ANALYSIS OF THE RISK OF INFECTION OF PARVOVIRUS INFECTION B19 DURING PREGNANCY

АНАЛІЗ РИЗИКУ ІНФІКУВАННЯ ПАРВОВІРУСНОЮ ІНФЕКЦІЄЮ B19 ПІД ЧАС ВАГІТНОСТІ

Tsapenko T. V.
*Candidate of Medical Sciences,
Assistant Professor at the Department of
Obstetrics and Gynecology № 1
Bogomolets National Medical University*

Цапенко Т. В.
*кандидат медичних наук,
асистент кафедри акушерства
і гінекології № 1
Національний медичний університет
імені О. О. Богомольця*

Bondarenko N. P.
*Doctor of Medical Sciences,
Associate Professor at the Department of
Obstetrics and Gynecology № 1
Bogomolets National Medical University
Kyiv, Ukraine*

Бондаренко Н. П.
*доктор медичних наук,
доцент кафедри акушерства
і гінекології № 1
Національний медичний університет
імені О. О. Богомольця
м. Київ, Україна*

Parvovirus infection is an acute infectious disease caused by parvovirus B19 (Primate erythroparvovirus), which is associated with a wide range of different diseases [1]. It is most pronounced clinically in children in the form of infectious erythema, and also causes aplastic anemia, thrombocytopenia, acute and chronic arthritis [2; 3]. The most sensitive to the PV19 virus are patients with hematological diseases and immune system deficiency [5]. Pregnant women are at high risk of parvovirus B19 infection due to the development of transient physiological immune suppression during pregnancy and the particular susceptibility of the fetus. According to various literature data, in 25-55% of cases of parvovirus infection, intrauterine infection (IUI) of the fetus occurs [4]. The most common results of PV19 infection are: abortion, intrauterine fetal death, non-immune fetal hydrops, preterm birth, placental dysfunction, IUGR, preeclampsia [1; 4].

With a possible search for new diagnostic approaches, the authors of this research work proposed a mathematical model of predictive risk factors for parvovirus infection during pregnancy.

According to the goal of the research work, 1090 pregnant women were examined for parvovirus infection at different stages of pregnancy using

PCR test systems (in real time) and enzyme immunoassay for specific IgM, IgG PV19 (Immunoblot).

Of the total number of pregnant women examined, acute parvovirus infection at the time of the survey was diagnosed in 129 pregnant women with acute parvovirus infection, who constituted the main group for further research. The control group consisted of 130 non-infected patients with a physiological course of pregnancy,

A retrospective analysis of clinical and epidemic factors and complications of pregnancy in those infected with parvovirus B19 was carried out female patients. The obtained data were compared with the frequency of such manifestations in the absence of this infection. To create a PB19 forecasting program, a logistic regression analysis was used, which allows you to build a statistical model to predict the probability of an event from the available data, which may or may not happen. The assessment is carried out by determining the list of factors for each patient and, depending on the presence or absence of the factor, we determine the sum of prognostic coefficients: $\Sigma PC = PC1+PC2+PC3……$

The maximum possible amount (in the presence of all adverse factors) is 148 points. The minimum amount (in the absence of all factors) is 38 points. The whole range can be divided into 3 parts:

1) From -38 to +20 – a group of low risk of infection

2) From +21 to +80 – a group of medium risk of infection

3) Above 80 points for the amount of PC – a group of high risk of infection.

Calculations of prognostic coefficients were carried out by the following formula:

$$\Pi K(x_j) = 100 \lg \frac{P(x_j / A1)}{P(x_j / A2)}$$

where:

PK (xj) – prognostic coefficient of information group j of feature x;

P (xj/A1) – the probability of information group j of the corresponding feature X in the totality of patients with certain complications (A1);

P (xj/A2) – the probability of the information group j of the corresponding feature X in the control group.

The results of observations and examinations of each pregnant woman were entered into the created individual card, as well as into a spreadsheet in the MS Excel program.

As a result of the study, data were obtained on a sufficiently high frequency and prevalence of parvovirus B19 in pregnant women with obstetric pathology. Acute parvovirus infection was diagnosed in 11.8% (129/1090) of patients in the study group with a high risk of infection. The most significant pathogenic role of parvovirus B19 in the development of spontaneous abortions – 24.6% of cases, non-immune dropsy of the fetus in 14.9% of cases; placental dysfunction, IGR – in 9.5% of cases. It should be noted that in 2.3% of women infected with parvovirus B19, no negative effect on the fetus was noticed.

A statistical analysis of clinical and epidemiological parameters of parvovirus B19 infection factors was carried out; a mathematical model of prognostic risk factors for parvovirus infection in pregnant women was developed. This model is offered for practical use by doctors, with a possible search for new diagnostic approaches and preventive measures for parvovirus infection. There was a 42.35-fold increase in the relative risk of parvovirus B19 infection during pregnancy, with an OR=42.35 (25.59-70.08) (p<0.0001) for contact with children under 6 years of age. The likelihood of developing anemia during pregnancy in infected women increases 36.44-fold – OR=36.44. The relative risk of fetal immune hydrops when infected with parvovirus B19 at different gestational terms increases at the end of the first trimester – OR=3.4 (1.03-11.2) with the highest frequency of occurrence in the second trimester of pregnancy – OR=12.6 (6.65-23.9), then decreases in the third trimester to OR=4.32 (2.76-6.8). Other factors in the ranking represent approximately the same statistical significance with fluctuation of relative probability of infection with risk in the range OR=3-9. These factors are such as contact with teenagers OR=7.19, household contact at home OR=3.94, contact among teachers OR=5.84, employees of pediatric medical institutions OR=6.75, seasonal outbreaks in late winter OR=6.49 and in early spring OR=7.27, rash OR=6.03. The chart presents the main risks of PV19 infection, on the basis of which testing for parvovirus B19 in combination with TORCH should be recommended. When several factors are added together, the likelihood of PV19 infection increases.

Conclusions. The strategy for preventing parvovirus infection in pregnant women should include risk factors: bad habits, lack of hygiene, environmental conditions, health awareness. The main risk factor for primary infection during pregnancy is the lack of immunity to PV19. If a woman belongs to a risk group, this requires limiting her stay in children's groups. The course of pregnancy in infected women in endemic and epidemic situations is associated with a high risk of perinatal losses.

Undoubtedly, in the context of modern medical advances and new knowledge about parvovirus infection, the question of the need for early diagnosis of PV19 in pregnant women is paramount. The presented prognostic model according to epidemiological and clinical criteria is also a preventive measure, contributes to the formation of high-risk groups for PV19 infection, wound healing.

References:

1. Бондаренко Н.П, Лакатош В.П, Аксенова А.В. Прогнозирование критических состояний у плода при внутриутробной парвовирусной инфекции на разных сроках гестации. *Репродуктив. здоровье. Вост. Европа.* 2019; (Прил, Сб. материалов конф. Контроверсии в современном акушерстве: преэклампсия и преждевременные роды; 2019 Мар 22-23; Киев): 8-9 с.

2. HeegaardED, BrownKE. Human parvovirus B19. Clin Microbiol Rev. 2002 Jul;15(3):485-505.

3. Huang YM, Li ZQ, Qiao FY, Liu HY. Application of factor analysis in the study of risk factors on human parvovirus B19 infection during pregnancy. Zhonghua Liu Xing Bing Xue Za Zhi. 2004 Oct;25(10):859-62. Chinese.

4. Lamont RF, Sobel JD, Vaisbuch E, Kusanovic JP, Mazaki-Tovi S, Kim SK, et al. Parvovirus B19 infection in human pregnancy. *BJOG*. 2011 Jan;118(2):175-86.

5. Macauley P, Abu-Hishmeh M, Dumancas C, Alexander-Rajan V, Piedra-Chavez F, Nada K, et al. Hemophagocytic Lymphohistiocytosis Associated With Parvovirus B19 in a Patient With Acquired Immunodeficiency Syndrome. *J Investig Med High Impact Case Rep.* 2019 Jan-Dec;7:2324709619883698.