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PECTIN THERAPY IS A METHOD OF PREVENTION OF REPRODUCTIVE LOSSES ASSOCIATED WITH INTRAPLACENTARY ACCUMULATION OF RADIONUCLIDES

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Summary

To date, environmental factors play a decisive role in the pathogenesis of miscarriage. The ecology of Ukraine suffered due to the accident at the Chornobyl NPP, which has no analogs in terms of the number of radionuclides that entered the environment, the area affected, and the consequences. In modern conditions, people are exposed to radioactive substances through food. Among the 200 radionuclides that have entered the environment,^{137}Cs represent the greatest danger in the long term due to soil and water contamination. Internal radiation is one of the causes of reproductive losses. The accumulation of^{137}Cs in the placenta disrupts its architecture, functionality, and peroxide hemostasis. Detox defects due to^{137}Cs require correction to prevent reproductive losses.

***Aim of the study:** to determine the effectiveness of pectin therapy in preventing reproductive losses associated with the incorporation of^{137}Cs into the placenta.*

***Materials and methods.** According to the study design, the first (research) group included 153 women with reproductive losses in anamnesis and signs of termination of the current pregnancy; the second (control) group included 30 women with an uncomplicated history and pregnancy. The article is based on the results of past studies, which relate to the peculiarities of the functioning of the detox system in the event of miscarriage due to the accumulation of^{137}Cs in the placenta. We found a connection between the redox processes, pregnancy scenarios, and^{137}Cs activity in the placenta. Taking into account that one cause of miscarriage is the reaction of the placenta to^{137}Cs, measures preventing reproductive losses included «Apple Pectin Antioxidant» («APA») with high sorption potential. The effectiveness of therapy was evaluated by dividing pregnant women into subgroups: 1A – without «APA» and 1B – with «APA». The criteria for treatment effectiveness were indicators of antioxidant protection and pregnancy scenarios.*

Statistical data analysis was performed using Microsoft Excel (2016) and Fisher angular transformation. The difference between comparative values was considered significant at $p < 0.05$ (probability index greater than 95 %).

Permission to conduct research was obtained from the Medical Ethics Committee of the SI «Institute of Pediatrics, Obstetrics, and Gynecology named academic Elena M. Lukyanova of the National Academy of Medical Sciences of Ukraine» (protocol No 3 of 07.06.2017).

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***Research results.** It has been established that internal irradiation with incorporated radiocesium disrupts the architecture and functional capacity of the placenta. Accumulation in the placenta up to 1.0 Bq/kg of^{137}Cs does not affect the course of pregnancy. The compensatory capacity of the placenta remains preserved with the accumulation of 1.1 to 4.4 Bq/kg of^{137}Cs. Internal irradiation with an activity of 4.5-10.4 Bq/kg^{137}Cs damages the maternal stroma of the placenta and premature birth at 28-36^{+6} weeks. As a result of the accumulation of more than 10.4 Bq/kg of^{137}Cs, maternal and fetal structures of the placenta are damaged, which leads to early premature birth and antenatal death of the fetus.*

The biochemical amplifier of the radiation effect is the activation of lipid peroxidation (LPO). Malondialdehyde is an indicator of LPO activation. An increase in the content of MDA in blood in the 1st trimester by 8.7 % against the reference values is acceptable. An increase in MDA by 17.4 % is a trigger for late preterm labor. An increase in MDA by 23.4 % indicates a high probability of early preterm birth. Superoxide dismutase is a powerful antioxidant capable of neutralizing POL products. A manifestation of oxidative stress and a trigger for premature birth is a decrease in the activity of SOD in the blood by more than 11.1 % against the reference values. Decreased activity of SOD in the blood in 2nd trimester by 26.3 % indicates decompensation of antioxidant protection, which leads to early premature birth and antenatal fetal loss.

***Conclusions.** It is impossible to develop optimal measures for the treatment and prevention of miscarriage with universal effectiveness due to the multifactorial nature of pathology. Using «APA» as part of the pathogenetic therapy of miscarriage allows you to count on its high efficiency. The effectiveness of «APA» is explained by the minimization of the radiation effect on the placenta due to the accelerated removal of^{137}Cs while maintaining the functional capacity of the placenta. Against the background of «APF», there is a decrease in the deficiency of SOD and the excess of MDA in the blood, an increase in the number of timely births by 27.9 %, and a decrease in cases of premature births by 11.4 %, and spontaneous abortions by 11.0 %, and halt develop of the embryo by 5.5 %. Thanks to «APA» it was possible to get rid of early preterm births, which led to a 0.9 % increase in the frequency of late preterm births. At the same time, the minimum gestation age for premature births has been increased to 34 weeks, which improves the prospects of newborns. It is advisable to prescribe «APA» from the pre-gravid period and during pregnancy to all women, regardless of the region of residence.*

***Keywords:** Pregnancy Failure; Placenta;137Cs; Internal Radiation; Lipid Peroxidation; Antioxidant Protection; Pectin Therapy.*

Introduction

To this day, miscarriage remains an actual problem of practical obstetrics. The frequency of miscarriage in Ukraine reaches 25 % [1-3]. The causes of miscarriage are various [1-11]. Despite a wide range of known factors, it is impossible to establish the reason for the termination of pregnancy in 41,2 % of women [1, 2]. The high frequency of miscarriage inspires the search for new links in the pathogenesis of this pathology. In modern, there is a connection between pregnancy failure and environmental and social factors [2, 9, 10].

Ecology in Ukraine suffered due to an accident at the Chornobyl nuclear power plant (ChNPP) [12-17]. In April 1986, more than 200 isotopes were released into the environment. The area of radiation pollution reached 53.5 thousand km^2. Radiation pollution of ecosystems is a source of human exposure. After 38 years, the ecological condition of Ukraine has improved due to the decay and redistribution of isotopes in the environment. Despite this, the question of the remote effects of the Chornobyl disaster has not lost its relevance for the population.

The most dangerous long-term due to contamination of soil, drinking water, and products of plant origin is radiocesium – a radionuclide of the chemical element cesium with atomic number 55 and mass number 137. Radiocesium is the main component of technogenic radioactive contamination of the biosphere, formed by the fission of uranium, plutonium, and thorium nuclei under the influence of thermal and fast neutrons.^{137}Cs is a beta and gamma emitter with a half-life of 30 years and a biological half-life of 100 days in adults and 20-50 days in children.^{137}Cs is intensively sorbed by soil and bottom sediments. The behavior of radiocesium corresponds to the chemical properties of alkali metal and a powerful reducing agent [18-20].

38 years after the accident at the ChNPP, radioactive exposure to humans is possible through food. Sources of^{137}Cs for humans are milk, meat, eggs, wild berries, and mushrooms. The radioactive contamination of these products is still high [13-17, 20]. In connection with the exchange of products between regions, living in radiation-free territories does not guarantee the absence of radionuclides in food. In the body,^{137}Cs accumulate in organs and systems with increased radiosensitivity. One of them is the placenta, whose compensatory capacity determines pregnancy scenarios. Decompensation of placental capacity is the cause of reproductive losses.

The absence of evolutionary resistance to radioactive substances in pregnant contributes to functional and organic disorders in the «mother-placenta-fetus» system. Accumulation of^{137}Cs in the placenta causes tension in the sympathoadrenal and hypothalamic-pituitary-adrenal systems. Internal exposure to^{137}Cs disrupts the architecture of the placenta, redox processes, hormone synthesis, and uterine-placental and placental-fetal microcirculation. The consequences depend on the dose of^{137}Cs, the intensity of removal from the body, and adequate antioxidant protection [9, 10].

Any pathological process develops against the background of pro-oxidant reactions, which requires the mobilization of antioxidant protection. Numerous studies confirm the role of radiation-induced oxidative stress in pregnancy failure [21-23].

The system of antioxidant protection consists of four stages. In the first stage, toxic substances are transformed into oxygen and water with the participation of catalase, superoxide dismutase (SOD), and ceruloplasmin. In the second stage, hydrophilic metabolites bind to glutathione. Enzymes of the second phase detoxification are arylamine acetyl-, methyl-, glucuronosyl- and glutathione-S-transferase. Conjugation reactions with glutathione are the basis of antioxidant protection. Depletion of its endogenous reserves slows down detoxification. The third stage is the elimination of conjugated derivatives from the body through the lungs, kidneys, and intestines. The fourth stage is associated with the reparative regeneration of damaged molecules [24, 25].

Pectins provide the necessary support for the proper functioning of the detoxification system. Thanks to complex formation, they can remove radionuclides from the body. Placental response to internal radiation requires radioprotection to prevent pregnancy loss. With this in mind, attention was paid to pectinotherapy [26-29].

Purpose. Determinate the effectiveness of pectin therapy in preventing reproductive losses associated with the incorporation of^{137}Cs into the placenta.

Materials and methods

The article is based on the results of previous research on the functioning of the detox system in the case of miscarriage due to the accumulation of^{137}Cs in the placenta [9, 10, 22, 23].

According to the research plan, pregnant women were divided into groups: the first included 153 women with reproductive losses in anamnesis and signs of termination of the current pregnancy. Control group included 30 women with uncomplicated anamnesis and physiological pregnancy. Most women were from Kyiv and the region (69.4 %); from the western, eastern, and central of Ukraine – 8.2 %, 5.5 %, and 16.9 % of pregnant women, respectively. The average age of the examined was 33.4 ± 5.2 years. More than 37.3 % of women in the first group suffered from habitual miscarriage. They had from 2 to 9 recurrent miscarriages, mostly in the 1st trimester. Almost 20.9 % of women had previously given birth prematurely. There were 4.6 % of women with experience of antenatal losses at 34, 36, and 38 weeks of gestation. Each unsuccessful pregnancy contributed to the depletion of the reproductive reserve. Earlier, hormonal dysfunction was detected in 73.3 % of women, thrombophilia – in 30.1 % of cases, infection – in 53.0 % of patients, and cervical insufficiency – in 33.3 % of people. Combinations of factors were observed in 90 % of cases. In this regard, on the eve of conception and during pregnancy, women were prescribed therapy to correct disorders, not always with a positive effect. The answer to the question about different pregnancy scenarios against the background of similar factors was the detection of^{137}Cs in placentas. Its effects are associated with disruption of

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the histological structure of the placenta, microcirculation, redox, hormonal, and immune processes. Extreme effects depend on the activity of ^{137}Cs and the compensatory capacity of the placenta [22, 23].

So, according to the data of β-spectrometry, the accumulation of ^{137}Cs up to 1.0 Bq/kg was found in the placentas of the control without damage to their architectonics. Histological changes in the placentas of the first group depend on the absorbed dose of ^{137}Cs. The activity of 1.1-4.4 Bq/kg of ^{137}Cs disrupts microcirculation and leads to dystrophic changes in the placenta. At the same time, the placenta remains functionally capable. Carrying a pregnancy is considered promising. Internal exposure to 4.5-10.4 Bq/kg of ^{137}Cs is a trigger for late preterm birth due to damage to the maternal surface of the placenta. Internal exposure with an activity of more than 10.4 Bq/kg of ^{137}Cs due to damage to the maternal and fetus structures of the placenta is the most likely cause of early premature birth and antenatal fetal death [9, 10].

The severity of radiation damage is proportional to the rate of removal of radionuclides from the body. The main principle of etiotropic therapy is to stop or reduce the radiation load on the responsible organ [30]. Among the means of individual radioprotection, special attention is paid to pectins, which form complexes with radionuclides for elimination from the body [26, 27]. Based on this, «Apple Pectin Antioxidant» («APA») was included in the complex therapy of miscarriage. «APA» contains apple pectin, rose hip, nettle, mint, echinacea, and stevia extracts. «APA» was prescribed to women before conception three pills per day for a month. The number of such courses is not limited. During pregnancy, treatment was carried out in the 1st, 2nd, and 3rd trimesters. The effectiveness of therapy was evaluated by dividing pregnant into subgroups: 1A – without «APA» and 1B – with «APA». Criteria for treatment effectiveness were indicators of antioxidant protection and pregnancy scenarios. Peculiarities of redox processes in pregnant women of the first group were studied using biochemical research.

Statistical data analysis was performed using Microsoft Excel (2016) and Fisher angular transformation. The difference between comparative values was considered significant at $p < 0.05$ (probability index greater than 95 %).

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Results and discussion

Placental failure accompanies almost all gestational complications, the basis of which are anatomical disorders and abnormal angiogenesis. The functioning of cell membranes is related to the state of peroxide hemostasis. Radiation in the human body causes oxidative stress. The level of diene conjugates (DK), lipid hydroperoxides, malondialdehyde (MDA), and anion-radical oxygen increases in blood women of the 1A subgroup from 1st trimester. High concentrations of reactive oxygen in the intervillous cause damage to the chorionic tree, hemorrhages, and placental infarcts. Depletion of the antioxidant protection system activates the arachidonic cascade and synthesis of prostaglandins. Excessive expression of CO_2 causes protein denaturation, tissue destruction, and intrauterine death of the fetus. The absorbed dose of radiation plays a decisive role [9, 10, 22, 23].

Malondialdehyde is an indicator of lipid peroxidation (LPO) activation. Its level in the blood of pregnant women is significant for predicting pregnancy outcomes. A high content of MDA in the blood at the beginning of pregnancy indicates the probability of placental dysfunction, premature birth, and intrauterine fetal loss. An increase in MDA by 8.7 % compared to the control in pregnant women of the 1A subgroup up to 12 weeks was acceptable, as their pregnancy ended with a timely delivery (TD). An increase of MDA in the 1st trimester by 17.4 % is a trigger for late preterm labor (LPL). An increase in MDA in the 1st trimester by 23.4 % compared to the control increases the risk of early preterm birth (EPB) (Table 1, Fig. 1) [23].

Table 1

Dynamics of MDA depending on pregnancy scenarios and treatment method, M ± m

Group & subgroups before 12 weeks		MDA, μmol/ml		
		13-24 weeks	25-28-36 weeks	
1A	TD (n=38)	139.6 ± 4.1[1]	137.6 ± 2.9	144.5 ± 3.2
	LPL (n=13)	150.8 ± 2.6[1, 2]	144.0 ± 2.0[1, 2]	152.1 ± 2.9[1, 2]
	EPB (n=9)	158.4 ± 4.2[1, 2, 3]	151.6 ± 2.9[1, 2, 3]	160.0 ± 3.2[1, 2, 3]
1B	TD (n=64)	135.5 ± 4.1	134.7 ± 2.9	141.3 ± 3.2
	LPL (n=15)	151.2 ± 3.4[1]	145.4 ± 2.5[1]	153.0 ± 3.1[1]
Control group (n=30)		128.4 ± 3.7	136.4 ± 2.9	142.6 ± 3.6

Notes:[1]the probability of difference with control, p < 0.05;
[2]the probability of difference with control and subgroup 1A (TD), p < 0.05;
[3]the probability of difference with subgroup 1A (LPL), p < 0.05;
[NB!] for EPB – 25-27[+6] weeks.

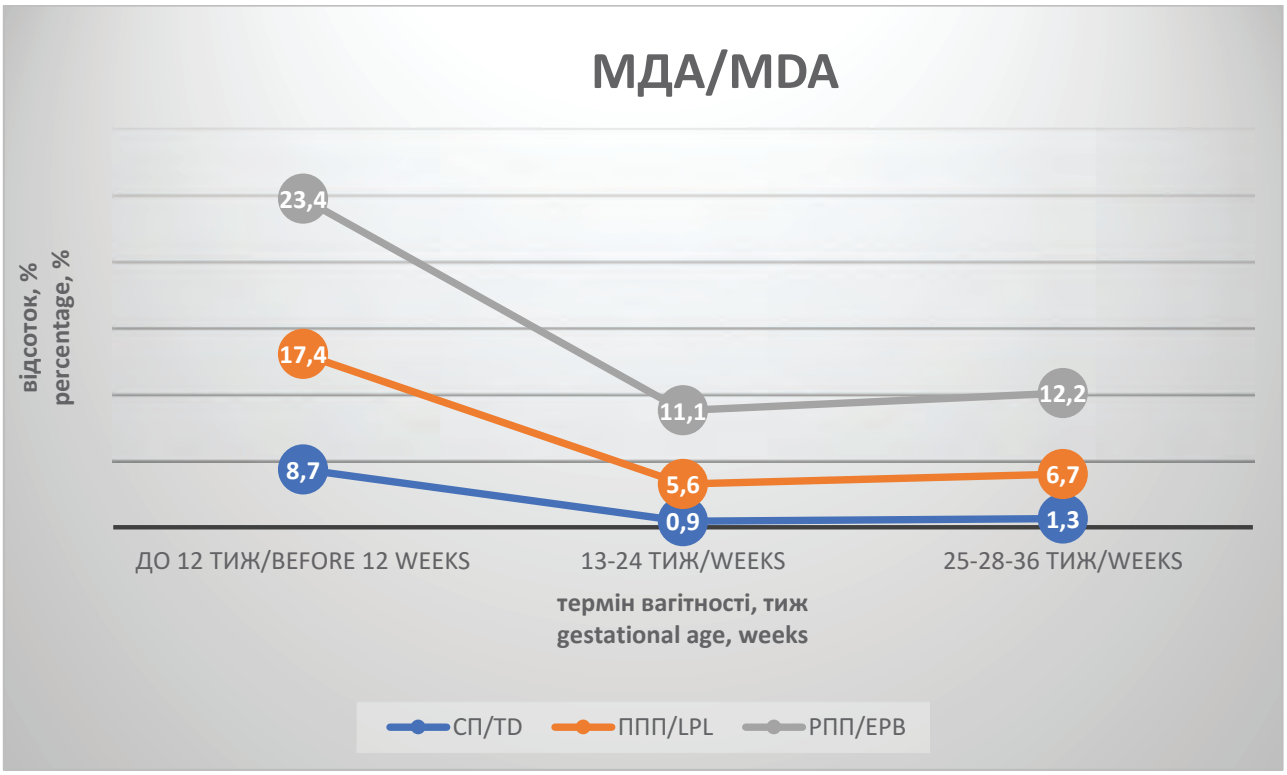

Fig. 1. The percentage increase in the level of MDA in the blood of the pregnant 1A subgroup relative to the control.

Maintaining adequate levels of antioxidants is critical to prolonging pregnancy. Research [18, 19] shows that enzymes such as superoxide dismutase (SOD), catalase, glutathione peroxidase, and reduced glutathione play a vital role in ensuring proper antioxidant protection of the body. However, catalase, reduced glutathione, glutathione peroxidase, and SOD deficiency were detected in the blood of pregnant women of the 1A subgroup from 1st trimester [24, 25, 28]. Exhaustion of the reserve of reduced glutathione leads to the accumulation of free radicals in the body. Intensification of reactive oxygen species production leads to oxidative stress and cell death. The antioxidant system neutralizes its destructive effect.

The compensatory capabilities of the «mother-placenta-fetus» system are associated with the activity of SOD. A decrease in the activity of SOD in pregnant women of the 1A subgroup in the 1st trimester against the background of a high level of MDA in the blood indicates a violation of the detoxification mechanism and the formation of primary placental insufficiency. A manifestation of oxidative stress and a trigger of premature birth in pregnant women of the 1A subgroup was a decrease in SOD activity in the blood by 11.1 %. A 26.3 % decrease in blood SOD activity in the 2nd trimester indicates the decompensation of adaptation mechanisms, which results in early premature birth and antenatal fetal loss (Table 3, Fig. 2).

Table 2

Dynamics of SOD depending on the pregnancy scenario and treatment method, M ± m

Group & subgroups before 12 weeks		SOD, um. od. act/ml/min		
		13-24 weeks	25-28-36 weeks	
1A	TD (n=38)	51.0 ± 2.6	57.6 ± 2.7	57.9 ± 2.3
	LPL (n=13)	47.7 ± 2.8	54.2 ± 2.9[1]	51.7 ± 2.4[1]
	EPB[NB!] (n=9)	44.8 ± 2.7[1, 2]	45.1 ± 2.8[1, 2, 3]	39.8 ± 2.2[1, 2, 3]
1B	TD (n=64)	53.6 ± 2.8	60.3 ± 2.9	60.2 ± 2.4
	LPL (n=15)	50.6 ± 2.8	57.2 ± 2.9	52.1 ± 2.4[1]
Control group (n=30)		54.8 ± 3.6	61.2 ± 1.4	62.4 ± 2.6

Notes:[1]the probability of difference with control, p < 0.05;
[2]the probability of difference with control and subgroup 1A (TD), p < 0.05;
[3]the probability of difference with subgroup 1A (LPL), p < 0.05;
[NB!] for EPB – 25-27[+6] weeks.

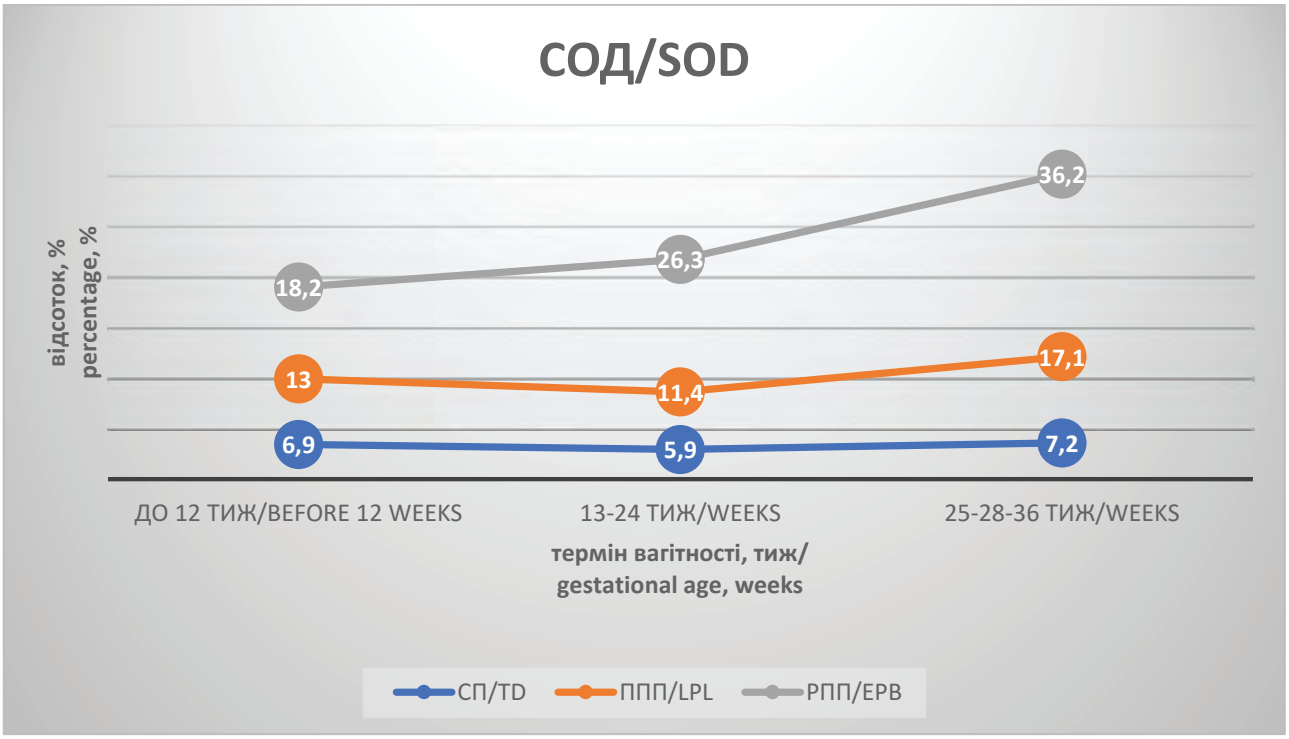

Fig. 2. The percentage of SOD deficiency in the blood of pregnant women of the 1A subgroup relative to the control.

Thus, defects in POL and antioxidant protection cause organ and tissue hypoxia. An increase in the content of malondialdehyde in the blood and a decrease in the activity of superoxide dismutase are associated with the severity of radiation damage. The accumulation of reactive oxygen destroys cells. Overexpression of CO2 triggers pregnancy termination mechanisms: arachidonic cascade and prostaglandin synthesis [9, 25]. In 38 women of the 1A subgroup, the pregnancy ended in timely childbirth, in 13 people in late preterm labor, and in 9 women – early premature birth.

Minimizing the impact of internal radiation is related to limiting the entry of radionuclides into the human body, blocking their absorption, and accelerating excretion. Determining ways of reducing the number of radionuclides during migration through trophic chains is an urgent problem of radiobiology and radioecology. Medicine aims to develop mechanisms for accelerated radionuclide removal from the body. Sorption is an effective means of removing radionuclides. Pectins have a high sorption potential, which adsorbs up to 30-40 % of137Cs, reducing its destructive effect. The healing properties of pectins are determined by their complex-forming ability, which depends on the presence of carboxyl groups [26-29].

Based on this, it is recommended to include «Apple pectin antioxidant» («APA») in treatment and preventive measures aimed at preserving pregnancy. «APA» increases redox, phagocytic activity, resistance to infections, and detoxification function of the liver. «APA» triggers events that induce the expression SOD, catalase, glutathione-S-transferase (GST), and glutathione peroxidase. Glutathione (GSH) neutralizes the excess reactive oxygen species formed in the pregnant woman's body radiation stress. Hydrophilic glutathione binds to hydrophobic toxic substances for excretion in the bile. GST catalyzes conjugation reactions with glutathione. In the erythrocytes of pregnant women of the 1B subgroup, GST activity was 1.8 times higher than in the 1A subgroup (3.32 ± 0.18 CHDNB-SG μmol/mg protein/min vs. 1.88 ± 0.16 CHDNB-SG μmol/mg protein /min; $p < 0.05$). This confirms the effectiveness of APA».

Internal exposure disrupts placental architecture. The consequences depend on the duration of radiation exposure and the compensatory ability of the placenta. Superoxide dismutase is a powerful antioxidant agent that inactivates free radicals at the site of formation, preventing their diffusion. Information on the dynamics of SOD and MDA depending on the pregnancy scenario and treatment method is given in Tables 1 and 2 and supplemented by Figures 2 and 4. A significant decrease in SOD deficiency and MDA excess in the blood was observed in pregnant women who took «APA».

Therapy with the «APA» improves pregnancy scenarios (Table 3). «APA» as a part of the pathogenetic therapy of HB contributed to an increase in the number of timely births by 27.9 % due to a decrease in cases of premature births by 11.4 %, spontaneous abortions by 11.0 %, and halting the development of the embryo by 5.5 %. With «APA» it became possible to avoid early premature births. However, this led to an increase in the frequency of late premature births by 0.9 %. At the same time, the term of premature birth increased to 34 weeks, which improved the prospects for newborns (Table 4). An increase in the gestational age of premature birth contributed to a decrease in the frequency of severe asphyxia in newborns by 18.7 %, hypoxic-ischemic lesions of the central nervous system by 13.5 %, respiratory distress by 17.3 %, intraventricular hemorrhage of the II-III degree by 12, 7 %.

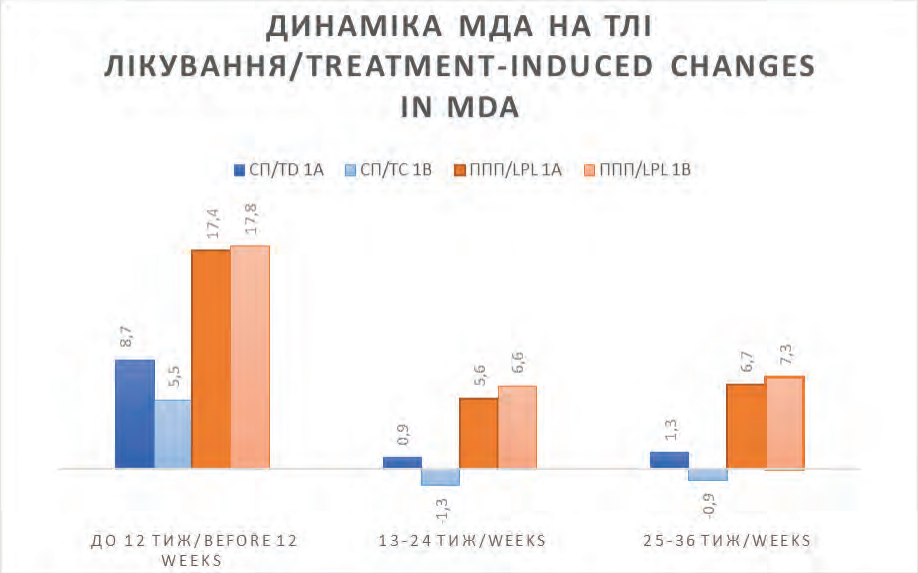

Fig. 3. Dynamics of MDA level relative to control in the blood of pregnant of the first group under the influence of treatment, in percent.

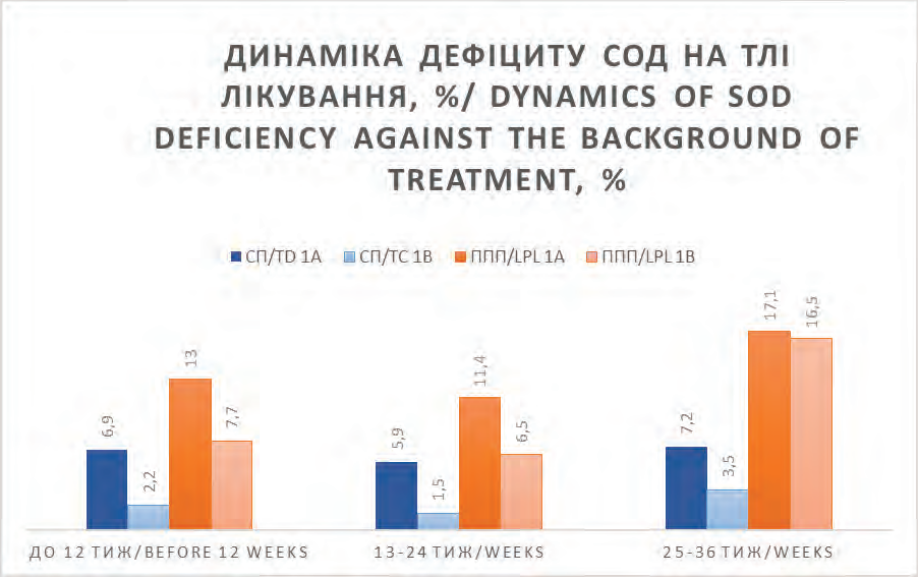

Fig. 4. Dynamics of SOD deficiency relative to control in the blood of pregnant of the first group against the background of treatment, in percent.

Table 3

Indicators of the effectiveness of therapy according to pregnancy outcomes, abs., (%)

Pregnancy scenarios	Subgroup		Efficiency, %
	1A (n=73)	1B (n=80)	
Timely delivery	38 (52,1)	64 (80,0)	+ 27,9
Premature birth: early preterm birth (EPB) late preterm labor (LPL)	22 (30,1) 9 (12,3) 13 (17,8)	15 (18,7) - 15 (18,7)	- 11,4 - 12,3 + 0,9
Spontaneous abortions: а) in the 1st trimester б) in the 2nd trimester	9 (12,3) 4 (5,5) 5 (6,8)	1 (1,3) 1 (1,3) -	- 11,0 - 4,2 - 6,8
Termination of embryo development	4 (5,5)	-	- 5,5

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Table 4

Indicators of effectiveness therapy according to the condition of newborns, abs., (%)

Pathological conditions	Subgroup		Efficiency, %
	1A (n=57)	1B (n=79)	
Severe asphyxia	15 (26.3)	6 (7.6)	- 18.7
Moderate asphyxia	10 (17.5)	5 (6.3)	- 11.2
Hypoxic-ischemic damage of the central nervous system	12 (21.1)	6 (7.6)	- 13.5
Syndrome of oppression	13 (22.8)	6 (7.6)	- 15.2
Arousal Syndrome	2 (3.5)	-	- 3.5
Congenital pneumonia	17 (29.8)	19 (24.1)	- 5.7
Intraventricular hemorrhage of the 1st degree	4 (7.0)	3 (3.8)	- 3.2
Intraventricular hemorrhage of the 2nd and 3rd degrees	8 (14.0)	1 (1.3)	- 12.7
Subependymal hemorrhage	9 (15.8)	3 (3.8)	- 12.0
Respiratory distress syndrome	12 (21.1)	3 (3.8)	- 17.3
Intrauterine fetal growth retardation	13 (22.8)	6 (7.6)	- 15.2

Thus, intraplacental exposure to137Cs causes oxidative stress, which disrupts the architecture and functional capacity of the placenta. «Apple Pectin Antioxidant» as part of complex pathogenetic therapy of pregnancy preservation demonstrates high efficiency. «APA» helps reduce the destructive effect of radiocesium by decorporation and accelerated removal from the body. The prevention of placental dysfunction is a reliable way to preserve pregnancy and the health of future generations.

Conclusions.

1. The biochemical enhancer of the action of137Cs incorporated into the placenta is the activation of lipid peroxidation (LPO).

2. The level of malondialdehyde is an indicator of LPO activation. An increase in the content of MDA in blood in the 1st trimester by 8.7 % against the reference values is acceptable since pregnancy ends with timely delivery. An increase in MDA by 17.4 % is a trigger for late preterm labor. An increase in MDA by 23.4 % indicates a high probability of early preterm birth.

3. Superoxide dismutase, as a powerful antioxidant, neutralizes the effects of LPO. The compensatory ability of the «mother-placenta-fetus» system is related to SOD activity. A manifestation of oxidative stress and a trigger for premature birth is a decrease in the activity of SOD in the blood by more than 11.1 % against the reference values. Decreased activity of SOD in the blood in 2nd trimester by 26.3 % indicates decompensation of antioxidant protection which leads to early premature birth and antenatal fetal loss.

4. The effects of «APA» are based on decorporation and accelerated removal of radiocesium from the body. «APA» reduces the deficiency of SOD and the excess of MDA in the blood. «APA» improves pregnancy scenarios. With the use of «APA», the number of timely deliveries increased by 27.9 % due to a decrease in cases of premature births by 11.4 %, spontaneous abortions by 11.0 %, and halting of embryo development by 5.5 %. With «APA» it is possible to avoid early premature births. Increasing the gestational age during premature births to 34 weeks improves the prospects of newborns.

5. Due to the multifactorial nature of miscarriage, it is impossible to develop optimal therapeutic and preventive measures with universal effectiveness. The high efficiency of «APA» can be considered only as part of the complex pathogenetic therapy of miscarriage. It is advisable to prescribe «APA» from the pre-gravid and during pregnancy for all women, regardless of the region of residence.

Prospects for further research are aimed at solving the problem of miscarriage.

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Conflicts of interest: authors have no conflict of interest to declare.

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ПЕКТИНОТЕРАПІЯ – МЕТОД ПРОФІЛАКТИКИ РЕПРОДУКТИВНИХ ВТРАТ, ПОВ'ЯЗАНИХ З ІНТРАПЛАЦЕНТАРНИМ НАКОПИЧЕННЯМ РАДІОНУКЛІДІВ

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Резюме.

На сьогоднішній день фактори зовнішнього середовища відіграють вирішальну роль у патогенезі невиношування вагітності. Екологія України постраждала через аварію на Чорнобильській АЕС, яка не має аналогів за кількістю радіонуклідів, що потрапили у довкілля, площею ураження і наслідками. У сучасних умовах люди піддаються впливу радіоактивних речовин через їжу. Серед 200 радіонуклідів, які потрапили в навколишнє середовище,137Cs становить найбільшу небезпеку в довгостроковій перспективі через забруднення ґрунту та води. Внутрішнє опромінення є однією з причин репродуктивних втрат. Накопичення137Cs у плаценті порушує її архітектуру, функціональну здатність та перекисний гемостаз. Дефекти детоксикації, викликані137Cs, потребують корекції для запобігання репродуктивним втратам.

Мета дослідження: визначити ефективність пектинової терапії щодо попередження репродуктивних втрат, пов'язаних із інкорпорацією137Cs у плаценту.

Матеріали і методи. Відповідно до плану дослідження до першої (дослідної) групи увійшли 153 жінки з репродуктивними втратами в анамнезі та ознаками переривання поточної вагітності; до другої (контрольної) групи – 30 жінок з неускладненим анамнезом і вагітністю. Стаття базується на результатах наших попередніх досліджень, які стосуються особливостей функціонування системи детоксикації при невиношуванні вагітності внаслідок накопичення137Cs у плаценті. Встановлено зв'язок між перебігом редокс-процесів, сценаріями вагітності та активністю137Cs у плаценті. Враховуючи те, що однією з причин передчасного переривання вагітності є реакція плаценти на опромінення137Cs, до заходів профілактики репродуктивних втрат включено «Яблупект антиоксидантий» («ЯПА»), що має високий сорбційний потенціал. Ефективність терапії оцінювали шляхом поділу вагітних на підгрупи: 1А – без «ЯПА» і 1В – з «ЯПА». Критеріями ефективності лікування були показники антиоксидантного захисту та сценарії вагітності.

Статистичний аналіз даних проводили за допомогою Microsoft Excel (2016) та кутового перетворення Фішера. Різницю між порівняльними значеннями вважали достовірною при $p < 0,05$ (індекс вірогідності більше 95 %).

Дозвіл на проведення досліджень отримано від Комісії з медичної етики ДУ «Інститут педіатрії, акушерства і гінекології ім. академіка О. М. Лук'янової НАМН України» (протокол № 3 від 07.06.2017).

НДР «Розробити новітні та вдосконалити існуючі технології діагностики, профілактики та лікування передчасного переривання вагітності у жінок з невиношуванням з урахуванням паспорта плаценти» (2018-2020 рр.). Шифр ВН.20.00.02.18, № держреєстрації 0118U000039, КПКВ 6561040.

Результати дослідження. Було встановлено, що внутрішнє опромінення137Cs порушує архітектоніку та функціональну здатність плаценти. Накопичення в плаценті до 1,0 Бк/кг137Cs не впливає на перебіг вагітності. Компенсаторна здатність плаценти залишається збереженою при накопиченні від 1,1 до 4,4 Бк/кг137Cs. Внутрішнє опромінення з активністю 4,5-10,4 Бк/кг137Cs призводить до пошкодження материнської строми плаценти та передчасних пологів у 28-36+ 6 тижнів. Внаслідок накопичення понад 10,4 Бк/кг137Cs пошкоджуються материнські та плодові структури плаценти, що призводить до ранніх передчасних пологів та антенатальної загибелі плода.

Біохімічним підсилювачем променевої дії є активація перекисного окислення ліпідів (ПОЛ). Малоновий діальдегід є індикатором активації ПОЛ. Підвищення вмісту МДА в крові в I триместрі на 8,7 % від референтних значень допустимо. Збільшення МДА на 17,4 % є тригером пізніх передчасних пологів. Збільшення МДА на 23,4 % вказує на високу ймовірність ранніх передчасних пологів. Потужним антиоксидантом, здатним нейтралізувати продукти ПОЛ є супероксиддисмутаза. Проявом оксидативного стресу та тригером передчасних пологів є зниження активності СОД у крові більше ніж на 11,1 % від референтних значень. Зниження активності СОД крові в II триместрі на 26,3 % свідчить про декомпенсацію адаптаційних механізмів, що призводить до ранніх передчасних пологів і антенатальної втрати плода.

Висновки. Розробити оптимальні заходи лікування і профілактики НВ з універсальною ефективністю неможливо через багатофакторність патології. Використання «ЯПА» у складі патогенетичної терапії НВ дозволяє розраховувати на його високу ефективність. Ефективність «ЯПА» пояснюється мінімізацією променевого впливу на плаценту за рахунок прискореного виведення137Cs при збереженні функціональної здатності плаценти.

На фоні «ЯПА» спостерігається зменшення дефіциту СОД та надлишку МДА в крові, збільшення кількості своєчасних пологів на 27,9 %, зменшення випадків передчасних пологів на 11,4 %, та спонтанних абортів на 11,0 %, зупинки розвитку ембріона на 5,5 %. Завдяки «ЯПА» вдалося позбутися ранніх передчасних пологів, що призвело до збільшення частоти пізніх передчасних пологів на 0,9 %. Водночас мінімальний гестаційний термін передчасних пологів збільшено до 34 тижнів, що покращує перспективи новонароджених. «ЯПА» доцільно призначати з прегравідарного періоду та під час вагітності всім жінкам незалежно від регіону проживання.

Ключові слова: невиношування вагітності; плацента;137Cs; внутрішнє опромінення; перекисне окислення ліпідів, антиоксидантний захист; пектинотерапія.

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