e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 7, Issue 12, December 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.521

© 2024 IJMRSET | Volume 7, Issue 12, December 2024| DOI: 10.15680/IJMRSET.2024.0712099

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Anemias and Prosthodontic Treatment- A Review

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ABSTRACT: Anemia is a common systemic disease that has a major impact on dental health and is defined by a decreased blood's ability to carry oxygen. The oral symptoms that are frequently linked to different forms of anemia, including glossitis, mucosal atrophy, delayed wound healing, and greater susceptibility to infections, make it relevant in prosthodontics. The categorization, oral symptoms, and indicators of anemia are examined in this research along with how they affect prosthodontic procedures. Effective prosthodontic care is hampered by anemia-specific issues such as mucosal sensitivity, delayed healing, and patient tiredness. Successful outcomes depend on key management tactics such atraumatic techniques, pre-treatment medical evaluation, and personalized prosthetic designs. Understanding and treating the effects of anemia guarantees improved oral function, patient comfort, and overall prosthodontic treatment success. This study emphasizes how effective management of anemic individuals requires an interdisciplinary approach.

I. INTRODUCTION

Reduced oxygen transfer to tissues is the result of anemia, a medical illness marked by a drop in hemoglobin concentration or red blood cell count. This might lead to inadequate oxygen delivery, which can cause fatigue and other symptoms. [1]

I.Reasons for Anemia

There are several causes of anemia, which can be roughly divided into three categories:

Reduced RBC Production (insufficient bone marrow production):[2]

Deficits in nutrition:

A poor diet, prolonged blood loss (from menstruation or gastrointestinal bleeding), or increased demand during pregnancy are the most common causes of iron deficiency.

DNA synthesis is impacted by a vitamin B12 or folate deficit.[3]

Chronic illnesses: Decreased production of erythropoietin due to chronic renal failure. Rheumatoid arthritis is one example of a chronic inflammatory condition.

Disorders of the bone marrow: Leukemia, myelodysplasia, or aplastic anemia. Increased hemolysis, or RBC destruction,genetic disorders (such as thalasseia and sickle cell anemia),infections (malaria, for example),hemolysis brought on by drugs.

Loss of Blood:

Acute: Surgery or trauma, Chronic: Severe menstrual bleeding, stomach ulcers.

II.General Anemia Symptoms and Signs

Depending on their severity and underlying reason, symptoms might vary, but they typically include:

Symptoms in general:

weakness or exhaustion, breathlessness, particularly when exerting oneself, lightheadedness or dizziness.

heartbeat irregularities or palpitations, headaches.

Physical Indications: Mucosal membranes or pale skin (e.g., lips, conjunctiva),Cold feet and hands.

Hair loss or brittle nails (iron deficiency),Symptoms of neurological disorders (particularly prevalent in vitamin B12 deficiency),numbness or tingling in the limbs,inability to focus or memory problems.

Prolonged or Severe Anemia: Chest discomfort, fainting, severe hypotension or, in more severe situations, cardiac failure. [4,5,6]

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III.Classifications of Anemia:

Numerous factors, including as morphology (cell size), underlying mechanism, and etiology, can be used to categorize anemia. The main categories are listed below:[7]

1. Classification by Morphology

The mean corpuscular volume (MCV) and the size and appearance of red blood cells (RBCs) are the basis for this classification:

a) MCV < 80 fL, or microcytic anemia

Iron deficiency anemia: Usually brought on by inadequate nutrition or long-term blood loss.

Thalassemia: Hereditary conditions that impact the production of hemoglobin.

Some forms of chronic illness anemia are linked to chronic inflammation that prevents the body from using iron.

Hemoglobin's inability to incorporate iron is known as sideroblastic anemia.

Anemia Normocytic (MCV 80-100 fL)

Chronic illness anemia is prevalent in autoimmune disorders, cancer, and persistent infections.

Acute blood loss can result from surgery or trauma.

Autoimmune or drug-induced RBC destruction is known as hemolytic anemia.

RBC production failure in the bone marrow is known as aplastic anemia.

b) Anemia Macrocytic (MCV > 100 fL)

Vitamin B12 deficiency: Usually brought on by pernicious anemia or malabsorption.

Folate deficiency: Frequently linked to malnutrition or alcohol misuse.

RBC production is altered by liver illness.

Hypothyroidism: Lowers the body's total metabolism.

Megaloblastic anemia: Larger RBC precursors due to impaired DNA synthesis.

2. Classification by Etiology

This method determines the etiology of anemia:[8]

a) Anemia due to nutritional deficiencies

The most prevalent iron deficiency in the world is caused by diet or long-term blood loss.

Megaloblastic anemia is linked to deficiencies in vitamin B12 and folate.

b) Chronic Disease Anemia

found in autoimmune disorders, cancers, inflammation, and persistent infections.

c) Failure of Bone Marrow

includes myelodysplasia, aplastic anemia, and cancerous marrow invasion.

d) Anaemia Hemolytic

Hereditary spherocytosis, sickle cell disease, and thalassemia are examples of intrinsic causes.

Extrinsic causes include infections like malaria, drug-induced damage, and autoimmune hemolysis.

e) Anemia from Blood Loss

either chronic (like gastric ulcers or heavy periods) or acute (like trauma).

f) Hereditary Anaemias

ailments like thalassemia and sickle cell disease.

3. Classification Based on Function

Considering the physiological processes that cause anemia:[9]

Anemia with Hypoproliferation

Reduced RBC production as a result of nutritional deficits or marrow diseases. Examples include chronic illness anemia and iron deficiency. Anemia with hyperproliferation increased RBC production as a compensatory response, frequently observed in hemolytic anemias. RBC loss or destruction includes circumstances including early RBC breakdown or acute blood loss. [10]

4. Classification Based on Severity

Hemoglobin levels are the basis for this:[11]

Mild anemia: Hemoglobin levels that are somewhat below normal.

A markedly decreased hemoglobin level without severe symptoms is known as moderate anemia.

Severe anemia: Extremely low hemoglobin levels that need to be treated right now.

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5. Particular Forms of Anaemia

Certain categories defy easy categorization based on morphology or function: [12]
Pernicious Anemia: An autoimmune condition that hinders the absorption of vitamin B12.
A genetic abnormality that results in aberrant hemoglobin structure is known as sickle cell anemia.
A uncommon genetic condition that affects bone marrow is called Fanconi Anemia.

IV.General treatment of different types of anemia

The underlying cause of anemia determines how to treat it. A thorough method for treating different forms of anemia is provided below:

1. IDA, or iron deficiency anemia [13]

Goals of treatment include treating the underlying cause (e.g., blood loss) and correcting iron deficiency.
Supplementing with iron:
Ferrous fumarate, ferrous gluconate, or ferrous sulfate are examples of oral iron.
Dosage: 100–200 mg of elemental iron per day is typical.
Constipation, black stools, or digestive discomfort are possible side effects.
When there is a severe iron deficit, an intolerance to oral iron, or malabsorption (such as in celiac disease), intravenous iron is recommended. Increase consumption of foods high in iron, such as red meat, leafy greens, legumes, and fortified cereals, according to dietary recommendations.
Address the Cause: Take care of issues like heavy menstrual flow or gastrointestinal bleeding.

2. Anemia Due to Vitamin B12 Deficiency

Restoring vitamin B12 and addressing the root cause are the objectives of treatment.[14]
Supplementing with vitamin B12:
Parenteral route: Injections into the muscles (e.g., hydroxocobalamin or cyanocobalamin).
1,000 µg every day for one week, then weekly for one month, and finally monthly maintenance for the initial dosage.
Oral route: Good for maintenance therapy or mild instances (e.g., 1,000–2,000 µg/day).
Dietary Advice: Consume more foods high in B12, such as meat, fish, eggs, and dairy products.
Keep an eye on neurological symptoms since irreparable harm can be avoided with early therapy.

3. Anemia due to Folate Deficiency

Restoring folate reserves and avoiding recurrence are the goals of treatment.[15]
Supplementing with Folic Acid:
Folic acid used orally: 1–5 mg each day for at least 4–6 weeks.
Dietary Advice: Consume more foods high in folate, such as citrus fruits, legumes, leafy greens, and fortified grains.
Handle Co-Existing Conditions: To prevent concealing neurological issues, rule out and treat concomitant vitamin B12 insufficiency.

4. Chronic Disease Anemia (ACD)

Goals of treatment: Take care of the underlying chronic illness.
Handling the Underlying Illness: Improve the course of treatment for diseases like cancer, rheumatoid arthritis, and persistent infections.
Iron Therapy: When there is a concurrent iron deficit, intravenous iron may be utilized.
Agents that stimulate erythropoiesis (ESAs):
used to treat severe anemia, particularly that caused by cancer or chronic kidney failure.
given in conjunction with iron supplements to enhance the response. [16]

5. Anemias caused by hemolysis

The purpose of treatment is to control RBC destruction and avoid problems.
Address the Root Cause: Immunosuppressive medications, splenectomy, or corticosteroids (like prednisone) can all treat autoimmune hemolytic anemia. Antimalarial medications are used for infections, such as malaria.
Hemolysis brought on by drugs: Stop using the problematic medication.
Helpful Care: transfusions of blood in extreme situations.
RBC production is supported by folic acid supplementation.[17]

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6. Aplastic Aplastic
Treatment Objectives: Supportive care or bone marrow stimulation.
Helpful Care: RBC and platelet transfusions when necessary. antibiotics for the treatment or prevention of illnesses.
Final Therapy: immunosuppressive treatment (e.g., cyclosporine and antithymocyte globulin).
bone marrow transplants for those who qualify. [18]

7. Anemia with sickle cells
The objectives of treatment are to control pain, avoid complications, and enhance quality of life.
Hydroxyurea: Reduces sickling episodes and increases the generation of fetal hemoglobin.
Blood transfusions: Recommended in cases of severe anemia or stroke-related consequences.
Analgesics are part of pain management in vaso-occlusive crises.
Vaccinations, prophylactic antibiotics (such as penicillin for children), and folic acid supplements are examples of preventive measures. [19]

8. Anemia with Acute Blood Loss
Restoring blood volume and stabilizing the patient are the objectives of treatment.
Fluid Resuscitation: To preserve hemodynamic stability, give intravenous fluids. RBCs are packed into blood transfusions to restore the body's ability to carry oxygen.
Control the Bleeding Source: If necessary, use medication or surgery. routine measurement of hematocrit and hemoglobin levels. Address the root reasons to stop recurrence. Patient education regarding dietary changes and treatment compliance. [20]

V.Oral Signs and Symptoms of various Anemias:
Reduced oxygen delivery to tissues, alterations in the epithelium, and concurrent insufficiencies of iron, vitamin B12, and folate are the main causes of anemia in the oral cavity. An inventory of oral symptoms and indicators associated with various forms of anemia is provided below:

1. Anemia due to Iron Deficiency
Oral Manifestations:
Inflamed tongue, or glossitis, is characterized by a red, glossy tongue that burns. Cracking or sores in the corners of the mouth are signs of angular cheilitis.
Atrophic Changes in the Oral Mucosa: The mucosa thins, becoming paler and more vulnerable to ulceration. The trio of esophageal webs, glossitis, and iron deficient anemia is known as Plummer-Vinson syndrome. Enhanced vulnerability to infections, such as stomatitis linked to Candida or other fungal illnesses.

2. Pernicious anemia, or vitamin B12 deficiency anemia
Oral Manifestations:
Atrophic papillae and a painful, beefy-red tongue are symptoms of hunter's glossitis. On the tongue, lips, and other mucosal surfaces, a burning sensation is felt. Recurrent oral ulcers: ulcers that don't heal because of poor epithelial repair. Tongue paresthesia or numbness: associated with neurological involvement. Pale Oral Mucosa: As a result of generalized pallor.

3. Anemia due to Folate Deficiency
Oral Manifestations:
Glossitis: A red, smooth tongue that hurts. Ankle cracks are a sign of angular cheilitis. sores: Sore, superficial sores on the lips, cheeks, or tongue. Oral wounds heal more slowly because of compromised epithelial cell division. [23]

4. Anemia of Chronic Disease
Oral Manifestations: Because of lower hemoglobin levels, the oral mucosa is pale.
Xerostomia, or dry mouth, is associated with the systemic symptoms of long-term illnesses such as Sjögren's syndrome.
Delayed Healing: Mucosal repair may be hampered by decreased oxygen flow. [24]

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5. Hemolytic Anemia

Oral Manifestations: The yellowish staining of the oral mucosa caused by increased bilirubin is known as jaundiced mucosa. In severe situations, darkened oral tissues are linked to hemosiderin deposition. Ulcers or sores: Associated with heightened vulnerability to infections. In children, delayed tooth emergence is observed in diseases such as thalassemia. [23]

6. Sickle cell Anemia

Oral Manifestations:

Chronic anemia is the cause of the oral mucosa's pallor. Children who have sickle cell disease frequently experience delayed tooth emergence. Bone Changes: Radiographs show a "stepladder" look and less trabeculation in the jaw. Vaso-occlusive events are the cause of painful crises in the jaw bones. Oral ulcers: recurring ulcers that don't go away. [25]

7. Aplastic Anemia

Oral Manifestations:

Ecchymosis or petechiae: Tiny purple or crimson patches on the mucosa brought on by thrombocytopenia.

Gingival Bleeding: Exaggerated or spontaneous bleeding brought on by low platelet counts. Infections: More bacterial or fungal infections of the mouth. Ulcerations: Immunosuppressive sores that are persistent. [26]

8. Thalassemia

Oral Manifestations:

Chronic anemia is the cause of the pallor in the oral tissues. Chipmunk face appearance: marrow hyperplasia causes malocclusion and a prominent maxilla. In more severe cases of the condition, delayed tooth eruption or hypoplasia is observed. [27]

VI.The anemias which are most concern for prosthodontic treatment

Anemias of Concern in Prosthodontic Treatment

Because of their systemic and oral symptoms, several anemias present unique difficulties during prosthodontic treatment. The anemias that are most pertinent to prosthodontics, together with their consequences and necessary safety measures, are listed below:

1. IDA, or iron deficiency anemia

Issues:

Delayed Healing: Following prosthodontic operations, wound healing may be delayed by atrophic oral mucosa and inadequate oxygenation.

Increased Infection Risk: Fungal infections such as candidiasis may be more likely to occur in atrophic mucosa.

Oral Mucosa Pain: Wearing prosthesis can be painful for people with angular cheilitis and glossitis.

Precautions:

Pre-Treatment Evaluation: Prior to heavy prosthetic work, measure hemoglobin and iron levels.

Soft Tissue Care: To prevent harm to the atrophic mucosa, employ mild methods.

Prosthesis Design: To prevent pressure points that could make discomfort worse, make sure the prosthesis fits properly.

Nutritional counseling: To promote systemic improvement, promote food intake high in iron. [28]

2. Pernicious anemia, or vitamin B12 deficiency anemia

Issues:

Glossitis and Mucosal Atrophy: Tolerance for prostheses may be hampered by painful tongue and mucosa.

Neurological Symptoms: The sense of prosthesis comfort may be impacted by numbness or paresthesia.

Impaired epithelial repair following surgical or prosthetic adjustments is known as delayed healing.

Precautions:

Handle Deficiency First: Prior to extensive prosthodontic treatments, adjust vitamin B12 levels with supplements.

Soft-Lining Materials: To reduce irritation to the mucosa, use soft liners in dentures.

Regular Follow-Ups: Keep an eye on the patient's comfort level with the prosthesis and the condition of the mucosa. [22]

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3. Anemia of Chronic Disease (ACD)

Issues:

Fatigue: During protracted prosthesis surgeries, patients may become fatigued quickly.

Dry mouth and mucosal pallor: Decreased salivary flow might affect prosthesis comfort and retention.

Higher Risk of Infections: Especially when immunocompromised.

Precautions:

Short Appointments: To lessen weariness, schedule shorter treatment sessions.

Salivary Substitutes: To improve oral moisture, suggest goods or alternatives that stimulate saliva.

Hygiene Emphasis: To reduce the risk of infection, emphasize the significance of maintaining good denture hygiene. [29]

4. Hemolytic Anemias (e.g. sickle cell anemia)

Issues:

Bone Changes: Implant insertion may become more difficult if sickle cell anemia results in decreased trabeculation in the jaws.

Osteonecrosis Risk: In patients with inadequate oxygenation or concurrent bisphosphonate medication, there is a higher chance of developing jaw necrosis.

Painful Crises: Treatment plans may be disrupted by vaso-occlusive events.

Precautions:

Stress management: Steer clear of tense or drawn-out processes that could lead to an emergency.

Pre-therapy Evaluation: Before elective prosthodontic therapy, work with the patient's doctor to make sure the disease is stable.

Non-Surgical Methods: To prevent making jaw issues worse, choose non-invasive techniques. [23]

5. Aplastic Anemia

Issues:

Bleeding Risks: Excessive bleeding during surgery or prosthesis adjustments may result from thrombocytopenia.

Immunosuppression makes people more vulnerable to oral infections.

Ulceration: Non-healing ulcers beneath prosthesis may be caused by mucosal fragility.

Precautions:

Hemostatic Measures: Prior to invasive procedures, make sure platelet counts are sufficient. If required, apply local hemostatic agents.

Sterile Techniques: To reduce the danger of infection, maintain stringent asepsis.

Frequent Adjustments: To avoid damaging the mucosa, make sure the prosthesis fits correctly. [30]

6. Thalassemia

Issues:

Changes in the Facial Bones: A noticeable maxillary protrusion could make fitting a prosthesis more difficult.

Occlusal irregularities resulting from delayed tooth emergence may impact prosthodontic planning.

Frequent transfusions can cause iron overload, which can hinder the healing process.

Precautions:

Careful Planning: When designing a prosthesis, take anomalies of the face bones into account.

Work along with orthodontists: In situations where malocclusion is severe.

Track Healing: Because of the systemic implications, post-treatment healing needs to be closely tracked. [31]

VII.General Precautions for Prosthodontic Management in Anemic Patients

Medical Clearance: If you have severe or uncontrolled anemia, get your doctor's approval.

Prevent Trauma: When taking impressions, making modifications, or having surgery, employ atraumatic approaches.

Nutritional Support: To correct nutritional deficits, promote the use of supplements or dietary changes.

Keep an eye on oral hygiene: To avoid infections, emphasize how crucial it is to keep good oral and prosthetic cleanliness.

Soft Liners in Prostheses: To help patients who are uncomfortable due to pain or mucosal atrophy.

For patients with systemic diseases, the best results can be obtained by addressing the unique issues of each individual and customizing the prosthodontic treatment strategy.

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II. CONCLUSION

Oral tissues are impacted by anemia, which increases vulnerability to infections, delays healing, and causes discomfort. Anemia's systemic nature affects a patient's general health and preparedness for prosthodontic operations. Recognizing and treating anemia-related issues is essential to providing effective prosthodontic care. Better patient outcomes are ensured by a multidisciplinary strategy that involves cooperation with medical specialists. Treatment planning for prosthodontic patients should incorporate routine screening for anemia and its severity. modifying prosthodontic procedures to treat particular anemia-related oral and systemic issues. End with a statement that is forward-looking or significant: "Understanding and addressing the impact of anemia on prosthodontic treatment is critical to optimizing oral rehabilitation outcomes. By adopting an individualized and informed approach, prosthodontists can significantly improve patient comfort, function, and quality of life, reaffirming the importance of integrating systemic health considerations into dental practice."

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