of early (CD25⁺) and late (CD95⁺) activation antigens on immune cells has been decreased, and expression of anti-inflammatory cytokine IL17 has been increased in statistically-significant values ($p < 0,05$) among the studied children. Intake of chemical polluting substances (strontium) defines development of immune disturbances that can cause heavy pathological processes in an organism.

Keywords: cellular immunity, strontium, water

An impact of anthropogenic chemical factors of various degree of expression create conditions for emergence of stable premises for formation of immune system malfunction among children that can display in disturbance of cellular regulation [2].

The objective of this work is to define special features of immune status among children who consume water with increased contents of strontium.

Materials and methods of research

The research has been carried out at the example of children population throughout various environmental conditions. Biomedical diagnostic studies among children have been carried out according to necessary following of ethical principles of medical-biological researches, described in Helsinki declaration of 1975 and its addendums of 1983. The research has been approved by Ethical committee of Federal scientific center of medical-prevention technologies of managing risks to health of population. Criteria of inclusion into the study are: children from 4 to 7 years of age, residence of the studied territory. Criteria of exclusion are: impossibility or refusal to provide informational approval for participation in the research by parents, participation of the studied children in a different research. All parents (guardians) have signed informational approval for participation in the research and usage of personal data. The observation group was formed of 113 children (an average of $7,20 \pm 0,14$ of age, 50 boys (44,2%) and 63 girls (61%) among them) who constantly live on a territory where waters of low quality according to sanitary-chemical indexes are provided as sources of household-consumable water supply (territory of observation). The control group was formed of 100 children (an average of $6,58 \pm 0,13$ years of age, 39 boys (39%) and 61 girl (61%) among them) who live at the territory of relative sanitary-hygienic wellbeing, where underground soil waters are used as a source of household-consumable water supply (control territory). Groups of observation and control were comparable in their age and gender composition. Selection of the studied has been sufficient for reliable definition of intergroup differences.

In order to define impacts of environment chemical factors upon health condition, we have carried out natural researches of prior polluting substances' (strontium) contents in water of household-consumable purpose at territories of research. Study of bioenvironments (blood) for metal contents (strontium) has been carried out upon

atomic-absorption spectrophotometer of produced by «Perkin Elmer 3110» (USA) with implementation of acetylene-air composition as an oxidant and detection in regime of flame atomization as well as state standard specimen solutions of the studied metals in accordance with methodical guidances [3].

Definition of lymphocytes' populations (CD25⁺, CD95⁺) has been carried out via method of membrane immunofluorescence with implementation of panel of marked monoclonal antibodies to membrane CD-receptors «Becton Dickinson» («BD», USA), besides, no more than total of 10000 events have been registered simultaneously. In order to identify membrane markers of apoptosis, we have used suspension of mononuclear cells of peripheral blood, singled out by centrifugation in gradient of ficoll-voidigen density («Pharmacia Fine Chemicals», Sweden) [5]. Cytokines (IL7) have been defined by immune-ferment analysis (tests-systems, produced by «Vector-Best», Novosibirsk, Russia) at analyser «Elx808IU» (Biotek, USA).

To select criterions of evaluating significance of intergroup differences of averages, we have tested correspondence of forms of selective distributions to normal, using criterion χ^2 , and also controlled equality of general dispersions with F-criterion of Fisher. In case of inclination from normal distribution non-parametric U-criterion of Mann-Whitney has been used to compare the data. In case of correspondence between the received data and this normal distribution t-criterion of Student has been used. The research results are provided as an average value (M) and average error (m) of the studied indexes. The achieved level of significance (p) has been calculated in all procedures of statistical analysis, besides, critical level of significance in this research has been set as 0,05 [1, 4].

Results of research and their discussion

Increases in utmost acceptable concentrations of strontium have been registered in water samples, taken at observation territory during evaluation of household-consumable water supply quality (Table 1). The part of non-standard samples according to strontium contents equaled 16,7%. Strontium contents in water supply of the control territory do not exceed maximum permissible concentration according to SanPiN 2.1.4.1074-01 «Consumable water. Hygienic requirements towards water quality of centralized systems of consumable water supply. Quality control».

Table 1

Results of chemical analysis of consumable water of observation territory (exposition to strontium) and control area ($M \pm m$)

Territory	Place of water probing	Strontium, PDC = 7,0 mg/l	
		Concentration, mg/l	Part of PDC
Control	Water from faucet	0,71 ± 0,06	0,10
Observation	Water from faucet	7,8 ± 0,62	1,11

According to results of chemical-analytic research, we have established that strontium contents in blood samples of observation group children have been increased by 2,9 ($p < 0,05$) in relation to average-group contents of the analysed component in bioenvironments of control group children (Table 2).

Evaluation of immune state of all studied children has shown that number of early

CD25⁺-lymphocytes and late CD95⁺-lymphocytes has been decreased ($p < 0,05$) in comparison to results, received from children who live on territories of relative sanitary-hygienic wellness. Analysis of cytokine status has shown that expression of IL17 is increased ($p < 0,05$) among children of observation group in comparison to the similar index of control group children.

Table 2

Exposition markers and markers of immune system effect among studied children who live in different conditions of sanitary-hygienic wellness of environment ($M \pm m$)

Indexes	Control group ($n = 100$)	Observation group ($n = 113$)
Strontium, mg/dm ³	0,0442 ± 0,00424	0,11055 ± 0,01111 ^p
CD25 ⁺ , %	6,29 ± 0,30	4,70 ± 0,53 ^p
CD25 ⁺ , 10 ⁹ / dm ³	0,16 ± 0,01	0,15 ± 0,02 ^p
CD95 ⁺ , %	27,13 ± 1,05	15,82 ± 1,60 ^p
CD95 ⁺ , 10 ⁹ / dm ³	0,67 ± 0,03	0,52 ± 0,08 ^p
IL17, pg/cm ³	0,54 ± 0,07	1,68 ± 1,73 ^p

Note. ^p is a difference between groups of observation and control according to average values $p < 0,05$.

Thus, alteration of activation and regulatory markers of cellular immunity is registered among children who live in conditions of environmental impact of strontium, and this phenomenon can be one of pathogenic mechanisms of immune system malfunction development. It has been established that reliable ($p < 0,05$) alteration in immune response among children, exposed to impact of strontium is related to decrease in expression of early (CD25⁺) and late (CD95⁺) activation antigens on immunocytes and increase in expression of anti-inflammatory cytokine (statistically-reliable ($p < 0,05$) increase in IL17).

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