Interpretation of RBCs Count (Anemia)

By

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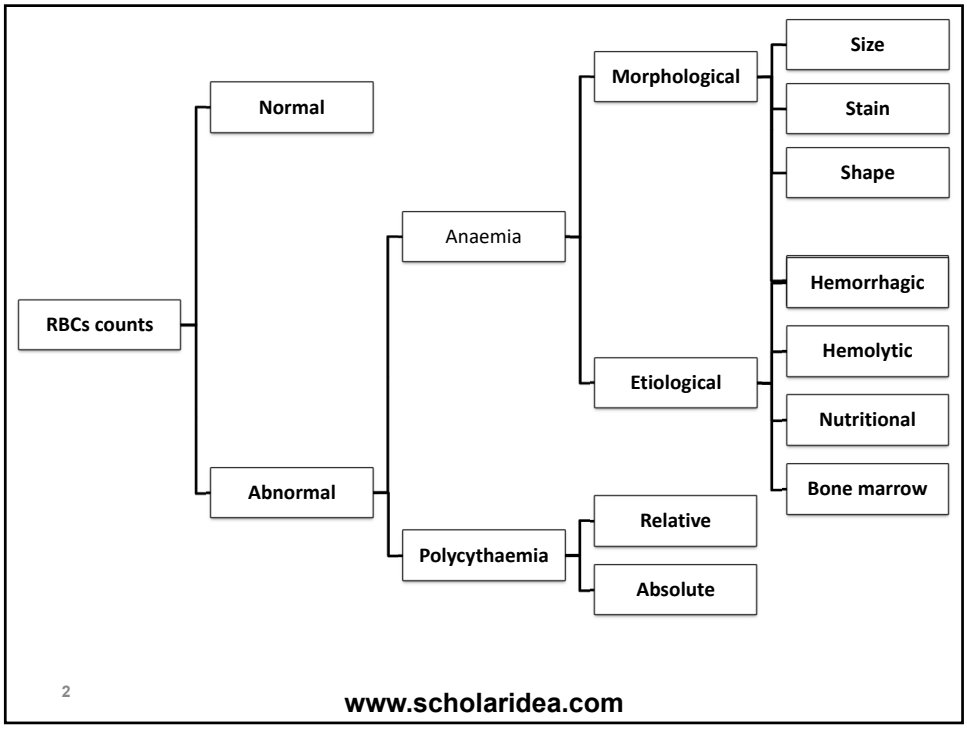

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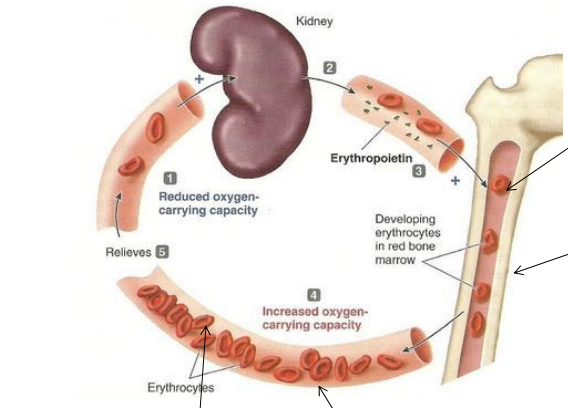
Anemia

Anaemia is a reduction below normal in the number of erythrocytes or hemoglobin concentration or both in the circulating blood per unit volume of blood.

Diagnosis of anemia

- Red blood cells count.
- Hemoglobin concentration.
- Packed cell volume.
- Mean corpuscular values.
- Stained blood smear.

Basics of Classification of Anemia



Hypoplastic anemia

- Iron
- Copper
- Vit. B12
- Folic acid
- Cobalt
- Protein

Hemolytic anemia

Hemorrhagic anemia

Nutritional deficiency anemia

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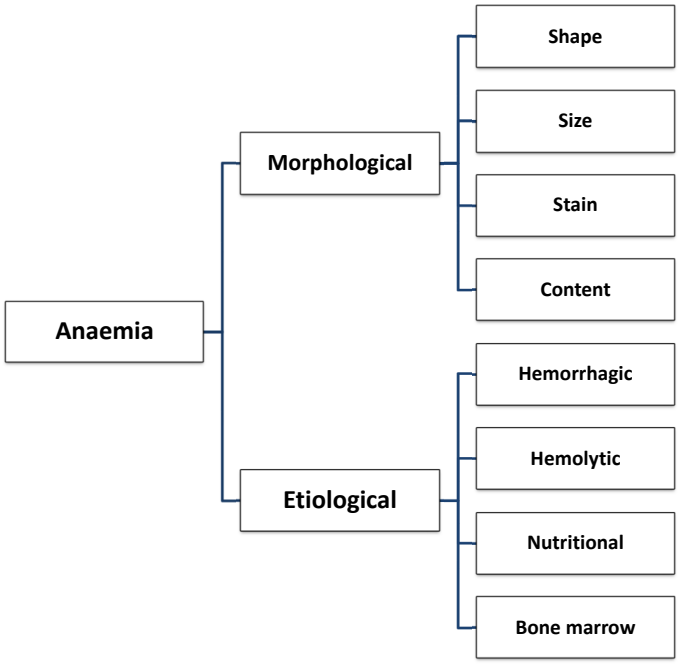

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Morphological classification of anemia

- Abnormalities in shape
- Abnormalities in size
- Abnormalities in stain
- Inclusion bodies of erythrocytes

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7

Abnormalities in shape of the erythrocytes (Poikilocytosis)

1. Elliptocytes
2. Spherocyes
3. Ovalocytes
4. Target cell
5. Nucleated

6. Tear Drop cell
7. Crenation
8. Eccentrocytes

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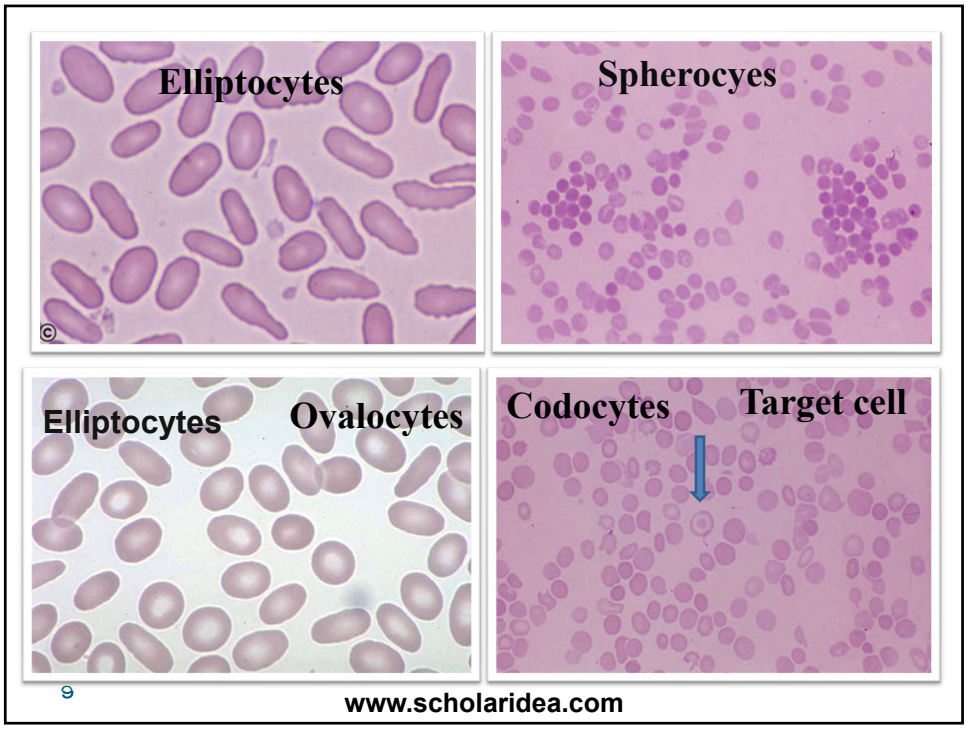
Elliptocytes
Spherocyes
Elliptocytes
Ovalocytes
Codocytes
Target cell
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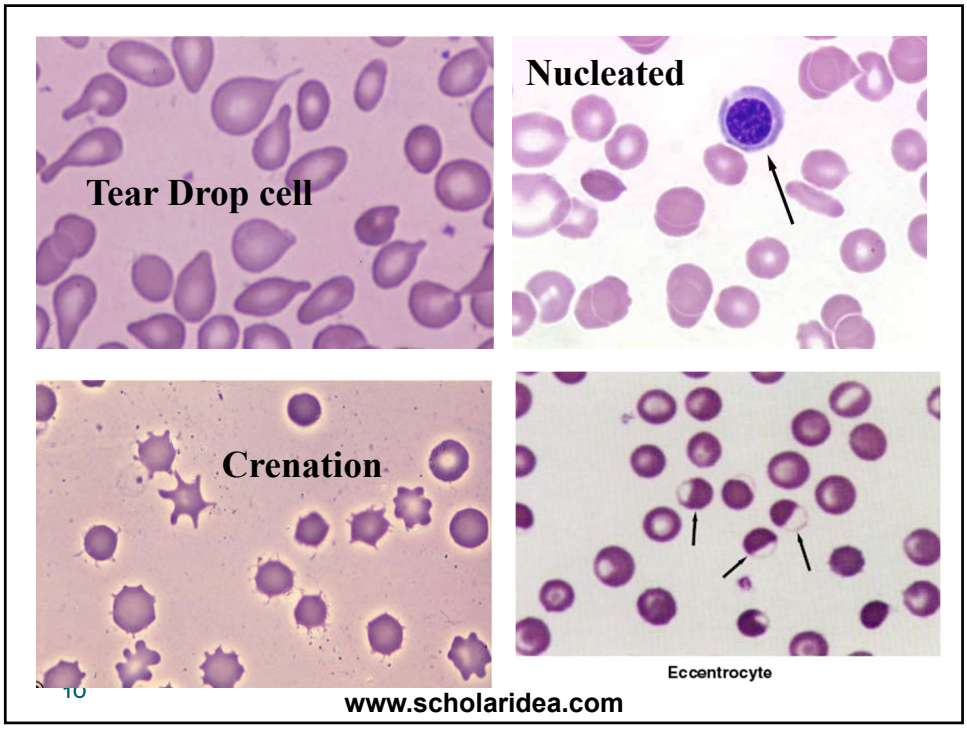
Tear Drop cell
Nucleated
Crenation
Eccentrocyte
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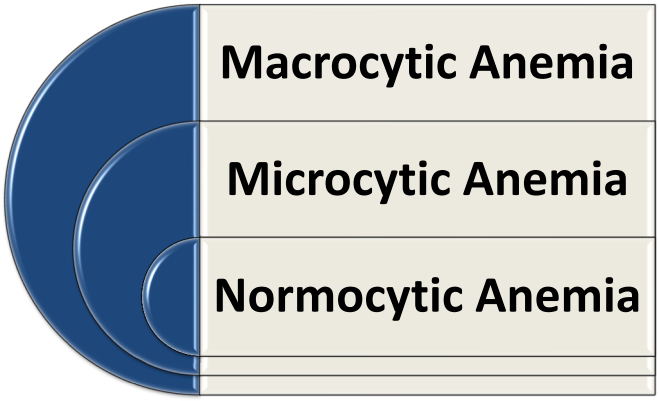
Abnormalities in size and stain

Abnormalities in size (anisocytosis)

Mean Corpuscular Volume (MCV)



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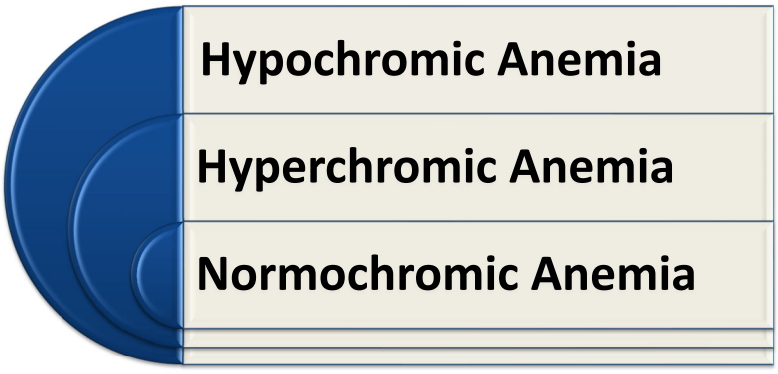
Abnormalities in stain

Mean Corpuscular Hemoglobin (MCH)

Mean Corpuscular Hemoglobin concentration (MCHC)



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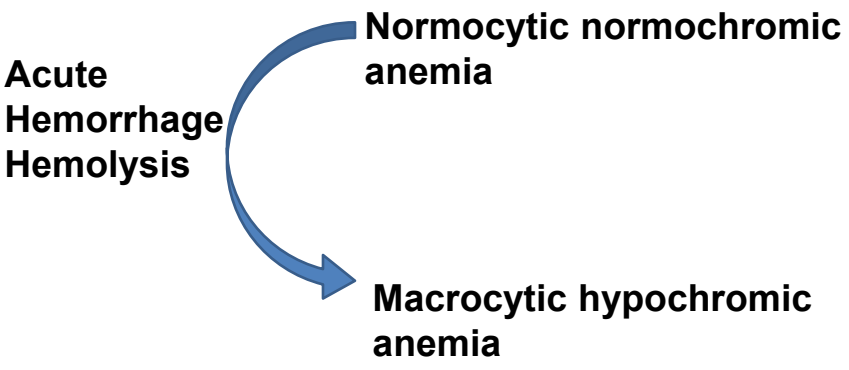
Microcytic Hypochromic anemia

- Deficiency of Iron.
- Deficiency of Copper.
- Molybdenum Poisoning.
- Chronic Blood Loss.

13

13

Macrocytic Hypochromic anemia



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Macrocytic normochromic anemia

- Pernicious Anemia
- Deficiency of Cobalt

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15

Abnormalities in content of the red blood cell

Inclusion bodies of erythrocytes:

1. Reticulocytes.
2. Basophilic stippling.
3. Howell Jolly body.
4. Heinz bodies.
5. Distemper inclusion bodies.
6. Protozoal parasites.

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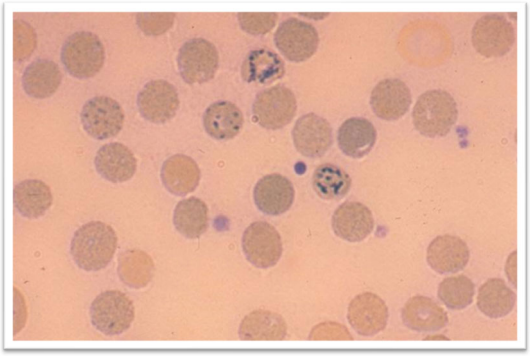
1. Reticulocytes

Reticulocyte is a non-nucleated cell of the erythrocytic series, which when stained with brilliant cresyl blue, present one or more granules or diffuse network of fibrils.



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The reticulocytes differ from erythrocytes in:

A. **Larger in size**
B. **More resistant to crenation.**
C. **Has a lower specific gravity.**
D. **More resistant to hypotonic saline solution.**
E. **Reticulocytes don't participate in Rouleux formation.**

Reticulocytosis: Occur in cases of acute hemorrhage or hemolytic anaemia.

18

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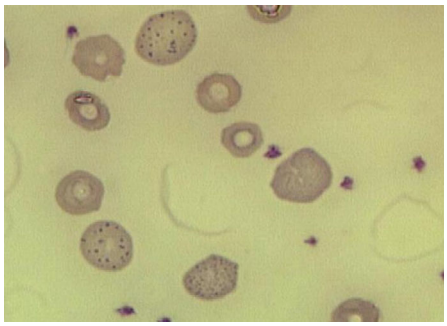
2. Basophilic stippling

A condition of the erythrocyte in which blue staining basophilic granules are scattered over the cell.

- Punctuate basophilic granules.
- Diffuse basophilic granules



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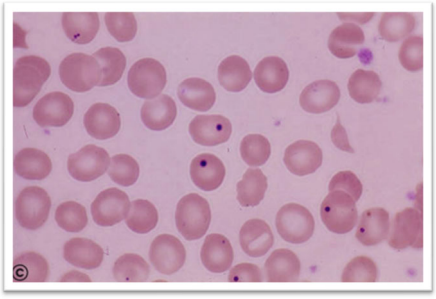
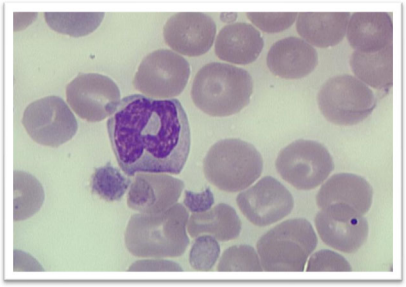
3. Howell Jolly body

This is a nuclear remnant of 1-2 microns in diameter.

In a Giemsa stained smear, Howell jolly bodies appear as single and at times double spherical bluish bodies within red blood cells.





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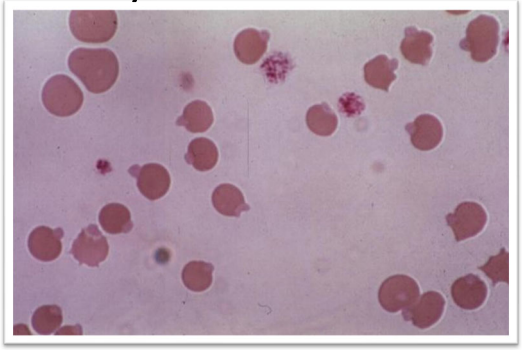
4. Heinz bodies

Heinz bodies are small, round to irregularly shaped inclusion bodies.

They formed within the RBCs of man and animals exposed to toxic drugs and chemicals and often resulting in hemolytic anaemia.



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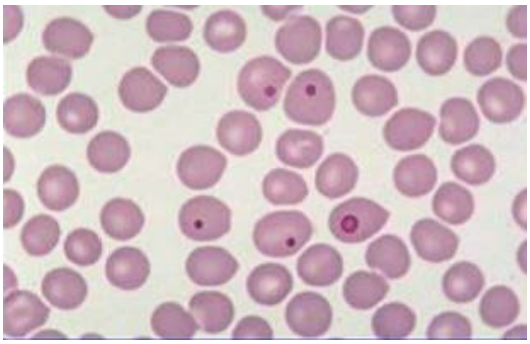
5. Distemper inclusion bodies

- In Giemsa or Leishman stained blood film, the inclusion bodies take a pale blue stain, and it is larger than Howell jolly bodies.



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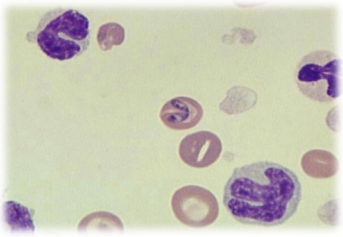
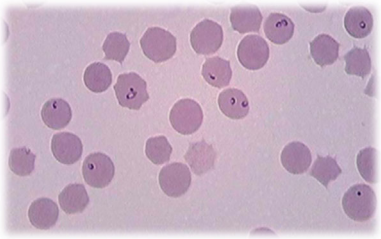
6. Protozoal parasites

***Babesia* Sp.**



***Theileria* Sp.**



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23

Etiological Classification of Anemia

- Hemorrhagic anemia
- Hemolytic anemia
- Nutritional Deficiency anemia
- Pathological anemia

24

24

1. Hemorrhagic anemia

In hemorrhagic anemia, circulating red cell lifespan is normal but red cells are lost from the body due to external bleeding.

The availability of iron for incorporation into hemoglobin directly influences the rate of red cell production.

Cases of chronic blood loss may be non-regenerative because of the lack of iron.

25

25

1. Hemorrhagic anemia

a) Acute hemorrhagic anaemia

b) Chronic hemorrhagic anemia

Acute hemorrhagic anaemia

The anaemia of acute blood loss occurs when large proportion generally 25% of the circulating blood volume is lost in a period of several minutes to several hours.

26

26

Causes of acute hemorrhagic anaemia

- Trauma, cutting of major blood vessel or surgery.
- Hemorrhage from highly vascular malignant neoplasm especially hemangio-endotheliomas.
- Defect of coagulation mechanisms such that occur with:
  - Sweet clover poisoning.
  - Warfarin poisoning.
  - Bracken fern poisoning.

27

27

b. Chronic hemorrhagic anaemia

Causes

1. Internal parasites such as stomach worm, hock worms, coccidia, and liver flukes, which produce anaemia by combination of blood loss and poor nutrition.
2. External parasites such as ticks, blood sucking lice and certain types of flea.

28

28

3. Hemorrhagic gastritis and enteritis.
4. Gastric ulcer.
5. Chronic hemorrhage in the genitourinary tract.
6. Hemorrhage into body cavities from neoplasm.

29

29

Laboratory findings of chronic hemorrhagic anaemia:

- Anisocytosis.
- Decrease RBCs count, Hb and PCV.
- Decrease serum iron level.
- Decrease serum ferritin level.
- Increase serum transferrin.
- Decrease MCV.
- Decrease MCH.

30

30

2- Haemolytic anaemia

This type of anaemia is associated with excessive destruction of erythrocytes.

Causes

1. Blood parasites.
2. Bacterial infection.
3. Viral infection.
4. Chemical agents
5. Some metabolic diseases
6. Poisonous plants.
7. Immune mediated diseases.

31

31

1. Blood parasites

- **Babesia sp.**

2. Bacterial infection

- **There are two common bacterial infection in which anaemia occurs which are *leptospirosis* and *Clostridium haemolyticum* infection.**

32

32

3. Viral infection

- Equine infectious anaemia characterized by chronic illness. Animal infected with the virus become carrier.
- Clinically the disease is characterized by an intermittent fever, jaundice, oedema and petechial haemorrhages in the mucosa.

4. Chemical agents

Copper Toxicity

Phenothiazine

33

33

5. Some metabolic diseases

- Post-parturient haemoglobinuria
- Cold haemoglobinuria

6. Poisonous plants

Caster bean

34

34

7. Immune mediated diseases

A. **Autoimmune haemolytic anaemia:** Where the body forms antibodies against its own RBCs.

B. **Isoimmunne haemolytic anaemia:** The antibodies against RBCs come from another individual which either:

- **Incompatible blood transfusion**
- **Neonatal isoerythrolysis.**

35

35

Laboratory findings of hemolytic anaemia:

- Decrease RBCs count, Hb and PCV.
- Increase total bilirubin and indirect bilirubin levels (Jaundice).
- Decrease haptoglobin level.
- Hemoglobinuria.
- Increase urobilinogen in urine.
- Anisocytosis.
- Increase MCV.
- Decrease MCH.

36

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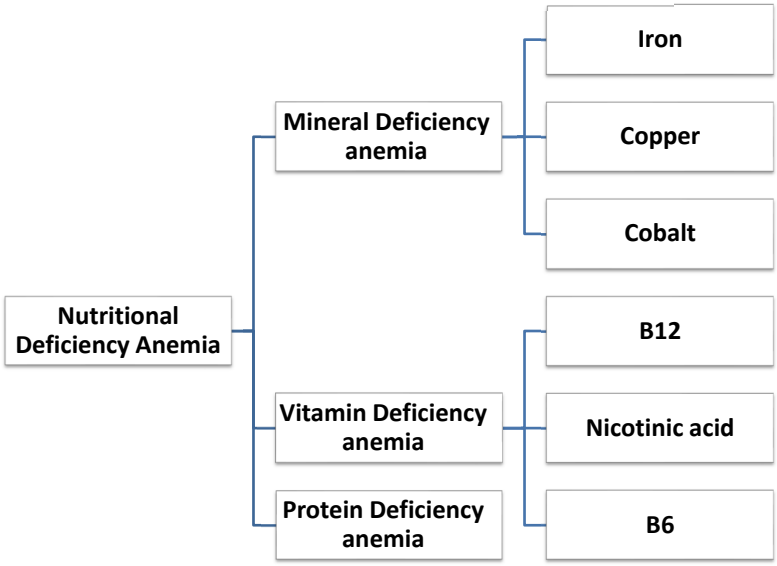
3- Nutritional deficiency anaemia



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Iron Deficiency anemia

- Deficiency of Iron.
- Deficiency of Copper.
- Molybdenum Poisoning.
- Chronic Blood Loss.

38

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Iron deficiency anaemia

- Anisocytosis.
- Decrease RBCs count, Hb and PCV.
- Decrease serum iron level.
- Decrease serum ferritin level.
- Increase serum transferrin.
- Decrease MCV.
- Decrease MCH.

39

39

4- Pathological Anemia

A. Hypoplastic anaemia

The hemopoietic tissues fail to produce the required number of erythrocytes to maintain the normal erythrocyte count in the circulating blood.

B. Aplastic anaemia

40

40

b. Aplastic anaemia

Failure of the bone marrow to produce erythrocytes.

Causes

1. **Radiation (X ray).**
2. **Certain chemicals as sulphonamides, chloramphenicol, lead, copper, arsenic and mercury.**
3. **Exhaustion of the bone marrow may follow chronic blood loss.**

41

41

Regenerative and none Regenerative anemia

Regenerative anemia is characterized by the presence of immature RBCs (reticulocytes) in the peripheral blood. Regenerative anemia is usually associate hemorrhagic (Blood loss) and hemolytic anemia.

42

42

Non-regenerative anemia is characterized by absence of immature RBCs from the peripheral blood.

- **Conditions characterized by non-regenerative anemia include:**
  - Anemia of inflammation, which is mild to moderate anemia.
  - Renal disease, due to the lack of erythropoietin and consequently decrease erythrocyte synthesis by the bone marrow.
  - Iron deficiency anemia, which characterized by microcytic hypochromic anemia.

43

43

Infectious and inflammatory diseases:

- As part of the immune response that occurs with infection and noninfectious inflammatory diseases, cells of the immune system release proteins called cytokines. These proteins help heal and defend the body against infection. But they can also affect normal body functions. Cytokines interfere with the body's ability to absorb and use iron. Cytokines may also interfere with the production and normal activity of erythropoietin (EPO), a hormone made by the kidneys that stimulates bone marrow to produce RBCs.

44

44

Myelophthisic anemia

Myelophthisic anemia is due to the infiltration of abnormal cells into the bone marrow and subsequent destruction and replacement of normal hematopoietic cells.

With disruption of normal bone marrow architecture by the infiltrating cells, the marrow releases immature hematopoietic cells. Furthermore, because of the unfavorable bone marrow environment, stem and progenitor cells migrate to the spleen and liver and establish extramedullary hematopoietic sites.

45

45

Anemia due to reduced erythropoietin

In many cases of end-stage renal disease, erythropoietin production by the kidney is reduced. This results in normocytic, normochromic, nonregenerative anemia. In hypothyroid animals, there are also reductions in circulating erythropoietin primarily because of reduced metabolic demands for oxygen at the tissue level. Once again, the net effect is normocytic, normochromic, nonregenerative anemia.

46

46

Anemia due to marrow toxicity

Marrow cytotoxicity can be caused by both infectious and noninfectious etiologies.

Noninfectious causes of marrow cytotoxicity such as cancer chemotherapeutic agent, and ionizing radiation, some antibiotics and heavy metals.

The peripheral blood indicator of marrow toxicity is progressive cytopenia of one or more cell lines.

47

47

Anemia due to marrow toxicity

Clinical signs depend upon which cell lines are affected and how severely. In the case of red cells, the degree of anemia can be quite severe and is non-regenerative. Patient with this kind of anemia are lethargic with extremely pale mucous membranes.

Patient with severe thrombocytopenia may be present with bleeding disorders while those with severe granulocytopenia may be presented with secondary inflammatory conditions.

48

48

Handouts of the Lecture is

The Video of the Lecture is Available on

49