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RISK FACTORS AND PREDICTION CHART OF VIOLATIONS OF HEALTH OF THE ONE-YEAR-OLDS BORN WITH VERY LOW AND EXTREMELY LOW BIRTH WEIGHT

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The study revealed biological and social risk factors for the formation of life of the one-year-olds such as the low length, deficit of body weight, delay of mental development, frequent acute respiratory infections, the formation of cerebral palsy in children born with very low and extremely low birth weight. In identifying risk factors and prognostic drafting tables the method of sequential mathematical analysis of Wald has been used. It was found that the greatest influence on the formation of these health disorders in children with birth weight less than 1500g have the biological risk factors – health status and age of the mother, during pregnancy and childbirth, the child's health condition in the neonatal period. An algorithm for predicting the data of health disorders in the child's admission with a birth weight less than 1500 grams under the supervision of the district pediatrician.

Key words: risk factors, forecasting health disorders, children with very low and extremely low birth weight.

Nowadays a special attention is given to researches dedicated to health of children born with very low and extremely low birth weight. The importance of the problem has increased greatly over the last few years as new criteria for giving birth to a viable fetus recommended by the World Health Organization have been implemented in the Russian Federation. Due to intensive care development we can see a significant rise in survival rate for premature children born with birth weight lower than 1 500 grams [4, 5, 11]. Now the rate of infants with extremely low birth weight (less than 1 000 grams) equals to 0.2% and with very low birth weight (from 1 000 to 1 500 grams) – to 0.8% [5]. Among premature children the rate of infants with extremely low

boy weight has grown up to 5.6%, and with very low birth weight – to 10.5% [5, 11].

Prematurity and low birth weight determine further development and health of a child to a great extent [2, 8, 9, 16]. Premature children with very low and extremely low birth weight belong to a category with high risks of central nervous system affection, incapacitating pathology and persistent non-incapacitating disorders evolvement. Therefore an extremely cautious prediction of their development is required [1, 2, 4, 5, 7, 8, 9, 13]. Prediction plays a very important role in children health formation control as it helps not only to detect risk factors but also to define positive ones and it allows us to work out prevention techniques

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aimed at positive safety factors prevailing [6, 14]. Hence we should regularly estimate the influence of both separate factors and their aggregates [6, 12, 15]. Prevention is the most promising sphere in children health care but it can be efficient only with early detection of children who run the risk of somatic health disorders, physical retardation, and neurologic and behavioral retardation [3, 6, 10, 15, 17].

The purpose of the research is to identify risk factors and to work out a prediction algorithm which helps to detect physical disorders, neurologic and behavioral retardation, frequent acute respiratory diseases, and infantile cerebral paralysis in children born with very low and extremely low birth weight over the first year of life.

Data and techniques. We have carried out clinical research which comprised 100 premature one-year-old children born with birth weight lower than 1 500 grams. We have also collected the necessary biological and social data from child development reports (form No. 112/1-y), questionnaires filled in by parents, and parents' interviews. We have used Wald sequential mathematic analysis when determining risk factors for most frequent health disorders and creating a prediction table. After we have proved discrepancy accuracy in occurrence frequency for a factor of interest in groups of children with health disorders (short body length, weight deficiency, neurological and behavioral retardation, frequent acute respiratory diseases, and infantile cerebral paralysis) and groups of children without them, we have calculated predictive ratios for each factor level. A predictive ratio has been calculated as $PR = 10 \lg (P1/P2)$ when a factor occurred, and $PR = 10 \lg (1 - P1/1 - P2)$ when a factor was absent, where P1 and P2 are factors occurrence frequencies in groups being compared. A positive result value was the evidence of unfavorable prediction.

Results and discussion. When we examined a one-year-old children born with birth weight lower than 1 500 grams we defined that more than a half of such children (58%) had physical disorders namely weight deficiency (40%) and short body length (34%), as well as both these disorders. 20% had moderate and 41% had marked neurological and behavioral retardation. 19% suffered from infantile cerebral paralysis. When we analysed the frequency of acute respiratory diseases occurring during the first year of life we found out that 24% of children born with body

weight lower than 1 500 grams often had such diseases.

On the basis of social and biological data analysis we have determined significant risk factors which can cause physical disorders (short body length and weight deficiency), neurological and behavioral retardation, frequent acute respiratory diseases, and infantile cerebral paralysis.

Among significant biological risk factors we can name unfavourable professional factors in a mother's life and their duration for more than 5 years before conception; a mother suffering from urinary tract pathology; threat of miscarriage; fetoplacental insufficiency; oligoamnios; 3 degree cerebral ischemia; a child having two-side intraventricular hemorrhage in neonatal period; a child being on artificial pulmonary ventilation for more than 7 days; bronchopulmonary dysplasia; fetal infection; a child having bowels dysbacteriosis. Social risk factors include marital status at the moment of conception (common marriage); a mother's social status (employed); a father having secondary special education; a father's social status (employed); a father working irregular hours without days off.

Biological factors having the greatest influence on weight deficiency are the age of a mother (older than 35); pregnancy being the third or more; a mother having acute respiratory diseases during pregnancy; fetal growth retardation syndrome. Social factors having the greatest influence on weight deficiency include a mother's level of education, a mother's social status (unemployed), a father working irregular hours.

Neurological and behavioral retardation of children born with birth weight lower than 1 500 grams is mostly caused by such biological factors as the age of mother (older than 35); a mother suffering from acute and chronic inflammatory diseases of genital system; induced abortion of early pregnancy; birth weight lower than 1 000 grams; APGAR rates 1-3; extremely poor condition of a newborn; breast feeding absence. And social factors include parents' workplaces.

We have determined the following biological factors as having the greatest influence on frequency of acute respiratory diseases for children born with birth weight lower than 1 500 grams. They are duration of unfavourable professional factors in a mother's life for more than 5 years before conception; a mother suffering from cardiovascular disorders, a mother suffering from acute and chronic inflammatory diseases of genital system; threat of

miscarriage. Social factors are the age of mother when getting married and a father's education.

Infantile cerebral paralysis is greatly determined by such biological factors as therapeutic abortions and miscarriages in past history of a

mother; 1st minute APGAR rates 1-3, extremely poor condition of a newborn; 3 degree cerebral ischemia; periventricular leukomalacia; congenital malformation; movement disorders syndrome.

Table 1

Risk factors causing short body length, neurological and behavioral retardation, frequent acute respiratory diseases, and infantile cerebral paralysis in children with birth weight lower than 1 500 grams by the age of 1 year

Risk factors	Short body length PR	Weight deficiency PR	Neurological and behavioral retardation PR	Frequent acute respiratory diseases PR	Infantile cerebral paralysis PR
1	2	3	4	5	6
Biological factors					
Age of mother:					
Older than 35		+1.65	+5.87		
35 and younger		-7.59	-0.92		
unfavorable professional factors in mother's life – frequent stresses:					
yes	+3.49				
no	-2.4				
Duration of unfavorable professional factors in mother's life before conception:					
5–10 years	+10.9			+5.76	
Less than 5 years	-1.36			-1.33	
Mother suffering from urinary tract pathology:					
yes	+4.98				
no	-1.43				
Mother suffering from cardiovascular diseases:					
yes				+3.03	
no				-1.43	
Mother suffering from chronic inflammatory diseases of genital system:					
yes			+6.45	+8.05	
no			-1.12	-1.61	
Acute inflammatory diseases of genital system in mother's past history:					
yes			+2.86	+3.06	
no			-1.61	-1.65	
Therapeutic abortions in mother's past history :					
yes					+2.33
no					-2.33
Induced abortion of early pregnancy (up to 12 weeks) in mother's past history:					
yes			+5.66		
no			-1.41		
Miscarriages in mother's past history:					
yes					+2.99
no					-1.09

The ordinal number of this pregnancy: second third and more		-6.54 +1.16			
Mother suffering from acute respiratory diseases during this pregnancy: yes no		+3.87 -3.61			
Miscarriage threat for this pregnancy: yes no	+2.18 -3.12			+2.10 -4.51	
Fetoplacental insufficiency during this pregnancy: yes no	+5.0 -4.51				
Oligoamnios during this pregnancy: yes no	+6.8 -0.7				

Table 1 continued

1	2	3	4	5	6
Fetal pathology during this pregnancy – arrested fetal development syndrome: yes no		+5.63 -1.57			
Prematurity of 28 weeks and less: yes no					+3.28 -2.01
Birth weight: less than 1 000 grams 1 000–1 500 grams			+5.74 -3.09		
First minute APGAR rate: 1–3 points more than 3 points			+4.41 -1.26		+2.65 -5.36
Newborn overall condition: poor extremely poor			-3.19 +3.67		-4.78 +3.69
Child suffering from 3 degree cerebral ischemia in neonatal period: yes no	+2.15 -2.14				+5.56 -6.86
Child having two-sided intraventricular hemorrhage in neonatal period: yes no	+2.8 -1.56				
Periventricular leukomalacia: yes no					+5.17 -2.49
Child being on artificial pulmonary ventilation: more than 7 days less than 7 days	+8.56 -3.84				
Child having bronchopulmonary dysplasia in neonatal period: yes no	+11.8 -1.26				

Fetal infections:					
yes	+11.0				
no	-1.1				
Congenital malformations:					
yes					+2.68
no					-1.79
Child having bowels dysbacteriosis in neonatal period :					
yes	+1.66				
no	-4.63				
Breast feeding:					
yes			+2.86		
no			-1.61		
Child having movement disorders syndrome:					
yes					+5.09
no					-3.97
Social factors					
Marital status at the moment of conception:					
common marriage	+5.12				
registered marriage	-2.94				
Age of mother when getting married:					
20–30 years				-8.25	
younger than 20 years				+3.39	
Mother having specialized secondary education:					
yes		-3.12			
no		+1.87			
Mother's social status:					
employed	+0.83				
housewife	-5.13				

Table 1 ending

1	2	3	4	5	6
Mother's social status:					
employed		-1.29			
unemployed		+6.09			
Mother's occupation:					
economy			-5.59		
trade. light industry			+0.94		
Father's education:					
specialized secondary	+2.22			+4.69	
unfinished higher	-4.77			-3.37	
Father's social status:					
blue-collar worker	+2.17				
white-collar worker	7.27				
Father's working hours:					
irregular	+3.39	+3.39			
regular	-3.19	-3.19			
Father having unfavourable professional factors – absence of days off					
yes	+3.63				
no	-1.34				
Father's sphere of occupation – construction work:					
yes			+9.18		

no			-1.31		
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Therefore we can state that such biological risk factors as a mother and a child health, pregnancy and delivery course, and a child health in neonatal period have the greatest significance for occurrence of short body length, weight deficiency, neurological and behavioral retardation, frequent acute respiratory diseases, and infantile cerebral paralysis in children with birth weight lower than 1 500 grams.

When a premature child born with birth weight lower than 1 500 grams starts to receive medical supervision by a district pediatrician, a medical nurse identifies presence or absence of social and biological risk factors that can cause short body length, neurological and behavioral retardation, frequent acute respiratory diseases, and infantile cerebral paralysis. She can do it by interviewing parents and collecting data from a child development report and maternity hospital records.

We suggest a predictive table (table 1) which can be used to sum up the predictive ratios (PR) values for health risk factors identified for a child for each health disorders (short body length, neurological and behavioral retardation, frequent acute respiratory diseases, and infantile cerebral paralysis).

The total value of predictive ratios sum determines the prediction. Predictive threshold (PT) value allows us to estimate degree of confidence for health disorders evolvement by the end of the first year (short body length, weight deficiency, neurological and behavioral retardation, frequent acute respiratory diseases, and infantile cerebral paralysis). This value was calculated by Wald sequential mathematic analysis. We admitted the 5% mistakes probability and defined the predictive threshold for such disorders by the end of the first year as +13 being their presence and -13 being their absence.

If the predictive ratios sum equals to or exceeds +13 the prediction is unfavourable and we predict presence of short body length (predictive ratios sum in the 2nd column), weight deficiency (predictive ratios sum in the 3rd column), neuro-

logical and behavioral retardation (predictive ratios sum in the 4th column), frequent acute respiratory diseases (predictive ratios sum in the 5th column) and infantile cerebral paralysis (predictive ratios sum in the 6th column) by the end of the first year.

If the predictive ratios sum equals to or is less than -13 the prediction is favourable and we predict absence of such health disorders.

If the predictive ratios sum is between +12 and -12 we can state that prediction is uncertain and we don't have enough data to formulate a certain one; therefore such children should be under constant supervision.

Children for whom prediction is unfavourable are included into risk group of health disorders evolvement and pediatricians prescribe prevention activities for them which can lower the risk of these disorders evolvement. The necessity to identify infantile cerebral paralysis risk groups among children born with birth weight lower than 1 500 grams is determined by the possibility to use differentiated approach to their treatment and early rehabilitation. These activities can lower the risk of this incapacitating pathology evolvement.

Conclusion.

To sum up, we can say that we have identified biological and social risk factors that can cause short body length, weight deficiency, neurological and behavioral retardation, frequent acute respiratory diseases, and infantile cerebral paralysis in children born with low and extremely low birth weight by the end of the first year of their life. Such biological factors as the age and health of a mother, pregnancy and delivery course, and a child condition in neonatal period have the greatest influence on such health disorders evolvement. We have also worked out prediction algorithm that is aimed at prediction of such health disorders when a child born with birth weight lower than 1 500 grams starts to receive medical observation by a district pediatrician.

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