



The Importance of Vitamin D in Acute Bronchitis in Children Against the Background of Rickets

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Abstract: The results of anamnestic, clinical, laboratory and special examination methods of 62 sick children with acute and bronchiolitis are analyzed. The level of vitamin D in the blood plasma is determined by the method of chemiluminescent immune analysis and depends on the severity of clinical and laboratory data. Children with acute bronchiolitis occurring against the background of rickets are recommended to determine the level of vitamin D metabolites in the blood for the purpose of early detection and prevention of complicated forms of the disease.

Key words: Children, acute obstructive bronchitis, vitamin D.

Relevance. The understanding of the role of vitamin D in the human body has significantly expanded. Research has led to a reassessment of the parameters of adequate vitamin D status in the body and demonstrated a high prevalence of its deficiency in the population of most countries of the world. Currently, it is proven that 30-50% of the world's population has vitamin D deficiency [10]. However, debates continue regarding the definition of the exact content of 25(OH)D and there is an opinion that vitamin D deficiency is widespread. Due to the wide distribution and detection of vitamin D in more than 40 organs and tissues, its extraskelatal effects are of great scientific interest. Most experts, having studied the effect of vitamin D on metabolic processes in the body, argue that the concentration of vitamin D in the blood serum of children and adults should correspond to a level of more than 30 ng / ml to ensure all the positive effects of this vitamin on the human body [3, 14.]. Currently, acute obstructive bronchitis (AOB) still remains the most common pathology in the pediatric population [11]. Research shows that vitamin D deficiency and rickets remain a pressing problem in pediatrics due to the lack of a decrease in prevalence, which in recent years has averaged 30% [7, 12, 16, 17.].

It is believed that the only reliable sign of rickets diagnosis is a decrease in the level of vitamin D (25-OH-D3) in the blood. The steady increase in diseases accompanied by broncho obstructive syndrome [9], insufficient study of the effect of vitamin D deficiency on the development and deterioration of respiratory diseases in childhood contribute to the need for further research to study all the mechanisms of the effect of vitamin D on pulmonary function in children.

The aim of the work was to determine the level of vitamin D in children with acute bronchitis against the background of rickets.

Material and methods. The study included 62 children with acute bronchiolitis who were undergoing inpatient treatment in the pediatric intensive care unit, I and II emergency pediatrics departments of the Samarkand branch of the Republican Research Center for Emergency Medical Care. The results of the examination of patients divided into II groups were analyzed: Group I (control) consisted of 20 sick children with acute and bronchiolitis without rickets; Group II (main) - 42 sick children with acute bronchiolitis against the background of rickets.



The diagnosis of acute obstructive bronchitis (J20.9) was made according to the International Classification of Diseases, Xth revision [1]. Rickets as a disease of the endocrine system and metabolism (ICD-X - E55.0. Active rickets) was established according to existing standards [6]. At the same time, the importance of hypovitaminosis D in its development is not denied [4].

The results of anamnestic, clinical and laboratory examination methods were studied in all children with acute obstructive bronchitis. The level of vitamin D in the blood plasma was determined by the chemiluminescent immune analysis method (Cobase 411). The concentration of 25 (OH) D in the blood plasma > 30 ng / ml was taken as the standard values, and a level of 21-29 ng / ml was considered a sign of hypovitaminosis D [7, 15].

Results of the study. Acute obstructive bronchitis was observed 1.5 times more often in boys (60.0%) than in girls (40.0%), which is possibly due to lower reserve capacity and tension of the adaptive mechanisms of their body. Patients under 6 months were 58.7% (37), over 6 months 41.3% (25). Prematurely born children accounted for 7.5% (6).

Among all hospitalized patients, mild broncho-obstruction was present in 8.7% (9) of children, moderate in 75.0% (47) of cases, and severe in 16.3% (6) of patients.

In patients of group I, mild broncho-obstruction was diagnosed in 7.8% (5) of patients, moderate in 15.7% (13) of patients, and severe in 3.7% (2) of cases, while in group II, in children with rickets, mild broncho-obstruction was present in 2.5% (2), moderate in 58.7% (47) of patients, and severe in 16.3% (11) of cases, i.e., broncho-obstruction with rickets was registered more often and was more severe.

Initial signs of rickets: softening of the edges of the anterior fontanelle, craniotables were present in 23.4% of patients and were accompanied by sweating, anxiety and poor sleep.

14.3% (9) of sick children were admitted with acute bronchial obstruction during the recovery period of rickets. X-ray examination revealed a calcification line with a normal phosphate level, there was slight hypocalcemia and a moderate increase in the level of alkaline phosphatase.

The proportion of children with manifestations of osteomalacia (softening of the edges of the anterior fontanelle, craniotables, rachitic kyphosis, curvature of the limbs, rachitic deformation of the chest) during the period of residual effects of rickets was 27.5% (22), the remaining patients had osteoid hyperplasia (frontal and occipital tubercles, rachitic beads, "strings of pearls"). Among children of group I with acute obstructive pulmonary disease without manifestations of rickets, the content of 25-hydroxycholecalciferol in the blood serum was within the age norm (30.2 ± 1.9 ng/ml) in 16.3% (13) of patients, in the remaining 8.7% (7) cases, deficiency (27.21 ± 0.6 ng/ml) of vitamin D was registered. In group II, 33.8% (26) of patients with acute obstructive pulmonary disease had a subacute course of rickets with a predominance of mild forms. Their content of vitamin D [25(OH)D₃] in the blood serum was within 24.62 ± 1.27 ng/ml, there was slight hypophosphatemia and increased alkaline phosphatase activity. In 45.0% (32) of children with OB against the background of moderate rickets, hypovitaminosis D [25(OH)D₃] – 21.282 ± 1.17 ng/ml was diagnosed, there was a decrease in the level of phosphates, calcium and an increase in the activity of alkaline phosphatase. In patients with OB against the background of severe rickets, vitamin D deficiency (17.52 ± 1.41 ng/ml) was recorded in 3.5% (2) of cases, which is associated with the predominance of sunny days in the region, since it is known that with sufficient insolation (10-minute irradiation of only the hands), the skin synthesizes the amount of vitamin D necessary for the body. X-ray examination showed a gross restructuring of the pattern and development of bones, expansion and blurring of the metaphyseal zone.

51.3% (43) of the patients were breastfed, of which 9.4% (9) grew up without additional vitamin D. 37.0% (28) of the children received drugs containing cholecalciferol, of which in 3 infants, rickets prevention was assessed as unsatisfactory (late onset, irregular drug intake). 49.4% (37) of the children were on mixed/artificial feeding and received cholecalciferol in a dose of 200-400 IU as part



of adapted milk formulas taking into account the volume of food. They were additionally prescribed vitamin D daily in a dose of 500-1000 IU.

In most children with hypovitaminosis D, specific rickets prevention was assessed as inadequate. 23.7% (18) of women did not receive vitamin D during pregnancy. In 25.9% (19) of cases, the socio-economic conditions of mothers during pregnancy were unfavorable, which could be the reason for inadequate provision of them with calcium and vitamin D.

A study of outpatient cards and medical records of patients showed the presence of a combination of 2 or more risk factors for the development of calcium-phosphorus metabolism disorders and vitamin D deficiency: unfavorable socio-economic conditions of life (23.7%), prematurity (7.5%), jaundice in newborns (11.3%), anemia (67.5%), protein-energy deficiency (15.0%), pathology of organs involved in vitamin D metabolism.

Insufficient intake of foods containing calcium and phosphates in the diet was revealed from the anamnesis of 34.7% (25) of mothers. Impaired absorption of calcium and phosphates in the intestine was present in 41.3% (33) of patients as a result of periodic stool disorders.

Exo- and endogenous vitamin D deficiency and low levels of vitamin D metabolite as a result of kidney, liver, and intestinal diseases, and nutritional deficiencies were present in every second patient. Reduced motor and support load was noted in 15.0% (12) of cases.

Children born in the autumn-winter months were 1.4 times more likely to have hypovitaminosis D than those born in the spring-summer period (47.5% and 27.5%, respectively).

In patients of group I, the content of trace elements in the blood of calcium (2.5 ± 1.1 mmol/l), phosphorus (1.68 ± 0.3 mmol/l), and alkaline phosphatase (489.5 ± 85.4 U/l); and also in urine calcium (2.5 ± 1.3 mmol/day) and phosphorus (9.7 ± 1.4 mmol/day) were within the age norm.

The excretion of calcium and phosphorus by the kidneys is parallel to their content in the blood. With normal calcium content, its excretion in the urine is insignificant, with hypocalcemia this amount decreases sharply, hypercalcemia increases the calcium content in the urine.

In patients of group II, hypocalcemia was detected up to the lower limit of the norm (1.7 ± 0.8 mmol/l), hypophosphatemia up to 1.31 ± 0.5 mmol/l and an increase in alkaline phosphatase up to 734.4 ± 175.3 U/l, as well as hypocalciuria up to 1.2 ± 1.1 mmol/day and hypophosphaturia up to 8.2 ± 0.8 mmol/day.

Pathology of other organs and systems in patients with sufficient vitamin D supply to the child's body creates unfavorable conditions for metabolism and leads to its deficiency.

Discussion of results. Analysis of literary data indicates that vitamin D deficiency, namely a decrease in the concentration of 25 (OH) D in the blood serum below 20 ng / ml, can contribute to the severe course of respiratory infections in young children. Canadian scientists have found that among children with bronchiolitis or pneumonia hospitalized in the intensive care unit, the average level of 25 (OH) D in the blood serum was significantly lower compared to the group of children treated in the pediatric department (20 ng / ml and 35 ng / ml, respectively). Clinical studies of Babarykin D.A. et al. [2] demonstrated that low levels of vitamin D (below 30 ng/ml) increase the risk of acute respiratory infections by 50% in children aged 3–15 years and confirmed its importance in providing anti-infective immunity.

Today, the role of vitamin D (25(OH)D, VD) and the significance of its deficiency in the susceptibility to frequent respiratory diseases are being actively studied [18]. The anti-infective mechanism of action of vitamin D is known, which is actively involved in the functioning of the innate immune system due to the production of antimicrobial peptides (AMPs), which play an important protective role against respiratory pathogens such as viruses, bacteria and fungi [19]. In this regard, the issue of the possible use of vitamin D as an adjuvant therapy for acute respiratory infections, including broncho-obstructive syndrome, is relevant in order to improve the clinical



course, reduce the recovery time and prevent repeated episodes of broncho-obstruction in children. Thus, a randomized placebo-controlled study conducted with the participation of Japanese schoolchildren aged 6-15 years showed that taking 1200 IU/day of vitamin D3 in winter and early spring helps prevent the occurrence of influenza and attacks of bronchial asthma [8, 13, 20].

Conclusions. Thus, children with acute bronchiolitis occurring against the background of rickets are recommended to determine the level of vitamin D metabolites in the blood for the purpose of early detection and prevention of broncho-obstruction and respiratory failure.

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