UDC: 616-021.2

THE RELATIONSHIP BETWEEN VARIOUS CAUSES OF RACHITIS IN CHILDREN


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БОЛАЛАРДА РАХИТ РИВОЖЛАНИШИНИНГ ТУРЛИ САБАБЛАРИ ЎРТАСИДАГИ БОҒЛИҚЛИК

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ВЗАИМОСВЯЗЬ РАЗЛИЧНЫХ ПРИЧИН РАЗВИТИЯ РАХИТА У ДЕТЕЙ

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Резюме. *Болаларда учрайдиган рахит ва у билан боғлиқ бўлган суяк массаси тўпланишининг бузилиши анча кеч ёшда остеопороз ривожланиш хавфини ошириши мумкин. Тадқиқотга Самарқанд шаҳридаги 3, 6, 8 ва 12-сонли поликлиникаларнинг педиатрия бўлимларида, шунингдек, Оқдарё шаҳар марказий туман касалхонасида даволанган 466 нафар бир ёшгача бўлган болалар киритилган. Рахит ривожланишининг хавф омилларини баҳолаш учун Йейтс тузатмаси билан ўзаро боғлиқлик жадваллари учун χ2-квадрат тестидан фойдаланилди (эркинлик даражалари сони v=1). Таҳлиллар шуни кўрсатдики, пренатал даврда рахитнинг прогностик белгилари ҳомиладорлик пайтида D витаминининг етарли даражада истеъмол қилинмаслиги, оналар анемияси ва мувозанатсиз овқатланишдир. Постнатал омиллар орасида энг катта ролни очиқ ҳавода етарлича бўлиш, туғруқ вақти ва D витамини билан етарли даражада профилактика қилмаслик ўйнади. Бундан ташқари, перинатал омиллар, шу жумладан чала туғилиш, асаб тизимининг перинатал шикастланиши оқибатларининг (АТПШО) ривожланишига сезиларли таъсир кўрсатди. Шуни таъкидлаш керакки, рахит ҳам АТПШО ривожланишига ёрдам берувчи омил бўлиб, бу ҳолатлар ўртасида маълум боғлиқликни кўрсатади.*

Калит сўзлар: *рахит, ҳаётининг биринчи йилидаги болалар, хавф омиллари, ҳомиладорлик, туғиш, асаб тизимининг перинатал шикастланиши оқибатлари.*

Abstract. *Pediatric rickets and related disorders of bone mass accumulation may increase the risk of osteoporosis later in life. The study included 466 infants of the first year of life treated in the pediatric departments of Polyclinics No. 3, 6, 8 and 12 in Samarkand, as well as in the Central District Hospital of Akdarya. The chi-square test for conjugation tables with Yates correction (number of degrees of freedom v=1) was used to assess the risk factors of rickets development. The analysis revealed that in the prenatal period, lack of vitamin D intake during pregnancy, maternal anemia, and unbalanced nutrition are prognostic signs of rickets. Among postnatal factors, insufficient outdoor exposure, timing of childbirth, and inadequate vitamin D prophylaxis played the greatest role. In addition, perinatal factors, including prematurity, had a significant impact on the development of the consequences of perinatal nervous system damage (CPNSD). It is important to note that rickets was also a factor contributing to the development of CPNSD, indicating a definite relationship between these conditions.*

Key words: *rickets, children of the first year of life, risk factors, pregnancy, childbirth, consequences of perinatal lesions of the nervous system.*

Relevance: Infantile rickets is not only a medical but also a social problem, as its consequences can lead to high morbidity in older age [1,3,12]. Early-onset rickets and the resulting bone mineral density deficiency may contribute to the development of osteoporosis in later years [9,10]. This disease occurs worldwide, but is particularly common in populations in sunlight-deficient northern regions. In Uzbekistan, rickets is a widespread pathology and is second only to iron deficiency anemia in frequency [5,8]. Although severe forms of rickets (grade 3) are practically not registered, mild and moderately severe forms continue to be detected in children in the first year of life. According to data, vitamin D deficiency among infants in Samarkand reaches 77.2%, and clinical manifestations of rickets are observed in 27.8% of children [6,7,11]. Thus, the successes achieved in the prevention of rickets, the elimination of its social causes and in-depth study of the nature of the disease have made it possible to consider its impact on children's health from a new perspective [2,4,13]. Regular observation of infants by doctors of children's polyclinics, their attention to the issues of rickets

prevention should contribute to further improvement of methods of its prevention and treatment.

Purpose of the study: To determine the current factors contributing to the development of rickets for the purpose of timely prevention and effective treatment.

Materials and methods of research: The study involved 466 children of the first year of life. In addition to clinical examination, parents were surveyed and outpatient records were analyzed in children's polyclinics No. 3, 6, 8 and 12 in Samarkand city, as well as in the Central District Hospital of Akdarya district. Samarkand, as well as in the Central District Hospital of Akdarya district. Parents were informed about the purpose of the study and then gave written consent to participate. Children who had previously received vitamin D or had diseases affecting vitamin D levels were excluded from the study. Mothers filled out a questionnaire in Uzbek, which included information on ethnicity, medical history, sunlight exposure, pregnancy and child development.

Clinical (general blood, urine and fecal analysis), biochemical (determination of serum 25(OH)D3, calcium and phosphorus levels) and instrumental investigations (hand and chest X-ray) were performed to clarify the diagnosis. All children were examined by a pediatrician, neurologist, ophthalmologist, and other specialists. Statistical analysis of risk factors for rickets was performed using the chi-square test for conjugation tables with Yates correction (degree of freedom v=1).

Discussion of the results obtained: Children were divided into three groups based on the conducted research:

- Healthy children - 56.4%,
- Children with signs of rickets - 27.8%,
- Children with consequences of perinatal nervous system damage (CPNSD) - 15.6%.

To study the relationship between vitamin D deficiency and type of feeding, a subgroup of 141 children under six months of age was identified. It was found that the majority of healthy children and infants with rickets were predominantly breastfed, while mixed feeding was more common among children with CPNSD.

Artificially fed children accounted for 10.5% of healthy children and 12.5% of children with rickets. Detailed analysis showed that 74 (52.4%) out of 141 children were breastfed. Among them, 62.1% (46 children) were healthy. At the same time, only 32.4% (24 children) with rickets were breastfed, and among children with CPNSD, this figure was only 5.4% (4 children).

Thus, we can conclude that breastfeeding plays an important role in the prevention of rickets, providing children with the necessary nutrients and contributing to normal development (Table 1).

During in-depth clinical examination, 27.8% of children were diagnosed with rickets, and 15.6% had consequences of perinatal nervous system damage (CPNSD). For a more detailed analysis of the influence of various premorbid conditions on the disorder of phosphorus-calcium metabolism, the group of children with CPNSD was selected as the second control group. All study participants were further divided into two groups depending on the concentration of the main vitamin D metabolite (Table 2).

Analysis of the presented data shows that in healthy children low levels of 25(OH)D3 occur with the same frequency as in children with CPNSD. At the same time, in rickets there is a pronounced tendency to a more significant deficiency of this vitamin D metabolite, which was detected in 86.1% of patients.

One of the key factors contributing to the development of rickets in young children is the transferred diseases. Studies have shown that respiratory infections were the most common in all groups, but they were more frequently diagnosed in children with rickets and CPNSD. When comparing the frequency of iron deficiency anemia (IDA) between healthy children and the group with CPNSD, no statistically significant difference was found, while in children with rickets this indicator was three times higher. Thus, we can conclude that latent vitamin D deficiency leads to the development of the clinical picture of rickets in the context of concomitant iron deficiency anemia (Table 3).

To assess risk factors for rickets development, the criterion (χ^2) was calculated for conjugacy tables with Yates continuity correction (with degrees of freedom v=1) (Table 4).

Table 1. Distribution of children under 6 months of age according to type of feeding

Feeding	Healthy	Rakhitis	CPNSD	Total
Breast	62,1%	32,4%	5,4%	74 (52,4%)
Artificial	10,5%	12,5%	-	14 (9,9%)
Mixed	54,7%	18,8%	22,6%	53 (37,5%)

Table 2. Frequency of occurrence of normal and low levels of 25(OH)D3 in the serum of the examined children

Children	Low levels of 25(OH)D3	Normal level of 25(OH)D3	Total
Healthy children	198 (75,2%)	65 (24,7%)	263
Children with signs of rickets	112 (86,1%)	18 (13,8%)	130
Children with CPNSD	50 (68,4%)	23 (31,5%)	73
Total	360 (77,2%)	106 (22,7%)	466

Table 3. Frequency of illnesses in the history of children

Clinical diagnosis	Healthy %	Rakhitis %	CPNSD %
Acute respiratory infections	45,2	52,3	58,9
Diarrhea	2,8%	3,0	1,3%
iron deficiency anemia	16,3	50,0	13,6

Table 4. The χ2 -square criterion for prenatal risk factors for rickets

Maternal risk factors	Rakhitis	CPNSD
iron deficiency anemia	χ2 -square = 4.096 P < 0.043	χ2 -square = 20.132 P < 0.0001
Lack of vitamin D supplementation during pregnancy	χ2 -square = 40.059 P <0.0001	χ2 -square = 8.609 P <0.003
Age at 1 pregnancy (under 20 years of age)	χ2 -square = 0.418 P>0.518	χ2 -square = 0.761 P<0.383
Unbalanced nutrition during pregnancy	χ2 -square = 10.064 P<0.002	χ2 -square = 3.237 P < 0.072

Table 5. The χ2 -square criterion for postnatal risk factors for the development of rickets

Risk factors for children	Rakhitis	CPNSD
Inadequate prevention of rickets with vitamin D in the 1st year of life	χ2 -square = 4.334 P <0.037	χ2 -square = 1,55 P < 0.25
Insufficient outdoor activities (less than 20 min)	χ2 -square = 9.395 P <0.002	χ2 -square = 17.171 P < 0.0001
Time of birth (fall-winter period)	χ2 -square = 5.14 P < 0.025	χ2 -square P >0.5
Iron deficiency anemia in a child	χ2 -square = 7.083 P < 0.008	χ2 -square P >0.5
Perinatal factors	χ2 -square = 8.516 P < 0.004	χ2 -square = 4.228 P < 0.040
Prematurity	χ2 -square P >0.05	χ2 -square = 30.559 P < 0.0001

Analysis of prenatal risk factors in children with clinical manifestations of rickets showed statistically significant χ^2 values for the following factors: iron deficiency anemia, 4.096 (P<0.043), lack of vitamin D supplementation during pregnancy, 40.059 (P<0.0001), and unbalanced nutrition during pregnancy, 10.064 (P<0.002). At the same time, maternal age at first pregnancy (under 20 years), 0.418 (P>0.518), was not found to be a significant risk factor.

In mothers of children with PPPNS, significant risk factors for rickets included iron deficiency anemia, 20.132 (P<0.0001), lack of vitamin D supplementation during pregnancy, 8.609 (P<0.003), and unbalanced diet, 3.237 (P<0.072). However, maternal age at first pregnancy (before 20 years of age) 0.761 (P<0.383) also showed no statistically significant association with the development of rickets.

Additionally, a (χ^2) calculation was performed to identify the significance of postnatal risk factors for the development of rickets (Table 5).

The analysis showed high statistical significance of the following factors: Iron deficiency anemia - 7.083 (P<0.008), birth in the fall-winter period - 5.14 (P<0.025), influence of perinatal factors - 8.516 (P<0.004), insufficient fresh air exposure (less than 20 minutes per day) - 9.395 (P<0.002), and lack of prevention of rickets with vitamin D during the first year of life - 4.334 (P<0.037).

In children with CPNSD, the (χ^2) value confirmed the high statistical significance of such risk factors as prematurity, perinatal factors and insufficient outdoor exposure. At the same time, iron deficiency anemia and season of birth showed no significant association with the risk of developing this condition.

Conclusions: Thus, the analysis of risk factors for rickets revealed that among prenatal factors, insufficient vitamin D intake during pregnancy, iron deficiency anemia in the mother and unbalanced nutrition play a key role. Among postnatal factors, insufficient outdoor exposure, the influence of perinatal factors, the season of birth and the lack of vitamin D prophylaxis during the first year of life are significant predictors of rickets. At the same time, perinatal factors and prematurity were more significant in the development of CPNSD. In addition, the presence of rickets in children was considered as one of the factors contributing to the formation of CPNSD, indicating a relationship between these conditions.

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ВЗАИМОСВЯЗЬ РАЗЛИЧНЫХ ПРИЧИН РАЗВИТИЯ РАХИТА У ДЕТЕЙ

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Резюме. *Детский рахит и связанные с ним нарушения накопления костной массы могут повышать риск развития остеопороза в более позднем возрасте. В исследование включено 466 детей первого года жизни, проходивших лечение в педиатрических отделениях поликлиник № 3, 6, 8 и 12 г. Самарканда, а также в Центральной районной больнице г. Акдарьи. Для оценки факторов риска развития рахита использовали тест хи-квадрат для таблиц сопряженности с поправкой Йейтса (число степеней свободы ν=1). Анализ показал, что в пренатальном периоде прогностическими признаками рахита являются недостаточное потребление витамина D во время беременности, материнская анемия и несбалансированное питание. Среди постнатальных факторов наибольшую роль сыграли недостаточное пребывание на свежем воздухе, время родов и недостаточная профилактика витамином D. Кроме того, перинатальные факторы, включая недоношенность, оказывали значительное влияние на развитие последствий перинатального поражения нервной системы (ППППНС). Важно отметить, что рахит также являлся фактором, способствующим развитию ППППНС, что указывает на определенную взаимосвязь между этими состояниями.*

Ключевые слова: *рахит, дети первого года жизни, факторы риска, беременность, роды, последствия перинатального поражения нервной системы*.