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Impact of Coronavirus Infection on Pregnancy Development

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Annotation. The article presents data on the characteristics of the course and impact on the health of pregnant women, the fetus, and newborns caused by the SARS-COV-2 virus. Some of the currently existing protocols for the prevention of infection and treatment of COVID-19 in the world were analyzed and a modification adapted for pregnant women was proposed. A method for preventing one of the most common and dangerous complications of COVID-19 in pregnant women - miscarriage and nutritional deficiency correction - has been proposed.

Keywords: COVID-19, pregnancy, complications, miscarriage, correction, prevention.

Across the world, aspects of the pathogenesis, possible methods of prevention, diagnosis, and treatment of COVID-19 are being actively studied [2,11,19,26,34,41]. At the beginning of the pandemic, obstetrician-gynecologists' attention was focused on studying the impact of SARS-CoV-2 on obstetric and perinatal outcomes, while the impact of infection on the fetoplacental complex, which determines not only the child's condition at birth but also long-term outcomes, was studied to a lesser extent [5,13,20,28,33,40]. Despite the fact that pregnant women and newborns belong to the high-risk group for adverse outcomes, the frequency of such outcomes, according to some data, is quite low [1,9,17,25,32,39]. This circumstance may be partly due to the fact that pregnant women often endure SARS-CoV-2 infection practically without clinical symptoms, without suspecting the presence of coronavirus infection and its possible consequences for their children's health and future [4,12,18,24,31,42]. Infection with SARS-CoV-2 during pregnancy can have adverse effects on both the mother's body and the fetus, but to date, there are insufficient studies evaluating the consequences of COVID-19 for newborns, and they are based on a small number of observations. Scientists have concluded that the probability of vertical transmission from mother to child is negligible [6,14,21,27,35,38]. In practice, there are cases of

infection of children immediately after birth, but specialists have concluded that this could have occurred through the air in the operating room, due to the newborn's contact with a sick person or an asymptomatic virus carrier [3,10,16,23,30,37]. As a preventive measure, to prevent the child from getting infected, many believe that he and the infected mother should be separated.

Immunological shifts and physiological changes predispose pregnant women to a more severe and prolonged course of respiratory infections, including coronavirus infections [7,8,15,22,29,36]. Pregnant women are at risk of contracting the coronavirus infection due to changes in the body (primarily in the respiratory and immune systems), in connection with which they should be classified as a risk group and, accordingly, under observation, as any viral infection during pregnancy is associated with the risk of miscarriage and premature birth.

Physiological changes in the immune, cardiovascular, and respiratory systems during pregnancy suggest that pregnant women are particularly vulnerable to the effects of pathogenic infectious agents and the development of a severe infection, which, in turn, can lead to higher morbidity and mortality of the mother and fetus/newborn.

In pregnant women with pneumonia, the frequency of cesarean section is higher, premature births occur more often, premature babies are born with low, very low, and extremely low body weight, which leads to premature birth consequences for newborns. Additionally, predisposition to hypertension and gestational diabetes increases during pregnancy, which are currently recognized risk factors for the development of severe acute respiratory syndrome caused by coronaviruses, including SARS-CoV-2. Nevertheless, data for assessing the impact of SARS-CoV-2 infection on the health of pregnant women and newborns are fragmented and need to be systematized. During pregnancy, there is an increase in the level of circulating progesterone - a steroid hormone that has immunomodulatory properties. Progesterone also enhances lung recovery after flu-induced damage, making its high levels during pregnancy potentially beneficial for recovery after viral lung diseases. During pregnancy, congenital and adaptive immune responses shift from the inflammatory

phenotype to the anti-inflammatory one to prevent fetal rejection and facilitate the passive transmission of maternal antibodies to it. During pregnancy, in addition to changes in the immune system, systemic physiological changes occur in the vascular bed, in particular, an increase in the volume of circulating maternal blood, an increase in heart rate, stroke volume, and, consequently, an increase in cardiac output by 30-50% and a decrease in vascular resistance; in the respiratory system - a decrease in functional residual capacity and excursion of the chest cavity. Pregnancy is a state of hypercoagulation with increased thrombin formation and increased intravascular coagulation. All these factors suggest a greater vulnerability of pregnant women to COVID-19 infection compared to the general population. It is known that high estrogen concentrations disrupt vascular motility, causing vasomotor rhinitis during pregnancy, which usually affects one-fifth of women in later pregnancy and leads to pronounced nasal congestion and rhinorrhea, which can mask and exacerbate COVID-19 symptoms [3]. Physiological dyspnea, a consequence of increased maternal oxygen demand due to increased metabolism, gestational physiological hemodilution, and often anemia, as well as fetal oxygen consumption, is common during pregnancy [4]. At the same time, it should be noted that the functioning of the pulmonary respiratory system from the second half of gestation is complicated by the high position of the diaphragm, which arises as a result of the growth of the pregnant uterus, and the need to enhance lung function due to the increase in the body's need for oxygen [5]. This is important because pneumonia in COVID-19 often progresses from focal to diffuse bilateral consolidation of the lung parenchyma, which can quickly lead to hypoxemic respiratory failure during pregnancy [6]. Thus, physiological factors contributing to the unfavorable course of infection in pregnant women are: a high position of the diaphragm in the second half of pregnancy; increased load on the cardiorespiratory complex; the state of relative immunosuppression to prevent fetal rejection (suppression of the production of pro-inflammatory and increased production of anti-inflammatory cytokines) and passive transmission of maternal antibodies to the fetus; a tendency to develop arterial hypertension, diabetes mellitus, pathological weight gain; a state of hypercoagulation; hypervolemia, a relative decrease in hemoglobin per unit volume.

The virus's impact on the fetus remains the subject of numerous discussions and studies, with data showing that women with COVID-19 have a higher risk of premature birth with all the consequences for the newborn [5,6]. In a number of cohort studies, newborns born to mothers with a positive COVID-19 were tested for antibodies in their first month of life, none of the tests showed a positive result. The obtained results are consistent with the findings of another study, which did not record cases of pneumonia or lower respiratory tract diseases in newborns born to COVID-positive mothers up to 6-8 weeks of age. It has been reported that there have been several cases of mild symptoms in newborns diagnosed with COVID-19 at birth or shortly thereafter. The most common manifestations of COVID-19 in newborns are fever, pneumonia, cyanosis, respiratory distress. Most of these children showed moderate symptoms, and the outcome was favorable. It was determined that most of the complications were related to premature birth and sepsis, and not SARS-CoV-2. Perinatal mortality among newborns from mothers with COVID-19 is 5.6%, which is not significantly different from the general population, as is the stillbirth rate. Evidence of SARS-CoV-2 transmission through breast milk is limited, and current guidelines recommend continuing breastfeeding for mothers who have tested positive for COVID-19.

However, pregnant women have one important feature. COVID during pregnancy can suddenly worsen, even if the disease has previously been relatively stable and mild.

According to Borova S.Yu., Yakimova A.V. (2024), as a result of studying the impact of COVID-19 infection on the fetoplacental complex, it was determined that the frequency of adverse perinatal outcomes and the intensity of structural changes in the placenta are inversely proportional to the gestational age during infection. A correlation was observed between gestational age and the severity of COVID-19, explained by the dynamics of changes in the humoral regulation of the pregnant woman's body [2,8]. When the disease develops in the early stages of pregnancy, structural changes occur in the chorion or placenta, contributing not only to placental insufficiency and related complications, but also to hypertensive disorders as a consequence of superficial trophoblast invasion, leading to inadequate remodeling of spiral arteries.

Undoubtedly, the problem of COVID-19 infection during pregnancy still contains many unresolved issues that require further research. It is necessary to study the possibilities of predicting and preventing adverse perinatal outcomes, including taking into account the gestational age for COVID-19 and the severity of its course.

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