# HUMAN ANATOMY AND PHYSIOLOGY 1(BP101T)

## UNIT: 3 BODY FLUIDS AND BLOOD

## CLASS:6

## TOPIC: DISORDERS OF BLOOD

**POLYCYTHAEMIA:** There are an abnormally large number of erythrocytes in blood. The normal erythrocytes count in blood is:

In male: 4.5×1012 /L to 6.5×1012 /L or 4.5-6.5 millions/mm3.

In female: 3.8×1012 /L to 5.8×1012 /L or 3.8-5.8 millions/mm3.

The increased number of erythrocytes causing increase in blood viscosity slows the rate of flow and increases the risk of intravascular clotting, ischemia and infarction.

**REASONS:**

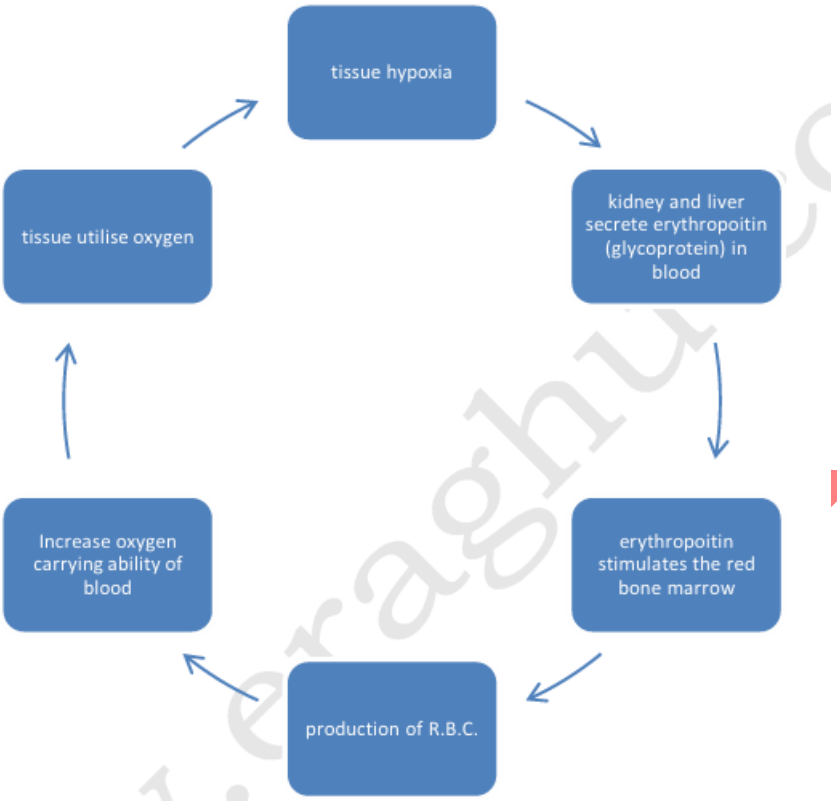
The increase in erythrocyte count is two types:

1) **RELATIVE INCREASE IN ERYTHROCYTE COUNT:** this occurs when the erythrocyte count is normal but the blood volume is reduced due to blood loss. Ex: excessive serum exudates from extensive burns.
2) **TRUE INCREASE IN ERYTHROCYTE COUNT:** It may be physiological or pathological.

   **a) Physiological:** Prolonged hypoxia stimulates erythropoisis and the number of cells released in to blood is increased. This occurs in people living at high altitude where the oxygen tension in air is low and partial pressure of oxygen in the alveoli of the lungs is correspondingly low.

**b) Pathological:** The reason for this increase in the circulating red cells some times to twice the normal number is known. It may be secondary to other factors that cause hypoxia of the red bone marrow.

Ex: Cigarette smoking, Pulmonary disease, Bone marrow cancer.




## LEUKEMIA:

Leukemia is a malignant proliferation of white blood cell precursors by the bone marrow. It results in the uncontrolled increase in the production of leucocytes and/or their precursors. As the tumor cells enter the blood the total leukocyte count is usually raised. Due to increased production of leucocytes, the production of RBC and plate count will be decreases. The proliferation of immature leukemic blast cells crowds out other blood cells formed in bone marrow causing :-

- Anaemia

- Thrombocytopenia
- Leucopenia

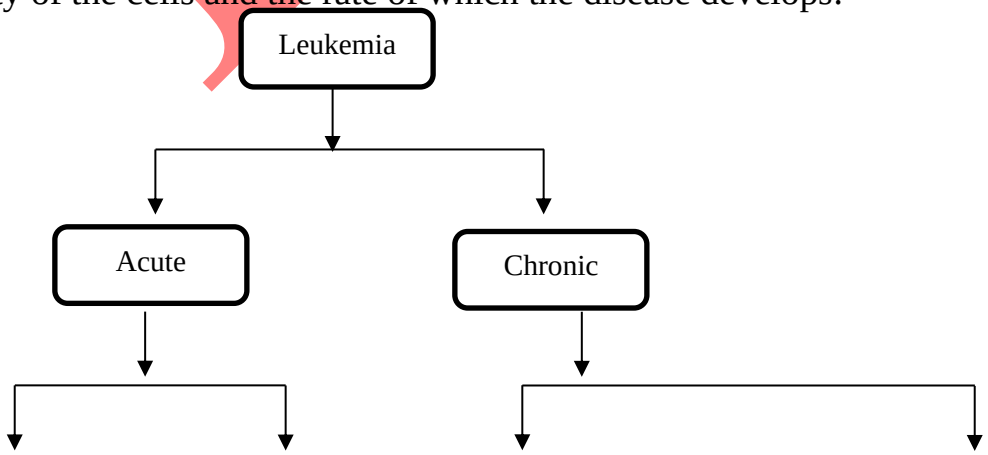
Because the leukocytes are immature when released, immunity is reduced and the risk of infection high.

**CAUSES OF LEUKAEMIA:** some known causes are:

- **Ionizing radiation:** Radiations such as that produced by X-rays and radioactive isotopes causes malignant changes in the precursors of white blood cells. The DNA of the cells may be damaged and some cells die while others reproducing at an abnormally rapid rate. Leukemia may be developed at any time after radiation, even 20 years or more years later.
- **Chemicals:** Some of the chemicals encountered in the general or work environment or work environment alter the DNA of the white cells precursors in the bone marrow. These include benzene and its derivatives, asbestos, cytotoxic drugs, chloramphenicol.
- **Genetic factors:** The identical twins of leukemia sufferers have a much higher risk than normal of developing the disease this is due to the involvement of genetic factor.

**TYPES OF LEUKAEMIA:**

LEUKEMIA is usually classified according to the type of cell involved, the maturity of the cells and the rate of which the disease develops:



| | | | |
|---|---|---|---|
| Acute myeloblastic Leukemia | Acute lymphoblastic leukaemia | Chronic myeloid leukemia | Acute lymphocytic leukaemia |

**ACUTE LEUKEMIA:** These types usually have onset and affect the poorly differentiated and immature blast cells. They are aggressive tumors that reach a climax within a few weeks or months. The rapid progress of bone marrow invasion impairs its function and culminates in anaemia, hemorrhage and susceptibility to infection. The mucous membranes of the mouth and upper GI TRACT are most commonly affected.

**A) ACUTE MYELOBLASTIC LEUKEMIA (AMC):** It involves proliferation of myeloblasts and is most common in adults between the ages of 25 and 60 risk gradually increases with age. The disease can often be cured or long-term remission achieved.

**B) ACUTE LYMPHOBLASTIC LEUKEMIA (ALL):** It is seen mainly in children, who have a better prognosis than adults, with up to 70% achieving cure. The cell responsible here is a primitive B- Lymphocytes.

**CHRONIC LEUKEMIA:** This condition is less aggressive than the acute forms and the leukocytes are more differentiated.

**A) CHRONIC MYELOID LEUKEMIA (CML):** Occurs at any ages and, although its onset is gradual, in most patients. Eventually transforms into a rapid progressive stage similar to AML and become fatal death usually occurs within five years.

**B) CHRONIC LYMPHOCYTIC LEUKEMIA:** Involves proliferation of B-Lymphocytes and is usually less aggressive than (CML), and it is most often seen in the elderly, disease progression is usually slow, and survival times can be as long as 25 years.

**THROMBOCYTOPENIA:** This is defined as a blood platelet count below 30,000 cells /mm3 . The normal count of platelets are 2, 00,000 to 4, 00,000 cells /mm3.

The count of platelets decreased due to following reasons:

a) **Reduced platelet production:** This is due to bone marrow deficiencies and therefore production of erythrocytes and leucocytes is also reduced.

**Reasons:**

- Platelet being crowded out of the bone marrow in bone marrow diseases. Ex: leukemia, pernicious anaemia, malignant tumors
- Ionizing radiation ex: x-rays or radioactive isotopes, which damage the rapidly divided precursors cells in the bone marrow.
- Drugs that cause damage to bone marrow ex: cytotoxic drugs, chloramphenicol, chlorpromazine, sulphonamides.

b) **Increased platelet destruction:** A reduced platelet count when production of new cells does not takes place with destruction or damage of worn-out cells.

- This occurs in “disseminated intravascular coagulation” and “autoimmune thrombocytopenic purpurea”
- Autoimmune thrombocytopenic purpurea: this condition usually affects children and young adults may trigger by a viral infection such as measles, dengue etc. the antiplatelet antibodies are formed that coat platelets, which leading to platelet destruction and they are removed from the circulation.
- Significant feature of this disease is purpurea.

## PURPUREA / PURPURA:

This is defined as a blood platelet count below 30,000 cells /mm3 . The normal count of platelets are 2, 00,000 to 4, 00,000 cells /mm3

- This results in patechial hemorrhages which undergo colour change leaving a pigment at the end.
- The clotting time is normal but bleeding time increases and clot refuses to retract.
- The severity of the disease varies from mild bleeding into the skin to severe internal hemorrhage.
- When the platelet count is very low there may be severe bruising, haematuria, gastrointestinal bleeding or intracranial hemorrhages.
- Some drugs also cause purpurea like chloramphenicol, chlorpromazine, and some cytotoxic drugs.

**TYPES AND CAUSES OF PURPUREA:**

The purpurea is classified in to different types depending on causes.

**1) Thrombocytopenic purpurea:** This is due to the deficiency of platelets. In bone marrow disease, platelet production is affected leading to deficiency of platelets.

**2) Idiopathic Thrombocytopenic purpurea:** Purpurea due to unknown causes is called Idiopathic Thrombocytopenic purpurea. It is believed that platelet count decreases due to the development of antibodies against platelets, which occurs after blood transfusion.

**3) Thrombasthenic purpurea:** this is due to structural or functional abnormality of platelets. However, the platelet count is normal. This is characterized by normal clotting time, normal or prolonged bleeding time but defective clot retraction.

## AGRANULOCYTOSIS:

Extreme shortage or absence of granulocytes is called agranulocytosis. According to the type of cell reduced, it is named as follows:

**Neutropenia:** when number of neutrophylls are decreases. It is in severe cases leads to septicaemia and death.

**Septicaemia:** is the presence of significant number of active pathogen in the blood. Lymphopenia: when number of lymphocytes are decreases. Eosinopenia: when number of Eosinophils are decreases. This agranulocytosis causes the reduction in resistance against infection. The WBC count is goes down to 2000-1000 cells/ mm3 . It is caused by:

**1) Drugs:** cytotoxic drugs, phenothiazines, sulphonamides antibiotics.

**2) Irradiations:** damage to granulocytes precursors in the bone marrow. Ex: x-rays, radioactive isotopes.

**3) Diseases of red bone marrow:** like leukaemia, some anaemia.

4) Some microbial infections also decrease the count. During this condition the spleen is enlarged, excessive number of granulocytes are trapped. So the less number of granulocytes are present in circulation