American Journal of Medicine and Medical Sciences 2022, 12(5): 499-501
DOI: 10.5923/j.ajmms.20221205.10

Prediction of Respiratory Disorders Syndrome in Underweight Children from Mothers with Preeclampsia

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Abstract The authors conducted a study to study the cytokine status of underweight children born to mothers with preeclampsia in order to predict the syndrome of respiratory disorders. The main clinical manifestations, methods of respiratory support of RDS syndrome are considered.

Keywords RDS syndrome, Respiratory therapy, Cytokine status, Preeclampsia, Gestation

1. Introduction

Preeclampsia still remains an extremely important problem, as it can often lead to an increase in maternal and perinatal morbidity and mortality [3,4]. The frequency of preeclampsia ranges from 7 to 16% and has no tendency to decrease [1,5]. The risk of perinatal mortality in this complication of pregnancy increases 5-fold and ranges from 10.0 to 30.0‰, the perinatal morbidity is 463.0-780.0 per 1000 [2].

Perinatal morbidity and mortality in preeclampsia are caused by prematurity (30%), chronic hypoxia (40%), intrauterine fetal growth retardation (30%) [8,11]. Preeclampsia accounts for 15% of the causes of premature birth [12]. The most important criterion for the complicated course of preeclampsia is the multiple organ lesion. The disease is characterized by a pronounced violation of fetal-uterine blood flow as a result of insufficient depth of cytotrophoblast invasion and inadequate placentation against the background of a conflict between pressor and idepressor factors of vascular tone reduction, as well as increased platelet aggregation. The basis for the formation of pathological placental circulation is a violation of angiogenic, atrombogenic and other functions of endotheliocytes. At the same time, proinflammatory and prothrombogenic changes lead to the appearance of areas of ischemia /reperfusion of the placenta and, under the influence of hypoxia, form a whole complex of aggressive factors affecting the fetus. It has been proved that if the adaptive and compensatory reserves of the fetus are preserved before childbirth, then the outcome of childbirth for the fetus is physiological, but if there is a lack of these reserves, then losses in fetal health are unpredictable [6,10]. According to WHO, every fifth child born to a mother with preeclampsia has some degree of impairment of physical and psycho-emotional development, the incidence is significantly higher in infancy and early childhood. In this group of children, respiratory disorders are 10 times more likely to develop, intrauterine infections are 8 times more likely, asphyxia is 3.5 times more common.

Respiratory distress syndrome (RDS) is one of the main causes of morbidity and mortality (25%) of premature newborns. The frequency of RDS in children born prematurely ranges from 35 to 65% with a gestation period of 30-34 weeks, in premature infants with a gestation period of more than 34 weeks, the frequency is less than 5%. The syndrome of respiratory disorders (RDS) of a newborn presents respiratory disorders in children in the first days of life due to primary surfactant deficiency and immaturity of the lungs. The main causes of RDS in newborns are impaired synthesis and excretion of surfactant by type 2 alveolocytes associated with functional and structural immaturity of lung tissue, as well as congenital qualitative defect of the surfactant structure. Predisposing factors for the development of RDS that can be identified before the birth of a child or in the first minutes of life: the development of RDS in siblings, gestational diabetes and type 1 diabetes mellitus in the mother, hemolytic fetal disease, premature placental abruption, premature birth, male fetal sex during premature birth, caesarean section before the onset of labor, asphyxia of a newborn. DN is characterized by the following clinical signs: cyanosis, tachypnea, swelling of the wings of the nose, difficulty exhaling, sinking of the pliable places of the chest, weakening of breathing during auscultation of the lungs [7,9]. In addition to clinical signs, respiratory insufficiency is laboratory manifested by respiratory acidosis, hypoxemia and hypercapnia.

The purpose of the study was to study the cytokine status in the first day after birth in the blood of premature newborns with respiratory disorders born from mothers with preeclampsia.

Received: April 13, 2022; Accepted: May 5, 2022; Published: May 10, 2022
Published online at http://journal.sapub.org/ajmms

2. Materials and Methods

On the basis of the Bukhara State Medical Institute in the department of neuro-resuscitation of the regional perinatal center, a comprehensive clinical and laboratory examination of 60 premature newborns born at gestation from 28-36 weeks was conducted. All the examined newborns were divided into the following groups: 1 group of 30 newborns born to mothers with preeclampsia, 2 group of 30 whose real pregnancy and childbirth proceeded physiologically. For immunological studies (IL-6, IL-8), venous blood was taken from the umbilical vein immediately after the birth of the child, urine was collected (IFNa, IFNy) during the first day.

3. The Results of the Study

Newborns born to women with preeclampsia and arterial hypertension had significantly lower birth weight and body length compared to children of the control group ($p<0.0001$) (table 1).

Table 1. Anthropometric parameters of newborn babies born at 28-36 weeks

№	Indicators	1-group (n=30) without preeclampsia	2-group (n=30) with preeclampsia
1	Body weight at birth (g)	1920,23±140,40	1605,40±110,3
2	Body length at birth (sm)	40,82±0,58	37,32±0,85***
3	Weight ≤ 2500 g	0	13(40%)
4	Weight ≤ 1500 g	0	17(60%)
5	Fetal Development Delay syndrome (FDDS)	0	27(64,4%)***
6	Asphyxia	7(23,3%)	15(50,0%)
7	SDR syndrome	15(50,0%)	25(83,3%)
8	Respiratory insufficiency 1st degree	5(16,6%)	2(6,6%)
9	Respiratory insufficiency 2 nd degree	7(23,3%)	8(26,6%)
10	Respiratory insufficiency 3 rd degree	3(10,0%)	15(50,0%)

Note: * - differences with respect to the control group data are significant (* - P<0,05, ** - P<0,01, *** - P<0,001)

At the same time, the body weight of premature infants of group 2 at birth was 1605.40 ±110.3g, and in the first group it was slightly higher than 1920.23 ±140.40g. The severity of preeclampsia in pregnant women was assessed according to the G.M. Savelyeva scale. At the same time, out of 30 women, 19 had severe preeclampsia and 11 had moderate preeclampsia.

Fetal development delay syndrome (FDD) in group 2 was observed in 27 (64.4%), and in group 1 in 1 (37.8%) newborn, which indicates a high risk of having children with FDD in mothers with preeclampsia, against the background of prolonged exposure to adverse conditions of intrauterine fetal development. Newborns from mothers with preeclampsia are more often born at 28-34 weeks and weighing less than 1500g and in 64.4% of cases have a syndrome of fetal development delay of the hypotrophic type.

The degree of respiratory disorders (severity of respiratory failure) was assessed on the Silverman scale. Respiratory insufficiency (RI) of the 1st degree was detected in 5 (16.6%) newborns of the first group, in group 2 2 (6.6%). The second degree of respiratory insufficiency was noted in group 1 in 7 (23.3%) newborns, in group 2 in 8 (26.6%). The third degree of respiratory insufficiency was determined in 3 (10.0%) premature infants in group 1, 15 (50.0%) in the second group.

Thus, respiratory disorders were more often noted in premature infants from women with preeclampsia, significant differences were found in subgroup 2 (p 0.01).

In the course of the conducted studies, it was revealed that 10 (33.3%) newborns in group 1 needed respiratory support, 23 (76.6%) - in the second group. It was found that the need for respiratory support depended not only on the gestation period, but also on the presence of preeclampsia in the mother. Surfactant therapy was used in group 1 of 2 (6.6%) children, in group 2 of the main group – 22 (73.30%), which was associated with the severity of respiratory disorders.

To predict the development of RDS syndrome and neonatal sepsis in underweight children, an analysis of the cytokine status was carried out (table 2).

Table 2. The level of cytokines in the blood serum of newborns in the period of early neonatal adaptation

№	Cytokine status of newborns	1-group (n=30) without preeclampsia	2-group (n=30) with preeclampsia
1	IL-6 (pg/ml)	22,19±3,83	55,07±12,22**
2	IL-8 (pg/ml)	33,62±4,77	75,21±13,4**

Note: * - differences with respect to the control group data are significant (* - P<0,05, ** - P<0,01, *** - P<0,001)

In our studies, the level of IL-6 in the blood serum of newborns from mothers with preeclampsia was 3-fold increased 55.07±12.22 pg/ml compared to the control of 22.19±3.83pg/ml, which indicates the presence of a systemic inflammatory response syndrome and a high risk of neonatal sepsis.

The values of IL-8 in both groups were increased 2-fold relative to the indicators of the control group, which indicates persistent violations of uteroplacental hemostasis in both groups.

Table 3. The level of cytokines in the urine of newborns in the period of early neonatal adaptation

№	Cytokine status of newborns	1-group (n=30) without preeclampsia	2-group (n=30) with preeclampsia
1	IFNγ (pg/ml)	37,57±6,22	17,32±2,2***
2	IFNα (pg/ml)	25,36±5,09	11,23±0,86***

Note: * - differences with respect to the control group data are significant (* - P<0,05, ** - P<0,01, *** - P<0,001)

In our study, in order to minimize invasive manipulations, the levels of IFNy and IFNa were studied in the urine of newborns. In group 2 children, a 3-fold decrease in the level of IFNy17.32±2.2pg/ml was observed in relation to the control of 37.57± 6.22pg/ml, which may be due to the low concentration capacity of the kidneys in preterm infants. The level of IFNa was almost the same in the 2nd group 11.23±0.86 2-fold decreased relative to healthy newborns 25.36±5.09pg/ml.

4. Conclusions

Respiratory distress syndrome (RDS) is more common in underweight children from mothers with preeclampsia. The need for respiratory support and the duration of its use are significantly higher in the group of premature infants with very low body weight born to women with preeclampsia. The need for surfactant administration depended not only on the degree of morpho-functional maturity of the lung tissue in a premature baby, but also on the presence of preeclampsia in the mother, so surfactant therapy was significantly more often used in newborns from women with preeclampsia. The functional state of underweight children depends not only on morpho-functional immaturity, but also on the presence of preeclampsia in the mother.

The level of IL-6, IL-8 in the blood serum of newborns from mothers with preeclampsia was increased, indicating the presence of a systemic inflammatory response syndrome and a high risk of neonatal sepsis. A decrease in the level of IFNy and IFNa is associated with a low concentration capacity of the kidneys in preterm infants.

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