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Vitamin D Use in Acute Obstructive Bronchitis in Children on the Background of Rachit

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Annotation. The results of anamnestic, clinical-laboratory and special examination methods of 80 patients of children with acute obstructive bronchitis were analysed. The level of vitamin D in blood plasma was determined by chemiluminescent immunoassay method and depends on the severity of clinical and laboratory data. It is recommended to determine the level of vitamin D metabolites in blood in children with acute obstructive bronchitis occurring on the background of rickets for the purpose of early detection and prevention of complicated forms of the disease

Keywords. Children, acute obstructive bronchitis, vitamin D.

Relevance. The understanding of the role of vitamin D in the human body has significantly expanded. Studies have led to a reassessment of the parameters of adequate vitamin D status in the body and demonstrated a high prevalence of vitamin D insufficiency in the population of most countries of the world. Currently, 30-50% of the world population has been shown to have vitamin D insufficiency [10]. Nevertheless, there is an ongoing debate about the definition of the exact 25(OH)D content and there is a belief that vitamin D insufficiency is widespread. Due to the widespread distribution and the detection of vitamin D in more than 40 organs and tissues, its extracellular effects are of great scientific interest. Most experts, having studied the effects of vitamin D on metabolic processes in the body, state that the concentration of vitamin D in the 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) is still the most common pathology in the pediatric population [11]. Studies indicate that vitamin D insufficiency and rickets remain a pressing problem in pediatrics, due to the lack of decrease in prevalence, which has averaged 30% in recent years [7, 12, 16, 17.].

An analysis of the literature suggests that vitamin D deficiency, namely a decrease in serum 25(OH)D concentrations below 20 ng/ml, may contribute to the severe course of respiratory infections in young children. Canadian researchers found that among children with bronchiolitis or pneumonia hospitalized in the intensive care unit, the mean serum 25(OH)D level was significantly lower compared with the group of children treated in the pediatric ward (20 ng/ml and 35 ng/ml, respectively). Clinical studies by 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 3-15 years of age and confirmed its importance in providing anti-infectious immunity.

To date, the role of vitamin D (25(OH)D, VD) and the significance of its deficiency in the propensity to frequent respiratory diseases have been actively studied [18]. The anti-infectious mechanism of action of vitamin D is known to be actively involved in the functioning of the innate immunity system through 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 question of the possible use of vitamin D as an adjunctive therapy of acute respiratory diseases, including bronchobstructive syndrome, to improve the clinical course, shorten recovery time and prevent recurrent episodes of bronchoobstruction in children is relevant. For example, a randomised placebo-controlled study involving Japanese schoolchildren aged 6-15 years showed that taking 1200 IU/day of vitamin D_3 in winter and early spring helps prevent influenza and bronchial asthma attacks [8, 13, 20].

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 growth of diseases accompanied by bronchobstructive syndrome [9**],** insufficient study of the effect of vitamin D deficiency on the development and worsening of respiratory diseases in childhood contribute to the need for further research to study all mechanisms of vitamin D effect on pulmonary function in children**.**

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

Material and Methods. Eighty children with acute obstructive bronchitis who were undergoing inpatient treatment in pediatric intensive care, I and II emergency pediatrics departments of the Samarkand branch of the Republican Research Centre for Emergency Medical Care were examined. The results of examination of patients divided into II groups were analyzed: Group I (control group) consisted of 20 children with acute obstructive bronchitis without rickets; Group II (main group) - 60 children with acute obstructive bronchitis on the background of rickets.

The diagnosis of acute obstructive bronchitis (J20.9) was made according to the International Classification of Diseases, X th revision [1]. Rakhitis as a disease of the endocrine system and metabolism (ICD-X - E55.0.Active Rakhitis) was established according to the existing standards [6]. 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 respiratory failure. The level of vitamin D in blood plasma was determined by chemiluminescent immunoassay (Combase 411). 25(OH)D concentration in blood plasma > 30 ng/ml was taken as normal values, and the level of 21-29 ng/ml was considered as 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 may be due to lower reserve abilities and tension of adaptation mechanisms of their organism. Patients under 6 months of age were 58.7% (47), over 6 months 41.3% (33). Children born prematurely were 7.5% (6).

Among all hospitalised patients, 8.7% (7) children had mild bronchoconstriction, 75.0% (60) had moderate bronchoconstriction and 16.3% (13) had severe bronchoconstriction.

In group I patients bronchoobstruction of mild degree was diagnosed in 6.2% (5) patients, of medium severity - in 16.3% (13) patients and severe degree - in 2.5% (2) cases, whereas in group II children with rickets mild degree was diagnosed in 2.5% (2), of medium severity was registered in 58.7% (47) patients and severe degree - in 16.3% (11) cases, i.e. bronchoobstruction on the background of rickets was registered more often and was more severe.

Initial signs of rickets: softening of the edges of the fontanelle, craniotabes were present in 22-27.5% of patients and were accompanied by sweating, restlessness and poor sleep.

Patients admitted with acute obstructive bronchitis at the height of rickets with signs of bone osteomalacia were 29-36.3%. They had pronounced clinical and radiological changes accompanied by marked hypophosphatemia.

11.3% (9) of sick children were admitted with acute bronchoconstriction during the period of rickets reconsolidation. X-ray examination revealed a line of calcification with normal phosphate levels, slight hypocalcaemia and moderate elevation of alkaline phosphatase.

The proportion of children with manifestations of osteomalacia (softening of the edges of the great fontanel, craniotabes, rachitic kyphosis, curvature of limbs, rachitic deformity of the thorax) during the period of residual rickets was 27.5% (22), the rest of the patients had osteoid hyperplasia (frontal and occipital tubercles, rachitic rosary, "strings of pearls").

Among the children of group I with APS without rickets manifestations in serum the content of 25-hydroxycholecalciferol was within the age norm (30.1±1.7 ng/ml) in 16.3% (13) of patients, in the remaining 8.7% (7) cases the insufficiency (28.1±0.4 ng/ml) of vitamin D was registered.

In group II, 32.5 per cent (26) of patients with APS had subacute rickets with predominance of mild forms. Their serum vitamin D [25(OH)D3] content was within 26.73±1.81 ng/ml, there was a slight hypophosphatemia and increased alkaline phosphatase activity. Hypovitaminosis D [25(OH)D3] was diagnosed in 40.0% (32) of children with APS on the background of rickets of medium severity - 22.52±1.37 ng/ml, there were decreased levels of phosphates, calcium and increased activity of alkaline phosphatase. Vitamin D deficiency (18,72±1,61 ng/ml) was registered in 2,5% (2) cases in patients with PLD on the background of severe rickets, which is connected with the prevalence of sunny days in the region, because it is known that at sufficient insolation (10-minute irradiation of hands only) the amount of vitamin D necessary for the organism is synthesized in the skin. In radiological examination, they showed a rough rearrangement of bone pattern and development, expansion and blurring of the metaphysis zone.

Breastfed 53.7% (43) of patients were breastfed, of whom 11.2% (9) were growing without additional vitamin D supplementation. 35.0% (28) of the children received preparations containing cholecalciferol, of which 3 infants had unsatisfactory rickets prophylaxis (late onset, irregular administration of preparations). 46.3% (37) of the children were on mixed artificial feeding and received cholecalciferol in a dose of 200-400 IU in the composition of adapted milk formulae, taking into account the volume of nutrition. They were additionally prescribed vitamin D at a dose of 500-1000 IU daily.

In the majority of children with hypovitaminosis D, specific prevention of rickets was considered inadequate. 22.5% (18) of women did not receive vitamin D during pregnancy. In 23.7% (19) cases, the socio-economic living conditions of mothers during pregnancy were unfavourable, which could be the reason for inadequate calcium and vitamin D supply.

The study of outpatient charts and case histories of patients showed the presence of a combination of 2 or more risk factors for the development of disorders of phosphorus-calcium metabolism and vitamin D deficiency: Adverse socioeconomic living conditions (23.7%), prematurity (7.5%), neonatal jaundice (11.3%), anaemia (67.5%), protein-energy deficiency (15.0%), pathology of organs involved in vitamin D metabolism (intestinal dysbiosis 48.5%, liver and kidney pathology 13.7%).

Insufficient intake of calcium and phosphate-containing foods in the diet was identified from the anamnesis of 31.3% (25) of mothers. Disorder of calcium and phosphate absorption in the intestine was present in 41.3% (33) of patients as a result of recurrent stool disturbance.

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

Children born in the autumn-winter months were 1.7 times more likely to have hypovitaminosis D than those born in the spring-summer period (47.5% and 27.5% respectively).

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

Excretion of calcium and phosphorus by the kidneys goes in parallel with their content in the blood. At normal calcium content its excretion with urine is insignificant, at hypocalcaemia this amount sharply decreases, hypercalcemia increases calcium content in urine.

Group II patients showed hypocalcaemia to the lower limit of norm (1.8±0.9 mmol/l), hypophosphatemia to 1.51±0.2 mmol/l and alkaline phosphatase increase to 734.4±175.3 U/l, as well as hypocalciuria to 1.2±1.1 mmol/day and hypophosphaturia to 8.2±0.8 mmol/day.

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

Conclusions. Thus, it is recommended to determine the level of vitamin D metabolites in the blood of children with acute obstructive bronchitis with rickets for the purpose of early detection and prevention of bronchoobstruction.

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