

## Indicators of 24-Hourly Monitoring of Blood Pressure and Trophoblast Function in Differential Diagnosis of Pregnant Hypertension and Preeclampsia

**Kramarskiy VA\*, Trusov Yu V and Dudakova VN**

*SBEE DPO Irkutsk State Academy of Postgraduate Education of the Ministry of Health and Social Development of the Russian Federation, A Branch of the Russian Medical Academy of Continuing Education, Russia*

**\*Corresponding Author:** Kramarskiy VA, Department of Obstetrics and Gynecology, SBEE DPO Irkutsk State Academy of Postgraduate Education of the Ministry of Health and Social Development of the Russian Federation, A Branch of the Russian Medical Academy of Continuing Education, Russia.

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### Abstract

The aim of the study was to evaluate the most significant indicators of SMAD and TBG level for the differential diagnosis of hypertension in pregnant women and preeclampsia using a mathematical model. The result of the study: preeclampsia is characterized by a time index greater than 50%, an area index greater than 110 mm<sup>2</sup>, variability not exceeding 12 mmHg, average dynamic blood pressure greater than 100 mmHg. To confirm the presence of preeclampsia or hypertension in pregnant women, it is advisable to determine the level of TBG.

In preeclampsia, the TBG level does not exceed 0.07 g/l. The level of TBG in hypertension of pregnant women is significantly less than in a normal pregnancy, but it is significantly higher than in preeclampsia of pregnant women of any severity and does not exceed the indicator of 0.12 g/l.

**Keywords:** *Preeclampsia; Hypertension of Pregnant Women; Trophoblastic Beta-Globulin (TBG); Daily Monitoring of Blood Pressure (SMAD)*

### Relevance

Preeclampsia, remaining one of the most frequent and dangerous complications of pregnancy and childbirth for many years, is one of the main causes of maternal perinatal morbidity and mortality [4]. In Russia, despite the decline in the absolute number of births observed in the last decade, the frequency of preeclampsia increases from year to year, reaching 16 - 21% [1]. In recent years, the frequency of combined preeclampsia has increased (about 70%) [2]. Against the background of the well-known significance of the problems of preeclampsia and its impact on the level of maternal mortality, perinatal losses and reproductive health, the existing differences in the classifications of hypertensive conditions and preeclampsia create difficulties in determining the optimal therapy and tactics of pregnancy management for these pathological conditions. According to M. M. Shekhtman (2005) [5], the test for preeclampsia should be simple, reliable and highly sensitive. Unfortunately, there are currently no such tests. The effective use of daily blood pressure monitoring (SMAD) for predicting preeclampsia in the risk group of pregnant women for this pathology does not exclude the possibility of using this type of study in the differential diagnosis of preeclampsia and hypertensive conditions, for the optimal solution of therapeutic and tactical tasks.

The functional state of the trophoblast ensures the physiological development of pregnancy, one of the mechanisms for preserving which is the state of immunological tolerance due to the presence of trophoblastic beta-globulin (TBG). In preeclampsia, due to pathological morpho structural changes in the placenta, there is a change in the functional activity of the trophoblast with a decrease in the concentration of TBG. At the same time, there are very few studies on the functional activity of the trophoblast in hypertensive conditions during pregnancy, and their data are contradictory. Clarification of the level of TBG concentration in preeclampsia and hypertension of pregnant women will expand the diagnostic aspect of the methods used for the differential diagnosis of these two pathological conditions.

### **Aim of the Study**

The aim of the study was to evaluate the most significant indicators of SMAD and TBG level for the differential diagnosis of hypertension in pregnant women and preeclampsia.

### **Materials and Methods**

To identify the possibilities of SMAD in the differential diagnosis of the above - mentioned pathology, we studied 88 pregnant women (group 1) with hypertensive syndrome, 56 with mild and moderate preeclampsia (group 2) and 15 women with normal pregnancy in terms of 35 to 40 weeks, in whom SMAD was performed in the following mode: for pregnant women 1 time in 30 minutes from 7 to 23 hours, 1 time in 60 minutes from 23 to 7 hours. The following indicators were taken into account: average blood pressure, the index of hypertension time, the index of the area under the blood pressure curve, indicators of variability, circadian rhythm, pulse and average dynamic blood pressure.

After prior informed consent, blood was taken to determine the level of TBG in 30 pregnant women in the first group, in 21 in the second and in 15 in the third. For the static analysis of the obtained results, a database was formed, in which the obtained quantitative indicators were entered. The whole range of modern static methods used in medicine (descriptive statistics, nonlinear regression, cluster analysis) was used in the work. Statistical databases were processed using the Statistica 6.0 software.

### **Results and Discussions**

In 56 pregnant women, the diagnosis of preeclampsia was verified in the course of the study according to the three-stage system for assessing the severity of preeclampsia developed by us, with the determination of the type of central hemodynamics, blood osmolarity, the biophysical profile of the fetoplacental complex (FPC), its functional state (in 8 of moderate severity and in 48 easy). In 32 pregnant women, the hypertensive condition was due to somatic pathology (pyelonephritis, hypothalamic syndrome, thyrotoxicosis and hypertension). In pregnant women with preeclampsia, all deliveries were urgent. At the same time, in 8 (14.3%) women, childbirth ended with cesarean section due to the inferiority of the scar on the uterus (4) and the ineffectiveness of the treatment of preeclampsia (4). In pregnant women with hypertension, premature birth in the period from 35 to 37 weeks occurred in 3 (3.4%) cases. In this group, surgical delivery was performed in 13 (14.8%) women due to the presence of a scar on the uterus and a violation of its contractile activity. There were no perinatal losses in the studied groups of women.

The condition of newborns in the first group in 4(4.5%) women was of moderate severity, in 8 (9%) - asymmetric fetal hypotrophy of mild (5) and moderate (3) severity was noted. In the second group, the condition of moderate severity was noted in 5 (8.9%) newborns, asymmetric hypotrophy in 7 (12.5%). Of which, 4 newborns were found to have hypotrophy of the second degree and 3 of the first. All women received hypotensive therapy with calcium antagonists, beta-blockers and magnesium sulfate according to Federal standards. For the differential diagnosis of preeclampsia and arterial hypertension, 6 evaluation criteria proposed by Prof. N. A. Zharkin (2000) were used as prognostic signs of preeclampsia: average blood pressure, the index of hypertension time, the index of the area under the curve of high blood pressure, the indicator of blood pressure variability, the indicator of daily rhythm, pulse and average dynamic blood pressure.

In the course of the study, it was noted that the only significant differences in the differential diagnosis of preeclampsia and hypertension of pregnant women are the indicators of the index of time, area, variability and average dynamic blood pressure. Thus, the average indicator of the time index, indicating the percentage of high blood pressure time to the entire follow-up time in the group of women with preeclampsia, for systolic blood pressure was  $55.3 \pm 2.1\%$ , for diastolic  $59.6 \pm 1.9\%$ . While for hypertensive conditions, these indicators were respectively equal to  $13.3 \pm 0.9\%$  and  $22.7 \pm 0.8\%$  ( $P < 0.005$ ). At the same time, an increase in the index indicated that the therapy was ineffective. The indicator of the area under the blood pressure curves for women with preeclampsia was  $122.8 \pm 1.6 \text{ mm}^2$ . for systolic blood pressure and  $119.1 \pm 1.4 \text{ mm}^2$ . for diastolic. In women with hypertension, these indicators were  $81.6 \pm 0.5 \text{ mm}^2$  and  $35.3 \pm 0.4 \text{ mm}^2$ , respectively, and were significantly different in both groups ( $P < 0.01$ ). At the same time, the indicators of the daily blood pressure rhythm in the groups of women with preeclampsia and hypertension did not significantly differ, averaging  $14.5 \pm 1.9\%$  and  $16.4 \pm 0.6\%$ , respectively ( $P > 0.01$ ). Normal indicators of this evaluation criterion range from 10 to 20%.

The levels of variability of systolic and diastolic blood pressure showed a significant decrease in variability in the group of women with preeclampsia and a decrease in the variability of night blood pressure in women with hypertension. The average values of pulse pressure in both groups did not significantly differ, averaging  $48.4 \pm 3.4 \text{ mmHg}$  for preeclampsia and  $52.8 \pm 1.9 \text{ mmHg}$  ( $P > 0.01$ ) for hypertension in pregnant women. The average dynamic pressure was calculated using the formula:  $\text{SDD} = \text{DB} + 1/3(\text{SAD} - \text{DAD}) \text{ mmHg}$ , where DBP is diastolic blood pressure, SAD is systolic blood pressure, and was significantly higher ( $P \leq 0.01$ ) in the group of women with preeclampsia, averaging  $102 \pm 0.6 \text{ mmHg}$ , compared with the groups of women with hypertension ( $89.2 \pm 0.2 \text{ mmHg}$ ) and a normally developing pregnancy ( $87.1 \pm 0.8 \text{ mmHg}$ ). At the same time, the difference in the average indicators of the average dynamic pressure in the first and third groups of women were also significantly different ( $P \leq 0.01$ ).

When assessing the level of TBG, it was noted that in the first group of women represented by pregnant women with mild and moderate preeclampsia, the average level of TBG was  $0.042 \pm 0.01 \text{ g/l}$ . At the same time, the average level of TBG among pregnant women with mild preeclampsia was  $0.0523 \pm 0.01 \text{ g/l}$ . In none of the observations, the TBG index in this group of women did not exceed  $0.07 \text{ g/l}$ , and among women with moderate preeclampsia was  $0.035 \pm 0.015 \text{ g/l}$  ( $P > 0.01$ ). In the group of women with hypertension of pregnant women, the average level of TBG was  $0.096 \pm 0.01 \text{ g/l}$  and it was significantly ( $P < 0.01$ ) higher than the average TBG index among women whose pregnancy was complicated by mild and moderate preeclampsia. At the same time, in none of the observations, the TBG level did not exceed the indicator of  $0.12 \text{ g/l}$ . In women of the control group (15), with a normal pregnancy, the average TBG level was  $0.157 \pm 0.01 \text{ g/l}$  and was significantly ( $p < 0.005$ ) higher than in the first and second groups and was not lower than  $0.14 \text{ g/l}$  in any of the observations.

## Conclusion

Thus, for the differential diagnosis of preeclampsia and gestational hypertension, it is necessary to conduct SMAD with an assessment of the time index, the area under the curve of high blood pressure, variability and the indicator of average dynamic blood pressure. At the same time, preeclampsia is characterized by: the time index is more than 50%, the area index is more than  $110 \text{ m}^2$ , the variability does not exceed  $12 \text{ mm Hg}$ , and the average dynamic blood pressure is more than  $100 \text{ mm Hg}$ .

In preeclampsia, the TBG level does not exceed  $0.07 \text{ g/l}$ . The level of TBG in hypertension of pregnant women is significantly less than in a normal pregnancy, but it is significantly higher than in preeclampsia of pregnant women of any severity and does not exceed the indicator of  $0.12 \text{ g/l}$ .

The characteristic features of the SMAD indicators for hypertension of pregnant women were a decrease in the nocturnal variability of blood pressure and not exceeding the average dynamic blood pressure of  $100 \text{ mm Hg}$ .

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