FORECASTING OF DEVELOPMENT OF HEALTHCARE-ASSOCIATED INFECTONS IN PUERPERAS

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Aim. **Identification of possible risk factors, assessment of their information value, and compilation of a prognostic table for assessing the risk of healthcare associated infections in puerperas.** ***Materials and Methods*****. Experimental and control groups were formed from among the puerperas. The experimental group included 147 women who developed purulent-septic infection within 30 days after delivery. The control group was formed by the mechanical selection of each 50th labor and delivery record for the aforementioned period and included 300 subjects. Possible risk factors were divided into groups: social factors, factors related to the state of woman's health, factors associated with the peculiarities of the pregnancy course, factors associated with the peculiarities of the labor course, factors associated with the postpartum period.** ***Results*****. During the study, the following risk factors were identified: unregistered marriage, prenatal hospitalization to the Department of Pathology of Pregnancy for more than 1 bed-day, first labor, uncoordinated contractions, amniotomy, episiotomy, hysterocervicorrhexis, staying in the ward of separate residence in the postpartum period. Based on the sum of the values of prognostic indices, calculated for each risk factor, three prognostic groups were formed: high, average and low risk. Forecasting of the risk for healthcare associated infection development in a patient is carried out by simple arithmetic addition of prognostic indices.** ***Conclusion*****. To prevent healthcare associated infections, it is recommended: to carry out bacteriological examination of an afterbirth and prescribing preventive course of antibiotics to puerperas of the high risk group in the postpartum period; to specify that a woman is at high or average risk, if any, in the discharge documentation to inform the Women's Health Department. The information on belonging of the puerperas to a particular risk group can be used by the hospital epidemiologist when carrying out operational and retrospective analysis.**

Keywords: *healthcare-associated infections, forecasting, risk factors, pregnancy, labor.*

Healthcare-associated infections (HAIs) are one of the main problems of patient safety, and their prevention should be a priority for healthcare facilities and institutions, obliged to provide more safe medical care [1]. This problem has acquired special relevance against the background of intensive development of high-tech and invasive methods of diagnosis and treatment combined with the wide spreading of microorganisms with multiple drug resistance [2]. In particular, modern technologies of medical care in obstetrics and neonatology not only allow to preserve pregnancy, nurse newborns, but also increase the risk of HAIs development among patients of obstetrical institutions [3]. Additionally, obstetrician-gynecological institutions are responsible for quality medical care in terms of reproduction of a healthy population [4]. Herewith, it is necessary to note the severity of the HAIs issue in the Ryazan region among such group of patients in obstetrical hospitals, as puerperas, whose incidence tends to increase [5].

The basis for a successful fight against HAIs is well-organized epidemiological surveillance, an integral part of which is monitoring of incidence, ensuring dynamic monitoring for the status and changes in the course of the epidemic process [6], epidemiological diagnosis and epidemiological analysis, including identification of risk factors and groups as well [7,3]. Considering, that epidemiologic and diagnostic work, which includes an operative and retrospective analysis of morbidity [7], providing the study of morbidity in risk groups from the patient population, should be the main direction in the activity of the hospital epidemiologist, it is important to identify and assess the impact of various HAIs risk factors on the incidence of certain groups of patients.

Aim of the study**:** identification of possible risk factors for HAIs, assessment of their information value, compilation of a prognostic table for assessing the risk for HAIs development in puerperas.

Materials and Methods

The study was carried out on the basis of one of the second level obstetrical institutions in the city of Ryazan. The data from labor and delivery records (form №096/y), obtained for the period from 2010 to the first half of 2017 were used in the work. To identify risk factors, an experimental group and a control group were formed from among the puerperas. The experimental group included 147 women who developed purulent-septic infection within 30 days after delivery. The control group was formed by the mechanical selection of each 50^{th} labor and delivery record without any signs of purulent-septic infection for the aforementioned period and included 300 subjects. Possible risk factors were divided into several groups: social factors; factors related to the state of woman's health; factors associated with the peculiarities of the pregnancy course; factors associated with the peculiarities of the labor course; factors associated with the postpartum period.

The work was carried out in the form of a "case control" retrospective study. Odds ratio (OR) and relative risk (RR) were calculated to assess the association of morbidity with possible risk factors. Statistical significance of the differences was estimated by the Pearson's test (χ^2 with the Yates correction), differences were considered relevant at $p < 0.05$. To assess the information value (R) of statistically significant risk factors, the modified Kullback formula was used [8]:

$$r = 0.5 \times (p2-p1) \times P,$$

where p1 – frequency of occurrence of factor X in the experimental group; p2 – frequency of occurrence of factor X in the control group; P – prognostic index, calculated by the formula:

$$P = 5 \times lg\ p2/p1.$$

The calculated prognostic indices were used to compile prognostic tables. Statistical processing of the data was carried out using the program *Epi Info 7*.

Results and Discussion

According to the results of the study, among the social factors the family status of the patient specified as unregistered marriage, was statistically significant, the share of women with such status in the experimental group was 12.24±5.40% of cases, while in the control group their share was 6.00±2.74% (OR = 2.19 CI: 1.20-4.34; RR=1.59 CI: 1.11-2.27; $p<0.05$). Among the factors related to the state of health of a woman, no statistically significant factors were identified. Of the factors associated with the peculiarities of the pregnancy course in the experimental group, prenatal hospitalization to the Department of Pathology of Pregnancy for more than 1 bed-day was significantly more frequent and occurred in 42.18±8.14% of cases in the experimental group and in 31.67±5.38% of cases in the control group (OR = 1.57 CI: 1.05-2.37; RR=1.35 CI: 1.03-1.75; $p<0.05$). The greatest number of statistically significant risk factors was identified in the group of factors associated with the peculiarities of the course of labor: first labor, uncoordinated contractions, amniotomy, episiotomy, hysterocervicorrhexis. In the experimental group, the share of primiparae was 72.79±7.34% versus 47.00±5.76% in the control group (OR = 3.02 CI: 1.97-4.63; RR=2.15 CI: 1.57-2.93; $p<0.05$); uncoordinated contractions occurred in 4.08 ± 3.26% of puerperas in the experimental group and in 0.67±0.94% – in the control group (OR = 6,34 CI: 1.26-31.81;

RR = 2.33 CI: 1.53-3.56; p<0.05); amniotomy in the experimental group was carried out in 33.33±7.78% of cases, and in the control group – in 24.00±4.94% of cases (OR = 1.58 CI: 1.03-2.44; RR=1.35 CI: 1.03-1.77; p<0.05); episiotomy was performed in 23.13±6,96% of patients in the experimental group and in 12.67±3.84% patients of the control group (OR = 2.07 CI: 1.24-3.46; RR=1.57 CI: 1.17-2.09; p<0.05); hysterocervicorrhexis in the experimental group occurred in 22.45 ± 6.88% of cases, and in the control group – in 14.33±4.04% (OR = 1.73 CI: 1.04-2.86; RR=1.41 CI: 1.05-1.90; p<0.05). In the group of factors related to the postpartum period, among patients of the experimental group, staying in the ward of separate residence in the postpartum period was significantly more frequent; this type of staying was observed in 89.80±5.00% of the puerperas in the experimental group and in 81.27±4, 50% of puerperas in the control group (OR = 2.03 CI: 1.10-3.72; RR=1.67 CI: 1.04-2.67; p<0.05).

For the above listed factors, calculation of information value was made and percent impact of each factor on the risk for HAIs development in puerperas was determined (Tab. 1). The greatest contribution to the overall information value belongs to the factors related to the peculiarities of the course of labor; their share is 79.0%; they are followed by social factors and factors associated with the characteristics of the pregnancy course with shares of 11.5% and 7.6% respectively; and the share of factors associated with the postpartum period was 1.9% of the total information value.

Table 3

Information value of risk factors for HAIs development in puerperas

Sequent No	Factor	Information value of the risk factor (R)
Social factors		
1.	Unregistered marriage	4.7
Factors, associated with peculiarities of pregnancy course		
2.	Prenatal hospitalization to the Department of Pathology of Pregnancy for more than 1 bed-day	3.1
Factors, associated with peculiarities of labor course		
3.	First labor	11.6
4.	Episiotomy	6.8
5.	Convulsive contractions	6.6
6.	Hysterocervicorrhexis	4.1
7.	Amniotomy	3.3
Factors, associated with postpartum period		
8.	Staying in the ward of separate residence	0.8

For each risk factor, the prognostic index was calculated. In the presence of a particular risk factor, this index acquires the sign "-", and in the absence of this factor, it has the sign "+", respectively (Tab. 2). The sum of prognostic indices in the absence of risk factors was 4.1, and in the presence of all these risk factors the sum was -10.1. Thus, three prognostic groups were obtained: low risk (scores from 0 to 4.1), average risk (scores from -0.1 to -5.0) and high risk (scores from -5.1 to -10.1). Risk forecasting for healthcare-associated infections in a patient is carried out by simple arithmetic addition of prognostic indices.

To prevent HAIs, carrying out of bacteriological examination of the afterbirth to predict the probable etiology of HAIs [9] and further use of these data by the hospital epidemiologist in the microbiological monitoring system, and the prescription of preventive antibiotic course in the postpartum period is to be recommended to puerperas of high risk group.

It should be noted that the list of identified risk factors is somewhat different in studies of different authors [10,11]. Perhaps this fact is related to the peculiarities of the work of institutions on which basis the studies were

Table 4

Prognostic table of risk factors for HAIs development in puerperas

Sequent No	Factor	Prognostic index (PI)	
		YES	NO
Social factors			
1.	Unregistered marriage	-1.5	0.1
Factors, associated with peculiarities of pregnancy course			
2.	Prenatal hospitalization to the Department of Pathology of Pregnancy for more than 1 bed-day	-0.6	0.4
Factors, associated with peculiarities of labor course			
3.	First labor	-0.9	1.4
4.	Episiotomy	-1.3	0.3
5.	Convulsive contractions	-3.9	0.1
6.	Hysterocervicorrhexis	-1.0	0.2
7.	Amniotomy	-0.7	0.3
Factors, associated with postpartum period			
8.	Staying in the ward of separate residence	-0.2	1.3

carried out. In that context, it is advisable to identify a set of risk factors for each individual healthcare facility or group of similar healthcare organizations.

Conclusion

It is recommended to specify that a woman belongs to a high or average risk group, in the discharge documentation to inform the Women's Health Department. In addition to the aforementioned, the information on belonging of the puerperas to a particular risk group can be used by the hospital epidemiologist when carrying out operational and retrospective analysis of morbidity to calculate incidence rates stratified by risk groups and more accurate forecasting of the epidemic situation, considering dynamics of the number of puerperas in risk groups.

Authors have no conflict of interest to declare.

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