HAEMATOLOGICAL DISEASES
ANAEMIA

For Class- B.Pharmacy 2nd Semester

Subject- Pathophysiology (BP204T)

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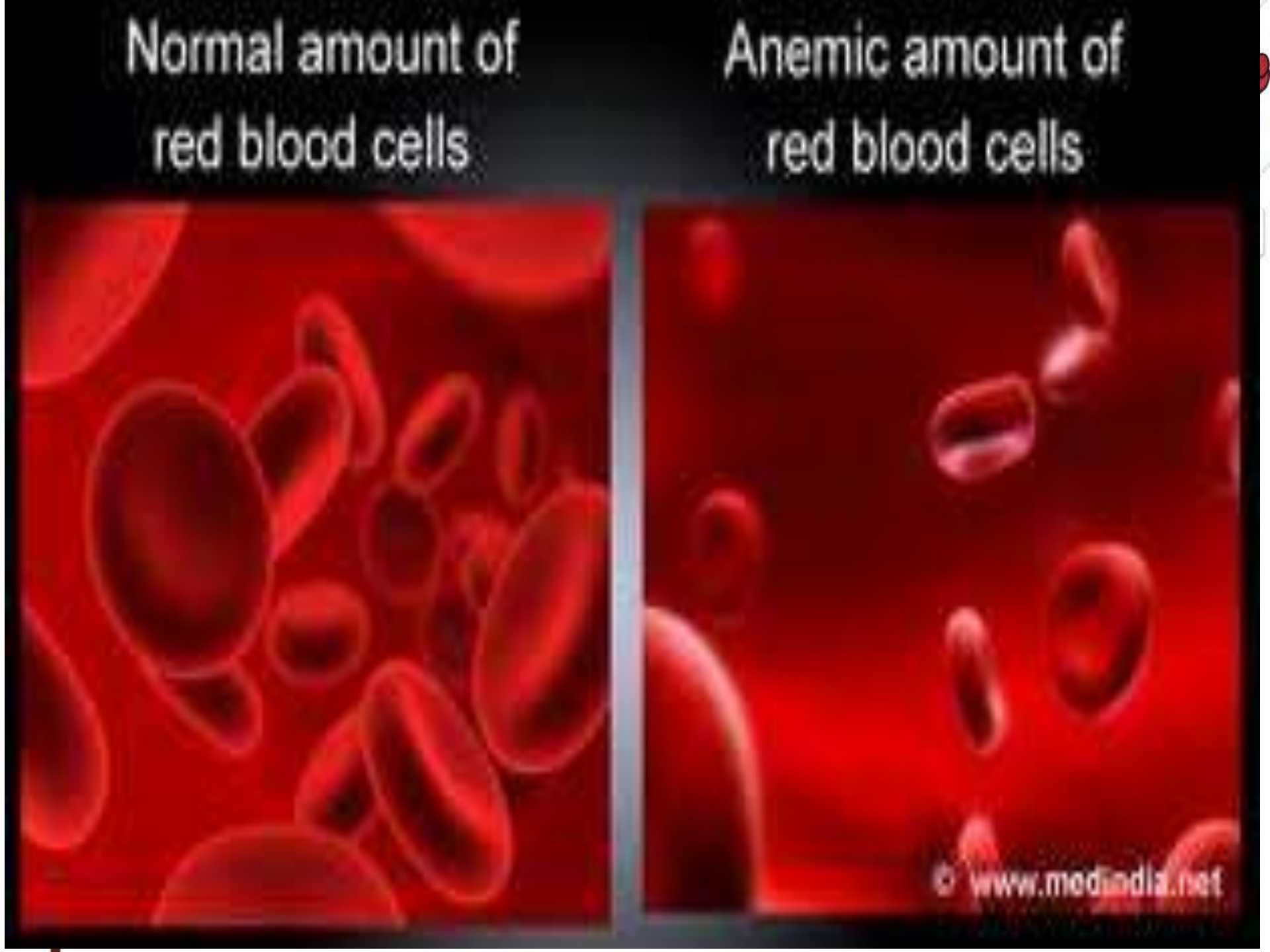
INTRODUCTION

- Anemia is a major killer disease in India.
- Statistics reveal that every second Indian woman is anemic
- One in every five maternal deaths is directly due to anemia.
- Anemia affects both adults and children of both sexes, although pregnant women and adolescent girls are most susceptible and most affected by this disease.

Content

- Definition of anemia
- Basics about RBC
- Classification of anemia
- Anemia Cause
- Anemia Sign & Symptoms
- Lab Investigation of Anemia
- Treatment
- Prevention


Normal Amount
of red blood cells
Anemic Amount
of red blood cells
Anemia in Children
www.medindia.net


Normal amount of red blood cells
Anemic amount of red blood cells
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DEFINITION

- Anemia (An-without, emia-blood)
- “ Decrease in number of red blood cells (RBCs) or less than the normal quantity of Haemoglobin in the blood.is Condition called Anaemia”

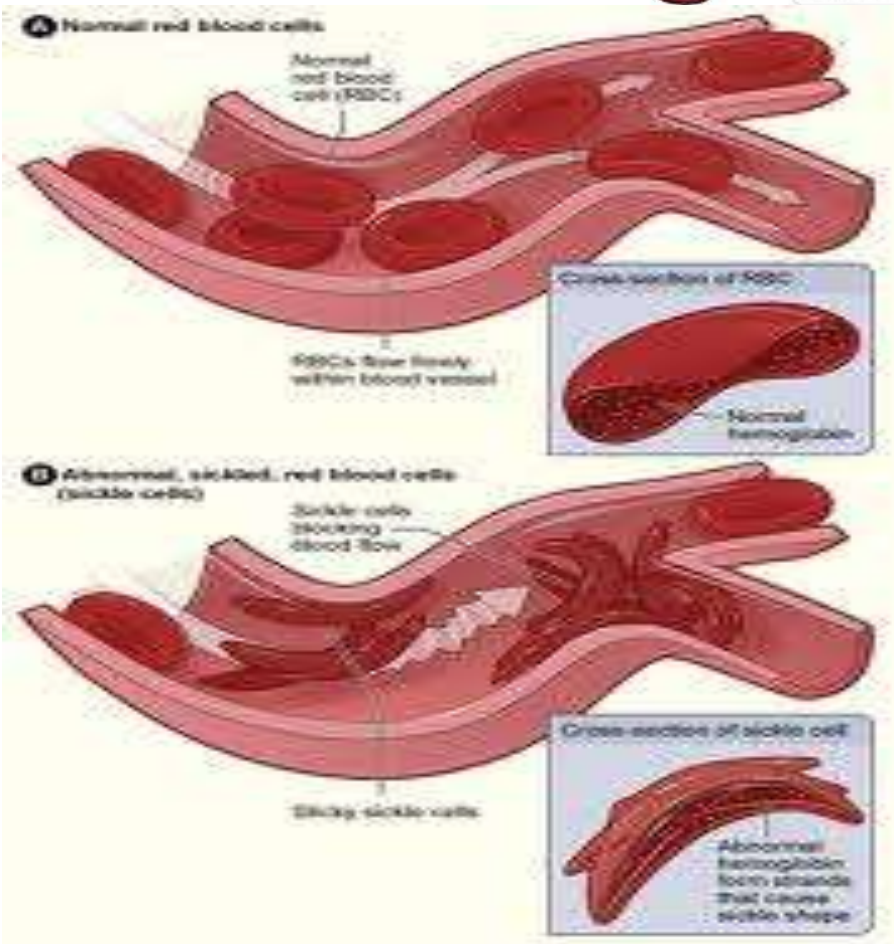
Shall we learn some basics about our Red Blood cells?

Red Blood Cells

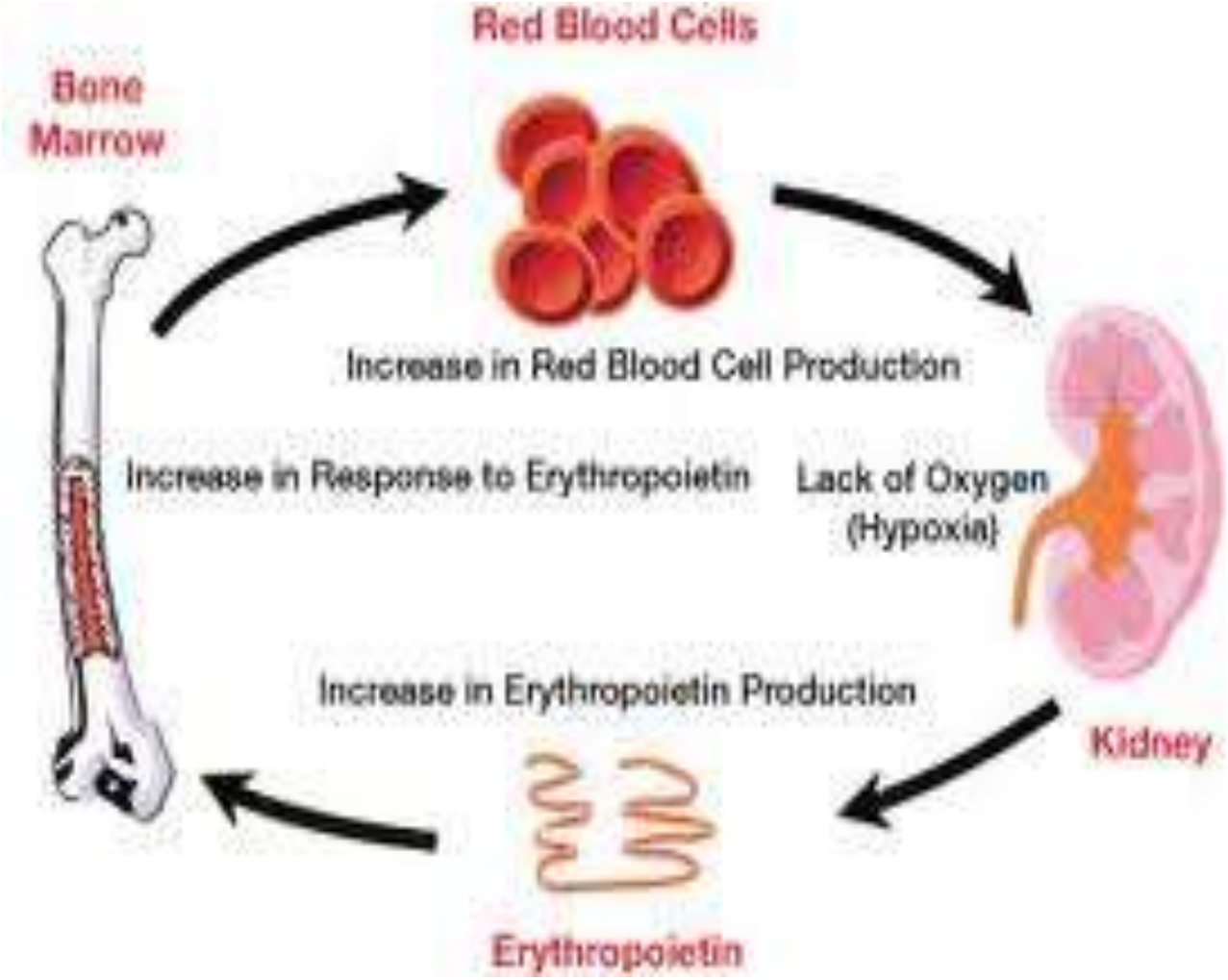
- mature red blood cells are flexible biconcave disk and Resembles a soft Ball Compressed b/w Two Fingers
- 2.4 million new erythrocytes are produced per second.
- It has a diameter about 8 micro meter and is flexible that it can pass easily through Capillaries
- The Membrane of RBC is very Thin , so that Gases such as Oxygen an Co2 can be Diffuse easily across it

Cont…

- Mature Erythrocytes have No Nucli
- Immature Erythrocytes (RBC) are called Reticulocytes
- Life Span of RBC – 120 Days
- RBC production Process Called Erythropoiesis
- In Erythropoiesis Process , The most Common Important Hormone participates is Erythropoietin , Which produced from Kidney
- The Entire Process of Erythropoiesis typically takes 5 Days


A Normal red blood cells
Normal red blood cell (RBC)
RBCs flow freely within blood vessel
Cross-section of RBC
Normal hemoglobin
B Abnormal, sickled, red blood cells (sickle cells)
Sickle cells blocking blood flow
Sticky sickle cells
Cross-section of sickle cell
Abnormal hemoglobin form strands that cause sickle shape

RBC Production
(Erythropoiesis)



MCV
(Mean Corpuscular Volume)

- measure of the average RBC size
- allows classification

MCV → $\frac{10 \times HCT\ (\%)}{RBC\ count\ (millions/mm^3)..}$

Cont..

- The normal range for MCV
- 80-99 fL(Femtoliter)

80-99 fL.

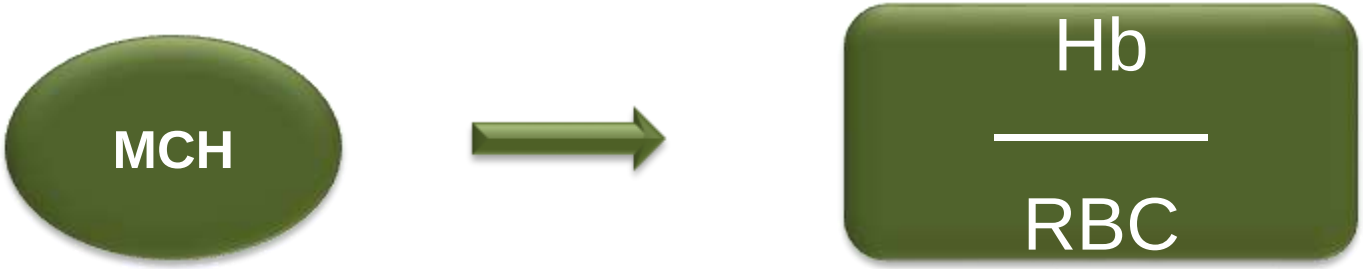
MCHC
(Mean Corpuscular Hb Concentration)

- measure of the concentration of Hb in a given volume of packed RBCs.
- 32 to 36 g/dl

MCHC → $\frac{Hb}{HCT}$

MCH
(Mean Corpuscular Haemoglobin)

- mean cell Hb.
- average mass of hemoglobin per red blood cell
- **MCH** = Hb / RBC



Cont..

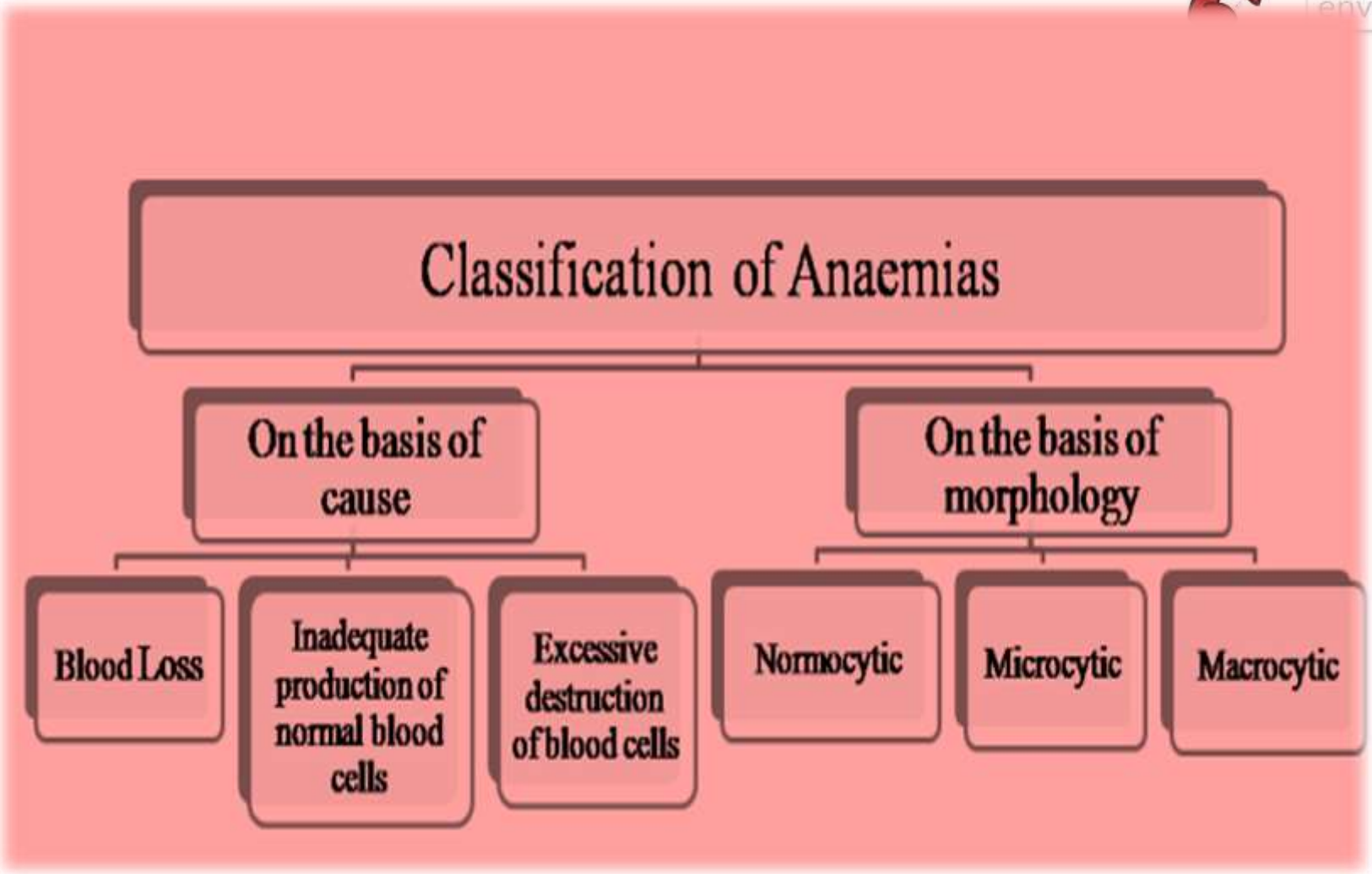
- The normal range for MCH
- 27-31 picograms/cell

27 to 31 pg/cell

WHO Grading of Anaemia

- Grade 1 (Mild Anemia): 10 g/dl
- Grade 2 (Moderate Anemia): 7-10 g/dl
- Grade 3 (Severe Anemia): below 7 g/dl

Classification



1. On The Basis of Cause

A. Hypo proliferative (Resulting From Defective RBC Production)

B. Haemorrhagic (Resulting from RBC Loss)

C. Haemolytic Anaemia (Resulting From RBC Destruction)

2. On the Basis of Morphology

A. Microcytic Anemia (Cells are smaller than normal under 80 fl)

B. Macrocytic Anaemia (cells are larger than normal over 100 fl)

C. Normocytic Anaemia (Cells are normal size 80–100 fl)

1.Microcytic Anaemia

- It Occurs in Iron Deficiency Anaemia and Ineffective RBC Production
- a result of Haemoglobin synthesis failure/insufficiency.
- Cells are smaller than normal under 80 fl
- Heme synthesis defect
  - Iron Deficiency Anaemia
- Globin Deficiency Defect
  - Thalassemia

2. Macrocytic Anaemia

- An Abnormally Large RBC
- cells are larger than normal over 100 fl
- It Occurs as Nutritional Deficiency.
- E.g.Vit.B12 , Folates and Protein
- It’s also occurs due to Drug toxicity (phenytoin)

&

- Liver Disease & Alcolism
- Hypothyrodism
- Chronic Haemolytic Anaemia & Leukaemia
- Gastric Bypass surgery

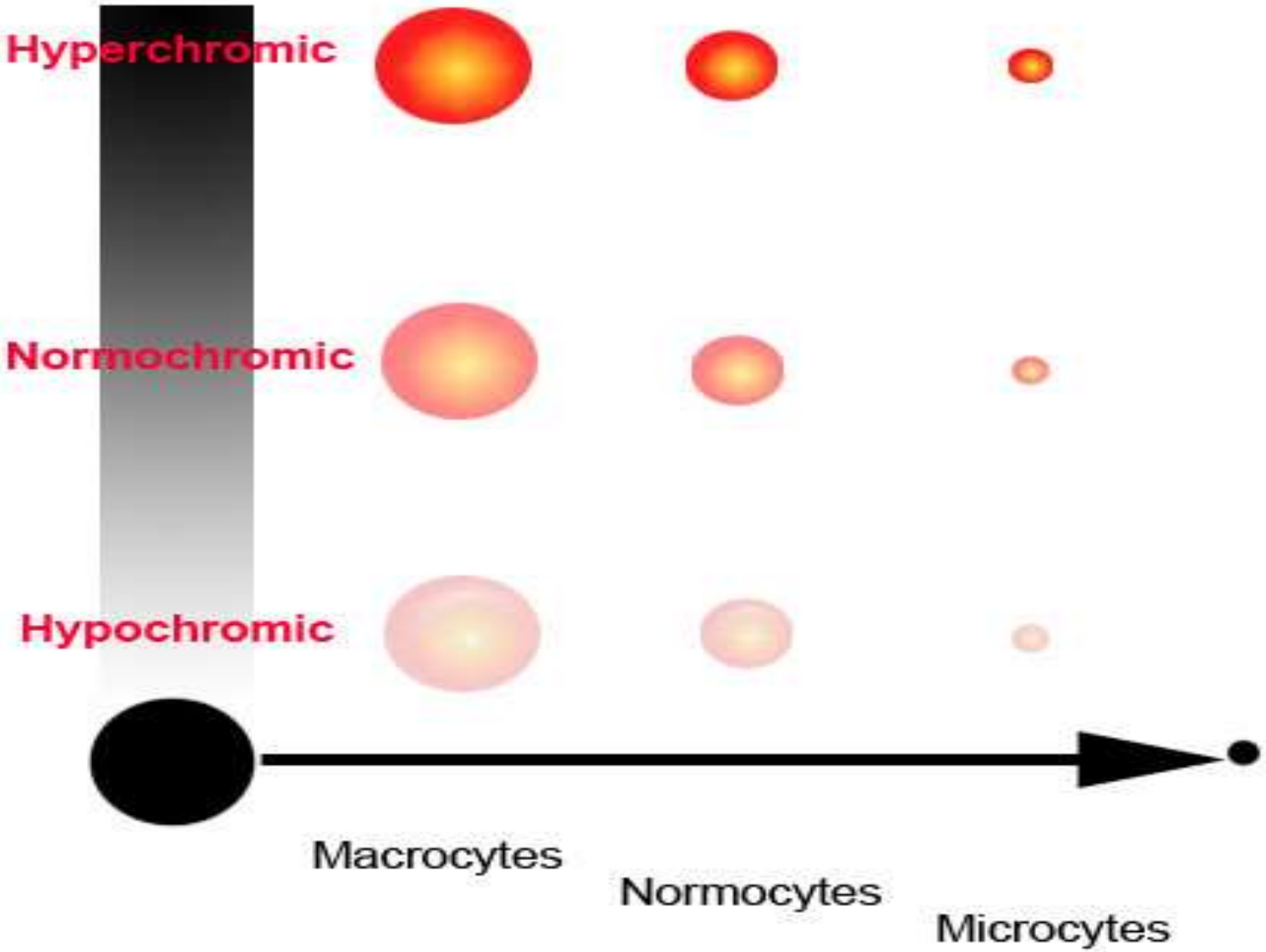
3. Normocytic Anaemia

- overall Haemoglobin levels are decreased
- but the red blood cell size(MCV) remains normal.
- Cells are normal size 80–100 fl

Causes

- Acute blood loss
- Haemolytic Anaemia
- Aplastic Anaemia

TYPES OF ANEMIA



CAUSES

Increased Requirements	• Menstruating females • Pregnancy • Lactation • Growing infants and children • Erythropoietin treatment
Increased Loss	• GI bleeding • Menorrhagia • Persistent hematuria • Intravascular hemolytic anemias • Regular blood donors • Parasitic infections
Decreased Intake	• Vegetarian diet • Socioeconomic factors
Decreased Absorption	• Upper GI pathology (eg: Celiac and Crohn's disease) • Gastrectomy • Medications (antacids, Zantac)

Cont..

- ***Idiopathic***
- ***Hereditary Spherocytosis***
- ***Impaired RBC Production(***

  - Deficiency of Nutrition (Iron,Vit.B12,Vit.B6)
  - Decreased Erythropoietin Production

- ***Increased Destruction of RBC(Haemolytic)***

  -Abnormal Haemoglobin Synthesis (Thalassemia)
  - Enzymatic Defect (Glucose-6-phosphate Deficiency)
  - Infections (Malaria)
  - Antibody Reaction (Rh **OR** ABO Isoimmunization)

Cont..

- Drugs Toxicity (Primaquine & Phenytoin)
  - -Poisoning (Lead Poisoning)
  - -Burns
  - - Splenomegaly

- ***Due to Increased Blood Loss(Haemorrhagic)***
  - -Acute (Trauma,Epistaxis,Scurvy,Hemophilia etc.)
  - -Chronic(Chronic Dysentry,Bleeding Piles,Haemorrhage etc.)
- ***↓ed RBC Production(Bone Marrow Depression)***
  - - Hypoplasia ,Chronic Illness (Leukaemia & Nephritis)
  - - TB , Neoplastic Disease , Liver Disease
  - - HypoThyrodism

Pathophysiology

Decrease in RBCs, Hb, or Hct level

↓

Diminished O_2-carrying capacity

↓

Hypoxia and hypoxia-induced effects on organ function

↓

Signs and symptoms of anemia

investigations

Anaemia Diagnosis

- complete blood count(CBC)
- thorough evaluation of the patient
- Physical examination and medical history

Lab tests for Anemia

1.CBC

2.Stool hemoglobin test

3.Peripheral blood smear

4.Iron level

5.Transferrin level

6.Ferritin

7.Folate

8.Vitamin B12

9.Bilirubin

10.Lead level

11.Hemoglobin

12.Reticulocyte count

13.LFT

14.RFT

15.Bone marrow biopsy

Cont..

The red cell population is defined by

1.Quantitative parameters:

- Volume of packed cells(PCV) i.e. the Hematocrit
- Haemoglobin concentration
- Red cell concentration per unit volume.

2.Qualitative parameters:

- Mean corpuscular volume (MCV)
- Mean corpuscular Haemoglobin (MCH)
- Mean corpuscular Haemoglobin concentration(MCHC)

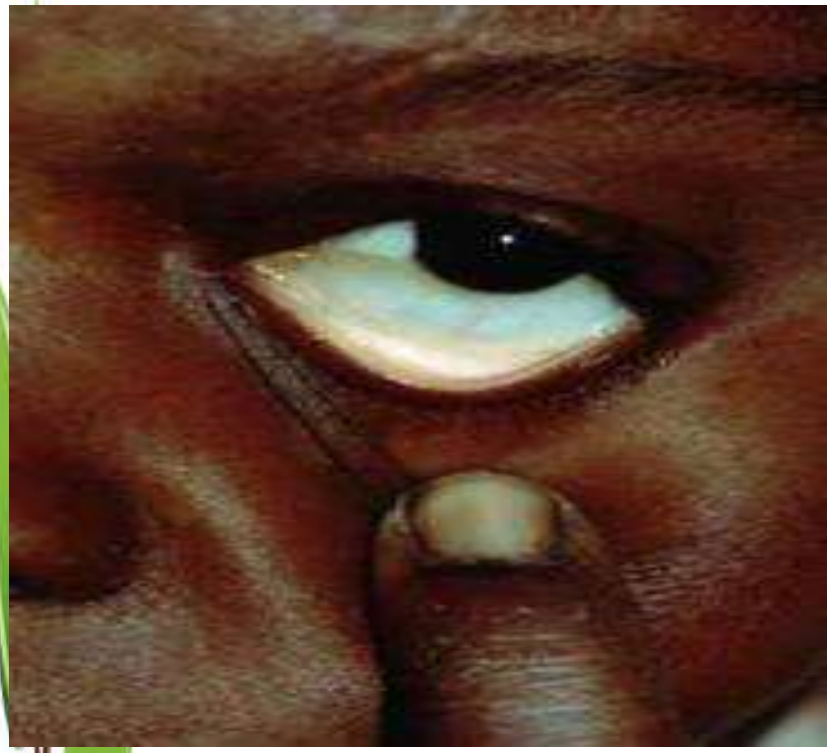
Name	Full Forms	Normal Value
PCV	Packed Cell Volume	33 to 45 %
RBC	Red Blood Cells	3.9 to 5.03
MCV	Mean Corpuscular Volume	80 to 100 fL
MCH	Mean Corpuscular Hb	27 to 31 Pg/cell
MCHC	Mean Corpuscular Hb Concentration	32 to 35 g/dl
Reticulocytes Count	-	0.8 to 2.2 %
RDW	Red Cell Distribution Width	12 to 14.5 gm/dl

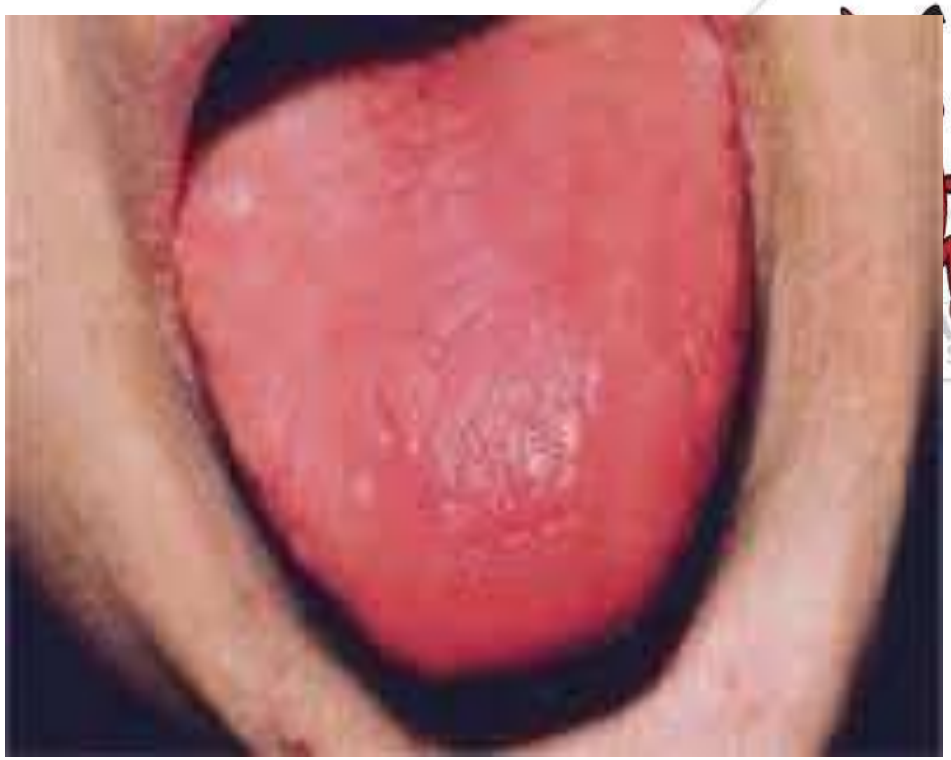
Cont…

Vitamin B12	Cobalamin	200to 500 Pg/ml
S. Iron	Iron	65 to 150 Microgram
S. Billirubin	-	0.2 to 1.2 mg/dl
SGPT	Serum Glutamic Pyruvic Transminase	10 to 50 IU/L
SGOT	Serum Glutamic Oxaloacetic Transminase	10 to 40 IU/L
TIBC	Total Iron Binding Capacity	250 to 370 mg/dl
Haemoglobin	-	12.5 to 15gm/dl
TC	Total Count	4000 to 1000 Cu/mm

SIGNS & SYMPTOMS

- Brittle nails
- Koilonychia (spoon shaped nails)
- Atrophy of the papillae of the tongue
- Angular Stomatitis
- Brittle hair
- Dysphagia and Glossitis
- Plummer vinson Syndrome /kelly patterson Syndrome (Dysphagia with Iron Deficiency Anaemia)

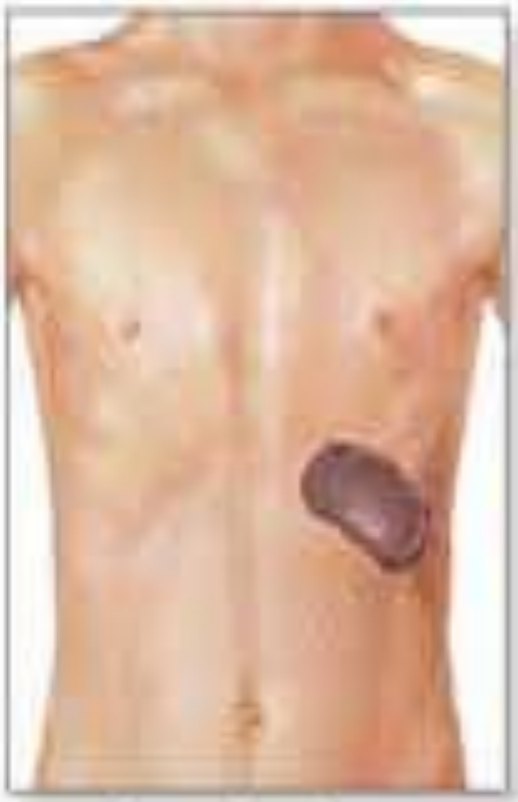




Koilonychia

Angular Cheilitis

Splenomegaly

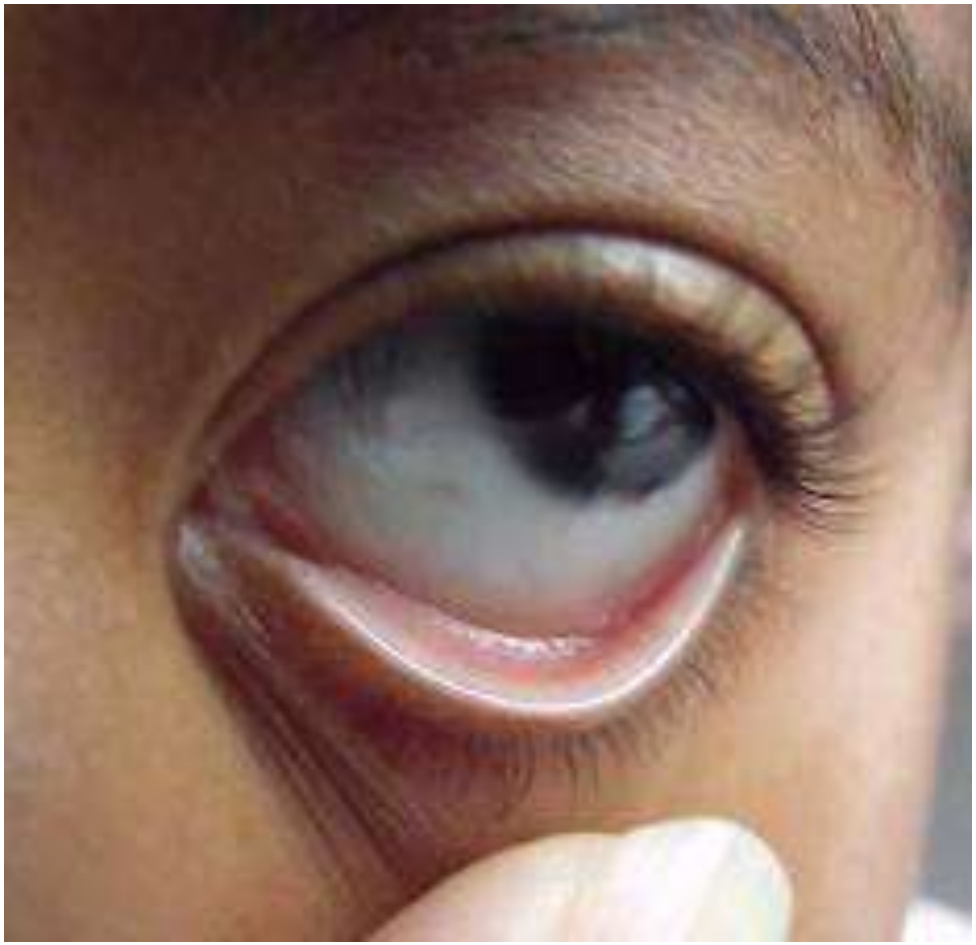


Normal spleen

Splenomegaly

ADAM.

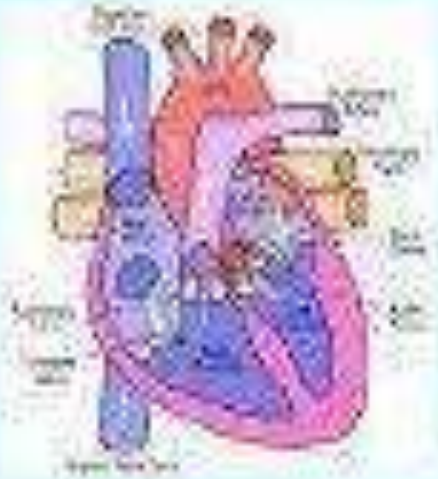
Anemic eyes



Pallor

When I was a kid I thought heart looked like this

and then one day the teacher drew this diagram



1.IRON DEFICIENCY ANEMIA

- Anaemia associated with either Inadequate Absorption or Excessive Loss of Iron/Blood.
- It is Chronic Microcytic Anaemia.
- The most common Cause of Anaemia in Children is Iron Deficiency Anaemia.It’s most common cause by Microcytic Hypochromic Anaemia.

Causes

- Insufficient Iron Supply at Birth
- Impaired Iron Absorption
- Blood Loss
- Insufficient Iron Intake in Diet
- Periods of Rapid Growth

Sign & Symptoms

- Decreases Serum Iron Level
- Decreased Hb Level (6 to 9 mg/dl)
- Cold Hands and Feet
- Shortness of breath
- Fatigue
- Sore Tongue
- Brittle Nails
- Irritability
- Pale Skin Colour
- Dizziness

Nursing Management

- ***Oral Iron Supplements***

A. Ferrous Sulphate-6 mg/kg/24 hours
B. Folic Acid – 0.4 mg/Day
C. Vitamin B12 – 30-100 mg IM/SC(5 to 10 Days)

- ***Parent Education***

A. The Side effects of Iron Therapy
B. The Importance of Dietary Intake of Iron

2.Megaloblastic Anaemia

- Megaloblastic Anaemia characterised by Deficiency of Vitamin B12 as well as Deficiency of Folic Acid(Folates).

- It is a Macrocytic Anaemia.

- Megaloblastic Anaemia have a Two types

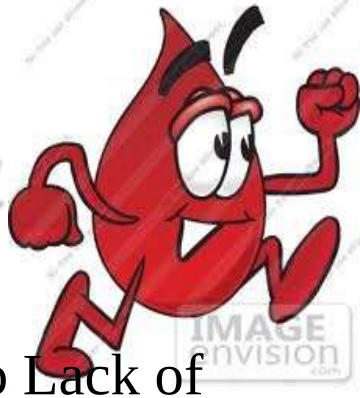
I. **Pernicious Anaemia(Lack of Vit B12)**

II. **Folate Deficiency Anaemia(Lake of Folates)**

(i) Pernicious Anaemia

- Decreases in Red Blood Cells that Occurs when the Body can not Properly absorb Vit B12 from the GI tract.
- Vit B12 is necessary for the proper Development of Red blood Cells.
- In this type Anaemia RBC's are larger than normal and Die Earlier than the 120 Days Life Expectancy.
- Red Blood cells can be Oval shaped.

(ii) Folate Deficiency Anaemia



- Folate Deficiency Anaemia is a Decrease in RBC due to Lack of Folate OR Lower than Normal Amount of Folic Acid in Blood.
- Folic Acid works along with Vit B12 and Vit C to help in the Create New Proteins and also helps to Form Red Blood Cells and produce DNA.
- Folic Acid is a type of Vit B,it was Water Soluble.which means it can not be stored in the Body.
- Water Soluble Vitamins are dissolves in Water,leftover amounts of the Vitamin leave the Body through the Urine.

Causes

- Lack of Intrinsic Factor(Produced by Parietal cells by Stomach) in Stomach.
- Poor Absorption of Vit B12 in Stomach
- Weakend Stomach Lining
- Digestive Disorders
- Alcohol Abuse
- Poor Dietary Intake
- Intestinal Dysfunction
- Certain Medications,Such as Phenytoin
- Complications of Hemolytic Anaemia

Sign & Symptoms

- Tingling & Numbness of Hands & Feet
- Muscles Weakness
- Neurological Problems e.g- Dementia,Depression,Memory Loss etc(If Severe)
- Glossitis
- Headache
- Pallor and Forgetfulness
- Slight Jaundice
- Weight Loss

Nursing Management

- The Goal is to Identify and Treat the Cause of The Folate Deficiency.
- Folic Acid Supplements orally Or through a Vein on a Short Term basis until The Anaemia has been Corrected.
- Dietary Treatment
- Intake of Green Leafy Vegetables and Fruits.
- Replacement Therapy in Case of Poor Absorption by the Intestine.

3.Aplastic Anaemia

- Aplastic Anaemia is Rare and Serious Blood Disorder in which Bone Marrow Stops making Enough New Blood Cells.
- This is Because The Bone Marrow's Stem Cells are Damaged.
- The Disorder tends to get Worse over Time,Unless it's cause is Found and Treated.
- Resulting Pancytopenia (Insufficient Numbers of RBCs,WBCs and Platelets)

Causes

- Exposure to Toxic Substances such as Arsenic, Benzene
- Cancer Therapy
- Use the Certain Drugs
- Autoimmune disorder such as Rheumatoid Arthritis
- Viral Infection such as Hepatitis, HIV etc.
- Damage to the Stem Cells in Bone Marrow that are Responsible for Blood Cell Production.
- Weakend Bone Marrow (Hypo parathyrodism)

Sign & Symptoms

- Pancytopenia
- Fatigue and Restlessness
- SOB
- Hypoxemia
- Irregular Heartbeat
- Heart Murmur
- Pale Skin , Gums and Nail beds
- Fever and Frequent Infection due to Leukocytopenia
- Increases Bleeding Tendency and Pinpoint Red Bleeding spots on the Skin due to Thrombocytopenia
- Oral Thrush

Nursing Management

- **Blood Transfusion**
- **BMT OR Stem cells Transplantation**
- **Medicines** :
  - Erythropoietin to Stimulates The Bone Marrow
  - Antibiotic & Anti Viral Medicines to Prevent & Treat Infection
- **Avoid Exercise**
- **Avoid Contact Sports**
- **Avoid Infections**

Haemolytic Anaemia

- The Rupture OR Destruction of Red Blood Cells is called Haemolysis.

- **Haemolytic Anaemia is a Condition in Which RBCs are Destroyed and Removed from the Blood stream before their Normal Life Spam.**

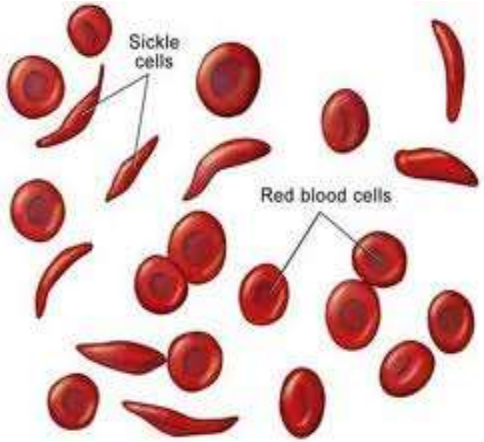
- **It's can be:**

I. Inherited (Parents passed the Gene for the condition on the Baby) e.g.-Sickle Cell Anaemia & Thalassemia

II. Acquired (Baby are not Born with this condition , But Develop it due to another Disease , Condition or Factor)

Sickle cell anemia

- Sickle Cell Anaemia is Serious Inherited Disease
- RBC that assume an abnormal, rigid, sickle shape
- Sickling decreases the cells' flexibility and results in a risk of various complications.
- The sickling occurs because of a mutation in the hemoglobin gene

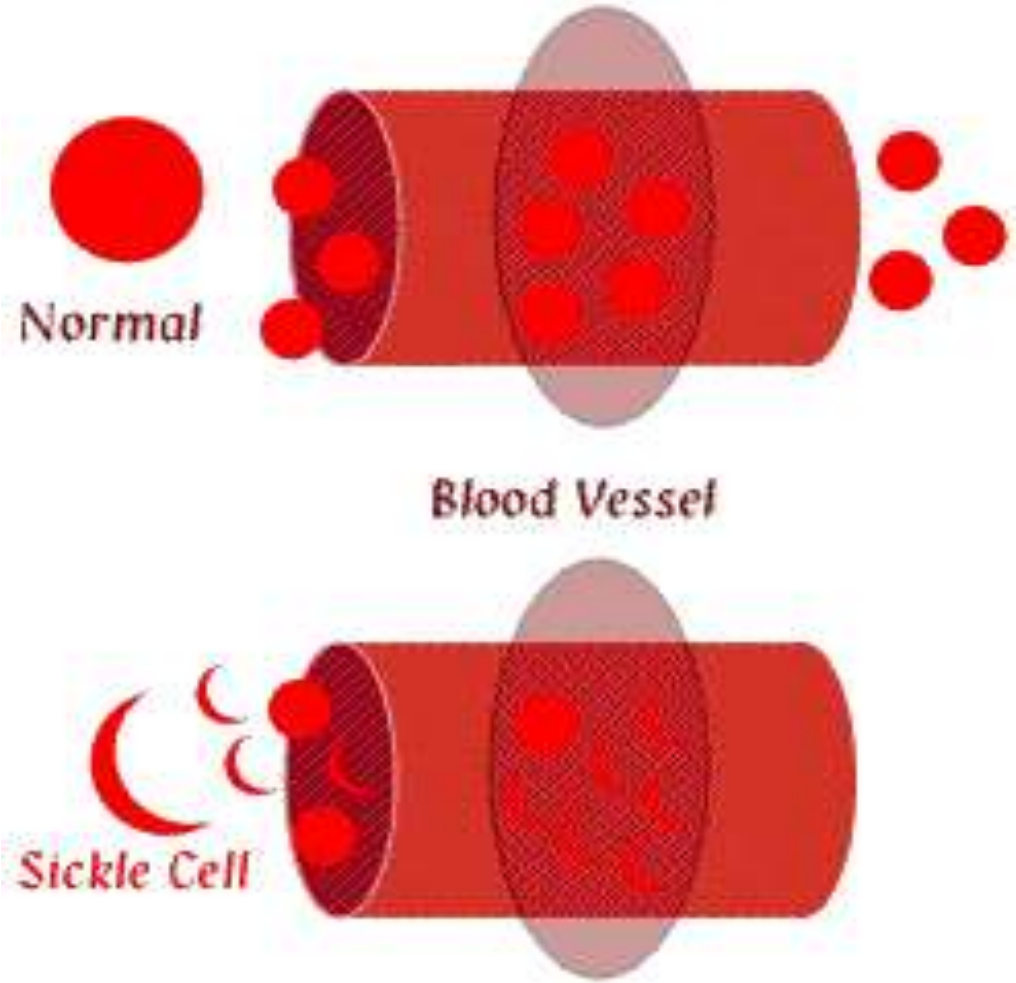


Cont…

- Sickle cells contain abnormal hemoglobin called sickle hemoglobin or hemoglobin S. Sickle hemoglobin causes the cells to develop a sickle, or crescent, shape.

- Sickle cells are stiff and sticky. They tend to block blood flow in the blood vessels of the limbs and organs. Blocked blood flow can cause pain and organ damage. It can also raise the risk for infection.

Sickle cell anemia



Sign & Symptoms

- The most common symptom of anemia is fatigue.
- Other signs and symptoms of anemia include:

✓ Shortness of breath
✓ Dizziness
✓ Headaches
✓ Coldness in the hands and feet
✓ Paler than normal skin or mucous membranes
✓ Jaundice

Nursing Management

- The goal of treatment is to manage and control symptoms, and to limit the number of crises. People with sickle cell disease need ongoing treatment, even when not having a crisis.
- People with this condition should take folic acid supplements. Folic acid helps make new red blood cells. Blood transfusions (may also be given regularly to prevent stroke)
- Pain medicines
- Plenty of fluids

Cont…

- Antibiotics, which help prevent bacterial infections that are common in children with sickle cell disease
- Medicines that reduce the amount of iron in the body People with sickle cell disease should have the following vaccinations to lower the risk of infection:
- Haemophilus influenzae vaccine (Hib)
- Pneumococcal conjugate vaccine (PCV)
- Pneumococcal polysaccharide vaccine (PPV)

- cause and the severity
- iron supplements
- investigations
- hospitalization and transfusion of red blood cells

Medications

- Iron
- Vitamin supplements
- Erythropoietin injection
- Stopping a medication that may be the cause of anaemia

Anaemia Prevention

- eating a healthy diet and limiting alcohol use.
- seeing a doctor regularly and when problems arise
- routine blood work







NURSING DIAGNOSiS

- Activity intolerance related to weakness, fatigue, and general malaise
- Altered nutritional Level, less than body requirements, related to inadequate intake of essential nutrients
- Ineffective tissue perfusion related to inadequate blood volume or HCT
- Ineffective Family Coping related to disabling and life-threatening disease

Nursing Interventions

MANAGING FATIGUE

- Assist the patient to prioritize activities and to establish a balance between activity and rest.
- Patients with chronic anaemia need to maintain some physical activity and exercise to prevent the deconditioning that results from inactivity.

Conti…

MAINTAINING ADEQUATE NUTRITION

- A healthy diet should be encouraged.
- Because alcohol interferes with the utilization of essential nutrients, the nurse should advise the patient to avoid alcoholic beverages or to limit their intake and should provide the rationale for this recommendation.
- Dietary teaching sessions should be individualized, including cultural aspects related to food preferences and food preparation.

Conti…

MAINTAINING ADEQUATE PERFUSION

- Lost volume is replaced with transfusions or intravenous fluids, based on the symptoms and the laboratory findings.
- Supplemental oxygen may be necessary, but it is rarely needed on a long-term basis unless there is underlying severe cardiac or pulmonary disease as well.
- The nurse monitors vital signs closely;
- other medications, such as antihypertensive agents, may need to be adjusted or withheld.

Conti…

PROMOTING COMPLIANCE WITH PRESCRIBED THERAPY

- Patients need to understand the purpose of the medication, how to take the medication and over what time period, and how to manage any side effects of therapy.
- To enhance compliance, the nurse can assist patients in developing ways to incorporate the therapeutic plan into their lives, rather than merely giving the patient a list of instructions.

Conti…

MONITORING AND MANAGING POTENTIAL COMPLICATIONS

- Assess for signs and symptoms of heart failure.
- A serial record of body weights can be more useful than a record of dietary intake and output, because the intake and output measurements may not be accurate.
- In the case of fluid retention resulting from congestive heart failure, diuretics may be required.
- In megaloblastic forms of anaemia, the significant potential complications are neurologic.
- A neurologic assessment should be performed for patients with known or suspected megaloblastic anaemia.

Conti…

- Provide blankets and warm clothing to increase comfort and aid circulation.
- Notify physician if excessive vomiting, coughing or straining at stools occurs so that medication can be prescribed to alleviate symptom.
- Avoid aspirin-containing products to prevent bleeding.

Conti…

- Avoid contact on gingival when brushing and flossing teeth.
- Avoid situations in which trauma may occur, such as shaving with straight-edge razor,and ambulating after taking medication
- Avoid purseful sexual intercourse and use adequate lubrication.

Conti…

- Use of stool softeners or laxative
- Ascorbic acid (Vitamin C) promotes iron absorption, thus iron preparations should be taken with orange juice.
- Bowel movements will be black from excess iron excretion.
- Iron supplements usually given for at least 6 months to restore body stores.

Conti…

- Keep skin clean and bedclothes dry.
- Encourage diet high in protein, vitamins, and minerals.
- Encourage cool, bland foods; flavored ices and ice cream are well tolerated.
- Monitor Hb/Hct and assess whether other factors (e.g., nutritional deficiencies, fluid and electrolyte disorders, depression, etc.)
- Assess activity schedule and suggest daily activities that allow for rest periods.
- Transfuse whole blood and packed red blood cells as ordered by physician.

Conti…

- Avoid rectal thermometers, suppositories, and enemas.
- Avoid heating pads or hot water bottles.
- Iron salts are gastric irritants and should always be taken following meals.
- Iron preparation taken on empty stomach cause dyspepsia, abdominal discomfort, and diarrhoea
- Liquid iron preparations should be well diluted and taken through a straw (undiluted liquid iron stains teeth).

PATIENT EDUCATION
Taking Iron Supplements

- Take iron on an empty stomach (1 hour before or 2 hours after a meal).
- Start with only one tablet per day for a few days, then increase to two tablets per day, then three tablets per day
- Increase the intake of vitamin C (citrus fruits and juices, strawberries , tomatoes, broccoli), to enhance iron absorption.
- Eat foods high in fiber to minimize problems with constipation.
- Remember that stools will become dark in colour.