AJPMHS GLOBAL RESEARCH NETWORK

AMERICAN Journal of Pediatric Medicine and Health Sciences
Volume 02, Issue 05, 2024 ISSN (E): 2993-2149

The Importance of Vitamin D in the Development of Rickets in Children

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Abstract: Based on questionnaires and level of 25(OH)D in 466 children under 1 year factors for rickets was identified. Reliable factors were iron deficiency anemia during pregnancy, toxemia of pregnancy of the mother and the lack of vitamin D during first year of life of a child, lack of outdoor stay (less then 20 minutes per day), frequent colds, not effective traditional prevention of rickets vitamin D.
Key words: *rickets, risk factors, serum 25 (OH) D3, children, biochemical parameters of blood, Student's criterion.*

Relevance. In the conditions of Uzbekistan, the causes of rickets are still poorly understood, however, the characteristic climatic, geographical and ethnic features can have a certain impact on the incidence and course of rickets in children of the first year of life. [3,7,14]. According to the authors, it was quite rightly noted that "for a correct understanding of the etiology and pathogenesis of rickets, it is necessary to clearly distinguish the factors predisposing to it and directly causing it [7, 10]." Thus, according to a study by Mamatkulov B. [2], the highest prevalence of rickets was noted among premature babies (77.4%) and those weighing up to 3000 g (71.4%), as well as those on a mixed (64.9%) and artificial breastfeeding (70.8%). The study of social and hygienic living conditions revealed that rickets is more common in families with the least favorable housing conditions (68.4%), in parents of students (81.8%), with incomplete secondary education (62.6%), with low family budget (60.4%). A direct factor causing rickets is a lack of vitamin D [4, 10, 15]. However, its deficiency has always been determined indirectly by the content of Ca and P [1,5, 9]. At the same time, the content of Ca and P does not always accurately reflect the severity and clinical manifestations of rickets, and according to Lukyanova, manifestations of rickets can also occur with a normal content of Ca and P in the blood [11, 13]. Studies to determine the active metabolite of vitamin D, which is a direct indicator of vitamin D deficiency, have not been conducted in Uzbekistan [6, 8, 12].

Purpose of the study: to study the risk factors for the development of rickets while monitoring the level of 25(OH)D3 in the blood serum.

Material and methods: 466 children were under observation, aged from 1 to 12 months, whom parents considered to be practically healthy and did not receive vitamin D within a month before blood sampling. There were 166 (35.6%) children under the age of 6 months, 204 (43.7%) under 12 months, 96 (20.6%) under 3 months. The predominance of boys was noted - 258 children (55.3±2.3%), while the number of girls was 208 (44.6±2.3). Mothers were interviewed and the questionnaire included topics such as ethnic background, medical history, exposure to sunlight, child development and pregnancy. The determination of 25(OH)D3 in blood serum was carried out in the laboratory of the Santa Clara Hospital in Rotterdam, Holland, using the radioimmunoassay method. Each child took 2 ml of venous blood. Serum was separated by centrifugation at 3000 rpm for 10 minutes. and stored at -200C. 25(OH)D3 deficiency was defined as a value below 30 mmol/L (12 mg/mL).

Results and discussions: depending on the level of 25(OH)D3 in the blood serum, all examined children were divided into 2 groups: group 1 - children with normal levels of 25(OH)D3 in the blood serum; Group 2 - children with low levels of 25(OH)D3 in blood serum. Group 1 included 84 (18.7%) children, group 2 - 365 (81.2%). The pathological course of pregnancy was detected in 73.4% of the examined mothers. Toxicosis of the 1st half of pregnancy was noted in 11.4%, the threat of termination - in 1.1%, nephropathy - in 1.5% of women. In 47.9%, the course of labor was pathological. This was mainly manifested by early discharge of water (4.7%), surgical interventions (3.2%). Rickets was detected in 28.9% of children, the consequences of perinatal damage to the nervous system - 16.2%, malnutrition - 4.8%, paratrophy - 0.6%, SARS - 51.2%, mild iron deficiency anemia was clinically detected in 25, 8% of the examined children.

It was of interest to elucidate the relationship between the content of the main metabolite of vitamin D, with risk factors for the development of rickets on the part of the child (Table 1).

Table 1

The frequency of occurrence of risk factors in children depending on the level of 25(OH)D3 in blood serum

risk factors	with a normal level of 25(OH)D3, n=84		with a low level of 25(OH)D3, n= 365		
	abs.	%	abs.	%	P<
mixed feeding	20	23,8±9,5	34	9,3±5,0	
Perinatal factors	28	33,3±8,9	122	33,4±4,3	
Lack of vitamin D prevention of rickets in the 1st year of life	32	38,1±8,6	283	77,5±2,5	0,001
SARS in a child	50	59,5±6,9	180	49,3±3,7	0,05
Time of birth of the child (autumn-winter period)	35	41,7±8,3	116	31,8±4,3	
Insufficient exposure to fresh air (no more than 20 minutes)	40	47,6±7,9	137	37,5±4,1	
Birth weight over 3500 g	23	27,4±9,3	85	23,3±4,6	
prematurity	13	15,5±10,0	30	8,2±5,0	
Iron deficiency anemia in a child	83	98,8±1,2	333	91,2±1,5	
Low blood calcium	19	22,6±9,6	93	25,5±4,5	
Low blood phosphorus	70	83,3±4,5	100	27,4±4,5	0,001

The table shows that in children from group 2, the causes of rickets development come first: lack of vitamin D intake in the first year of life - 77.5%, insufficient exposure to fresh air (less than 20

minutes a day) - 37.5%, frequent colds**.** Other factors were detected with the same frequency in both children with normal and low levels of 25(OH)D3 in the blood serum. A decrease in the level of Ca and P can occur both with normal and with a reduced level of 25(OH)D3 in the blood serum. We have analyzed the dependence of the level of 25(OH)D3 in the blood serum with the main risk factors on the part of mothers (Table 2).

Table 2

The frequency of occurrence of risk factors on the part of mothers depending on the level of 25(OH)D3 in blood serum

risk factors	with a normal level of 25(OH)D3, n=84		with a low level of 25(OH)D3, n= 365		
	abs.	%	abs.	%	P<
iron deficiency anemia during pregnancy	66	78,6±5,1	316	86,6±1,9	0,01
Lack of vitamin D during pregnancy	70	83,3±4,5	312	85,5±2,0	
Complicated childbirth	35	41,7±8,3	188	51,5±3,6	
Place of work of mothers (housewives)	35	41,7±8,3	184	50,4±3,7	
Nutritional deficiencies during pregnancy	48	57,1±7,1	213	58,4±3,4	
Mother's age at 1 pregnancy (up to 20 years)	48	57,1±7,1	198	54,2±3,5	
Toxicosis of pregnant women	18	21,4±9,7	44	12,0±4,9	0,05

Of the risk factors on the part of the mother, the lack of vitamin D intake during pregnancy can be brought to the fore - 85.4%; iron deficiency anemia during pregnancy - 59.1%.

When comparing tables with normal and reduced levels of 25(OH)D3 in blood serum, we used the criterion for estimating shares. Reliability was determined using the table of critical values Student's criterion. Of the indicated risk factors on the part of the mother, 4 significant factors were identified: iron deficiency anemia during pregnancy $Z=3.12$ $P<0.002$; complicated childbirth $Z=1.46$ $P<0.2$; housewife $Z=1.2$ $P<0.5$; maternal toxicosis during pregnancy $Z=1.8$ $P<0.1$.

On the part of the child, 6 significant risk factors were identified: lack of vitamin D prophylaxis in the first year of life $Z=6.9$ $P<0.00001$; SARS in a child $Z=1.5$ $P<0.02$; time of birth (autumn-winter period) $Z=1.6$ $P<0.2$; insufficient exposure to fresh air (less than 20 minutes a day) $Z=1.5$ $P<0.2$; iron deficiency anemia in a child $Z=16$ $P<0.01$. Of these risk factors on the part of the child, using statistical technologies, the most significant factors were determined: lack of vitamin D prophylaxis in the first year of life $P<0.00001$; iron deficiency anemia in a child $P<0.01$.

Conclusions: At present, recommendations for the prophylactic and therapeutic use of vitamin D3 preparations must be reasoned on the basis of the level of 25(OH)D3 in the blood serum of children. Moreover, the assessment of availability should be carried out not indirectly - by determining the content of Ca and P in the blood, but by the method of direct determination of vitamin D metabolites in the blood. -D).

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