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DYNAMICS OF IMMUNO-RHEUMATOLOGICAL PARAMETERS IN WOMEN WITH SYSTEMIC LUPUS ERYTHEMATOSUS DURING PREGNANCY

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Abstract. *In pregnant women with systemic lupus erythematosus (SLE), immuno-rheumatological parameters—including antinuclear antibodies (ANA), anti-double-stranded DNA antibodies (anti-dsDNA), complement components C3 and C4, C-reactive protein (CRP), and erythrocyte sedimentation rate (ESR)—demonstrate significant changes across each trimester of pregnancy. This article analyzes the dynamics of these biomarkers over the past five years of scientific research, their association with SLE disease activity, and their impact on pregnancy outcomes. These biomarkers play an important role in predicting maternal immune response and SLE activity and are essential for clinical monitoring.*

Keywords: *systemic lupus erythematosus (SLE), pregnancy, immuno-markers, antinuclear antibodies (ANA), anti-dsDNA, complement C3/C4, C-reactive protein (CRP), erythrocyte sedimentation rate (ESR).*

HOMILADORLIK DAVRIDA TIZIMLI QIZIL BO‘RICHA BILAN XASTALANGAN AYOLLARDA IMMUNO-REVMATOLOGIK KO‘RSATKICHLAR DINAMIKASI

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Annotatsiya. *Tizimli qizil bo‘richa (TQB) bilan kasallangan homilador ayollarda immuno-revmatologik ko‘rsatkichlar (ANA, anti-dsDNA, komplement komponentlari C3 va C4, C-reaktiv oqsil (CRO) va eritrosit sedimintatsiyasi (ESR) homiladorlikning har bir trimestrida sezilarli o‘zgarishlar ko‘rsatadi. Mazkur maqolada oxirgi besh yil ichidagi ilmiy izlanishlar bo‘yicha ushbu biomarkerlarning dinamikasini, TQB faolligi bilan bog‘liqligini va homiladorlik natijalariga ta’sirini tahlil qiladi. Bu biomarkerlar onaning immun javobini va TQB faolligini bashorat qilish hamda klinik kuzatuvda muhim o‘rinni egallaydi.*

Kalit so‘zlar: *Tizimli qizil bo‘richa (TQB), homiladorlik, immuno-markerlar, antinuklear antikorlar (ANA), anti-dsDNA, komplement C3/C4, C-reaktiv oqsil (CRO), eritrosit cho‘kish tezligi (ECHT).*

ДИНАМИКА ИММУНОРЕВМАТОЛОГИЧЕСКИХ ПОКАЗАТЕЛЕЙ У ЖЕНЩИН С СИСТЕМНОЙ КРАСНОЙ ВОЛЧАНКОЙ ВО ВРЕМЯ БЕРЕМЕННОСТИ

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Аннотация. *У беременных женщин с системной красной волчанкой (СКВ) иммуноревматологические показатели — антинуклеарные антитела (ANA), антитела к двухцепочечной ДНК (anti-dsDNA), компоненты системы комплемента C3 и C4, С-реактивный белок (СРБ) и скорость оседания эритроцитов (СОЭ) — демонстрируют выраженные изменения в каждом триместре беременности. В данной статье на основе научных исследований, опубликованных за последние пять лет, проанализирована динамика указанных биомаркеров, их взаимосвязь с активностью СКВ и влияние на исходы беременности. Эти биомаркеры играют важную роль в прогнозировании иммунного ответа матери и активности СКВ, а также имеют существенное значение для клинического наблюдения.*

Ключевые слова: *системная красная волчанка (СКВ), беременность, иммуномаркеры, антинуклеарные антитела (ANA), anti-dsDNA, комплемент C3/C4, С-реактивный белок (СРБ), скорость оседания эритроцитов (СОЭ).*

Relevance of the topic. Systemic lupus erythematosus is a common autoimmune disease among women of reproductive age, and changes in disease activity during pregnancy increase the risk of maternal and perinatal complications [2,19,22]. This disease is widespread worldwide, and its epidemiology varies significantly across different regions. According to global analyses, 3.41 million people live with SLE, which corresponds to approximately 43.7 cases per 100,000 population. The prevalence of SLE is estimated at about 78.7 per 100,000 among women and about 9.3 per 100,000 among men, indicating that the disease is 8.5 times more common in women. International epidemiological studies show that women aged 15–44 years have the highest risk of developing SLE, and this age group represents a strategically important population in terms of pregnancy and health outcomes.

In pregnant women with SLE, common perinatal complications such as preeclampsia, intrauterine growth restriction, and an increased risk of miscarriage are of significant clinical importance. Therefore, trimester-based immuno-rheumatological monitoring, assessment of the SLEDAI index, and management using a multidisciplinary approach are essential for pregnant women with SLE [6,25,29].

Research objective. Based on scientific studies conducted over the past five years, this research aims to analyze the trimester-based dynamics and clinical significance of ANA, anti-dsDNA, C3, C4, CRP, ESR, and SLEDAI indicators in women with systemic lupus erythematosus during pregnancy.

In global medical practice, sufficient experience has been accumulated in the management of pregnant women with systemic lupus erythematosus. However, due to significant advances in the treatment of this disease, new aspects of this problem are emerging. Currently, the influence of SLE activity on the course and outcomes of pregnancy, fetal and neonatal development, as well as the impact of pregnancy on the course of SLE—particularly the frequency and timing of disease exacerbations—remains highly relevant. This is associated with a significant reduction in contraindications to pregnancy and improved pregnancy outcomes.

The literature presents contradictory data regarding the frequency of various complications during pregnancy, childbirth, and the postpartum period in women with SLE, as well as conditions observed in their newborns in the early neonatal period. The effects of immunosuppressive therapy used during pregnancy, lupus nephritis, and associated antiphospholipid syndrome (APS) on pregnancy course, delivery outcomes, and neonatal health remain insufficiently studied. Research in this field and improvement of therapeutic approaches during gestation may help address several pressing issues.

Pregnant women with SLE exhibit signs of imbalance in cellular immunity, manifested by an increase in activated T lymphocytes and regulatory T cells, a decrease in natural killer cells, and reduced functional activity of phagocytes. Elevated levels of interleukin-2 (IL-2), interleukin-5 (IL-5), granulocyte colony-stimulating factor (G-CSF), and decreased macrophage inflammatory protein (MIP-1β) characterize changes in the cytokine profile in the blood of pregnant women with SLE. Despite ongoing therapy, these immunological changes may contribute to a high incidence of pregnancy and delivery complications.

In the umbilical cord blood of infants born to mothers with SLE, insufficient functional activity of phagocytes and innate immune cells, increased IL-8 levels, and decreased GM-CSF concentrations are observed [30].

ANA antibodies have high sensitivity for SLE, and their titers may remain stable during pregnancy; however, high titers have been reported to be associated with disease activity and neonatal complications [10,11]. Anti-dsDNA antibodies are among the most important laboratory markers of SLE activity, and their elevation is directly associated with disease exacerbation and the development of nephritis [4,9,25]. Several studies have shown that decreased C3 and C4 levels reflect immune complex–mediated activity [5,27].

Although complement synthesis physiologically increases during pregnancy, reduced C3 and C4 levels in women with SLE are considered reliable indicators of disease exacerbation [3,6,18]. C-reactive protein (CRP) in SLE usually reflects infection or active inflammation; during pregnancy, its elevation

has been shown to be moderately associated with disease activity [14,26]. Erythrocyte sedimentation rate (ESR) may increase due to physiological hemodilution in pregnancy and is therefore considered a less specific marker [23].

The Systemic Lupus Erythematosus Disease Activity Index (SLEDAI) is a widely used validated index for assessing SLE activity, incorporating immunological and clinical parameters [1,8]. Recent meta-analyses have demonstrated that pregnant women with SLEDAI ≥ 6 have a significantly increased risk of preeclampsia, preterm birth, and fetal growth restriction [17,29]. According to literature data, SLEDAI shows a strong positive correlation with anti-dsDNA (r = 0.48–0.72) and a negative correlation with C3 and C4 [4,5,27]. Its association with CRP and ESR is moderate, indicating the limited specificity of these markers during pregnancy [14,23,26].

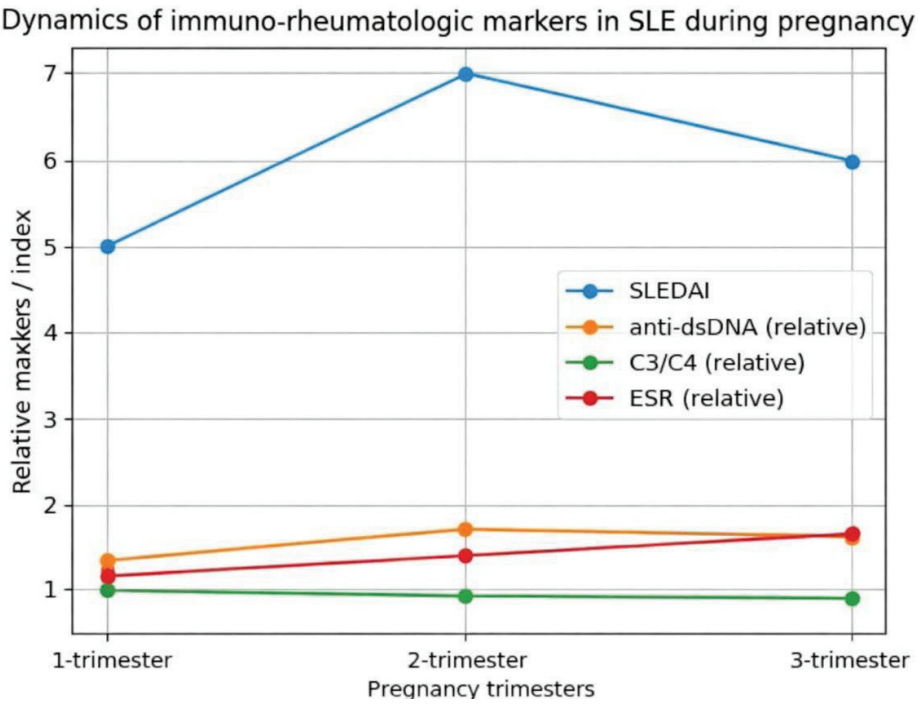
Table 1.

Correlation Between the SLEDAI Index and Immuno-Rheumatological Parameters in Pregnant Women with SLE

Parameter	Correlation Coefficient (r)	p-value	Direction of Association	Statistical Interpretation
Anti-dsDNA	+0,48 - +0,72	<0,001	Positive	Strong positive correlation
ANA titer	+0,35 - +0,58	<0,01	Positive	Moderate-to-strong positive association
C3 complement	-0,41 - -0,65	<0,01	Negative	Moderate-to-strong negative correlation
C4 complement	-0,38 - -0,62	<0,01	Negative	Moderate negative correlation
CRP	+0,32 - +0,55	<0,01	Positive	Moderate positive association
ESR	+0,28 - +0,49	<0,05	Positive	Low-to-moderate positive association

The analysis of scientific literature indicates that the SLEDAI index has a strong positive correlation with anti-dsDNA levels and a negative correlation with complement components C3 and C4. This phenomenon is explained by increased formation of immune complexes and enhanced complement consumption in the pathogenesis of systemic lupus erythematosus. CRP and ESR parameters demonstrate a moderate association with SLEDAI; however, ESR is considered a less specific marker due to physiological changes during pregnancy.

The presented correlations are statistically significant ($p < 0.05$) and confirm the integrative role of the SLEDAI index in assessing immuno-rheumatological activity.



The presented graph reflects the trimester-based dynamics of the main immuno-rheumatological parameters in women with systemic lupus erythematosus (SLE) during pregnancy. As shown in the graph, the SLEDAI index, which reflects disease activity, remains at a low-to-moderate level in the first trimester and reaches its maximum values in the second trimester. This indicates a possible intensification of SLE activity during this period and a high probability of disease exacerbation in some patients. In the third trimester, although SLEDAI demonstrates a slight downward trend, disease activity persists, indicating a continued risk of exacerbation in late gestation.

Relatively high anti-dsDNA antibody levels in the second and third trimesters confirm their positive correlation with SLEDAI values. This finding is particularly important in patients with lupus nephritis, where it serves as an immunological marker of disease activity and may be associated with an increased risk of pregnancy complications, including fetal growth restriction and preeclampsia.

A decreasing trend in C3 and C4 complement levels is observed in the second and third trimesters. This reduction is associated with increased SLE activity and demonstrates a negative correlation with anti-dsDNA and SLEDAI. Decreased complement levels reflect activation of immune complexes and intensified inflammatory processes and have significant prognostic value for the development of gestational complications.

The gradual increase in erythrocyte sedimentation rate (ESR) during pregnancy is partially explained by physiological changes. However, a marked increase in ESR in the third trimester may also be associated with disease activity, indicating its importance as an additional monitoring marker of inflammation in pregnant women with SLE.

Overall, the graph clearly demonstrates that the second trimester represents the most critical period for SLE activity, while changes in immunological parameters are closely related to clinical activity and the risk of pregnancy complications. These findings substantiate the need for trimester-based dynamic immunological monitoring and individualized therapeutic strategies in pregnant women with SLE.

Conclusion. A review of the literature indicates that pregnancy in women with SLE is complicated in 92% of cases. The most common complications include early miscarriage risk (53.1%), placental insufficiency (10.2%), preeclampsia (8.2%), fetal growth restriction syndrome (8.2%), intrahepatic cholestasis of pregnancy (6.1%), and arterial hypertension (4.1%). The frequency of preterm delivery is 20.4%, and antenatal fetal death occurs in 4.1% of cases.

Dynamic monitoring of immuno-rheumatological parameters during pregnancy in women with SLE is crucial for assessing disease activity and predicting complications. The SLEDAI index, when used in combination with anti-dsDNA and complement levels, has the highest prognostic value and requires a multidisciplinary approach.

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