

Pediatric Anaemia: Causes, Diagnosis, and Treatment

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DESCRIPTION

Pediatric anaemia is a common hematological condition characterized by a reduction in haemoglobin concentration or red blood cell mass below age-specific normal ranges. It affects infants, children, and adolescents worldwide and remains a significant public health concern, particularly in developing regions. Anaemia in children is not a single disease but a clinical manifestation of various underlying conditions, including nutritional deficiencies, genetic disorders, chronic diseases, infections, and bone marrow abnormalities. Because haemoglobin plays a critical role in oxygen transport, anaemia can have wide-ranging effects on physical growth, cognitive development, immunity, and overall quality of life in children.

One of the most prevalent causes of pediatric anaemia is iron deficiency, which often results from inadequate dietary intake, poor absorption, or increased physiological demand during periods of rapid growth. Infants and toddlers are particularly vulnerable due to low iron stores at birth and diets that may lack iron-rich foods. Iron deficiency anaemia typically presents with fatigue, pallor, irritability, poor appetite, and delayed developmental milestones. In severe cases, it can lead to behavioral disturbances and impaired cognitive performance. Diagnosis is usually based on low haemoglobin levels, reduced serum ferritin, low mean corpuscular volume, and elevated total iron-binding capacity. Treatment involves oral iron supplementation along with dietary modifications to include iron-rich foods such as meat, legumes, and fortified cereals.

Another important cause of pediatric anaemia is nutritional deficiency involving vitamins such as folate and vitamin B12. These deficiencies lead to megaloblastic anaemia, characterized by the production of abnormally large and immature red blood cells. Folate deficiency is often associated with poor dietary intake, malabsorption, or increased demand during growth spurts. Vitamin B12 deficiency may occur due to inadequate dietary intake, particularly in strict vegetarian diets, or due to gastrointestinal disorders affecting absorption. Clinical features include pallor, weakness, glossitis, and sometimes neurological symptoms such as irritability or developmental delay. Diagnosis is confirmed through blood tests showing macrocytic anaemia and low levels of vitamin B12 or folate. Treatment includes

supplementation and dietary correction, which usually leads to rapid improvement.

Haemolytic anaemias are another important category in pediatric patients, resulting from increased destruction of red blood cells. These may be inherited or acquired. Common inherited forms include sickle cell disease and thalassemia, both of which are caused by genetic mutations affecting haemoglobin structure or production. Sickle cell disease is characterized by abnormal haemoglobin S, leading to red blood cell sickling, haemolysis, vaso-occlusion, and chronic anaemia. Thalassemia involves defective synthesis of globin chains, resulting in ineffective erythropoiesis and severe anaemia. Children with these conditions often present with pallor, jaundice, splenomegaly, and growth retardation. Diagnosis involves haemoglobin electrophoresis, genetic testing, and complete blood count analysis. Management includes regular blood transfusions, folic acid supplementation, iron chelation therapy, and in some cases, bone marrow transplantation.

Anaemia of chronic disease is commonly seen in children with long-standing infections, inflammatory disorders, or malignancies. In this condition, iron metabolism is altered due to inflammatory cytokines, leading to impaired iron utilization despite adequate iron stores. Conditions such as tuberculosis, juvenile idiopathic arthritis, and chronic kidney disease can contribute to this type of anaemia. Laboratory findings typically show low serum iron levels with normal or increased ferritin levels. Treatment focuses on addressing the underlying condition rather than direct iron supplementation, although supportive therapy may be required in severe cases.

Parasitic infections, particularly in tropical and subtropical regions, also contribute significantly to pediatric anaemia. Hookworm infections, for example, cause chronic blood loss in the gastrointestinal tract, leading to iron deficiency anemia. Malaria is another major cause, especially in endemic areas, where repeated infections lead to hemolysis and destruction of red blood cells.

Bone marrow disorders such as aplastic anemia and leukemia are less common but serious causes of anemia in children. Aplastic anemia is characterized by bone marrow failure, leading to

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pancytopenia and severe anemia. It may be caused by autoimmune mechanisms, infections, toxins, or genetic factors. Leukemia, particularly acute lymphoblastic leukemia, can also present with anemia due to infiltration of the bone marrow by malignant cells. Clinical features often include fatigue, recurrent infections, bruising, and bone pain. Diagnosis requires bone marrow examination and specialized laboratory tests. Treatment depends on the underlying condition and may include immunosuppressive therapy, chemotherapy, or stem cell transplantation.

The diagnostic approach to pediatric anemia begins with a detailed clinical history and physical examination. Important aspects include dietary habits, family history of hematological disorders, presence of chronic illnesses, and exposure to infections. Physical examination may reveal pallor, jaundice, lymphadenopathy, or splenomegaly. Laboratory investigations typically start with a complete blood count, peripheral blood smear, and reticulocyte count. Additional tests such as iron studies, vitamin levels, hemoglobin electrophoresis, and bone marrow examination may be required depending on the suspected cause.

Treatment of pediatric anemia is highly dependent on the underlying etiology. Nutritional anemias are managed with

supplementation and dietary modification, while hemolytic anemias may require transfusions, medications, or curative therapies such as bone marrow transplantation. In cases of anemia due to chronic disease, management of the primary condition is essential. Supportive care, including nutritional counseling and regular monitoring, plays an important role in all forms of anemia. Preventive strategies such as iron supplementation programs, vaccination, deworming, and maternal health interventions are critical in reducing the incidence of pediatric anemia globally.

CONCLUSION

Pediatric anemia is a multifactorial condition with diverse causes, ranging from nutritional deficiencies to genetic and chronic diseases. Early diagnosis and appropriate management are essential to prevent complications and ensure normal growth and development in children. A comprehensive approach that includes clinical evaluation, laboratory investigation, and targeted therapy is necessary for effective management. Public health interventions and preventive strategies also play a crucial role in reducing the global burden of pediatric anemia.