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Neonatal Outcomes in the Postpartum Period depending on Perinatal Risk Factors, Terms and Mode of Delivery

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Abstract

The aim of this study was to evaluate neonatal outcomes of preterm birth in the postpartum period, depending on perinatal risk factors, terms, and mode of delivery. Regardless of the mode of delivery, more than 60% of the infants died in the early neonatal period. The main diseases in the early neonatal period were asphyxia, respiratory distress syndrome and intraventricular hemorrhage. **(Int J Biomed. 2016;6(3):202-206.)**.

Key Words: preterm birth • perinatal mortality • perinatal morbidity • Cesarean delivery.

Introduction

Preterm birth (PB) is a significant cause of infant and child morbidity and mortality. Human viability, defined as gestational age at which the chance of survival is 50%, is now approximately 23–24 weeks in developed countries.[1] Despite technological advances, the extremely premature infant born at 22 to 25 weeks of gestation and with extremely low birth weight (<1000 g) remains at high risk for death and disability. Infants born less than 34 weeks comprise almost 60% of infant deaths.[2] Recent studies have demonstrated little progress in reducing the mortality and morbidities associated with extremely PB.[3-5] Nearly one-half of newborn deaths occur during the first 24 hours after birth.[1] Approximately 80% of low-birth-weight infants require resuscitation and stabilization at delivery.[6,7]

Over the last generation, a dramatic decline in infant mortality has been associated with medical innovations in the management of neonates, particularly those born preterm. Initiation of rational intravenous fluid therapies, development of artificial airways and breathing circuits, application of mechanical ventilation and airway distending pressure, and development of a resuscitation scoring system, the Apgar score (AS), have become important factors in the effective resuscitation of the newborn.

The aim of this study was to evaluate neonatal outcomes of PB in the postpartum period, depending on perinatal risk (PR) factors, terms, and mode of delivery.

Materials and Methods

The study was performed in Municipal clinical hospital № 29 named after N.E. Bauman. We carried out a prospective analysis of 236 medical records of pregnant women with premature labor (PL) at 28 to 33 weeks(plus 6 days) of gestation (code ICD X O60) and 236 infants born alive. The study was conducted in accordance with ethical principles of the Declaration of Helsinki.

According to PL classification, all pregnant women were divided into 2 cohorts: Cohort I (gestational age from 28 to 30 weeks plus 6 days) and Cohort II (gestational age from 31 to 33 weeks plus 6 days). Depending on the amount of PR factors, each cohort was divided into 3 groups: a low PR, a moderate PR, and a high PR.

We identified the degree of PR based on the scale developed by O.G. Frolova and E.I. Nikolaeva (1981) and

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modified in 2003 by V.E. Radzinsky et al.[8] A specific group for PR was defined in accordance with the number of points derived from S. Knyazev's scale (2003): low risk (< 15points), moderate risk (from 15 to 20 points), and high risk (≥ 25 points). Calculation of PR factors was performed twice: at admission and during labor. The ratio of these indexes determines the so-called "intrapartum gain" (IG) of PR factors.[9]

Inclusion criteria were singleton pregnancy, PB (gestational age from 28 to 33 weeks plus 6 days), and no treatment for cervical insufficiency (CI).

Exclusion criteria were polycyesis, congenital malformations of the fetus revealed during currently pregnancy and after childbirth, induced PB, the use of assisted reproductive technologies, and the scar on the uterus.

Statistical analysis was performed using the statistical software «STATISTICA 7». Group comparisons with respect to categorical variables are performed using chi-square tests with Yates correction. Multiple comparisons were performed with one-way ANOVA and post-hoc Tukey HSD test. A probability value of $P<0.05$ was considered statistically significant.

Results and Discussion

Neonatal anthropometric parameters of newborns are shown in Table 1. Evaluation of AS in the first and fifth minutes of life has revealed statistically significant differences between groups ($P<0.05$). In both cohorts of women with a low PR, and with a moderate PR in Cohort I, first- and fifth-minute ASs was significantly lower compared to newborns born to women with a high PR ($P<0.05$) (Table 2). Further analysis of the reasons for this paradoxical situation has shown that a low AS in newborns born to mothers with low to moderate PR was due to the fact that infants born to mothers of these groups died in the early neonatal period.

Table 1.

Anthropometric parameters of newborns

Cohort	Degree of PR	n	Birth weight (g)	Body length (cm)	HC (cm)	ChC (cm)
I	L (1)	20	1398.2±311.9	37.6±3.1	29.3±1.9	26.8±2.0
	M (2)	38	1462±363.1	38.2±3.3	28.0±1.3	24.0±1.9
	H (3)	70	1315.4±239.5	36.9±1.8	27.3±1.2	24.0±1.1
	Statistics	ANOVA Tukey HSD test	*P=0.0146* P_{1-2}=0.6260 P_{1-3}=0.3940 P_{2-3}=0.0118	*P=0.0404* P_{1-2}=0.6704 P_{1-3}=0.5250 P_{2-3}=0.0331	*P=0.0000* P_{1-2}=0.0021 P_{1-3}=0.0000 P_{2-3}=0.0312	*P=0.0000* P_{1-2}=0.0000 P_{1-3}=0.0000 P_{2-3}=0.9948
II	L (1)	32	1881.7±350.4	43.7±3.9	30.2±2.2	27.2±2.6
	M (2)	52	1907.3±337.5	42.3±2.3	31.9±1.8	29.4±1.7
	H (3)	24	1850.9±543.0	41.1±2.9	31.2±1.8	28.6±2.2
	Statistics	ANOVA Tukey HSD test	*P=0.8425* P_{1-2}=0.9552 P_{1-3}=0.9551 P_{2-3}=0.8320	*P=0.0062* P_{1-2}=0.0971 P_{1-3}=0.0047 P_{2-3}=0.2377	*P=0.0007* P_{1-2}=0.0004 P_{1-3}=0.1375 P_{2-3}=0.3084	*P=0.0001* P_{1-2}=0.0000 P_{1-3}=0.0413 P_{2-3}=0.2788

L- low, M- moderate, H- high, HC- head circumference, ChC- chest circumference.

Table 2.

Evaluation of AS in the first and fifth minutes of life

Cohort	Degree of PR	n	AS	
			the first minute of life	the fifth minute of life
I	Low (1)	20	4.6±1.8	6.1±1.4
	Moderate (2)	38	4.6±1.7	6.1±1.4
	High (3)	70	6.7±1.0	7.2±0.8
	Statistics	ANOVA Tukey HSD test	*P=0.0000* P_{1-2}=0.9948 P_{1-3}=0.0000 P_{2-3}=0.0000	*P=0.0000* P_{1-2}=0. 9948 P_{1-3}=0.0004 P_{2-3}=0.0000
II	Low (1)	32	5.6±1.7	6.7±1.1
	Moderate (2)	52	7.1±0.7	7.7±0.5
	High (3)	24	6.7±0.9	7.4±0.7
	Statistics	ANOVA Tukey HSD test	*P=0.0000* P_{1-2}=0.0000 P_{1-3}=0.0013 P_{2-3}=0.3247	*P=0.0000* P_{1-2}=0.0000 P_{1-3}=0.0028 P_{2-3}=0.2553

In each group of mothers, preterm infants had two to three neonatal diseases. Despite the prevention of respiratory distress syndrome (RDS), the frequency of apnea and respiratory failure was high (92.0% - 95.0%) in infants with a gestational age of 28 to 30 weeks (plus 6 days) without statistically significant differences, depending on the degree of PR (Figure 1).

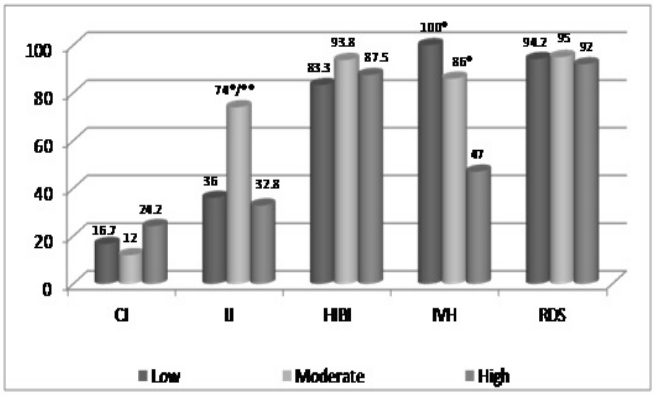

Fig. 1. *Perinatal morbidity (%) in Cohort 1 (vaginal delivery)*

**, **- P<0.05 compared with a high PR and a low PR, respectively*

A different situation was observed in newborns with intraventricular hemorrhage (IVH). IVH was diagnosed significantly more often in infants born to mothers with low and moderate PR (100% and 86%, respectively), whereas only 4.2% of infants born to mothers with a high PR had IVH. Hypoxic-ischemic brain injury (HIBI) was found with equal frequency in all groups of Cohort I. Intrauterine pneumonia (IP) was diagnosed significantly more often (75%) in infants born to mothers of Cohort I with a moderate PR compared

to infants born to mothers with low and high PR (every third newborn) ($p<0.05$). In Cohort II, IVH, HIBI and RDS were dominant in the structure of neonatal morbidity. IVH was diagnosed significantly more often (*P<0.05*) in infants born to mothers with low and moderate PR (78.0% and 58.5%) (Figure 2).

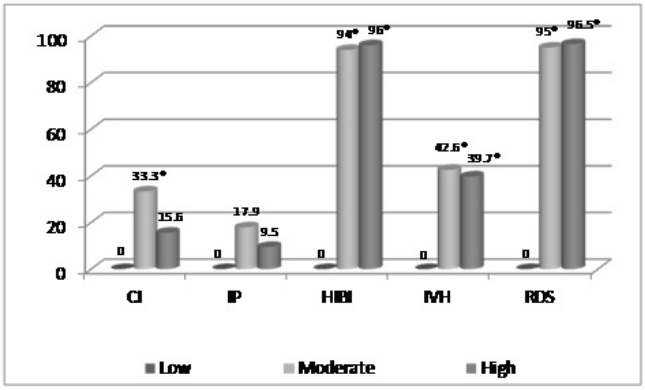

Fig. 2. *Perinatal morbidity (%) in Cohort 1 (*Cesarean delivery)

** - P<0.05 compared with a low PR*

A comparison between the two cohorts showed that a statistically significant reduction in the RDS frequency occurred only in newborns of Cohort II to mothers with a high PR (*P<0.05*). In other groups, despite a longer period of gestation, we did not find a significant reduction in the RDS frequency.

There were no significant differences in IVH rate depending on the term of delivery. With regard to the term of delivery, statistically significant differences were found for IP. In Cohort II, the incidence of IP was significantly lower in all analyzed groups compared with Cohort I (*P<0.05*).

We evaluated the frequency of perinatal morbidity depending on the mode of delivery. The frequency of IVH with a Cesarean delivery decreased 2.3 and 2.5 times in the groups with moderate and high PRs, respectively. We found no significant differences (Figure 3, 4) between groups in such diseases as HIBI, IP and conjugated jaundice.

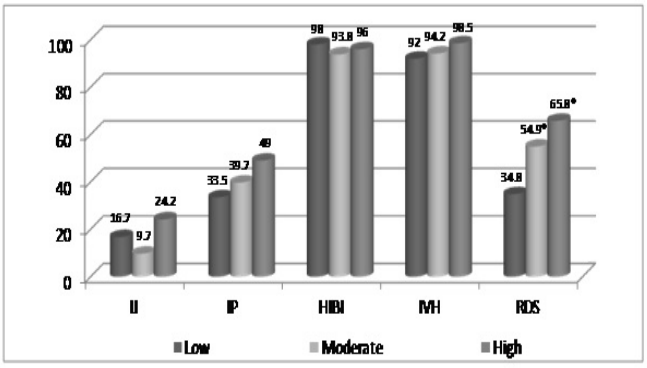

Fig. 3. *Perinatal morbidity (%) in Cohort 2 (vaginal* delivery)

** - P<0.05 compared with a low PR*

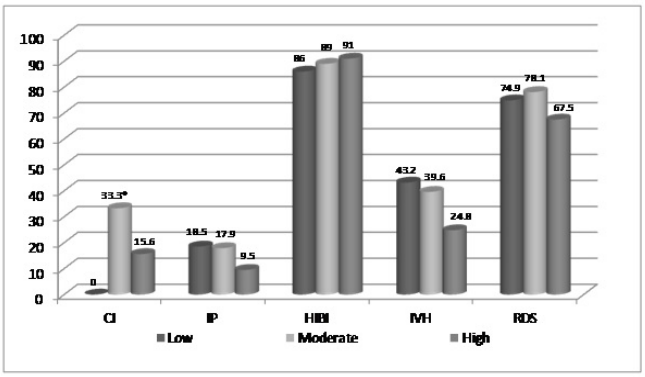

Fig. 4. *Perinatal morbidity (%) in Cohort 2 (*Cesarean delivery)

** - P<0.05 compared with a low PR*

Evaluation of the duration of mechanical ventilation (MV) showed (Table 3) that the most long-term MVs were in infants born to mothers of Cohort I with low to moderate PR that was associated with a significantly higher incidence of intrauterine growth retardation. The MV duration was in 3-4 times lower in infants born by Cesarean delivery. In both cohorts, the infants born to mothers with moderate to low PR were transferred to the second stage of nursing and treated significantly later in the postnatal period (Table 4) because they were significantly longer on MV.

Table 3.

Duration of MV and CPAP

Cohort	Degree of PR	n	MV, min	CPAP, min
I	Low (1)	20	260.7±462.1	103.1±112.0
	Moderate (2)	38	212.1±480.1	68.0±63.4
	High (3)	70	72.2±84.6	79.9±76.7
	Statistics	ANOVA Tukey HSD test	*P=0.0235* P_{1-2}*=0.8498* P_{1-3}*=0.0597* P_{2-3}*=0.0848*	*P=0.2837* P_{1-2}*=0.2515* P_{1-3}*=0.4860* P_{2-3}*=0.7393*
II	Low (1)	32	194.8±240.4	47.8±27.6
	Moderate (2)	52	164.2±29.8	38.5±18.6
	High (3)	24	41.5±33.4	67±73.9
	Statistics	ANOVA Tukey HSD test	*P=0.0001* P_{1-2}*=0.5643* P_{1-3}*=0.0001* P_{2-3}*=0.0009*	*P=0.0176* P_{1-2}*=0.5545* P_{1-3}*=0.1801* P_{2-3}*=0.0126*

Table 4.

Transfer time for second stage of nursing and treatment (age in days)

Cohort	Degree of PR	n	Transfer to specialized care for second stage of nursing (days)	ANOVA	Tukey HSD test
I	Low (1)	20	4.0±1.9	*P=0.0002*	P_{1-2}*=0.5855* P_{1-3}*=0.0012* P_{2-3}*=0.0049*
	Moderate (2)	38	5.1±3.9		
	High (3)	70	7.7±4.5		
II	Low (1)	32	3.2±2.7	*P=0.0006*	P_{1-2}*=0.0088* P_{1-3}*=0.0008* P_{2-3}*=0.3576*
	Moderate (2)	52	4.8±2.5		
	High (3)	24	5.6±1.3		

Analysis of PNM showed that 8 (3.39%) newborns died, including 6 (75.0%) newborns born to mothers at 28 to 30 weeks (plus 6 days) of gestation. In Cohort I, the vast majority of the deceased newborns (66.7%) were born to mothers with a moderate PR that was significantly more than in other groups ($P<0.05$). In Cohort II, two newborns died; they were born to mothers with moderate to high PR (Table 5). These data confirm a known fact: PNM decreases with increasing gestational age.

Table 5.

PNM and degree of PR

Cohort		I (n=128)						II (n=108)					
Degree of PR		Low (n=20)		Moderate (n=38)		High (n=70)		Low (n=32)		Moderate (n=52)		High (n=24)	
Number of infant (<30 days) deaths	n	abs	%	abs	%	abs	%	abs	%	abs	%	abs	%
	8	1	12.5	4	50	1	12.5	0	0	1	12.5	1	12.5

A retrospective analysis of PNM according to the revised risk factors, taking into account their IG, showed another distribution of the analyzed indicators (Table 6). After recalculation of PR factors with regard to IG, we found that the vast majority of deceased newborns (87.5%) were born to mothers with a high PR. In this regard, we have analyzed the critical threshold of IG for PR factors that affected the perinatal outcomes. It was found that 6 of 8 deceased newborns were born vaginally and belonged to groups of low and moderate PRs. The decision for vaginal delivery was based only on PR factors, despite the fact that the women were patients with moderate and high PRs, according to IG. In general, if the situation with the choice of delivery method in pregnant women with a high PR is very clear, namely, a planned en caul (within intact membranes), C-section is the method of choice for delivery in PL at 28-33 weeks (plus 6 days) of gestation, the choice of mode of delivery in women with moderate to low PR is ambiguous.

Table 6.

PNM according to the revised PR factors, taking into account IG

Cohort		I				II			
Degree of PR		Moderate (n=58)		High (n=70)		Moderate (n=84)		High (n=24)	
Number of infant (< 30 days) deaths	n	abs	%	abs	%	abs	%	abs	%
	8	1	12.5	5	62.5	0	0	2	25

Clinical diagnoses of the preterm infants who died

Vaginal delivery

1. Severe RDS, respiratory failure III. First- and fifth-minute ASs of 3-6. Neonatal resuscitation. Rapid labor (3hrs and 5 min). Newborn died at the age of one day from severe asphyxia and multiple organ failure. Histologically: placental lesions with inflammation (foci of necrosis, diffuse amnionitis, accumulation of inflammatory cells).

2. RDS, moderate asphyxia. First- and fifth-minute ASs of 5-6. Neonatal resuscitation. Waterless interval of 10 minutes, rapid labor (5hrs and 55 min) on the background of intrapartum tocolysis with Gynipral. Newborn died at the age of one day from severe asphyxia and multiple organ failure. Histologically: the expressed pathological villous immaturity

3. Hypoxic-ischemic brain injury (depressed fracture of the parietal bone, subdural hematoma, IVH III), bilateral intrauterine pneumonia (antibiotic-resistant Staphylococcus epidermidis), aplasia of thymus and adrenal glands. Skin hemorrhage, hemorrhagic anemia, multiorgan failure. First- and fifth-minute ASs of 5-6. Neonatal resuscitation. Waterless interval of 10 minutes, rapid labor (4hrs and 40 min). Newborn died at the age of 11 days. Histologically: the expressed pathological villous immaturity on the background of inflammation.

4. Severe RDS, respiratory failure III, fetal malnutrition III, IVH. First- and fifth-minute ASs of 3-6. Waterless interval of 18 hours. Neonatal resuscitation. Newborn died at the age of 2 days. Histologically: the expressed pathological villous immaturity on the background of inflammation.

5. Neonatal CNS depression, hemorrhagic disease, antibiotic-resistant E. coli infection, RDS. First- and fifth-minute ASAs of 6-7. Neonatal resuscitation. Rapid labor (3hrs and 35 min) with birth injuries. Newborn died at the age of 30 days. Histologically: the expressed pathological villous immaturity and inflammation.

6. IVH, RDS. intrauterine pneumonia. First- and fifth-minute ASs of 4-5. Neonatal resuscitation. Newborn died at the age of 4 days. Histologically: the expressed pathological immaturity of placental tissues on the background of inflammation.

Abdominal delivery

7. Acute hypoxia, IVH grade 2, RDS, respiratory failure II, HIDI, intrauterine infection. First- and fifth-minute ASs of 2-5. Neonatal resuscitation. Abdominal delivery due to the increasing severity of preeclampsia. Newborn died at the age of 15 days from IVC and bilateral intrauterine pneumonia complicated by DIC. Histologically: the expressed pathological immaturity of placental tissues on the background of inflammation.

8. Severe asphyxia, IVH, multiple organ failure, DIC, segmental pneumonia of the left lung. Emergency C-section due to bleeding placenta previa. First- and fifth-minute ASs of 3-5. Waterless interval of 35 minutes. Neonatal resuscitation. Newborn died at the age of 8 days. Histologically: the expressed pathological villous immaturity, placental insufficiency.

Thus, regardless of the mode of delivery, more than 60% of the infants died in the early neonatal period. The main diseases in the early neonatal period were asphyxia, RDS and IVH. Newborns with severe asphyxia and comorbidity (perinatal brain damage and intrauterine infection/ inflammation) died in the late neonatal period.

Competing interests

The authors declare that they have no competing interests.

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