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IRON DEFICIENCY STATES IN CHILDREN: CLINICAL AND DIAGNOSTIC CRITERIA AND MODERN STRATEGIES FOR CORRECTION

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Abstract

Iron deficiency anemia (IDA) remains one of the most common forms of nutritional deficiency in children and represents a significant medical and social problem worldwide, including in the Republic of Uzbekistan. The most vulnerable age groups include infants and young children, preschool-aged children, and adolescents, whose increased iron requirements are associated with intensive growth and development. Delayed diagnosis and inadequate treatment of IDA may result in impaired physical and neuropsychological development, reduced cognitive function, altered immune responsiveness, and decreased quality of life. This article reviews current approaches to the diagnosis and treatment of iron deficiency anemia in children, taking into account international clinical guidelines and the specific characteristics of pediatric healthcare delivery in the Republic of Uzbekistan. Modern laboratory diagnostic methods are discussed, including the assessment of hemoglobin concentration, serum ferritin levels, transferrin saturation, and other indicators of iron metabolism. Current treatment principles are presented, including the use of oral iron preparations,



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dietary modification, prevention of iron deficiency, and monitoring of treatment efficacy. Particular emphasis is placed on the importance of early detection, timely initiation of treatment, and preventive measures aimed at reducing the prevalence of iron deficiency anemia among the pediatric population of Uzbekistan. Improvement of diagnostic algorithms and implementation of current clinical guidelines may contribute to enhancing the quality of pediatric healthcare and improving long-term treatment outcomes.

Keywords: Iron deficiency anemia, children, iron deficiency, diagnosis, treatment, serum ferritin, hemoglobin, iron preparations, pediatrics, prevention.

Introduction

Iron deficiency anemia (IDA) is the most common type of anemia and remains one of the major medical and social challenges in pediatrics. According to the World Health Organization (WHO), iron deficiency remains the most common cause of anemia in children, particularly among those under five years of age, when the body's iron requirements increase substantially due to rapid growth and development. Iron plays a crucial role in hematopoiesis, tissue oxygenation, immune system function, and the development of the central nervous system. Iron deficiency not only results in decreased hemoglobin levels but may also lead to impaired cognitive development, reduced learning capacity, increased susceptibility to infectious diseases, and a diminished quality of life in children [1,2].

Iron deficiency anemia remains a significant public health concern in low- and middle-income countries, including the Republic of Uzbekistan. Despite ongoing national programs aimed at improving maternal and child health, strengthening primary healthcare services, and preventing micronutrient deficiencies, iron



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deficiency continues to account for a substantial proportion of health disorders among children. Major risk factors include inadequate dietary iron intake, an unbalanced diet, prematurity, recurrent infections, rapid growth, and low iron stores at birth.

In recent years, substantial changes have occurred in the diagnostic approach to iron deficiency anemia. Current international guidelines recommend assessing not only hemoglobin concentration but also a comprehensive panel of iron status parameters, including serum ferritin and transferrin saturation. In the presence of an inflammatory process, measurement of C-reactive protein (CRP) is recommended to facilitate the appropriate interpretation of serum ferritin levels. This comprehensive approach enables the detection of iron deficiency at an early, including pre-anemic, stage and allows treatment to be initiated in a timely manner [2].

The management of IDA in children has also undergone significant refinement. According to current clinical guidelines, treatment primarily relies on oral iron preparations with established efficacy and safety, individualized dosing, dietary modification, and regular laboratory monitoring of treatment response. Intravenous iron preparations may be considered when clinically indicated, particularly in selected patient groups in whom oral iron therapy is ineffective, poorly tolerated, or otherwise unsuitable [3]. Given the high prevalence of iron deficiency anemia among children and the need to improve its early detection and management, the evaluation of contemporary approaches to the diagnosis and treatment of IDA in the Republic of Uzbekistan represents a relevant area of pediatric research. Analysis of current international guidelines and assessment of their applicability within the national healthcare system may contribute to improving the quality and effectiveness of pediatric care and reducing the risk of complications associated with iron deficiency [4].



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Aim of the Study

The aim of this study is to analyze current approaches to the diagnosis and treatment of iron deficiency anemia in children based on national and international scientific literature, as well as to assess the applicability of current clinical guidelines within the healthcare system of the Republic of Uzbekistan. Particular attention is given to modern laboratory methods for diagnosing iron deficiency, the principles of rational iron therapy, and the prevention of iron deficiency states in children of different age groups in accordance with the recommendations of the World Health Organization (WHO) and international professional organizations [5].

Materials and Methods

The present study is a narrative literature review based on an analysis of current national and international scientific publications addressing the diagnosis, treatment, and prevention of iron deficiency anemia in children.

The study included an analysis of clinical guidelines issued by the World Health Organization (WHO), publications of the American Academy of Pediatrics (AAP), scientific articles indexed in international databases, including PubMed and NCBI, as well as publications from medical and scientific journals in the Republic of Uzbekistan addressing the diagnosis and management of iron deficiency anemia in children. A total of 28 publications were included in the review, comprising 15 international, 7 Russian, and 6 Uzbek studies. Particular emphasis was placed on publications from recent years (2020–2026) reflecting current concepts of disease pathogenesis, diagnostic criteria, laboratory assessment of iron status, and contemporary therapeutic approaches [6].

The literature was analyzed using methods of systematization, comparative analysis, synthesis, and critical appraisal of scientific evidence. Particular



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attention was paid to current diagnostic algorithms, including clinical assessment, complete blood count, measurement of serum ferritin and serum iron concentrations, transferrin saturation, and inflammatory markers such as C-reactive protein (CRP) to facilitate accurate interpretation of iron status parameters [7].

In addition, current approaches to the treatment of iron deficiency anemia in children were evaluated, including the use of oral and intravenous iron preparations, recommended dosing regimens, treatment duration, monitoring of therapeutic response, and prevention of disease recurrence. The findings were compared with approaches currently used in pediatric practice in the Republic of Uzbekistan, which allowed the identification of promising areas for improving the diagnosis and management of iron deficiency anemia in children.

Results

The analysis of current national and international scientific literature demonstrated that iron deficiency anemia (IDA) remains one of the most prevalent forms of nutritional deficiency in children and represents a significant public health concern. According to the World Health Organization, iron deficiency is the leading cause of anemia in young children, with the highest prevalence reported in low- and middle-income countries, including the Republic of Uzbekistan [8].

The analysis identified inadequate dietary iron intake, prematurity, low birth weight, rapid growth, prolonged exclusive breastfeeding without timely introduction of complementary foods, chronic infectious diseases, and parasitic infestations as the major risk factors for IDA in children. Children during the first two years of life and adolescents undergoing periods of rapid physical development constitute particularly vulnerable groups [9]. An analysis of current



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clinical guidelines demonstrated that the diagnosis of iron deficiency anemia should not be based solely on hemoglobin concentration but should include a comprehensive assessment of iron status parameters. Serum ferritin is considered one of the most informative laboratory markers of depleted iron stores. However, in the presence of inflammation, ferritin levels should be interpreted in conjunction with C-reactive protein (CRP), as ferritin is an acute-phase reactant. Additional diagnostic information may be obtained from transferrin saturation, total iron-binding capacity (TIBC), and, when clinically indicated, soluble transferrin receptor levels [10].

The literature review demonstrated that the current therapeutic strategy for IDA primarily involves the use of oral iron preparations with adequate bioavailability and a favorable safety profile. The duration of treatment should ensure not only normalization of hemoglobin levels but also replenishment of depleted iron stores; therefore, therapy generally needs to be continued for several months after hematological normalization. In cases of severe anemia, impaired intestinal iron absorption, or intolerance to oral iron preparations, intravenous iron therapy may be considered under appropriate medical supervision [11,12].

The analysis of scientific publications also demonstrated that early detection of iron deficiency and timely initiation of treatment may reduce the risk of impaired cognitive development, growth retardation, decreased immune function, and other complications associated with iron deficiency. Therefore, preventive measures are of particular importance and include an adequate and balanced diet, timely introduction of complementary foods, prophylactic iron supplementation in children at high risk of iron deficiency, and regular laboratory monitoring [13]. The findings indicate that the implementation of current international clinical guidelines into pediatric healthcare practice in the Republic of Uzbekistan may improve the quality of diagnosis and management of iron deficiency anemia,



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facilitate its early detection, and contribute to reducing the prevalence of the condition among the pediatric population [14].

Conclusion

Iron deficiency anemia remains one of the most prevalent conditions in childhood and represents a significant medical and social problem both globally and in the Republic of Uzbekistan. Its high prevalence among young children and adolescents highlights the need to improve the systems for early detection, timely treatment, and prevention of iron deficiency states.

The analysis of current scientific literature demonstrated that effective diagnosis of IDA should be based on a comprehensive assessment of clinical findings and relevant laboratory parameters, including hemoglobin concentration, serum ferritin, transferrin saturation, and other markers of iron status. The use of these diagnostic approaches enables the detection of iron deficiency at an early stage, facilitates timely initiation of therapy, and helps prevent the development of associated complications. Current treatment strategies primarily involve the use of oral iron preparations as first-line therapy, with individualized dosing based on the child's age and the severity of the condition, dietary modification, and regular laboratory monitoring of treatment response. In selected clinical situations, parenteral iron preparations may be administered when appropriate indications are present.

In the Republic of Uzbekistan, particular importance should be given to strengthening preventive measures, increasing parental awareness of the causes and consequences of iron deficiency, implementing current clinical guidelines into routine pediatric practice, and expanding early screening programs for children at increased risk. A comprehensive approach to the diagnosis, treatment, and prevention of iron deficiency anemia may contribute to reducing its



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prevalence, minimizing the risk of impaired physical and neurodevelopmental outcomes in children, and improving the quality of pediatric healthcare.

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