ADAPTIVE MECHANISMS OF FETAL INNATE IMMUNITY IN PREGNANT WOMEN AFTER COVID-19

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Background. Coronavirus disease (COVID-19) remains an important global health problem. Pregnant women represent a vulnerable population because SARS-CoV-2 infection may affect maternal health, placental function, and fetal development. The immune responses at the maternal–fetal interface are complex and may influence pregnancy outcomes. However, the characteristics of fetal innate immunity in pregnancies complicated by COVID-19 remain insufficiently studied.

Objective. To evaluate the indicators of fetal innate immunity in pregnant women who had COVID-19 depending on the severity of the disease.

Materials and Methods. The study included 60 pregnant women who had moderate or severe COVID-19 during the second and third trimesters of pregnancy and were hospitalized at the Republican Perinatal Center during 2021–2022. The control group consisted of 10 healthy pregnant women with physiological pregnancy. Clinical, instrumental (Doppler ultrasound and transabdominal cordocentesis), immunological, and statistical methods were used. Fetal blood samples obtained from the umbilical vein were analyzed to determine the levels of immunoglobulins (IgG, IgM) and cytokines (IL-1β, IL-4, IL-6, IL-18).

Results. The study revealed significant changes in the fetal immune system in pregnancies complicated by COVID-19. Analysis of fetal immunoglobulin levels demonstrated a pronounced activation of humoral immunity. In cases of severe maternal COVID-19, the concentration of IgG in fetal blood was 2.3 times higher than in the control group, reflecting the transplacental transfer of maternal

antibodies. At the same time, IgM levels increased approximately twofold, indicating activation of the fetus's own immune response.

Significant alterations were also observed in the cytokine profile of fetal blood. During the second trimester, fetuses of mothers with severe COVID-19 demonstrated a marked increase in pro-inflammatory cytokines. The levels of IL-1β and IL-18 increased approximately 9-fold and 11-fold, respectively, compared with the control group. In addition, anti-inflammatory and regulatory cytokines such as IL-4 and IL-6 were elevated by 4-fold and 2.65-fold. These findings suggest an intrauterine inflammatory response and immune activation in the fetal organism.

In the third trimester, cytokine alterations remained significant but were less pronounced compared with the second trimester. IL-18, IL-4, and IL-6 levels were increased by approximately 1.5, 1.6, and 2 times, respectively. However, the level of IL-1β did not demonstrate a statistically significant difference compared with the control group.

Doppler ultrasound assessment also indicated functional changes in fetoplacental circulation in some cases, which may be associated with inflammatory processes and immune activation during maternal SARS-CoV-2 infection. Overall, the obtained results indicate that maternal COVID-19 contributes to immune activation in the fetus and may influence intrauterine adaptation mechanisms.

Conclusion. Maternal COVID-19 infection is associated with significant changes in fetal innate immune responses. Elevated levels of immunoglobulins and cytokines indicate intrauterine antigenic stimulation and activation of the fetal immune system. These immunological markers may serve as potential predictors of pregnancy complications and adverse perinatal outcomes