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Dental mangment of blood dyscrasia in pediatric patient

A Project Submitted to the College of Dentistry, University of Baghdad, Department of Pedodontics and Prevention dentistry in partial fulfillment for the requirement to award the degree B.D.S

Prepared by:
Rania saddam hussien

Supervised by:

Lect. Noor Ahmed

B.D.S., M.Sc. Pediatric Dent.

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Declaration

This is to certify that the organization and the preparation of this thesis had been made by graduate student **Rania saddam hussien** under my supervision in the College of Dentistry, University of Baghdad in partial fulfillment of the requirement for the 5th grade.

Signature:
Lect. Noor Ahmed
The supervisor

Dedication

To…

my family who supported me and was the biggest supporter for me, and to my mother in particular, the person who made all her efforts and her life in order to become what I am today, and to every friend and person who supported me, especially my close friends **(Rania and Shahad)** who were the first supporter and companion for me in the march of five years.

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LIST OF ABBREVATIONS AND SYMBOLS

Symbol	**meneings**
G6PD	Glucose-6-phosphate dehydrogenase
SCA	Sickle cell anemia
USA	United states
PV	Polycythemia vera
MPN	Myeloproliferative Neoplasms
JAK2	Janus Kinase 2
EPO	Erythropoietin
LA	Local anesthesia
GA	General anesthesia
ALL	Acute lymphoblastic leukaemia
AML	Acute mylogenous leukaemia
CLL	Chronic lymphocytic leukemia
CML	Chronic myloid leukemia
ONS	Office for national statistics
HL	Hodgkin lymphoma
NHL	Non Hodgkin lymphoma

EBV	Epstein Barr virus
LWMH	Low weight molecular heparin
DVT	Deep vein thrombosis
MABs	Monoclonal antibodies

Introduction

Blood is a fluid connective tissue comprises of a liquid component called plasma and a cellular component that includes red blood cells, white blood cells, and platelets. Diseases involving the blood and bone marrow are included under hemopoietic system disorders. It is generally defined as the study of circulating blood constituents, which encompasses illnesses of red blood cells, white blood cells, platelets **(vanishree et al,2022).**

Pediatric blood disorders represent a category of noncancerous diseases typically affecting infants, children and adolescents **(Galanello etal,2010).**

the child is commonly affected by hematological diseases including anemia and leukemia in child is very frequently about several. Anemia and iron deficiency are real public health problem worldwide, especially in developing countries, as well as leukemias often found in children in recent years, where instead of doctor or pharmacist biologist, primary care remains important, particularly with regard to the diagnosis, monitoring during treatment, and follow- up after remission **(Veronique ,2006).**

Aim of study

1_In order to get a knowlage about the blood and its functions.

2_To learn about blood-related diseases, their symptoms, and how to deal with them and treat them in order to avoid complications and reduce the risk for children with such diseases in the pediatric dental clinic.

1.1Compositon of Blood

Blood is a circulating tissue composed of fluid plasma and cells. It is composed of different kinds of cells (occasionally called corpuscles); these formed elements of the blood constitute about 45% of whole blood. The other 55% is blood plasma, a fluid that is the blood's liquid medium, appearing yellow in color. The formed elements of the blood are broadly classified as red blood cells (erythrocytes), white blood cells (leucocytes) and platelets (thrombocytes) and their numbers remain remarkably constant for each individual in health **(Yared Alemu et al, 2006).**

1.2The main functions of blood are the following**(Johann schaller et al, 2008):**

I .Transport system of many types of components.

II. Defence system against hostile pathogens such as bacteria, virus and fungi, thus maintaining a balance between the organism and the environment.

III . The wound sealing and wound healing system, life-saving precautions in the case of injuries.

IV. The balance of heat distribution throughout the body, thus guaranteeing a constant body temperature.

1.3Blood dyscrasias

There are several relatively common disorders of the red and white blood cells that may influence dental care in the child. Many of these conditions also give rise to abnormal bleeding, but in addition may lead to delayed healing, infection, or mucosal ulceration **(Richard et al,2017).**

1.3.1Classification of blood dyscrasia (Richard et al,2017):

1.Red blood cell disorder

A_Anaemia

B_Polycythaemia

2.white blood disorders

A. Leukocytosis

b.Leucopenia

c.Leukaemias

d.Lymphomas

1.4.Red blood cell disorders:

1.4.1Anaemia

When there is a reduction in the red blood cell volume or haemoglobin concentration,the oxygen-carrying capacity of the blood is lowered.

(Richard et al,2017):

1.4.2Types of anemia

(Richard et al,2017):

1.Iron-Deficiency Anemia(microcytic,hypochromic anemia)

2. Glucose-6-phosphate dehydrogenase(G6PD) deficiency anemia

3. Sickle cell anemia

4. Thalassemia

5. Vitamin B12- And Folate-Deficiency(macrcytic anemia)

Anemias

6.Aplastic anemia

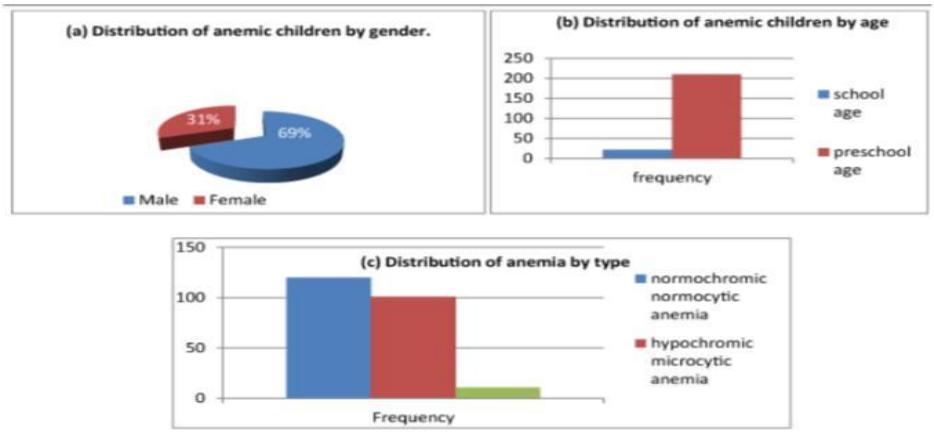


Figure (1) Distribution of anemic children by: gender (a), age (b),type(c)

(Abdessalam et al,2015)

According to study done by (**abdessalam et al ,2015)**There was a high rate of anemia (232 cases out of 418 cases) which means that 55.5% of patients were anemic, of which 28.70% had hypochromic microcytic anemia, 24.16% had normcohromic normocytic anemia and 11 % had macrocytic anemia (Figure 1c). The male gender was most affected by anemia with almost 69% (Figure 1a). Children with preschool age (1 month-5 years) were the most affected by anemia (90.11%) of all the anemic children.

Children with school age (5 years - 15 years) were the least affected by anemia (9.48%) of anemic children (Figure 1b) **.**

1.4.2.1 Iron - Deficiency Anemia.

Is microcytic, usually hypochromic, affecting around one-third of the worldwide population. Its incidence increases along with age, and it is more frequent in women **(Georges aoun et al ,2021).**

The main causes of this type(Shobha tendon ,2018) :

1.Early introduction of cow's milk, too much milk and less solids

2. Found in conjugation with a pro- longed bottle feeding habit where the transition to balanced solid diet has been incomplete and where cow's milk continues to be the main dietary component.

1.4.2.2 G6PD deficiency anemia

Is a hereditary, normocytic hemolytic-type anemia linked to the high rated destruction of RBCs as a result of oxidative stress. It is the main frequent enzyme disorder occurring especially among Mediterranean, Middle Eastern, and Asian populations **(Georges aoun et al ,2021).**

1.4.2.3 Sickle cell anemia

It is a hereditary type of chronic hemolytic anemia, characterized by peculiar microscopic appearance of sickle or crescent shaped erythrocytes in the blood There is substitution of valine for glutamine in the ß globin chain of the hemoglobin. It is common in females and manifests before the age of 30 years**(Arathi,2012).**
SCA preferentially affects populations of malaria- endemic countries (e.g. Africa, USA, and Brazil). The prevalence of SCA in USA ranges between 0.10% and 0.15% and in some regions in Brazil 0.20%. It is to be noted that African Americans followed by the Hispanic Americans are the most affected in USA**(Georges aoun et al ,2021)**

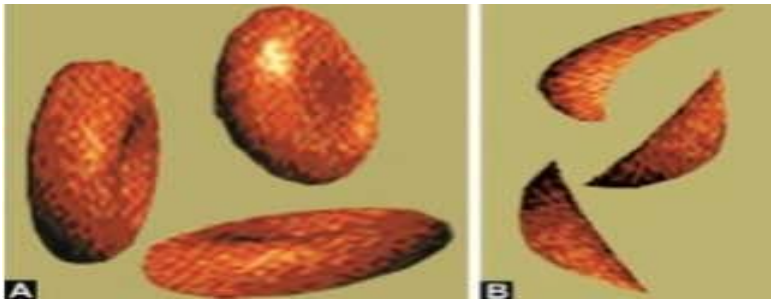


Figure (2)change seen in red blood cell,(A)normal red blood ,(B)sickle shaped cells**(Arathi,2012)**

1.4.2.4 Thalassemia

Two types of thalassemia exists-a thalassemia (minor) and ß thalassemia (major). There is production of unstable hemoglobins that damage the erythrocytes and increase their vulnerability to destruction. It is observed within the first two years of

life. The child has a yellowish pallor of the skin with fever, chills, malaise and generalized weakness. Splenomegaly and hepatomegaly may cause protrusion of the abdomen. Intercurrent infection are seen and the chid may die within afew months**(Arathi,2012).**

1.4.2.5Vitamin B12- And Folate-Deficiency Anemias(macrocytic)

Vitamin B12- and folate-deficiency anemias are classified as hypoproliferative and macrocytic. Moreover, both are considered megaloblastic anemias, in which neutrophils are segmented and present disordered DNA synthesis. They result from vitamin B12 and/or folate (formerly known as vitamin B9) deficiencies(**Georges aoun et al ,2021).**

Its Unusual in children, but may be associated with celiac disease or Crohn's disease or in strict vegetarians with inadequate dietary intake**(Shobha tendon et al, 2018).**

1.4.2.6 Aplastic Anemia

This is a rare life-threatening idiopathic condition characterized by bone marrow failure and, consequently, pancytopenia (reduction in the three types of blood cells RBCs, white blood cells (WBCs), and platelets**(Georges aoun et al ,2021).**

1.4.3Oral Manifestations of anemia**(Georges aoun et al ,2021):**

Anemia oral manifestations may include the following: a) pallor of the oral mucosa, especially the soft palate and floor of the mouth, b) depapillated and atrophic tongue, c) glossodynia, d) petechiae, e) mucosal ulcers, f) gingival hypertrophy and bleeding g) jaundice and icteric presentation of the oral mucosa due to hyperbilirubinemia in hemolytic anemias, h) dysphagia and taste aberrations, i) xerostomia, j) angular stomatitis, k) protrusive**.**

1.4.4Dental management of anemia

All anaemic children have a greater tendency to bleed after invasive dental procedures. Therefore any signs or symptoms suggestive of anaemia should be investigated. The haemoglobin level and haematocrit are simple tests used for screening, and a white blood cell and platelet count should also be obtained. If these reveal any abnormalities, further more complex tests may need to be undertaken. Ideally, the underlying defect should be corrected before embarking on a course of routine dental care. A family history of conditions such as sickle cell anaemia and thalassaemia is significant, and individual hospital policies should be followed for testing prior to a general anaesthetic. It is no longer necessary to test all patients of African origin. Sickle cell crises are caused by inadequate oxygenation, and if possible general anaesthetics should be avoided in preference to the use of local anaesthesiab**(Richard et al,2017).**

1.5Polycythaemia

Polycythaemia or erythrocytosis refers to an elevation of the haemoglobin or haematocrit (haemoglobin >16.0 g/dL in women or >16.5 g/L in men; haemocrit >48% in women or 49% in men) or increased red cell mass (>25% above the mean normal predicted value). An initial concerning result on routine testing should always be confirmed by a second measurement in a non-fasting state**(Tefferi A,2016).**

1.5.1Relative Polycythaemia

Relative polycythaemia is secondary to a decreased plasma volume (without an increased red cell mass). This is generally the consequence of intravascular fluid depletion, which may be due to dehydration (including that induced by diuretics and caffeine), movement of fluid into the third-space, tobacco smoking and

ovarian hyperstimulation syndrome (IVF) **(Tefferiet al 2013).**

1.5.2Absolute Polycythaemia

Absolute polycythaemia is a true increase in red cell mass resulting in an elevated haemoglobin, haematocrit or red blood cell count. It is clinically significant and can arise as a primary or secondary phenomenon. **(Tefferi et al, 2013).**

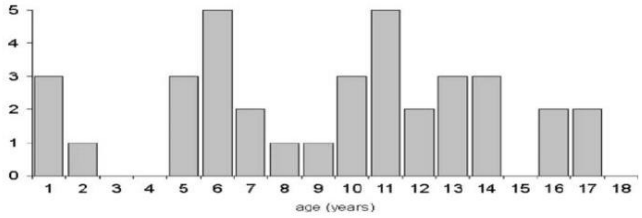
1.5.3Primary polycythaemia

Manifests when a congenital or acquired disorder leads to abnormal erythropoiesis. The most commonly encountered condition is polycythaemia vera (PV), a clonal myeloproliferative neoplasm (MPN) almost invariably accompanied by the JAK2 V617F mutation and frequently by a low serum erythropoietin (EPO) **(Tefferi et al ,2013).**

1.5.4Secondary polycythaemia

Caused by exogenous stimulation of erythropoiesis. It is generally associated with an elevated EPO level, which may be physiologically appropriate (stimulated by hypoxia) or inappropriate (in the absence of hypoxia).

(Tefferi et al ,2013)



Figure(3) (age distribution of pediatric patients with polycythemia vera)**(Marcello Di Nisio et al ,2006)**

(At onset of PV, the youngest patient was 7 months, the oldest was 17.5 years old (median age 11 years)The age distribution shows a first peak at the age of 5 to 6 years and a second at the prepubertal stage (10-14 years). It is very difficult to find a reasonable explanation for the observed age distribution. In very young patients, diagnostic problems (e.g., misinterpretation of blood counts) might result in a late diagnosis in some cases thus leading to an accumulation of diagnosed cases at the preschool age. It is likewise conceiv- able that the onset of puberty precipitates the occurrence of clinical symptoms leading to the second peak) **)(Marcello Di Nisio etal ,2006).**

1.5.5Signs and symptms of polycythemia

Patients with polycythemia may be asymptomatic or experience symptoms related to the increased red cell mass or the underlying disease process that leads to the increased red cell mass. The dominant symptoms from an increased red cell mass are related to hyperviscosity and thrombosis (both venous and arterial), because the blood viscosity increases logarithmically at hematocrits >55% **(Adamson et al ,2013).**

Manifestations include neurologic symptoms such as vertigo, tinnitus, headache, and visual disturbances. Hypertension is often present**(Adamson et al ,2013).**

1.5.6Dental management of polycythemia **(Adamson et al ,2013):**

1.LA regional blocks should be avoided if possible.

2.Conscious sedation can be given.

3.GA is allowed.

4.Susceptibility to thrombosis and hemorrhage should be considered.

5.Cytotoxic chemotherapy may cause oral complications that require Management.

1.6White blood cell disorders

1.6.1Leukocytosis

An increase in white blood cells, which can be a normal response of the immune system but also caused by certain cancerous or non-cancerous diseases .
Causes include: smoking, allergies, certain types of leukemia, infections, removal of the spleen, and pregnancy **(Riley et al al 2015).**

1.6.2Leukopenia

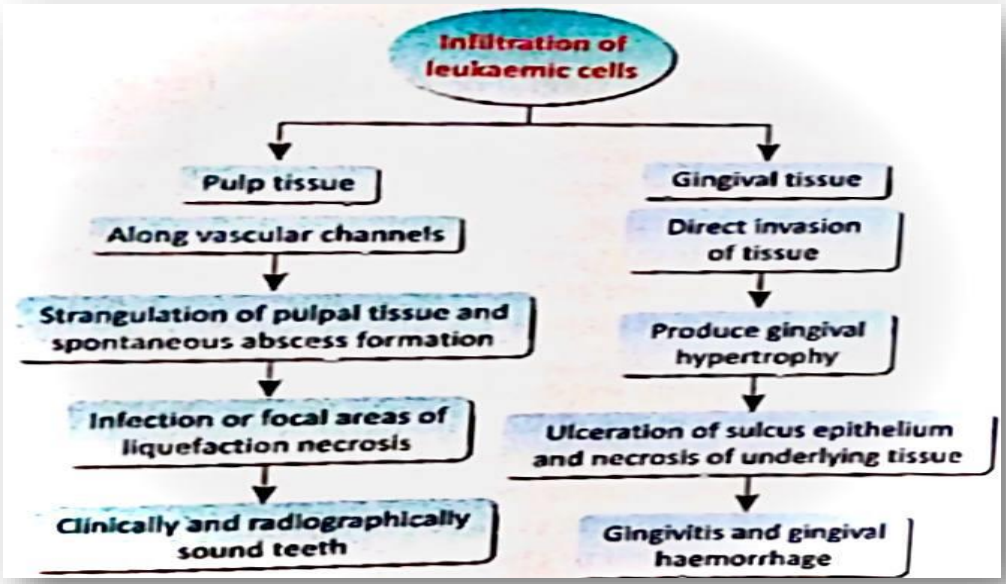
A decrease in white blood cells, which can be caused by cells being destroyed or by not enough cells being made .Causes include: aplastic anemia, autoimmune disorders, cancer treatments, antibiotics, vitamin deficiencies**(christen et al, 2017).**

1.6.3Leukaemia

Is a malignant proliferation of white blood cells. It is the most common form of childhood cancer, accounting for about one-third of new cancer cases diagnosed each year. Acute lymphocytic leukaemia (ALL) accounts for 75% of cases, with a peak incidence at 4 years of age. The general clinical features of all types of leukaemia are similar, as all involve severe disruption of bone marrow functions. However, specific clinical and laboratory features differ, and there are considerable differences in response to therapy and long-term prognosis**(Richard et al, 2017).**

1.6.3.1There are 4 types of leukemia with many subtypes **(Shobha tendon et al, 2018):**

1. Acute Lymphoblastic Leukemia ALL, it is the most common type in children.
2. Acute Mylogenous Leukemia AML, the most common type in adults.
3. Chronic Lymphocytic Leukemia CLL, the second most common type in adults.
4. Chronic Myloid Leukemia CML.

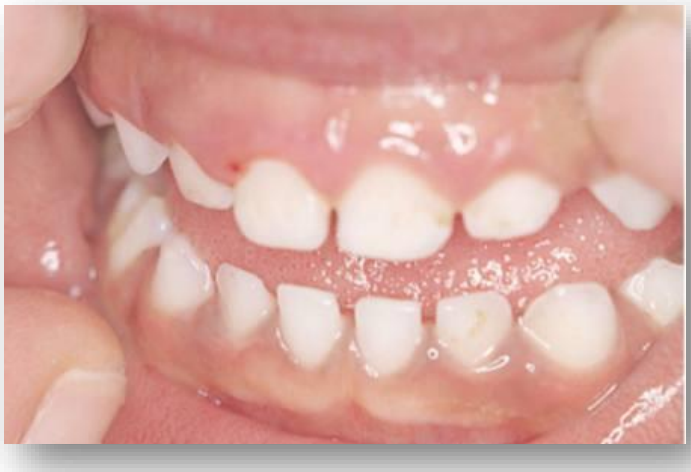


figure(4)(pathogenesis of leukaemia) **(Shobha tendon et al, 2018).**

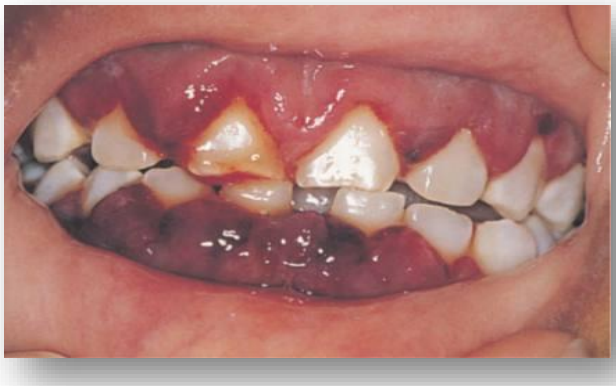
1.6.3.2Clinical features of leukemia **(Richard et al, 2017):**

It can be attributed to anemia, granulocytopenia and thrombocytopenia resulting from the replacement of normal bone marrow by undifferentiated blast cells.

1. Fatigue and weight loss
2. Anemia
3. Purpura
4. Infection and febrile episodes
5. Hepatosplenomegaly and lymphadenopathy
6. Bone pain
7. Regional lymphadenopathy
8. Gingival bleeding and hypertrophy
9. Candidiasis
10. Loose teeth



Figure(5) (This 3-year-old child was brought to the dental surgery with spontaneous bleeding from his gums. He had several nosebleeds and had become very lethargic. His skin and mucosa were very pale. Haematological investigation showed acute lymphocytic leukemia) **(Richard et al, 2017)**



Figure(6)(Oral appearance of a patient with acute myeloid leukaemia, with infiltration of the gingivae and spontaneous bleeding. This oral presentation and type of leukaemia is less common than the lymphocytic type shown in Fig..4) **(Richard et al, 2017).**

1.6.3.3Dental Management of leukaemia**(Arthi rao et al ,2012):**

1. Consultation with the oncologist.

2. All elective dental treatment to be deferred in children whose first remission is not obtained.

3. If the child is still undergoing chemotherapy but is in complete remission, routine preventive, restorative and surgical procedure can be done.

4. Routine blood profile is preferred to reduce the risk of hemorrhage and infection. But if the child is under remission for not less than 2 years and is not undergoing any therapy, then the child can be treated like routine patient.

5. Pulp therapy in deciduous teeth is contraindicated even in remission stage.

6. Platelet count should be more than 50,000/mm² prior to any routine preventive and restorative treatment that does not require injections. If the count is less than 20,000 mm², platelet transfusion is a must before any treatment, even prophylaxis.

7. Absolute neutrophil count is a better indicator of the child's susceptibility to infection. If it is less than 1000/mm², (Normal is >1500), elective dental treatment should be deferred and may require broad spectrum antibiotic therapy.

1.7Lymphomas

A solid neoplasm that arises in lymphoid tissues and spreads to distant lymphoid glands and organs .It occurs when abnormal lymphocytes increase in number without proper control. They divide in an abnormal pathway or do not die when they should **In 2015**, the Office for National Statistics (ONS) reported that non-Hodgkin's lymphoma affected 11,690 patients, while Hodgkin's lymphoma affected 1,782 patients.(However, **in 2016**, these incidences were increased to nearly 17,000 and 2,000 cases diagnosed with non-Hodgkin's lymphoma and Hodgkin's lymphoma, respectively. It affects any age, including children. Currently, it is mostly treatable, and people live for many years after being diagnosed **(Scully et al, 2007).**

1.7.1Age

Overall, incidence increases with age, although some subtypes of lymphoma are more common in children and young adults, such as Hodgkin lymphoma, anaplastic large-cell lymphoma and high-grade B-cell Non-Hodgkin lymphoma NHLS **(Chirs hatton et al, 2018).**

1.7.2Characteristics of lymphomas in children **(Chirs hatton et al ,2018):**

• Less common than in adults: annual incidence 0.8-1/100 000

• More often high grade (e.g. lymphoblastic lymphoma, Burkitt lymphoma, anaplastic large-cell lymphoma)

• Low mortality with appropriate treatment

1.7.3There are two large subdivisions of lymphoma**(scully c,et al 2007):**

1_ Hodgkin lymphoma (HL)

2_non-Hodgkin lymphoma (NHL)

1.7.3.1Hodgkin lymphoma (HL):

Dr Thomas Hodgkin first described Hodgkin's lymphoma in 1832. It develops from B-cell lymphocytes. Reed-Sternberg cells (large bi-nuclear cells) are seen histologically and confirm the diagnosis of HL,while they are absent in NHL **(Scully ,et al 2007)**

Types	Classification
I. Classical Hodgkin's lymphoma (main type of Hodgkin's lymphoma)	• Nodular sclerosis Hodgkin's lymphoma (most common type)
	• Mixed cellularity Hodgkin's lymphoma
	• Lymphocyte-rich classical Hodgkin's lymphoma
	• Lymphocyte-depleted classical Hodgkin's lymphoma
II. Nodular lymphocyte-predominant Hodgkin's lymphoma (NLPHL)	• This much rarer type of Hodgkin's lymphoma involves large, abnormal cells that are sometimes called popcorn cells because of their appearance • Early diagnosis raises the chance of better cure

Figure(7) The Revised European-American classification system of Hodgkin's lymphoma **(Urquhart, Berg R,2001)**

1.7.3.2Non-Hodgkin's lymphoma

Is classified by the types of lymphocyte, either B-lymphocyte (major type) or T-lymphocyte. However, it is the behaviour of a non- Hodgkin (low grade or high grade) that will determine the treatment. **(Urquhart, Berg,.2001).**

1.7.4The classification of non-Hodgkin's lymphoma based on the neoplasm behaviour(Urquhart, Berg,2001)

I. Low-grade lymphoma (indolent lymphoma): in this type the cells appear to be dividing slowly. Some patients do not require early treatment, but they need a regular monitoring until treatment is needed and this is called the 'watch and wait' approach.

II. II. High-grade lymphoma (aggressive lymphoma): in this type the cells

III. appear to be dividing quickly.

1.7.5Burkitt's Lymphoma

Burkitt's lymphoma is an uncommon type of non-Hodgkin lymphoma (NHL). It commonly affects children. It is a highly aggressive type of B-cell lymphoma that often starts and involves body parts other than lymph nodes. In spite of its fast-growing nature, Burkitt's lymphoma is often curable with modern intensive therapies**(Shobha tendon et al ,2018).**

1.7.6There are two broad types of Burkitt's lymphoma**(Shobha tendon et al, 2018):**

1.the endemic

2.the sporadic

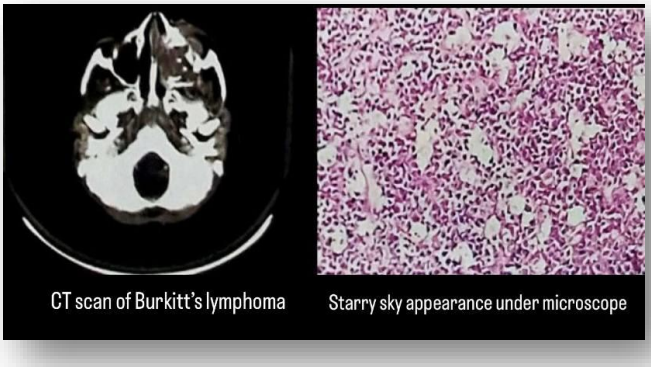
There is a very high indence of this disease in equatorial Africa, and disease in this region is called endemic Burkitt's lymphoma. Disease in other regions of the world is much less common, and is called sporadic Burkitt's lymphoma. Although they are the same disease, the two forms are different in many ways **(Shobha tendon et al ,2018).**

1.7.6.1Endemic Burkitt's Lymphoma

In equatorial Africa, about half of all childhood cancers are Burkitt's lymphoma. The disease involves children much more than adults, and is related to Epstein Barr virus (EBV) infection in 95% cases. It characteristically has a high chance of involving the jaw bone, a
rather distinctive feature that is rare in sporadic Burkitt's. It also commonly involves the abdomen. **(Shobha tendonet al, 2018)**

1.7.6.2Sporadic Burkitt's Lymphoma

The type of Burkitt's lymphoma that affects the rest of the world, including Europe and the Americas is the sporadic type. Here too, it's mainly a disease in children. **(Shobha tendon et al ,2018)**



Figure(8)CT scan and histologic features of Burkitt's lymphoma**(Shobha tendonet al ,2018)**

Figure(9)clinical features of Burkitt's lymphoma**(Shobha tendon et al ,2018)**

1.7.7The main treatment modalities for patients with lymphoma

(Kumar et al ,2013):

1.Monoclonal antibodies (MABs);

2. Chemotherapy;

3. Radiotherapy;

4. Corticosteroid;

5. Haematopoietic stem cell transplant

(HSCT).

Table (1) common side-effects of chemotherapy regimens with some dental considerations**(KumarN et al ,2013):**

Common Side-effects of Chemotherapy Regimens	**Dental Considerations**
Bruising and prolonged bleeding	patients may be on a daily dose of low weigh molecular heparin (LWMH) injection to reduce risk of deep vein thrombosis (DVT). Therefore, liaison with the patient haematooncology team is recommended prior to invasive dental treatment.
Vomiting or nausea	Postpone dental treatment if necessary. Severe vomiting can lead to tooth wear.
Generalized fatigue, frequent headache, flu-like symptoms and tiredness	Dental team should ensure that the patient is well on day of the treatment and consider postponing if necessary.
Brown marking on the skin, hair loss, brittle and chipped nails	If patient shaved or lost hair during chemotherapy, they may be wearing a wig, scarf or hat. It is important to be sensitive to this and ensure that patient is not asked to remove any hat/scarf unless absolutely necessary.
Feeling very cold and tingling hands or feet	Use of blankets and warm water for hands if cannulation is necessary, eg for treatment under

	sedation.
Conjunctivitis, blurred vision and photosensitivity	Dental team should adjust dental chair's light carefully and avoid light shining directly on patient's eyes. Some new dental chairs can reduce light brightness. Consider use of accessible information such as large print for patients with visual impairment. Ensure patient can read consent forms, dental information sheets.
Raise in blood uric acid	High level of uric acid in the blood increases risk of gout, which can affect fingers and joints. If this effects patient's manual dexterity and ability to carry out good oral hygiene, simple adjustments may help, such as using silicon-based material or a rubber ball to amend the patient's toothbrush handle. Alternatively, some patients may find an electric toothbrush easier to use.
Altered kidney and liver functions	Drug metabolism is affected. For example, a sedative drug (ie midazolam) may produce exaggerated effects due to increased levels of free drug. Dental team should be aware that drug metabolism may be slow and recovery prolonged because of altered kidney function. Additionally, due to liver damage, the patient could be anaemic, conscious sedation should not usually be carried out when the haemoglobin level is less than 10g/dL.3 Liver damage can also lead to problems with clotting and therefore risk of prolonged bleeding.

Breathless, inflammation of the lung and damage of the heart muscle in some patients	Liaison with the haematooncology team prior to dental treatment and especially treatment under conscious sedation to check patient's cardiorespiratory function.

1.7.8 Dental management of patients with lymphoma(Hassan et al, 2019):

1_Pre-lymphoma treatment assessment (pre- chemotherapy cycles, monoclonal antibodies and pre-radiotherapy)

• A dental assessment prior to starting lymphoma treatment is recommended to ensure that patients are dentally fit. The general dental practitioner in primary care can carry this out after liaison with the patient's haemato- oncologist and special care dentists, if required, about the suggested treatment plan.

• Periodontal treatment (ie scaling and root surface debridement), restorative treatment and adjustment of ill-fitting dentures are essential.

• Dental extraction of teeth with poor prognosis at least 10–14 days prior to chemotherapy cycles and MABs is recommended. Otherwise, it is recommended to wait until the next cycle of chemotherapy and manage any dental infection with antibiotics with/without pulp extirpation.

• Dental care providers should check platelets and neutrophil counts prior to dental treatment. No dental extraction for patients with platelet counts below 50 x 109/L, and no regional block injection for patients with platelet counts below 30 x 109/L. Liaison with the haemato-oncology team is necessary for platelets transfusion. Conscious sedation is not recommended for patients with haemoglobin below 10g/dl. Again, liaison with haemato-oncology team is necessary.

• Antibiotic prophylaxis for patients with neutrophil counts below 2 x 109/L is recommended to reduce possible septicaemia (granulocyte colony-stimulating factor) might be considered by the haemato-oncologist prior to dental procedures.

• Topical anti-fungal agents (ie Nystatin 100,000 U/ml) 4 times per day for oral candidiasis and aciclovir 200 mg three times per day could be prescribed for herpes simplex viral infection as a prophylactic.
• Dry mouth advice involves advising patients to take sips of water, use sugar-free chewing gum and saliva substitute.
• Diet advice at this stage is important. Patients should consider soft diet and avoid rough and spicy food, acidic fruit and salt.
• Advice to avoid alcohol and smoking.
• Oral hygiene instructions to include using a soft toothbrush with alcohol-free mouthrinse.
• Advise patients to register with the local general dental practitioner, if they are not registered. A referral letter to
patient's GDP should include patient's medical history, treatment received and the importance of future follows up every 3_6 months.
• All dental treatment should be planned in liaison with patient's haemato-oncologist.

2_During chemotherapy cycles or radiotherapy

• Dental treatment is not recommended at this stage and urgent dental care should be managed with antibiotics and analgesics with/without pulp extirpation.
• If dental extraction is necessary, it should be carried out in secondary care setting in liaison with the haemato-oncology team as patients might require blood transfusion at this stage.
• Emphasizing oral hygiene instructions and maintaining good oral hygiene are essential.
• Mucositis will complicate maintaining good oral hygiene, advise to use soft toothbrushes or sponge toothbrush with alcohol-free mouthrinse. Topical gel (ie Lidocaine) or 15% benzydamine hydrochloride (15 ml every 8 hours and up to three weeks) could be considered to help reduce pain.
• Anti-fungal or anti-viral infections can be prescribed for the treatment of fungal and viral infections.

3_Pre-HSCT treatment

• Dental assessment is necessary and it is similar to pre-lymphoma treatment assessment, but it should be carried out in secondary care centre.

• Patient education about side-effects of immunosuppressive agents (ie ciclosporin and tacrolimus) such as gingival hyperplasia and the importance of maintaining good oral hygiene to reduce gingival enlargement.

4_Post-HSCT

• No dental treatment recommended in the first six months post-HSCT, while urgent dental care should be managed with antibiotic or analgesic with/without pulp extirpation. If dental extraction is necessary it should be carried out in secondary care centre after liaison with the haemato-oncology team.

• Six months post-HSCT, patients can receive dental treatment in primary care centre.

• Anti-fungal or anti-viral infections can be prescribed for the treatment of fungal and viral infections, but liaison with haemato-oncology team is important at this stage in patients taking immunosuppressive agents (ie ciclosporin or tacrolimus) to avoid drug interaction.

• HSCT patients are at high risk of developing oral squamous cell carcinoma and early referral to secondary care
centre is essential.

• Pathological findings, tooth mobility with sudden displacement and oral bleeding could be a clinical scenario of a relapsing lymphoma and patients need urgent referral to a specialist centre.

5_Long-term follow- up

• The importance of reviews every 3–6 months, with the provision of an intensive

preventive programme should be stressed. For example, regular review, emphasize oral hygiene instructions and preventive dentistry (fluoride application and pit and fissure sealants).

• Any suspicious oral lesions should be referred to a secondary care centre.

• Patients can receive dental treatment in primary care setting in liaison with haemato-oncology team to receive recent blood counts.

• The number of platelets and neutrophil should be reviewed prior to dental treatment under local anaesthesia and conscious sedation.

1.8 Iraqi studies

1_**May Muhammad Shareef et al, 2019 their study about** (**Prevalence of Iron Deficiency Anemia (I.D.A.)** A prospective study was done at Azadi Teaching Hospital pediatrics department in **kirkuk**.The samples were children aged from 6 month to 2 years old age, who were admitted to hospital.

This study concluded:

I. Peak age of Iron deficiency anemia (I.D.A) is between 6-12 months of age.

II. Iron deficiency anemia is more common among rural children.

III. The majority of infants with I.D.A. were underweight.

IV. Early introduction of food from 6 months of age with bad nutritional supplement with no iron contents can lead to I.D.A.

2_**Yousif A. Al-Raheem et al ,2009 their study about(The Impact of Thalassemia Major on Dental Integrity and Development)** The data for this cross sectional study were collected from patients in thalassemia centers in AL-karama (Al Karkh district) and Ebin-AL Balady (Al Resafa district) hospitals in Baghdad for the period from January, 1st 2004 till December, 31st 2005.

The number of thalassemic patients who were resident in Baghdad with an age range 6-15 years was 380 in Ebin- AL Balady center and 352 in AL- Karama center. A random sample consisted of 50 patients were selected from each hospital.

This study concluded:

I_calculus index difference was statistically not significant between thalassemic and control group in age group 6-10 years, however the difference was statistically significant for age group 11-15 years.

II_ In the thalassemic group, the higher percentage was those having moderate type of gingivitis while in the control group the higher percentage was those having mild gingivitis the gingival index among thalassemic group was higher than that seen in the control; difference was statistically significant in age group 6-10 years and highly significant in age group 11-15 years.

3_**Shaymaa Rasheed Ali,2022 her study about (Relation of Salivary Calcium, Phosphorus and Alkaline Phosphatase enzyme levels with Dental Caries among Children with β-Thalassemia Major Syndrome)in university of Baghdad.**

This study concluded:

Lower mean values of salivary flow rate and pH among β-thalassemias group than those in their healthy group may be an influential factors for increasing their dental caries.

Conclusions

1.Children with various blood dyscrasia are a significant challenge for clinicians.

2.The patients with blood dyscracia can be managed safely in a dental setup if certain guidelines are followed.

3. Dentists must be aware of about the clinical presentation of these disorders, possibility of the associated bleeding complications, and management protocols that need to be devised as an outcome. It is important to ensure clear channels of communication and close collaboration with the haematologist prior to any dental procedure. Taking a thorough A good, elaborative medical history, and applying sound clinical judgement together help to ensure that patients with blood dyscrasia receive effective dental therapy.

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