

## EARLY POSTNATAL ADAPTATION IN INFANTS WITH HYPOVITAMINOSIS D.

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**Abstract:** Deficiency of vitamins and minerals in pregnant women and their newborns in modern conditions is of current importance for perinatology. Provision of a newborn with vitamin D plays a major role in the implementation of adaptation processes in the neonatal period and promotes intensive growth and development processes. The article presents the results of our own research on the study of the period of postnatal adaptation in newborns with vitamin D deficiency. It was revealed that the early adaptation period in newborns with vitamin D deficiency proceeds with disorders manifested by the pathological course of physiological jaundice in newborns, a dysfunctional state of the cardiovascular system, and a significant decrease in the initial weight body and its longer recovery.

**Keywords:** newborns, vitamin D deficiency, postnatal adaptation.

Vitamin D deficiency is now recognized as an epidemic with many consequences affecting population health and is a risk factor for cardiovascular disease, type 1 diabetes, pregnancy complications, and more. [2,5]. Deficiency of vitamins and minerals in pregnant women and their newborns in modern conditions is of current importance for perinatology. Provision of a newborn with vitamin D plays a major role in the implementation of adaptation processes in the neonatal period and promotes intensive growth and development processes. [1,7,9]. Over the past decade, researchers from different countries have actively studied the level of vitamin D provision of pregnant women and found that 18% in England, 25% in the UAE, 80% in Iran, 42% in India, 61% in New Zealand had low values of 25 (OH) D <25 nmol/l. Researchers are especially interested in vitamin D deficiency during pregnancy due to the fact that intrauterine development of the fetus occurs under conditions of hypovitaminosis D, which has a negative impact on both the development of the fetal skeleton and susceptibility to diseases after birth and later in life [8]. Along with this, the question of the effect of hypovitaminosis D during pregnancy on the processes of postnatal adaptation of newborns has not been studied enough. The mechanism of development of disorders in the neonatal period associated with such an important hormonal factor as 25(OH)D<sub>3</sub>(calcidiol) remains unexplained. Infants are most susceptible to the formation of hypovitaminosis D. The content of vitamin D in the fetus and newborn is directly correlated with the levels of vitamin D in mothers. The degree of saturation of the cord blood of a newborn with vitamin D, regardless of the gestational age, is approximately 50-80% of the level of this vitamin in the mother's body [4]. The high prevalence of hypovitaminosis D among newborns is explained by the presence of vitamin D deficiency in most pregnant women [3]. All of the above dictates the need for further study of the issues of vitamin D supply in newborns during their adaptation to the external environment. **Purpose of the study.** To study the features of the course of the adaptation period in newborns, depending on the level of vitamin D supply.

**Materials and methods.** 50 newborns were examined on the basis of the Republican Perinatal Center of the Ministry of Health of the Republic of Uzbekistan. Depending on the provision of the body of newborns with calcidiol, the subjects were divided into 2 groups: the main

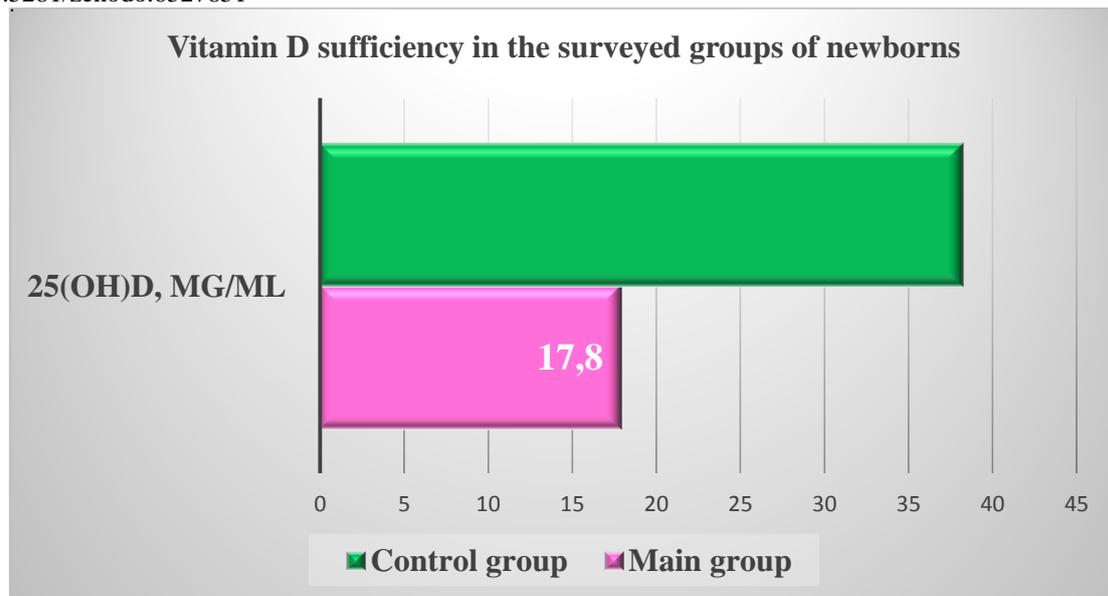
group - 30 newborns with a deficiency of 25(OH)D<sub>3</sub> (<20 ng/ml) and the control group consisted of 20 newborns with a normal content of 25(OH)D<sub>3</sub> (> 30 ng/ml). For each newborn included in this study, an individual registration card was created, which included data on the course of pregnancy, delivery, anthropometric indicators of the child at birth, type of feeding, physical examination data and indicators of physical development at the time of the examination. Physical examination and assessment of the neurological status of newborns were carried out according to the standard method in neonatology. During the examination, the general physical condition and development of the child was assessed, the anthropometric parameters of newborns were assessed, the respiratory rate and heart rate were counted, the condition of the pharynx and upper respiratory tract was examined. Inspection, palpation, and percussion of the chest were also performed, as well as auscultation of the heart, lungs, and palpation of the abdomen. The concentration of calcidiol in cord blood was determined by ELISA, test system "Osteia 25-HydroxyVitD" company "IDS", Germany. Cord blood sampling was carried out during childbirth, subject to the informed consent of the mother and the absence of contraindications - positive results of testing the mother's blood for infectious agents: HIV, syphilis, hepatitis B, C. The cord blood collection procedure is a simple, fast, safe and painless process that does not require contact with the baby. In the delivery room, the baby was separated from the mother by clamping and cutting the umbilical cord. Before separation of the placenta, the area of the umbilical cord, located in close proximity to the clamp, was treated with a 70% alcohol solution, after which the vein of the umbilical cord was punctured with a sterile syringe and 5 ml of blood was taken into a disposable test tube, in which the preservative Solution anticoagulant CPDA- was placed under factory conditions. one. After blood collection, the contents of the tube were carefully mixed by inverting it 8-10 times. The obtained umbilical cord blood was stored at 22 °C in a dark place and analyzed no later than 18 hours after collection. When analyzing the provision of newborns with vitamin D in terms of 25(OH)D concentration, the following criteria recommended by the International Society of Endocrinologists were taken into account:

- adequate level of vitamin D - more than 30 ng/ml (75 nmol/l)
- insufficiency — 21–30 ng/ml (51–75 nmol/l),
- deficiency — less than 20 ng/ml (50 nmol/l)
- severe deficiency - less than 10 ng/ml (less than 25 nmol/l) [6].

Statistical data processing was carried out using MS Excel for Windows 7 software. Statistical significance was determined using correlation analysis (Pearson's method), at  $p < 0.05$  the differences were considered statistically significant.

**Results and discussion.** According to the level of supply of newborns with vitamin D, two groups were distinguished: the main group with a low content of vitamin D consisted of 30 newborns, the average level of 25(OH)D was  $17.82 \pm 0.73$  ng/ml, and the comparison group with the optimal content of vitamin D consisted of 20 newborns, the average level of 25(OH)D was  $38.12 \pm 3.30$  ng/ml - Picture 1.

Picture 1.



\*p<0.05 between the main and comparative groups

In accordance with the purpose of the study, we studied the clinical features of postnatal adaptation and health indicators in two groups of newborns, depending on the supply of vitamin D. The average indicators of weight and body length, head and chest circumferences at birth in children of the main group are presented in Table 1.

Table 1.

**Anthropometric indicators in the examined newborns**

Parameter	Main group	Comparison group	p
Body weight, g	3540,0±10,2	3573,0±43,7	>0,05
Body length	53,5±0,6	54,0±0,2	>0,05
Head circumference, cm	35,1±0,2	35,3±0,1	>0,05
Chest circumference, cm	33,9±0,3	34,1±0,1	>0,05
Macrosomia (large by gestational age),%	29,8±5,4	28,0±5,1	<0,05
Microsomia (small to gestational age),%	8,1±2,9	5,1±2,5	>0,05

Note: n - is the number of examined; p - statistical significance of differences between groups.

As can be seen from the presented data, the average anthropometric parameters of the newborns of the main group did not significantly differ from those in the comparison group. According to our data, three newborns of the main group (10%) were born prematurely - I degree (35-36 weeks). In the comparison group, only one prematurity of the 1st degree was noted. Adaptation disorders in the early neonatal period were observed in 83.3% of newborns of the main group (in the comparison group - 25%; p <0.05). As the main manifestations of the disadaptation syndrome, identified in the first week of life, the presence of edematous syndrome, transient changes in the cardiovascular system, pronounced weight loss, early and prolonged jaundice, and hypoglycemia should be indicated (Table 2). The maximum weight loss of more than 10%, requiring medical correction, was observed 3 times more often in newborns of the main group. By the end of the early neonatal period, 10% of newborns of the main group restored their original body weight, which is 3 times less than in the comparison group (30%; p<0.001). When analyzing the course of physiological jaundice in newborns, it was found that the average values of maximum bilirubinemia did not differ significantly in both groups. However, the appearance of jaundice on

the first day of life and its longer course (more than 14 days) was noted much more often in newborns of the main group (36.6%, in the comparison group - 10%;  $p < 0.01$ ) - Table 2.

Table 2.

**Characteristics of the adaptation period in the examined newborns**

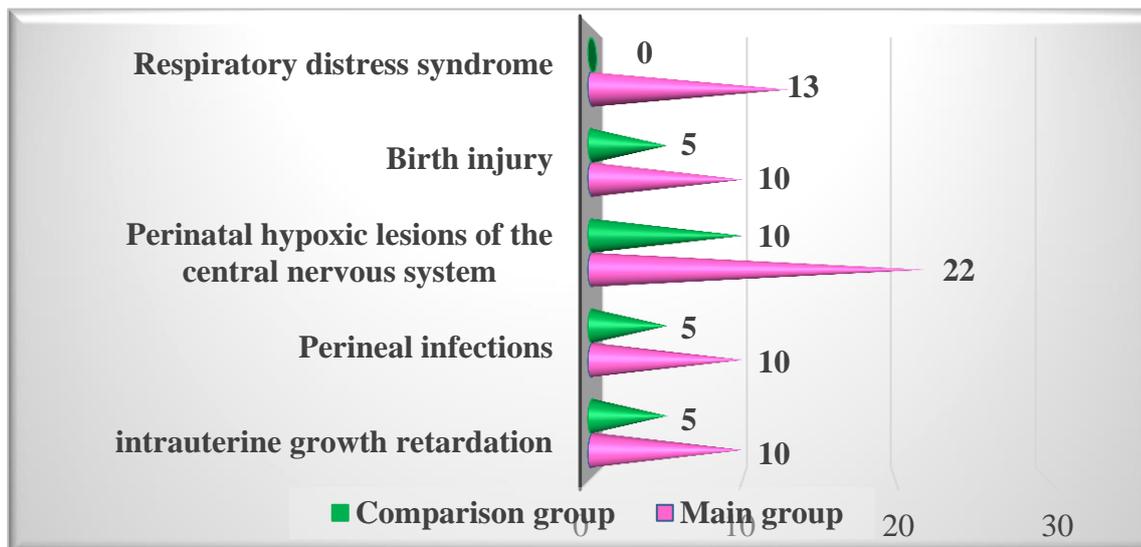
Parameter	Main group (n=30)	Comparison group (n=20)	p
Violations of postnatal adaptation, (%), including:	86,6 (26)	25 (5)	<0,01
• morphofunctional immaturity	23,3(7)	10 (2)	<0,01
• edematous syndrome	60 (18)	45 (9)	<0,05
• syndrome of disadaptation of the cardiovascular system	20 (6)	15 (3)	>0,05
• early development and prolonged course of jaundice	36,6 (11)	10 (2)	<0,001
• hypoglycemia in the early neonatal period	26,6 (8)	1 (5)	<0,05
• pathological weight loss (>10%)	36,6 (11)	10 (2)	>0,05
• no recovery of weight loss by day 7	6,6 (2)	1 (5)	<0,001
Apgar score, points, at 1 minute at 5 minutes	7,14±0,17 8,08±0,12	7,88±0,09 8,26±0,02	<0,01 >0,05
Children born in asphyxia, %	13,3 (4)	5 (1)	<0,001
Total bilirubin (maximum level), μmol/l	218,3±11,1	197,7±6,9	>0,05

Note: n is the number of examined; p - statistical significance of differences between groups.

As shown in Table 2, birth asphyxia was significantly more common in newborns in the main group of 13.3% versus 5% in the comparison group ( $p < 0.001$ ). Apgar score in the first minute in children of the main group is significantly lower than in newborns in the comparison group ( $7.14 \pm 0.17$  points and  $7.88 \pm 0.09$  points in the main group and the comparison group, respectively,  $p < 0,05$ ). The lowest Apgar scores ( $6.80 \pm 0.45$  points) were noted in newborns with macrosomia ( $r = 0.5$ ;  $p < 0.01$ ). Newborns of the main group were more often born with various deviations in the state of health (Fig. 2), compared with children of the control group. Practically healthy newborns in the main group were 49% of children, in the comparison group this figure was 75%. 13.3% (4) of the children of the main group needed further nursing and treatment at the II stage in the neonatal pathology department, the newborns of the comparison group did not require inpatient treatment.

Figure 2.

**Characteristics and frequency (%) of the detected pathology in the examined newborns.**



Signs of perinatal damage to the CNS of hypoxic and dysmetabolic genesis with different syndromic characteristics were significantly more often observed in newborns of the main group. The severity of neurological disorders was more pronounced in newborns of the main group.

Natal trauma in the form of subarachnoid hemorrhage, fracture of the clavicle, muscular torticollis was diagnosed in 3 (10%) children of the main group. In the comparison group, natal injury (cephalohematoma) was registered in 1 case (5%).

According to our data, in newborns of the main group, infections specific to the perinatal period were diagnosed much more often (10%, in the comparison group 5%;  $p < 0.001$ ). In both groups, localized forms of infection were recorded in the form of omphalitis and conjunctivitis. Infections such as pneumonia (congenital and aspiration), intrauterine sepsis, and intrauterine chlamydial infection were not diagnosed. Respiratory distress syndrome was detected only in two newborns of the main group.

Thus, in newborns of the main group with vitamin D deficiency, the risk of developing abnormalities during the early adaptation period increases. In the genesis of these disorders in the early neonatal period, insufficient vitamin and mineral supply during fetal development is of particular importance. The revealed changes are the basis for further research on the development of effective programs for the prevention of mineral metabolism disorders in newborns with vitamin D deficiency.

### Findings

1. The early adaptation period in newborns with vitamin D deficiency proceeds with disorders manifested by the pathological course of physiological jaundice in newborns, a dysfunctional state of the cardiovascular system, a significant decrease in the initial body weight and its longer recovery.
2. The most significant deviations in the state of health of newborns with vitamin D deficiency are perinatal damage to the central nervous system of various origins, infections specific to the perinatal period, intrauterine growth retardation.
3. The revealed changes are the basis for further research on the development of effective programs for the prevention of mineral metabolism disorders in newborns with vitamin D deficiency.

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