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ECOLOGIC CONSTITUENT OF RISK OF REPRODUCTIVE COMPLICATIONS

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Abstract

Technogenic pressure contributes to the constant emission of significant amounts of chemical pollutants in the environment, thus increasing the risk of ecologically conditioned pathology in the population of urbanized areas. Of the variety of environmental factors that have a detrimental effect on the body of a future mother, cadmium plays a particularly important role as a risk factor for complications in the course of pregnancy. Therefore, the purpose of the research was to determine the influence of external exposures of cadmium on

the level of internal contamination of the body of pregnant women and the frequency of manifestation of nephropathy among residents of Dnipropetrovsk region in the complex impact of different levels of environmental pollution. The research program included an assessment of the cadmium content in life-saving environmental facilities and biological substrates of 89 healthy pregnant women, as well as a retrospective analysis of data of the primary statistical documentation on the complication of pregnancy. It is established that cadmium has a constant presence in environmental objects, in concentrations that do not exceed the normative meanings. The level of cadmium in the blood and urine of women in industrial districts is significantly higher in comparison with the control ($p < 0.01$), up to 36-50% of Dnipro citizens have an increased cadmium content in urine relative to norm, and its concentrations have a direct correlation dependence with the frequency of manifestations of nephropathy of pregnant women in apparently women. The established enhanced renal excretion of cadmium reflects the stresses of adaptation processes in the body of the pregnant woman, which is possibly due to an increase in the toxic effect of xenobiotics in this vulnerable to the physiological state period.

Key words: pregnant women, cadmium, blood, urine, nephropathy of pregnant women.

Anthropogenic transformation of natural ecosystems in some regions of Ukraine, in particular in the Dnipropetrovsk region, is accompanied by man-made load both on the environment and on the population. The incidence rate among the population in this region is higher than the average Ukrainian almost by 1.5 times. The mortality rate of the population over the last 15 years has steadily exceeded birth rate, the negative population growth is 1.2-1.5 in different regions of the oblast [1, p. 36].

Under the influence of ecological stress-factors of chemical nature, the body's resistance decreases, homeostatic functions, adaptive-compensatory processes are violated, an "ecological maladaptation" syndrome and ecologically determined pathology arise, general morbidity increases. Therefore, the problem of studying peculiarities of the impact of heavy metals on a human being, cadmium compounds in particular, which are the priority toxicants of the environment [2, p. 8-30] is relevant. The distribution of cadmium in the environment of large cities is due to technogenic contamination with the emissions of metallurgical enterprises, sewage from galvanic plants and other industries, which use cadmium-containing stabilizers, pigments, paints, materials, as well as the result of using phosphate fertilizers,

storage and processing of industrial wastes. The object of anthropogenic emission of cadmium is cigarette smoke [3, p.126]. With the increased content of cadmium in the human environment, its concentration in the biological mediums increases. The peculiarity of the harmful effects of cadmium is its rapid absorption by the body and slow release, which leads to the cumulation of this metal in the tissues. Thus, during reproductive life the content of cadmium in the blood plasma of women increases up to 74.7% relative to the initial period of reproduction [4, p. 220-221]. Due to the long period of half-life (up to 30 years) for a person, the deposition of cadmium in the body is life-long and the total weight of the metal in the human body can reach 30-50 mg. The main "repository" of cadmium in the body is the kidneys (30-60% of the total amount) [5, p. 105], and the level of toxicant content in this organ characterizes the intensity of the cadmium load on the body [6, p. 53; 7, p.184]. Cadmium is a poison of polytropic action, which determines the diversity of pathogenetic mechanisms of its influence, including the manifestation of toxic nephropathy [8, p. 251-253; 9, p.42]. Particularly acute is the problem of the influence of cadmium on the reproductive function, on the mother-featus complex in particular.

In this regard, the problem of the long-term effects of cadmium on the sensitive population, in terms of possibly hidden, time-varying changes in the body, which have negative consequences in manifestation of reproductive complications during pregnancy is of particular interest [10, p. 33].

The aim of the study was to determine the effect of external exposure of cadmium on the level of internal contamination of the body of pregnant women and the frequency of manifestation of nephropathy in residents of Dnipropetrovsk region in the complex impact of various levels of environmental pollution.

Materials and methods. The research program included the assessment of the cadmium content in the air, drinking water, food in the areas under observation, and conducting of biological montoring in the blood and urine of 89 women with physiological pregnancy through the atomic absorption spectrophotometry. The examined subjects were divided into three groups depending on the place of permanent residence: 1st and 2nd groups - women of the Industrial and Novokodatsky district of Dnipro, the 3d group (control) - women who live in the city of comparison - Novomoskovsk, Dnipropetrovsk region. Epidemiological studies were carried out by means of a retrospective analysis of the data of the primary statistical documentation as for the complication of pregnancy of the residents of the monitoring areas. The obtained results were processed by means of traditional methods of variation statistics using Microsoft Excel licensed computer programs and Statistica 10.

Results and discussion. The results obtained by us indicate that cadmium is constantly defined in the environmental objects of industrial areas within the limits of maximum permissible concentrations, but in the control city xenobiotic is determined in the air and drinking water samples periodically, with statistically-valid lower content than in the districts of Dnipro.

In the blood of women cadmium is determined at concentrations of 0.01-0.17 μg/ml. In women of the group I this value is on average 0.062 ± 0.004 μg/ml, which is significantly lower ($p < 0.01$) than in pregnant women of the group II - 0,092 ± 0,006 μg/ml. The content of cadmium in the blood of the examined subjects of the control group is 0,028 ± 0,002 μg/ml, which is significantly lower ($p < 0,01$) than in women of Dnipro. By the average and maximum values, cadmium in the blood of the inhabitants of the observation areas does not exceed the normative content - 0.3μg/ml. But in 96.7% of pregnant women in the Novokodatsky district, the concentration of cadmium in the blood is higher than 0.02 μg/ml, which is considered to be the limit of presence of metal for this toxicant. In the Industrial district in 18% of the examined subjects presence of cadmium in the blood has been identified.

The concentration of cadmium in the urine of pregnant women ranges from 0.006 to 0.253 μg/ml. Its average concentrations for women of the I group is 0.079 ± 0.01 μg/ml, which is practically at the level of the normative value - 0.08 μg/ml. For the II group, the average value of cadmium in urine is higher by 10% than the standard and makes up 0.89 ± 0.006 μg/ml. Despite the fact that the average concentration of this metal in the urine of women in group I is by 11% lower than in the group II, no statistically-valid evidence of this difference was obtained ($p > 0.05$). In the control group, the concentration of cadmium in the urine is on average 0.034 ± 0.004 μg / ml, which does not exceed the normative one and reliably ($p < 0.01$) lower than in women of Dnipro. In addition, in 36% of women of group I, in 50% of women of group II, the level of cadmium in urine is higher than the standard. In the control group, only 7.7% of pregnant women have an increased value of this indicator.

The largest amounts of cadmium are registered in the body of the inhabitants of the Novokodatsky district. Thus, its average content in the blood exceeds the data of the industrial region by 1.5 times, and in urine - by 0.01 μg / ml. Compared to the city of Novomoskovsk, the average value of cadmium in the blood is 3.3 times lower and in urine it is 2.6 times. Correlation analysis revealed a statistically significant ($p < 0.05$) positive relationship between the concentration of cadmium in the blood and its content in the urine in the three groups.

The incidence of nephropathy of pregnant women made up 6.95 ± 0.73% for women in the industrial region, 9.72 ± 0.76% for Novokodatsky, 4.58 ± 0.26% for Novomoskovsk, with a statistical difference between all areas under observation, a tendency to link with cadmium content in drinking water ($r = 0.76$; $p < 0.1$), as well as a correlation-consistent dependence with the amount of toxicant in female biosubstrates. Considering reliably increased cadmium content in the organism of women of the II group in comparison to the data of other areas surveyed, it is possible to assume an unfavorable man-made influence on the system of adaptation of women's body during pregnancy with the further development of nephropathy.

Conclusions. The environment of the areas under observation has a contrast content of xenobiotic. Despite the fact that the content of cadmium in women's blood in experimental regions by the average values was within the norm, 55% of the subjects examined are estimated to have metal presence, along with this in 36-50% of residents of the city of Dnipro the concentrations of metal-toxicants in urine exceed the permissible values. The level of body contamination with cadmium has a correlation dependence with the frequency of manifestation of nephropathy of pregnant women in apparently healthy women. The established enhanced renal excretion of cadmium reflects the strain of adaptive processes in the body of pregnant women, which is possibly due to its increased toxic effect in this vulnerable period for the physiological state. Over time, the growth of a negative effect on cellular metabolism causes damage to the morphofunctional structure of the kidneys and leads to pathological conditions,being a risk factor for reproductive complications. In the conditions of the long-term intake of harmful chemical factors of the environment into the body of a pregnant woman, an increase in the content of toxic metals in the urine, in most cases, is observed earlier than biochemical and much less than clinical changes, and in the context of external intake is an informative indicator of the body's load.

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