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Investigation of Blood Biochemical Parameters as Predictors of the Severity of Early Toxicosis in Pregnant Women

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ABSTRACT

Early toxicosis is a frequent phenomenon that accompanies the first trimester of pregnancy. Occurs, as a rule, from the second to the twelfth-fifteenth week of gestation. Usually, early toxicosis consists of hypersalivation, general weakness, nausea, and frequent vomiting, which manifest disorders of the autonomic and central nervous systems. Early toxicosis is a multifactorial disease that includes a cumulative group of gestational complications. The pathogenesis of early toxicosis has many etiological causes, among which the predominant importance is given to the effect of chorionic gonadotropin on the mother's body. In particularly severe and difficult-to-control cases, electrolyte disorders occur in women, and alkalosis develops. Today there are no generally accepted standards for diagnosing the severity of gestosis, but doctors actively use clinical and laboratory criteria, referring to the generally accepted parameters of the functional state of the cardiovascular system, liver, and urinary system. This scientific work is aimed at the study of biochemical blood parameters as predictors of the severity of early toxicosis in pregnant women.

Key words: *Early toxicosis, Vomiting of pregnant women, Pregnancy, Gestosis*

INTRODUCTION

Early toxicosis is a pathological multifactorial disease that occurs in the first trimester of pregnancy and can last until the end of gestation [1, 2]. Among the serious complications of early toxicosis, metabolic disorders are distinguished, including electrolyte disturbances, the development of alkalosis and/or ketonuria, and dehydration [3, 4]. All this is accompanied by investigative changes in blood and urine tests [5, 6].

According to world statistics, early toxicosis accompanies 70% of pregnancies [7]. In the Russian Federation, it was found that about 60% of pregnant women experience only nausea and vomiting, but 2% of women are diagnosed with complicated early toxicosis, which involves hospitalization in a hospital [8, 9]. In rare cases, this leads to maternal mortality [10]. As a rule, the occurrence of early toxicosis is associated with a genetic predisposition, diseases of the gastrointestinal tract, hormonal imbalance, and neurological disorders [11]. Concomitant pathologies play a special role among risk factors (**Figure 1**).

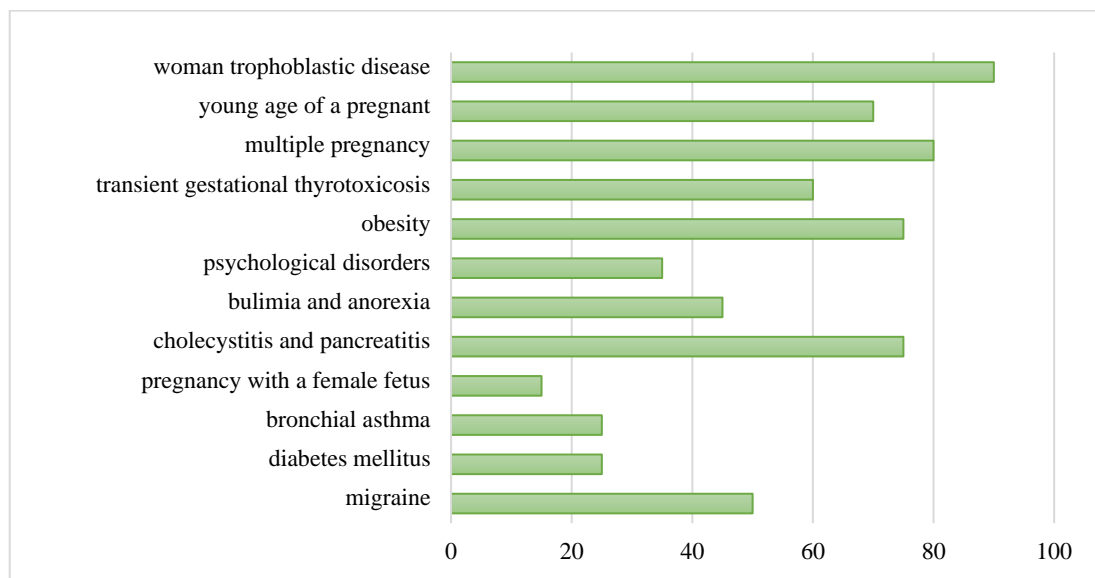


Figure 1. The most common risk factors for early toxicosis in pregnant women

It is important to emphasize that timely registration in the women's clinic and monitoring of clinical and laboratory parameters is an important component of prevention and prevention of the progression of metabolic disorders from mild to severe early toxicosis [12].

Nausea and vomiting in pregnant women should be strictly differentiated from other pathological conditions (esophageal, gastric, pancreatic, and biliary vomiting, in particular) [13]. The clinical manifestations of early toxicosis are based on a violation of embryo-placental interaction [14]. The fundamental point is the inadequate functioning of the endothelial system and the platelet link of hemostasis, as well as the programmed death of lymphocytes as a result of activation of the placental immunopathological reaction [15, 16]. In this regard, a clear algorithm is needed to construct a differential diagnosis scheme, starting from the collection of anamnesis to the use of instrumental diagnostics. **Table 1** presents the main criteria for determining the severity of early toxicosis. According to **Table 1**, early toxicosis has three degrees of severity: mild, moderate, and severe. Criteria such as the frequency of vomiting during the day, heart rate, blood pressure, body weight loss for 7 days, the presence of temperature, assessment of jaundice of the sclera and skin, assessment of dryness of the skin, stool frequency, diuresis and the severity of ketonuria are taken into account [17, 18].

Diagnostic criteria for early toxicosis are based for the most part on the determination of clinical and laboratory parameters. As laboratory tests, general blood, and urine tests are usually used (hematocrit examination: biochemical blood analysis, especially data including bilirubin, residual nitrogen, urea, electrolytes, total protein, protein fractions, glucose) [19-21]. It is advisable to determine the presence and level of acetone, urobilin, and protein in the urine [22, 23].

In women with severe gestosis, elevated hemoglobin, erythrocytes, and protein levels can be determined by a blood test, and the true degree of dehydration must be determined by the level of hematocrit. With its value above 40%, we can talk about pronounced dehydration [24].

The purpose of the study: to study the protein composition of the blood of pregnant women, as well as the parameters of bilirubin, urea, and creatinine to identify diagnostic and prognostic predictors of the course of early toxicosis of pregnant women.

Table 1. The severity of vomiting in pregnant women

Symptoms	Severity		
	Light	Medium	Heavy
Frequency of vomiting per day	from 3 to 5 times	from 6 to 10 times	from 11 times and above
Heart rate	80-90	90-100	more than 100
Average blood pressure	110-120 mmHg	100-110 mmHg	less than 100 mmHg
Weight loss (per week)	Up to 5% of the initial mass	6-10% of the initial mass	more than 10% of the initial mass
Subfebrile temperature	no	rarely	often

Jaundice of the sclera and skin	no	5-7% of patients	20-30% of patients
Hyperbilirubinemia	no	21-40 $\mu\text{mol/l}$	21-60 $\mu\text{mol/l}$
Dryness of the skin	+	++	+++
Bowel movements	Daily	1 time in 3 days	constipation
Diuresis	900-800 ml	800-700 ml	less than 700 ml
Ketonuria	+, ++	+, +++	+++ ,++++

MATERIALS AND METHODS

The current study involved 40 pregnant women who were patients of antenatal clinics in Vladikavkaz (Republic of North Ossetia-Alania). All patients had a pregnancy in the first trimester and underwent inpatient treatment in the department of conservative gynecology. According to the classification of the severity of toxicosis (**Table 1**), three experimental groups were selected:

Group 1 (10 people) - patients with mild early toxicosis. The general condition of the patients remained satisfactory throughout their stay in the hospital. Vomiting was observed up to 3 times a day, more often after meals, sometimes on an empty stomach in the morning. Patients lost no more than 2-3 kg in weight, body temperature remained within normal limits. The heart rate did not exceed 80 beats per minute. Blood pressure did not change significantly, there were no registered hypertensive crises. Clinical tests of urine and blood were without pathological changes.

Group 2 (10 people) - patients with a moderate course of early toxicosis. Vomiting was observed on average from 5 to 10 times a day and was no longer associated with eating. Body weight loss averaged from 2 to 3 kg in 1.5-2 weeks. Subfebrile temperature was often recorded in women. Tachycardia - up to 100 beats per minute. Acetonuria was observed in 6 out of 10 women.

Group 3 (10 people) - patients with severe toxicosis in the first trimester. Vomiting was recorded on average up to 20-25 times a day, sometimes with any movement of patients. Sleep was disturbed, and adynamia was registered. Body weight loss up to 8-10 kg. Body temperature in the group is from 37.2 to 37.5 C. Tachycardia - up to 110-120 beats per minute, hypotension. It should be noted that all the women of the third group had their tongues overlaid, and the mucous membranes and skin were dry. The daily diuresis was reduced in all. All women had acetonuria, protein, and cylinders in the urine.

Blood parameters such as the content of total protein and its fractions, the level of bilirubin, urea, creatinine, and medium-weight molecules (AST, ALT) were studied in all pregnant women.

Statistical processing of the results of the study was carried out using the application software package "Statistica 6.0" ("StatSoft inc", USA). The data obtained as a result of the study correspond to the normal distribution law. To assess the statistical significance of differences in quantitative characteristics in independent samples, the Student's t criterion was used. The description of quantitative features was carried out in the form of an average and its standard error, and the description of qualitative features was carried out in the form of percentages indicating the boundaries of the 95% confidence interval. The statistical significance of the differences was assumed to be reliable with a confidence probability of $p < 0.05$.

RESULTS AND DISCUSSION

In the first group with a mild course of early toxicosis, the concentration of albumins decreased ($p < 0.05$) and the level of $\alpha 1$ -globulins in the blood increased ($p < 0.05$). At the same time, there were no changes in the level of total protein in the blood and other comparable indicators.

Concerning the nature of systemic metabolic shifts in the second group with a moderate course of early toxicosis, noticeable quantitative and qualitative changes in the blood protein spectrum should be noted: the level of serum albumins remained low, as in patients with the mild course, and the amount of $\alpha 1$ - and $\alpha 2$ -globulins exceeded the indicators of the control group ($p < 0.05$). There was no decrease in the level of total protein in the blood of patients with moderate to severe early toxicosis. C-reactive protein is found in the blood of 70% of women. A significant increase in the fibrinogen level was recorded ($p < 0.05$). The detected increase in the activity of alanine-aminotransferase ($p < 0.01$) and aspartate-aminotransferase ($p < 0.02$) in the blood of pregnant women with moderate early toxicosis indicated an increasing violation of the stability of biological membranes and the development of cytolysis syndrome. Thus, in the moderate course of early toxicosis, systemic metabolic shifts progressed.

As the results demonstrated, in the third group of severe early toxicosis, there was a significant increase in the activity of ALT and AST in the blood serum. At the same time, the progression of hypoalbuminemia and dysproteinemia was detected, while the concentration of total protein in the blood serum remained within normal values. C-reactive protein was found in the blood of all patients of the third group, the fibrinogen content significantly exceeded both the indicators in the comparison group and the indicators in the groups of patients with moderate early toxicosis.

With the aggravation of the clinical manifestations of the disease, the level of average weight molecules progressively increased: in patients with severe early toxicosis, the level of medium-weight serum molecules was maximal compared to the same indicator in the control group ($p < 0.01$) and in patients of the first and second observation groups ($p < 0.05$).

CONCLUSION

The detection of metabolic disorders such as hypoalbuminemia and dysproteinemia in pregnant women with early toxicosis, the severity of which correlated with the severity of the pathology, allows us to recommend the determination of several integrative biochemical parameters of the blood to clarify the severity of the course of early toxicosis and, accordingly, the prognosis of the disease. In conclusion, we can say that early toxicosis in the modern world is a serious complication of pregnancy, but with adequate diagnosis and timely treatment, the outcomes for the mother and fetus are favorable in most cases.

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CONFLICT OF INTEREST : None

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ETHICS STATEMENT : The experiment was carried out with patients who signed an agreement for volunteer participation in the experiment. All raw data are available upon request from the corresponding author.

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