

MODERN APPROACHES TO THE TREATMENT OF RICKETS.

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Annotation: This article explores the modern approaches to the treatment and prevention of rickets, a pediatric condition caused by deficiencies in vitamin D, calcium, or phosphorus. The article delves into the etiology and pathogenesis of the disease, detailing its clinical manifestations and diagnostic evaluation. The primary focus is on contemporary treatment methods, including vitamin D, calcium, and phosphorus supplementation, sunlight exposure, nutritional intervention, physical therapy, and surgical intervention for severe cases. Additionally, the article emphasizes the importance of preventive measures such as prenatal care, neonatal supplementation, public health initiatives, and food fortification. The comprehensive discussion highlights the necessity of early diagnosis and intervention to prevent the long-term complications of rickets and promote optimal bone health in children.

Keywords: Rickets, Vitamin D deficiency, Calcium supplementation, Phosphorus supplementation Pediatric bone disease, Sunlight exposure, Nutritional intervention, Physical therapy, Surgical intervention, Preventive measures

Rickets is a non-infectious disease associated with metabolic disorders, mainly caused by a lack of vitamin D, calcium or phosphorus in the body. The fracture leads to softening and deformation of the bones. Often, rickets in children is observed during the period of intensive growth, when the body's need for these substances is especially great (the first years of life). Rickets is a pediatric condition characterized by the softening and weakening of bones, primarily due to deficiencies in vitamin D, calcium, or phosphorus. This disease, although largely preventable, remains a significant health concern in various parts of the world. This article delves into the etiology, pathogenesis, and modern treatment approaches for rickets, highlighting the importance of early diagnosis and intervention.

Etiology and Pathogenesis. Rickets is predominantly caused by a deficiency in vitamin D, which is essential for the absorption of calcium and phosphorus in the intestines. Vitamin D is synthesized in the skin upon exposure to ultraviolet B (UVB) rays from sunlight and can also be obtained from dietary sources. A deficiency in vitamin D leads to decreased calcium absorption, resulting in hypocalcemia. This condition stimulates the release of parathyroid hormone (PTH), which in turn increases bone resorption to maintain serum calcium levels, leading to weakened and deformed bones.

Other factors contributing to rickets include: - Nutritional Deficiency: Insufficient intake of vitamin D, calcium, or phosphorus. - Malabsorption Disorders: Conditions such as celiac disease or inflammatory bowel disease that impair nutrient absorption. - Chronic Kidney Disease: Impairs the conversion of vitamin D to its active form, calcitriol. - Genetic Disorders: Conditions such as hypophosphatemic rickets that affect phosphate metabolism.

Clinical Manifestations. Rickets presents with various clinical signs and symptoms, including: - Skeletal Deformities: Bowing of the legs, thickening of the wrists and ankles, and curvature of the spine. - Growth Retardation: Delayed growth and short stature. - Dental Issues: Delayed tooth

eruption and dental deformities. - **Muscle Weakness:** Generalized muscle weakness and hypotonia. - **Bone Pain and Tenderness:** Especially in the legs, pelvis, and spine. In the early stages of rickets, symptoms may be non-specific and difficult to distinguish. One of the first signs is general weakness and fatigue. Children with rickets are irritable, restless, cry often and have difficulty sleeping. Parents may notice an increase in sweating, especially on the scalp, which is also an early sign of the disorder. These manifestations are often ignored or due to other, less serious reasons. As the disease progresses, the symptoms of rickets become more specific and specific. One of the main symptoms is the softening of the skull bones. When palpating the occipital region, you can feel that the bones of the skull have become soft and pliable. This is especially noticeable in babies and young children. In addition, there may be a delay in the closure of the fontanelles.

Another important sign of rickets is bone deformation. The most common curvature of the legs, which can be manifested as varus (O-shaped) or valgus (X-shaped) deformity. These curvatures are caused by insufficient bone mineralization and increased load on them during walking. Thickening of the wrists and ankles, called rickets wrists, is also a characteristic sign of rickets. It occurs due to the expansion of bone growth plates, which leads to thickening and deformation. Other bony signs of rickets include chest deformity. The so-called "chest ridge" appears, in which the sternum protrudes forward, and the ribs take on the appearance of a "rachitic rosary" due to the thickening of their front ends. Changes in the spine such as kyphosis or lordosis can also occur with rickets and cause poor posture and back pain.

Diagnostic Evaluation. Diagnosis of rickets involves a combination of clinical, biochemical, and radiological assessments:- **Clinical Examination:** Identification of skeletal deformities and growth delays.- **Biochemical Tests:** Measurement of serum levels of calcium, phosphorus, alkaline phosphatase, and parathyroid hormone. Vitamin D levels (25-hydroxyvitamin D) are also crucial.- **Radiological Imaging:** X-rays of affected bones to identify characteristic features such as metaphyseal widening, cupping, and fraying.

Treatment Approaches

1. **Vitamin D Supplementation.** Vitamin D supplementation is the cornerstone of rickets treatment. The dosage depends on the severity of the deficiency and the patient's age. For mild cases, oral vitamin D (cholecalciferol or ergocalciferol) is administered. In severe cases, higher doses or intramuscular injections may be required. The goal is to restore normal serum levels of 25-hydroxyvitamin D and alleviate symptoms.
2. **Calcium and Phosphorus Supplementation.** Alongside vitamin D, calcium and phosphorus supplements are essential to correct deficiencies and promote bone mineralization. Calcium supplements are commonly provided in the form of calcium carbonate or calcium citrate, while phosphate supplements are given as oral phosphates or milk.
3. **Sunlight Exposure.** Adequate sunlight exposure is vital for natural vitamin D synthesis. Patients are encouraged to spend at least 10-15 minutes daily in sunlight, especially during early morning or late afternoon when UVB rays are less harmful.
4. **Nutritional Intervention.** A balanced diet rich in vitamin D, calcium, and phosphorus is critical. Foods such as fatty fish (salmon, mackerel), fortified dairy products, egg yolks, and leafy green vegetables are excellent sources. Nutrition counseling by a dietitian can help in formulating an appropriate dietary plan.

5. **Physical Therapy.**Physical therapy is beneficial in managing skeletal deformities and muscle weakness associated with rickets. Exercises aimed at strengthening bones and muscles, improving posture, and enhancing mobility are integral parts of the rehabilitation process.

6. **Surgical Intervention** In severe cases with significant bone deformities, surgical intervention may be necessary. Osteotomy, a surgical procedure to correct bone alignment, can help restore normal bone structure and function.

In addition, the causes of rickets include a variety of medical conditions that can impair the absorption and metabolism of vitamin D. These conditions include diseases of the gastrointestinal tract that disrupt the absorption of nutrients (gastritis, ulcers, colitis). Liver and kidney disease can also affect the body's ability to convert vitamin D into the active form needed for normal calcium metabolism. Patients with rickets often have chronic diseases that aggravate the lack of vitamins and minerals. Vitamin D deficiency and calcium-phosphorus metabolism disorders affect not only bones, but also other body systems. Symptoms of rickets can include muscle weakness and hypotension. Children with rickets have difficulties in motor activities: delays in reaching areas of development such as sitting, crawling and walking. Symptoms of rickets can also include seizures caused by low blood calcium levels.

Rickets can also affect the teeth. In children suffering from this disease, teething is delayed, the formation of tooth enamel is disturbed, and the susceptibility to caries increases. Teeth may be misshapen and irregularly shaped, reflecting general problems with bone mineralization. In more severe cases of rickets, symptoms may include problems with the functioning of internal organs. An enlarged liver and spleen, anemia, and growth retardation may be associated with long-term deficiency of vitamin D and other essential nutrients. Children's psychomotor development can also be affected, as a result of which speech development and cognitive abilities are delayed.

Prevention. Preventive measures are crucial in reducing the incidence of rickets:

- **Prenatal Care:** Ensuring adequate vitamin D levels in pregnant women through supplementation and dietary intake to promote fetal bone development.
- **Neonatal and Infant Supplementation:** Routine vitamin D supplementation for newborns and infants, especially those who are breastfed, to prevent deficiency.
- **Public Health Initiatives:** Promoting awareness about the importance of vitamin D, adequate sunlight exposure, and a balanced diet through community health programs.
- **Fortification of Foods:** Enhancing the vitamin D content in commonly consumed foods, such as milk, cereals, and juices, to improve population-wide vitamin D status.

There are also a number of lifestyle and social factors that contribute to the development of rickets. Low levels of physical activity, lack of outdoor time, and general malnutrition are all risk factors. Children living in poor social conditions are more likely to develop rickets due to limited access to quality nutrition and medical care. In addition, certain cultural and religious practices, such as wearing full-body clothing, may limit the skin's exposure to sunlight and contribute to vitamin D deficiency. Due to vitamin D deficiency, rickets can also develop in exclusively breastfed babies, if the mother is deficient in this vitamin. Breast milk, although the best source of nutrition for babies, may not contain enough vitamins, especially if the mother herself is deficient. In such cases, it is recommended to add additional vitamin D to the child's diet to prevent the development of rickets.

The main goal of therapy is to restore the child's normal growth and development, as well as to prevent possible complications associated with this disease. Treatment options for rickets

include both drug and non-drug methods. The mainstay of drug treatment for rickets is vitamin D intake. The dose is selected individually, and the level of calcium, phosphorus and vitamin D in the blood is monitored with regular laboratory tests to avoid overdose and possible side effects. In the treatment of rickets in children, along with vitamin D, calcium preparations are used. They help compensate for the lack of this element and contribute to the normalization of bone formation processes. Medicines can be prescribed in the form of tablets, syrups or solutions, depending on the age of the child and the doctor's wishes. It should be taken into account that the simultaneous use of vitamin D and calcium allows to achieve the best results in the treatment of the disease.

A child's diet should be balanced and contain sufficient amounts of vitamin D, calcium and phosphorus. It is recommended to include in your daily menu products rich in these substances, such as fish (especially fatty varieties such as salmon and herring), egg yolk, liver, dairy products (milk, cheese, yogurt), as well as foods enriched with vitamins. D, for example, some types of vegetable oils and milk mixtures. Breastfed babies may need extra vitamin D because breast milk may not contain enough vitamin D. Regular exposure to fresh air and sunlight is also an important component of rickets treatment. Sunlight promotes the synthesis of vitamin D in the skin, which helps compensate for its deficiency. It is recommended to spend at least 30 minutes a day outdoors, especially in the sunny season. To avoid the risk of sunburn, it is important to consider the climatic conditions and the time of year. Physiotherapy and exercise therapy are additional methods that help strengthen muscles and bones, improve the general physical condition of the child, and prevent the development of deformities. Exercises are selected individually depending on the age and physical condition of the child. Regular exercise helps improve motor activity and coordination, which is especially important for children with rickets who experience muscle weakness and hypotension.

One of the main ways to prevent rickets is to ensure a nutritious and balanced diet. Foods rich in vitamin D, calcium and phosphorus should be in the child's diet. These foods include: fatty fish (salmon, herring), liver, egg yolks, and dairy products such as milk, cheese, and yogurt. For breastfeeding babies, it is important that the mother's diet is balanced and contains all the necessary vitamins and minerals. In some cases, it is necessary to add vitamin D in the form of drops to ensure that this vitamin is sufficient in the child's body. Adequate exposure to fresh air and sunlight are the most important factors in preventing rickets. Ultraviolet rays of the sun help the synthesis of biologically active substances in the skin, which play a key role in maintaining its normal level in the body. It is recommended to spend at least 30 minutes a day outdoors, especially on sunny days. It is important to consider the time of year and the climate to avoid the risk of sunburn and heat stroke. In winter and in areas with low solar activity, vitamin supplements should be taken to compensate for the lack of ultraviolet radiation.

An important aspect of preventing rickets is educating parents and healthcare providers about the importance of vitamin D and calcium for bone health and overall child development. Information about proper nutrition, the benefits of spending time in the fresh air, and the need for regular medical monitoring can help prevent the development of rickets and related complications. Physicians and nurses should actively participate in educational programs aimed at increasing awareness of rickets prevention and ensuring access to necessary resources. Prevention of rickets also includes measures aimed at improving socio-economic living conditions. Providing quality nutrition, medical care and conditions for an active lifestyle is an important factor in reducing the

risk of rickets. State programs and initiatives aimed at supporting families with children can play an important role in ensuring the health and well-being of the next generation.

Conclusion: The modern treatment of rickets involves a multifaceted approach that includes vitamin D, calcium, and phosphorus supplementation, adequate sunlight exposure, proper nutrition, physical therapy, and, in severe cases, surgical intervention. Early diagnosis and intervention are paramount in preventing the long-term complications of rickets and ensuring optimal bone health in children. Public health measures and preventive strategies play a vital role in reducing the prevalence of this preventable disease.

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