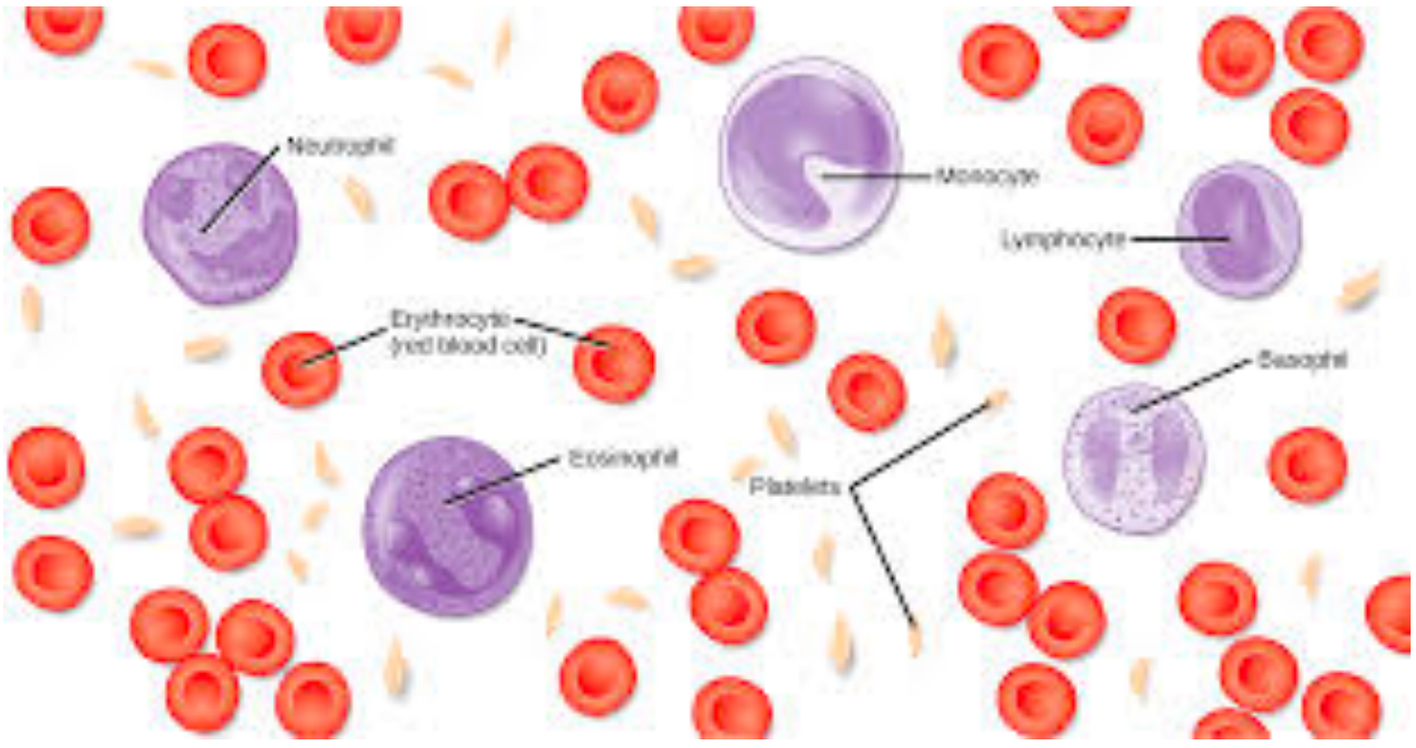
Diseases characterized by abnormalities of the cellular elements of the blood



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[I] Anemia

•It is a reduction in the number of erythrocytes, hemoglobin (Hb) or both in circulating blood.

•**Causes**

(1) Excessive loss of blood by hemorrhage.
(2) Insufficient production or excessive destruction of erythrocytes.

Etiological classification of anemia:

[1] Hemorrhagic or blood loss anemia

(1) Acute in cases of trauma, surgery or defects of the coagulation mechanism.

(2) Simple chronic or secondary anemia in cases of:

1) Internal parasites as hook worms, stomach worms, coccidia, nodular worm, liver fluke, strongylosis.

2) External parasites as ticks, some flea, blood suckling parasites.

3) GIT lesions as ulcer, hemorrhagic gastritis, enteritis.

4) Urogenital tract bleeding as nephritis, uremia, excessive esterus hemorrhage.

Hemorrhagic or blood loss anemia

[2] Hemolytic anemia

Due to destruction of red blood cells or shortened life span of erythrocytes in cases of:
(1) Blood parasites: Anaplasma, piroplasma, babesia, trypansoma.
(2) Bacterial infection: leptospirosis, bacillary hemoglobinuria.
(3) Viral infections: Equine infectious anemia.
(4) Chemical agents: Poisoning with copper, lead, phenothiazine & methylene blue.
(5) Poisonous plants: Caster bean, wild onion, kale.
(6) Hemolytic reptile poison: snake poison.
(7) Metabolic: Post parturient hemoglobinuria or hypophosphatemia, common in cattle which feed on diet rich in calcium &poor in phosphorus (Alfa alfa, berseem).
(8) Auto immune hemolytic anemia.
(9) Immune hemolytic anemia of the newborn due to mother & fetus antibodies incompatibility or due to hemolysin in the colostrum.
(10) Isoimmunization following multiple blood transfusions between animals.

Hemolytic anemia

[3] Hypoplastic anemia
Due to depression of bone marrow caused by:
(1) Physical agents: Irradiation from x-rays, radium, and radioactive isotopes.
(2) Chemical agents as estrogens, chloramphenical, sulphaguanidine, copper, lead, mercury.
(3) Biological toxin produced in course of chronic suppurative processes.
(4) Parasitic toxins produced by intestinal parasites (Taenia & Ascaris) or blood protozoa (Anaplasm, Theilaria, Trypansoma).
(5) Tumors of leukemic cells in the bone marrow or osteolytic tissue.

[4] Nutritional deficiency anemia: In cases of:

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(1) **Iron deficiency** in diet or pasture or malabsorption or severe chronic hemorrhage.

(2) **Copper deficiency** in diet or pasture or excessive molybdenum intake.

(3) **Cobalt deficiency** with decreased synthesis of vitamin B12 or diet or pasture deficient on cobalt (Vitamin B12 is erythrocyte maturing factor).

(4) **Vitamins deficiency:** Folic acid, riboflavin, pyridoxine, nicotic acid, and vitamin C.

(5) **Protein deficiency** due to insufficient intake or digestion of protein or marked serum protein loss.

Serial	Morphological classification		Etiological classification
	Size of RBC	Hb content	
[1]	Macrocytic	Normochromic	Cobalt & B_{12} deficiency
[2]	Macrocytic	Hypochromic	Anaplasma, Piroplasma leptospira, Bacillary Hb uria parturent Hb uria.
[3] or [4] or [5]	Normocytic Normocytic Microcytic	Normochromic Hypochromic Normochromic	1- Acute blood loss 2- Nephritis with terminal uremia 3- Subacute or chronic inflammatory diseases 4- Stomach worm infection (except Hemonchus causes blood loss). 5- Leukemia 6- Hypoplastic anemia, radiation, injury or soybean meal poisoning
[6]	Microcytic	Hypochromic	1- Deficiency of iron 2- Defect in utilization of iron stores of body in copper deficiency or molybdenum poisoning.

Pathogenesis

(1)Anemic anoxia may follow anemia which compensated by increase in depth of respiration (to take more oxygen) & increase in cardiac output due to increase in stroke volume &heart rate & a decrease in circulation time.

(2)Severe hemolytic anemia causes Hb urea, nephrosis & depression of renal function.

(3)In severe hemorrhage, loss plasma protein & decrease of blood volume occur, resulting in dehydration & hypovolemia.

General symptoms of anemia

(1) Pale mucous membranes, muscular weakness, depression, inability to work, sweating & cold extremities.
(2) Increase respiratory depth, but normal rates.
(3) Increase intensity of pulse, heart sound & rate.
(4) In chronic blood loss, there are general weakness, incoordination, anorexia, sweating, respiratory embracement &cold extremities.
(5) In severe hemolytic anemia; muscular tremors, labored respiration (air hunger), subnormal temperature even death may be occur due to anoxia.

(6) In acute post hemorrhagic anemia, symptoms develop rapidly with fainting & convulsions before death.
(7) In piroplasmosis &spleenomegaly Jaundice may be occur.
(8) In rapid hemolysis (^destruction of 40-50% RBCs, hemoglobinuria occurs.
(9) In late stage there are:
1) Rapid pulse but heart sounds & beats are weak with low intensity.
2) SC edema of thorax, abdomen & limbs.
3) Dyspnea, cold extremities, fainting & convulsion occur followed by death.

Clinical pathology

- Decrease blood levels of Hb (50% or lower), RBCs &
- PCV. In aplastic anemia, low level of mature & immature
- RBCs occur.

Diagnosis

Depend on symptoms & clinical pathology.

Treatment

(1) Treat the real cause (parasite, bacteria).
(2) Blood transfusion in acute or chronic anemia,
(3) Oral &IV sodium bicarbonate (2%) to facilitate elimination of Hb by kidneys.
(4) In nutritional anemia, use diets contain iron, copper, cobalt, protein & vitamins.
(5) In all cases of anemia give hematonics, polyvitamins, vitamins B12, folic acid & liver extract.