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ASSESSMENT OF THE ADVERSE ENVIRONMENTAL FACTORS INFLUENCE ON THE ORGANISM OF PREGNANT WOMEN

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ОЦІНКА ВПЛИВУ НЕСПРИЯТЛИВИХ ЧИННИКІВ НАВКОЛИШНЬОГО СЕРЕДОВИЩА НА ОРГАНІЗМ ВАГІТНИХ ЖІНОК

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ОЦЕНКА ВЛИЯНИЯ НЕБЛАГОПРИЯТНЫХ ФАКТОРОВ ОКРУЖАЮЩЕЙ СРЕДЫ НА ОРГАНИЗМ БЕРЕМЕННЫХ ЖЕНЩИН

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Summary/Резюме

From the standpoint of the hygienic significance, the chemical factor occupies the priority place in the spectrum of the harmful factors of human existence conditions, among which the attention is drawn to the compounds of HMs, because their influence on the population determines the diversity of pathogenic mechanisms.

The aim of the work was to determine the influence of environment, polluted by HMs on the organism of pregnant women — residents of Dnipropetrovsk Region.

Materials and methods. The work is based upon the long term complex research (2001 — 2017) which was conducted by the Department of General Hygiene of SI «DMA».

Results. The obtained results show that HMs are constantly determined in the environmental objects of the industrial areas within the limits of the MPC, but in the control city the xenobiotics in the air and drinking water samples were determined periodically, with statistically significant lower content — up to 30 times than in the industrial districts of Dnipro. Thus, despite the relatively low concentrations of HMs in environmental objects, their systematic intake is causing a significant internal contamination of the human's body, what in its turn leads to the increased risk of the arise of reproductive complications of women, who live on technogenically polluted areas. Presumably, the contradictory character of these data is associated with the ability of the HMs to be accumulated in the human's body, with the significant period

of biological half-decay, and with the ability to cumulate.

Key words: pregnant women, heavy metals, lead, cadmium, blood, urine.

З точки зору гігієнічної значущості хімічний фактор займає пріоритетне місце в спектрі шкідливих факторів умов існування людини, серед яких особливої уваги заслуговують сполуки важких металів, оскільки їх вплив на популяцію визначається різноманітними патогенними механізмами. Зазначена проблема є актуальною для промислових регіонів України, тому метою роботи було визначення впливу ТМ на організм вагітних жінок – мешканок Дніпропетровської області. Отримані результати свідчать, що важкі метали постійно визначаються в об'єктах навколишнього середовища промислових зон в межах гранично допустимих концентрацій, але в контрольному місті ксенобіотики у пробах повітря і питної води визначалися періодично, зі статистично значущим більш низьким вмістом — до 30 разів менше, ніж в промислових районах м. Дніпро. Незважаючи на відносно низькі концентрації ксенобіотиків в об'єктах навколишнього середовища, їх систематичне надходження викликає значне внутрішнє забруднення організму людини, що проявляється в підвищеному вмісті свинцю і кадмію в біосубстратах у порівнянні з фізіологічними значеннями. Вищевказане є причиною підвищеного ризику виникнення репродуктивних ускладнень у жінок, що живуть на техногенно забруднених територіях. Імовірно, суперечливий характер цих даних пов'язаний зі здатністю накопичення важких металів в організмі людини і значним періодом біологічного напіврозпаду.

Ключові слова: вагітні жінки, важкі метали, свинець, кадмій, кров, сеча**.**

С точки зрения гигиенического значения химический фактор занимает приоритетное место в спектре вредных факторов условий существования человека, среди которых особого внимания заслуживают соединения тяжелых металлов, поскольку их влияние на популяцию определяется разнообразными патогенными механизмами. Указанная проблема особенно актуальна для промышленных регионов Украины, поэтому целью работы было определение влияния ТМ на организм беременных женщин — жительниц Днепропетровской области. Полученные результаты показывают, что тяжелые металлы постоянно определяются в объектах окружающей среды промышленных зон в пределах предельно допустимых концентраций, но в контрольном городе ксенобиотики в пробах воздуха и питьевой воды определялись периодически, со статистически значимым более низким содержанием — до 30 раз меньше, чем в районах г. Днепр. Несмотря на относительно низкие концентрации ксенобиотиков в объектах окружающей среды, их систематическое поступление вызывает значительное внутреннее загрязнение организма человека, что проявляется в повышенном содержании свинца и кадмия в биосубстратах по сравнению с нормой. Вышеуказанное является причиной повышенного риска возникновения репродуктивных осложнений у женщин, живущих на техногенно загрязненных территориях. Предположительно, противоречивый характер этих данных связан со способностью накопления тяжелых металлов в организме человека и значительным периодом биологического полураспада.

Ключевые слова: беременные женщины, тяжелые металлы, свинец, кадмий, кровь, моча.

Introduction

The problem of limiting the adverse effects on human's organism is becoming increasingly relevant in connection with the development of the industry nowadays [9]. In particular the emissions of industrial enterprises, transport and the use of agrochemicals are the main causes of environmental pollution. On this point Dnipropetrovsk Region is the most illustrative example, where the largest source of environmental pollution is concentrated [4].

Chemical pollutants occupy a special place among the anthropogenic loading, because they are actively used in all branches of the economy and industry. For its turn heavy metals (HMs) and their compounds form a significant group of toxicants among chemical agents and their migration is carried out according to the conventional scheme: sources of pollution (emissions, drains) — depositing environments (ground, bottom sediments) — life-supporting environments (air, water, food products) — human body [2, 12].

According to WHO experts, HMs pollution of the environment occupies the third place after pesticides and radioactive contamination. This problem is particularly acute for Ukraine, as it is one of the most developed countries with a great industrial potential [3, 5]. HMs can be characterized by their stability, global prevalence, duality of bio effects, the ability to accumulate in the body both in objects of the environment and in biosubstrates, provoking a risk for health even in small concentrations of these xenobiotics [1, 6, 11].

In this regard, **the aim** of the work was to determine the influence of environment, polluted by HMs on the organism of pregnant women — residents of Dnipropetrovsk Region.

Methods and techniques of research

The work is based upon the long term complex research (2001 — 2017) which was conducted by the Department of General Hygiene of SI «DMA» as a fragment of State scientific work of the Ministry of Health of Ukraine: «Complex clinical-hygienic foundation of pregnant women's health preservation and strengthening measures during great industrial agglomeration (State registration N 0106V001588) and the fragment of scientific research work: "Hygienic diagnostics ecologically dependant microelementosis formation within the population of industrial region and its prevention" (State registration N 0114U005582).

Existence of environmental pollution sources by HMs, its power and the value of contribution in the general amount of emissions are the basis of the selection of the districts which are explored. Industrial districts of Dnipro, which appeared to be the most suitable for our research goals and tasks, were Industrial and Novokodatsk districts. Novomoskovsk was selected as a control town (it is 26 km to Dnipro) which was the most suitable for this: there were not many industrial objects there, the volume of the HMs emissions was 10 times less than in Dnipro itself. The main source of air pollution in this town was mainly exhaust fumes [4]. The water supply was carried out by a separate water pipe. On the first stage of the programme in the residential areas there were systematic air, drinkable water, stable foods sample analyses. With the help of atomic-absorbic method the lead and cadmium contents were found, in accordance with general normative documents requirements the hygiene estimation of received concentrations was done.

Metals biomonitoring was the next stage, which is considered by the method of the degree of harmful factors in the environment and it is necessary for hygienic research [8, 9]. While the defining

of the toxicants contents in pregnant women's blood and urine, women were divided into 3 groups according to their residence: the I and II groups were formed by those who lived in Dnipro (Industrial and Novokodatsk districts) and the group III is a control one — formed by Novomoskovsk residents. For the check — out 89, women who were totally healthy, aged 20-25, without professional harmfulness, without somatic and hereditary diseases and without bad habits had been selected. They had a normal pregnancy process in the second trimester.

Statistical processing of the results was carried out using statistical software packages of statistical analysis Statistica v.6.1 (StatsoftInc., США, licence N AJAR909E415822FA), Microsoft Excel.

Results and their discussion

The research results indicate the presence of lead in 91.7 % of samples in the atmosphere of Novokodatsk district, as for cadmium it is 59 %. In the air of Industrial district we can clearly see the continuous lead availability while cadmium can be found only in 75 % of samples. Along with that there is 100 % presence of these metals in the drinking water of both industrial areas. In the drinking water, which supplies Industrial district, the average monthly lead concentration sometimes reached the upper limit of the norm — 0.01 mg/dm^3.

Statistically significant is the fact of xenobiotics lower content in the air and drinking water samples of the control city, which were periodically taken in different districts of Dnipro. As for Dnipro foodstuffs contain toxic metals in concentrations not exceeded the corresponding maximum permissible concentration (MPC), except for the lead content of 0.12 mg/kg in edible fats with the MPC that makes 0.1 mg/kg. Analysis of lead and cadmium content in the examined products of Novomoskovsk shows that the concentrations of these metals do not have significant differences with the data of Dnipro, except for the group of edible fats, in which the average lead content is 30 times, and cadmium — 3.5 times less than in Novomoskovsk. In general, the average monthly concentrations of lead and cadmium in the environmental objects of the monitoring areas did not exceed the corresponding MPC in most cases.

The analysis of the biomonitoring data (table 1) of the women of three study groups indicates that the concentration of lead in the blood varies from 0.11 мg/ml to 0.77 мg/ml and this coincides with the data [13, 14] of women with the physiological gestation, who live in other industrial cities.

The average lead value in the blood for the Group I is 0.35 ± 0.027 мg/ml higher than that of women of the Group II ($p < 0.05$) and the Group III ($p < 0.01$) — 0.27 ± 0.017 мg/ml and 0.18 ± 0.007 мg/ml, respectively. On average, the blood lead level of pregnant women in the Group II is 33 % higher than that of women of the third group, which has been statistically significantly confirmed ($p < 0.01$). Average values of lead content in the blood of pregnant women who live in industrial and comparative cities do not exceed the intoxication limits — 0.4 mg / ml [7]. But there is an increase of lead concentrations in the blood relative to the physiological norm in 24 % of the surveyed of Industrial District and 6.7 % of the women of Novokodatsk District. At the same time 60 % of pregnant women of the Group I, and 76.6 % of the Group II and 30 % of the Group III have blood lead content which determined within the limits carrier state — from 0.2 to 0.4 мg/ml [7]. Only 16 % of women examined in the Industrial District and 16.7 % of Novokodatsk have blood lead concentrations that correspond to the existing physiological standards while this

indicator in is much higher Novomoskovsk and attains 70 %. Despite the fact that the lead content in the blood of women of the control city is reliably lower than such of the industrial city, this level exceeds the data for unpolluted territories [15].

The urine of examined women contains lead in concentrations varying from 0.01 to 0.103 мg/ml. The average values of lead in urine are 0.043 ± 0.004 мg/ml for the Group I, 0.038 ± 0.002 мg/ml for the Group II and 0.025 ± 0.002 мg/ml for the Group III corresponding to the norm which is 0.04 мg/ml [7], except for the values for the inhabitants of Industrial District. In this case the concentration of lead in the urine of women in the Industrial region is 11 % higher than in Novokodatsk, but without statistically significant differences ($p > 0,05$). It is typical that the content of this metal in the urine of women in the comparative city is reliably 0.013-0.018 мg/ml lower ($p < 0.01$) than of women of Industrial District. There is no single pregnant woman of the examined control group with the lead excess in urine, while in 44.8 % of pregnant women in the Group I and in 40 % of the Group II this index is higher than the standard. As in the blood so in the urine, the average lead content of examined women in Industrial District is 1.3 and 1.13 times higher than the one women in the Novokodatsk District had. In comparison with Novomoskovsk, this index almost 2.0 and 1.72 respectively higher in the blood and urine.

The cadmium level in the blood of women varies from 0.01 to 0.17 мg/ml and coincides with similar data of technogenicly polluted areas [11, 14]. This value of women of the Group I is on average 0.062 ± 0.004 мg/ml, which is statistically lower ($p < 0.01$) than for pregnants of the Group II — 0.092 ± 0.006 мg/ml. The content of cadmium in the blood of the examined control group is 0.028 ± 0.002 мg/ml, which is significantly lower ($p < 0,01$) than in women of Dnipro. Average and maximum values of cadmium in the blood of inhabitants of the observation areas do not exceed the normative content — 0.3 мg/ml [7]. But 96.7 % of pregnant women of Novokodatsk District have higher than 0.02 мg/ml concentrations of cadmium in the blood, which considered to be the limit of carrier state of this toxicant. In the Industrial District the carrier state of cadmium in the blood was found in 18 % of the examined women.

Table 1

Average concentrations of heavy metals in the blood and urine of pregnant women, who are residents of Dnipro and Novomoskovsk (M ± m)

Groups of observation		Heavy metals, μg/ml			
		Lead		Cadmium	
		Blood	Urine	Blood	Urine
I	Industrial District Dnipro (n = 33)	0.350 ± 0.027	0.043 ± 0.004	0.062 ± 0.004	0.079 ± 0.01
II	Novokodatsk District Dnipro (n = 30)	0.270 ± 0.017	0.038 ± 0.002	0.092 ± 0.006	0.089 ± 0.006
III	Novomoskovsk District (n = 26)	0.180 ± 0.007	0.025 ± 0.002	0.028 ± 0.002	0.034 ± 0.004
Reliability		$p_{I-II} < 0.05$ $p_{II-III} < 0.01$ $p_{I-III} < 0.01$	$p_{I-II} > 0.05$ $p_{II-III} < 0.01$ $p_{I-III} < 0.01$	$p_{I-II} > 0.05$ $p_{II-III} < 0.01$ $p_{I-III} < 0.01$	$p_{I-II} > 0.05$ $p_{II-III} < 0.01$ $p_{I-III} < 0.01$
Physiological limits of normal range	Norm	0.2		0,02	
	Carrier state of HMs	0.2-0.4		0.02-0.3	
	Intoxication	above 0.4	0.04	above 0.3	0.08

The urine concentration of cadmium of pregnant women varies from 0.006 to 0.253 мg/ml. An average cadmium concentration of women in the Group I was 0.079 ± 0.01 мg/ml, which is practically at the level of the normative value which amounts to 0.08 мg/ml [7]. For the Group II, the

average value of cadmium in urine was 10 % higher than the standard and was 0.89 ± 0.006 мg/ml. Despite the fact that the average concentration of this metal in the urine of women in Group I was 11 % lower than the data of the second group of the examined women, no statistically significant evidence of this difference was obtained ($p > 0.05$). In the control group the concentration of cadmium in the urine was on average 0.034 ± 0.004 мg/ml, which is lower than the norm and reliably lower ($p < 0.01$) than that of women in Dnipro. In addition, 36 % of women in the Group I, and 50 % of women in the Group II have higher value of cadmium in urine than standard. Only 7.7 % of pregnant women in the control group have increased levels of toxicant in urine.

The largest values of cadmium are registered in the body of the inhabitants of Novokodatsk District. Whereas its average concentrations in the blood of pregnant women of Group II are 1.5 times higher than that of the women living in Industrial District, urine concentrations of study Group II are on 0.01 мg/ml higher. Comparing with Novomoskovsk, the average cadmium value is 3.3 times and 2.6 times higher in the blood and in the urine correspondingly. Correlation analysis revealed a statistically significant *($p < 0.05$)* positive connection between the concentration of cadmium in the blood and its urine content of three study groups.

Conclusions

Thus, despite the relatively low concentrations of HMs in environmental objects, their systematic intake is causing a significant internal contamination of the human's body, what in its turn leads to the increased risk of the arise of reproductive complications of women, who live on technogenically polluted areas. Presumably, the contradictory character of these data is associated with the ability of the HMs to be accumulated in the human's body, with the significant period of biological half-decay, and with the ability to cumulate [2, 5].

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КЛИНИКО-ЛАБОРАТОРНАЯ ХАРАКТЕРИСТИКА ОСТРОГО ПОВРЕЖДЕНИЯ ПОЧЕК У БОЛЬНЫХ С ДОБРОКАЧЕСТВЕННОЙ ГИПЕРПЛАЗИЕЙ ПРЕДСТАТЕЛЬНОЙ ЖЕЛЕЗЫ

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КЛІНІКО-ЛАБОРАТОРНА ХАРАКТЕРИСТИКА ГОСТРОГО ПОШКОДЖЕННЯ НИРОК У ХВОРИХ НА ДОБРОЯКІСНУ ГІПЕРПЛАЗІЮ ПЕРЕДМІХУРОВОЇ ЗАЛОЗИ

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CLINICAL AND LABORATORY CHARACTERISTICS OF ACUTE KIDNEY DAMAGE IN PATIENTS WITH BENIGN PROSTATIC HYPERPLASIA

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Summary/Резюме

It is now known that the problem of acute kidney damage (AKI) is quite extensively addressed throughout the world. Considering the data on the prevalence of benign prostatic hyperplasia (BPH), it is known that among the male population, symptoms of the lower urinary tract by the age of 60 to some extent are detected in ap-