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SERUM SELENIUM CONCENTRATION CHRONIC ARTERIAL HYPERTENSION IN PREGNANT WOMEN

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ABSTRACT

Relevance. Hypertensive disorders during pregnancy are associated with an increased risk of hypertension among women of reproductive age is estimated at 7.7%. Hypertensive disorders of pregnant women (a unifying term that includes pre-existing and gestational hypertension, preeclampsia and eclampsia) complicate up to 10% of pregnancies and represent a significant cause of maternal and perinatal morbidity and mortality.Based on the analysis of a number of international studies, it was noted that people with hypertension produce more reactive oxygen species and at the same time have a disrupted antioxidant defense system, which increases oxidative stress and leads to the development of a vicious circle. **Objective:** to study the level of selenium in pregnant women with chronic arterial hypertension and preeclampsia.

KEYWORDS: chronic arterial hypertension, preeclampsia, mean blood pressure, selenium.

RESEARCH MATERIALS AND METHODS

To achieve this goal, we examined 100 pregnant women from 2019 to 2023. The criteria for inclusion in the study were pregnant women with high blood pressure. The obtained results were processed using modern statistical analysis software packages. The difference in values was considered statistically significant at $p< 0.05$. A comparative assessment of macronutrient indices was carried out using the nonparametric Mann-Whitney criterion (U), the Wilcoxon criterion (W) and the Student criterion for independent samples (t).

Resume. It was revealed that higher values of selenium in the blood serum of pregnant women, including those within the high normal range, are associated with hypertension. In addition, the results of the correlation between selenium and blood pressure demonstrate a stronger effect of selenium levels on diastolic blood pressure compared with systolic, which coincides with the literature data.

The prevalence of hypertension among women of reproductive age is estimated at 7.7%.[1] Hypertensive disorders of pregnant women (a unifying term that includes pre-existing and gestational hypertension, preeclampsia and eclampsia) complicate up to 10% of pregnancies and represent a significant cause of maternal and perinatal morbidity and mortality.[2]

Over the past decade, various methods have been developed for risk stratification and prediction of hypertensive conditions (including CAH and PE) women in the high-risk group. The aim of FIGO at the present stage is: (1) to raise awareness of the links between hypertensive conditions and poor maternal and perinatal outcomes, as well as future risks to maternal and child health, and to require a clearly defined program of action to address this problem everywhere; and (2) create a consensus document that contains recommendations on forecasting, risk stratification, monitoring and management of pregnant women with hypertensive disorders.[3,4]

Studies have proven that blood pressure must be maintained at a level below 160/110 mmHg.[5-11] Pregnant women are at a higher risk of complications from the central nervous system due to hypertension, which was confirmed in a cross-sectional study of more than 81 million pregnant women who went to the hospital.[12] An analysis of the subgroup of the study "Control of hypertension during pregnancy" (CHIPS) confirmed that hypertension has a correlation with higher maternal mortality rates and perinatal losses within > 48 hours.[13] Based on the analysis of a number of foreign studies, it was noted that people with hypertension produce more reactive oxygen species and at the same time have a disrupted antioxidant defense system, which increases oxidative stress and leads to the development of a vicious circle.[14] Selenium is known as a natural

element necessary for human physiological processes.[15] Selenium fulfills its biological role mainly by being incorporated into various selenoproteins. More than 25 selenoproteins have been identified, which play a diverse role in the regulation of cellular redox processes. Antioxidants inhibit oxidation reactions, thereby reducing the amount of free radicals formed and the amount of damage they can cause. It has been suggested that selenium, an important trace element with antioxidant properties, has a protective effect in hypertension.[16]

The purpose of this study is to investigate the level of selenium in pregnant women with chronic arterial hypertension and preeclampsia.

RESEARCH MATERIALS AND METHODS

To achieve this goal, we examined 100 pregnant women for the period from 2019 to 2023. The criteria for inclusion in the study were pregnant women with arterial hypertension.

The groups were distributed as follows. The main group (I) included 60 patients with CAH, the comparison group (group II) consisted of 30 patients with preeclampsia and the control group (group III) included 20 healthy patients.

According to the existing standards of obstetric examination, clinical and laboratory tests were performed on all patients. Randomization was carried out according to age, social factors, concomitant gynecological and extragenital diseases.

Quantitative analysis of serum selenium was performed by inductively coupled plasma atomic emission spectrometry (ICPMS 7700e spectrometer, Intertech. Corp., USA). The analysis procedure included preliminary mineralization of the sample by the method of dry salinization by microwave mineralization of samples (MARS-5, Intern. Equip. Trading Ltd., USA); Sc was used as an internal standard. To control the correctness of the analysis results, the method of varying the weight was used.

Within the groups, the parametric Wilcoxon criterion (W) and the Student's criterion for dependent samples (T) were used in the statistical processing.

The results of the study

The average age of pregnant women with CAH was 28.42±5.53 years, in the group with preeclampsia - 29.77±6.46 years, there were no statistical differences between the age groups (T=0.951, p=0.346, p>0.050). The average age of pregnant women in the control group was 33.50±2.12 years, there were statistical differences in age between patients with CAH and the control group (T=-5.556, p0,001). There were statistical differences in age between patients with preeclampsia and the control group (T=-2.937, p=0.006, p0,010).

Table 1: Selenium and blood pressure indicators in the studied groups by trimester (average indicators).

Patient groups	Selenium/trimester						Reliability
	I (12 weeks)		II (28 weeks)		III (36 weeks)		
n=50	81,70±9,19		71,22±6,26		67,20±5,67		P<0,001
n=30	102,33±8,21		92,17±6,52		101,27±3,04		$P^{I/II}$<0,001 $P^{I/III}$>0,050 $P^{II/III}$<0,001
n=20	116,55±1,76		118,05±1,19		119,40±0,68		$P^{I/II}$<0,010 $P^{I/III}$<0,001 $P^{II/III}$<0,001
Reliability	^{I}p<0,001		^{II}p <0,001		^{III}p<0,001		
	BP mm Hg						
	Systolic	diastolic	systolic	diastolic	systolic	diastolic	
n=50	130,0	75,0	147,2±5,9	88,1±6,2	146,6±8,9	85,0±8,9	P<0,001 $^{II/III}P_s$>0,050
n=30	114,3±7,5	70,0	143,0±2,5	83,0±2,5	137,8±2,8	78,0±2,5	P<0,001 $^{II/III}P_d$>0,050
n=20	113,0±3,4	73,2±3,3	123,5±2,4	83,5±2,4	119,8±3,8	79,5±2,8	P<0,001
Reliability	^{s}P<0,001	$^{d}P^{I/II}$<0,001 $^{d}P^{I/III}$<0,050 $^{d}P^{II/III}$>0,050	^{s}P<0,001	$^{d}P^{I/II}$<0,001 $^{d}P^{I/III}$<0,001 $^{d}P^{II/III}$>0,050	^{s}P<0,001	$^{d}P^{I/II}$<0,001 $^{d}P^{I/III}$<0,001 $^{d}P^{II/III}$>0,050	

Note: p<0,001, p<0,010, p<0,050 - statistical differences are observed
p>0,050 - no statistical differences

In the group (n=50) with CAH, in the first trimester, the average selenium values were 81.70±9.19, in the second trimester – 71.22±6.26, statistical differences were noted between the indicators (W=1094,500, p<0.001). In the third trimester, the selenium level was 67.20±5.67, statistical differences were noted between the I and III trimesters (W=1251,500, p<0.001). There were also statistical differences between the second and third trimesters (W=265,000, p=0.001, p<0.001).

In the group with CAH, in the first trimester, the average blood pressure was systolic – 130.0 mmhg, diastolic - 75.0 mmHg; in the second trimester – 147.2±5.9 mmHg, diastolic - 88.1±6.2 mmhg, statistical differences were noted between systolic and diastolic blood pressure (respectively, rs=-20.366, rd=-14.925, p<0.001). In the third trimester, the average blood pressure was systolic – 146.6±8.9 mmhg, diastolic - 85.0±8.9 mmhg.; There were statistical differences between systolic and diastolic blood pressure in the first and third trimesters (respectively, rs=-13.148, rd=-7.940, p<0.001). There were no statistical differences between systolic blood pressure in the second and third trimesters (rs=0.747, p>0.050), but there were statistical differences between diastolic blood pressure (rd=3.969, p<0.001).

In the group (n=30) with preeclampsia, in the first trimester the average selenium values were – 102.33±8.21, in the second trimester – 92.17±6.52, statistical differences were noted between the indicators (W=465,000, p<0.001). In the third trimester, the selenium level was 101.27±3.04, there were no statistical differences between the I and III trimesters (W=279,500, p=0.180, p>0.050). There were also statistical differences between the second and third trimesters (W=564,000, p<0.001).

Analysis of blood pressure in pregnant women with preeclampsia in the first trimester revealed that the systolic pressure index is 114.3±7.5 mm.p.st., diastolic - 70.0 mm.p.st.; in the second trimester, SAD – 143.0±2.5 mm.p.st., DAD - 83.0±2.5 mm.p.st., there were statistical differences between systolic and diastolic blood pressure differences (respectively, Ts=-20.232, Td=-28.750, p<0.001). In the third trimester, the average blood pressure was systolic – 137.8±2.8 mm, diastolic - 78.0±2.5 mm.; There were statistical differences between the I and III trimesters (respectively, rs=-17.026, d=-17.664, p<0.001). There were statistical differences between systolic blood pressure in the second and third trimesters (rs=17.696, p<0.001), but there were no statistical differences between diastolic blood pressure (rd=1.410, p=0.163, p>0.050).

In the first trimester, there were statistical differences between selenium values in the group with CAH and in the group with preeclampsia (T=-10.393, p<0.001), between selenium values in the group with CAH and in the control group there were statistical differences (T=-25.639, p<0.001), between selenium values in the group with preeclampsia Statistical differences were also observed in the control group (T=-7.592, p<0.001).

In the first trimester, there were statistical differences between blood pressure values not only among pregnant women with CAH and the control group (respectively, rs=22.361, p<0.001; rd=2.359, p=0.029, p<0.050), but also with preeclampsia (respectively, rs=11.436, rd=128.281, p<0.001). However, there were no statistical differences between diastolic blood pressure in the preeclampsia group and the control group (Td=0.850, p=0.400, p>0.050).

The same trend continued in statistical analysis in the second case, there were statistical differences between selenium indices in the group with CAH and in the group with preeclampsia (T=-14,114, p<0.001), statistical differences between selenium indices in the group with CAH and in the control group (T=-50,651, p<0.001), between selenium levels in the preeclampsia group and in the control group also showed statistical differences (T=-21.208, p<0.001). There were statistical differences between blood pressure values in the group with CAH and in the group with preeclampsia (respectively, rs=4.368, rd=5.151, p<0.001), statistical differences between blood pressure values in the group with CAH and in the control group (respectively, rs=23.773, rd=4.490, p<0.001).Systolic blood pressure in the preeclampsia group and in the control group also had statistical differences (rs=28.052, p<0.001), but there were no differences between diastolic blood pressure in the preeclampsia group and the control group (rd=-0.719, p=0.476, p>0.050).

The same trend continued in terms of selenium and blood pressure in pregnant women and in the third trimester. Table 2.

Correlation between selenium levels and blood pressure values in the studied groups

Patient groups	Trimester		
	I (12 weeks)	II (28 weeks)	III (36 weeks)
n=50			
Selenium/BP	No correlation	r_s=-0,238 r_d=-0,177	r_s=-0,166; r_d=-0,161
n=30			
Selenium/BP	r_s=0,137 r_d=0,279	r_s=-0,205 r_d=-0,047	r_s=-0,112 r_d=-0,243
n=20			
Selenium/BP	r_s=0,092, r_d=0,003	r_s=0,020, r_d=-0,047	r_s=-0,009 r_d=-0,188

In the CAH group, in the first trimester (12 weeks), there was no correlation between selenium levels and systolic/diastolic blood pressure values. In the second trimester (28 weeks), in the group with CAH, the relationship between selenium levels and systolic/diastolic blood pressure was described by a very weak negative correlation (respectively rs=-0.238; rd=-0.177), i.e., an increase in selenium levels very slightly reduced systolic/diastolic blood pressure. In the third trimester (36 weeks), in the group with CAH, the relationship between selenium levels and systolic/diastolic blood pressure was described by a very weak negative correlation (respectively rs=-0.166; rd=-0.161), i.e., an increase in selenium levels very slightly reduced systolic/diastolic blood pressure.

If we had a negative correlation among pregnant women with CAH, then among pregnant women with PE it was either absent or had a weakly positive one.

In the group with preeclampsia, in the first trimester (12 weeks), the correlation between selenium levels and systolic blood pressure values had a very weak positive trend (rs=0.137), i.e., an increase in selenium levels very slightly increased systolic blood pressure. The correlation between selenium levels and diastolic blood pressure values also had a very weak positive trend (rd=0.279), however, compared with systolic blood pressure, an increase in selenium levels, although slightly, increased diastolic blood pressure more.

In the second trimester (28 weeks), in the group with preeclampsia, the relationship between selenium levels and systolic blood pressure was described by a very weak negative correlation (rs=-0.205), i.e., an increase in selenium levels led to a slight decrease in systolic blood pressure. There was no correlation between selenium levels and diastolic blood pressure (rd=-0.047).

In the third trimester (36 weeks), in the group with preeclampsia, the relationship between selenium levels and systolic blood pressure was described by a very weak negative correlation (rs=-0.112), i.e., an increase in selenium levels very slightly reduced systolic blood pressure. The correlation between selenium levels and diastolic blood pressure values also had a very weak negative dynamics (rd=-0.243), however, compared with systolic blood pressure, an increase in selenium levels, although slightly, reduced diastolic blood pressure.

In the control group, there was no correlation between selenium levels and systolic/diastolic blood pressure values.

DISCUSSION

The study of the relationship between selenium levels and the development of cardiovascular diseases is of considerable interest, but the literature data are quite contradictory.[17] Based on the material of our study, it was revealed that higher values of selenium in the blood serum of pregnant women, including those within the high normal range, are associated with hypertension. In addition, the results of the correlation between selenium and blood pressure demonstrate a stronger effect of selenium levels on diastolic blood pressure compared with systolic, which coincides with the literature data.[18]

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