1.polycythemia: Increase in Total RBC Mass Above Normal Range:

A. Erythrocytosis:

- Definition: Increased number of red blood cells (RBCs).

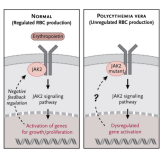
B. Relative Polycythemia:

- Causes:
- Secondary to decreased plasma volume (e.g., water deprivation, severe diarrhea, or use of diuretics).

2. Absolute Polycythemia (True Increase in RBC Mass):

- Definition: Increased RBC mass due to increased bone marrow production.

A. Primary Polycythemia (Polycythemia Vera):



- Causes:
- Autonomous high bone marrow production of RBCs.
- Low erythropoietin levels.
- Mutation in tyrosine kinase JAK2 in bone marrow stem cells, leading to less dependence on growth factors.
- Pathophysiology:
- Excessive proliferation of erythroid, myeloid cells, and megakaryocytes (panmyelosis).
- Erythrocytosis is most prominent, resulting in polycythemia.
- Symptoms:
- Splenomegaly (enlarged spleen).
- Plethora and cyanosis.
- Headache and dizziness (from hypertension).
- Slow circulation and hyperviscosity causing cyanosis, blurred vision, and tissue ischemia.
- Thrombosis or bleeding (due to disturbed function of von Willebrand factor).
- Pruritus (aquagenic, after water contact).
- Peptic ulcer, secondary gout (arthritis, kidney stones, tophi).
- Chronic disease.
- Spent phase: After 10 years, bone marrow becomes fibrotic, and hematopoiesis shifts to the spleen.
- Blast crisis: Rare transformation to acute myeloid leukemia.
- Diagnostic Findings:
- High hemoglobin concentration (>16.5 g/dL in men, >16 g/dL in women).
- High hematocrit (>49% in men, >48% in women).
- High RBC count, possibly masked by iron deficiency.
- Leukocytosis and thrombocytosis are common.
- JAK2 mutation.
- Low erythropoietin level.
- Hypercellular bone marrow with panmyelosis.

~~The~~ symptoms in green are common between primary and secondary.

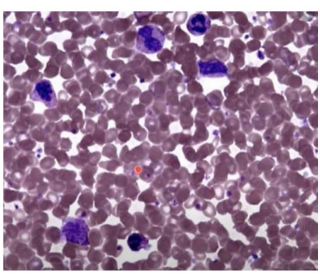
B. Secondary Polycythemia:

- Causes:
- Systemic Hypoxia: Leads to high erythropoietin levels and increased erythropoiesis.
- Adaptive Causes: Living at high altitude, cyanotic heart disease, chronic pulmonary diseases, sleep apnea.
- Paraneoplastic Causes: Renal cancer, liver cancer.
- Surreptitious Causes: Blood doping in endurance athletes.
- Alcohol consumption (frequent urination, depressed respiration).
- Smoking.
- Symptoms:
- No splenomegaly.

Plethora/ cyanosis
? Headache and dizziness (from hypertension)
? Slow circulation and hyperviscosity cause cyanosis, blurred vision, tissue ischemia
? Thrombosis, or bleeding (disturbed function of vWF

LABORATORY FINDINGS OF POLYCYTHEMIA

- High hemoglobin concentration (>16.5 g/dL in men, 16 in women) and high hematocrit (>49% in men, 48% in women)
- High RBCs count
- These tests might be masked if iron deficiency develops



- Peripheral blood smear in polycythemia: packed RBCs

Why does splenomegaly occur in primary polycythemia but not in secondary polycythemia?

Explanation:

- **Primary Polycythemia (Polycythemia Vera):**

In this condition, there is uncontrolled and excessive production of red blood cells (RBCs) due to a mutation in the JAK2 gene. This abnormal proliferation of RBCs, along with other blood cell types (like white blood cells and platelets), overwhelms the body's normal regulatory systems. The spleen becomes enlarged (splenomegaly) because it acts as a filtration organ to remove excess and abnormal blood cells. Additionally, in advanced stages (spent phase), the bone marrow becomes fibrotic, and hematopoiesis shifts to the spleen, further enlarging it.

- **Secondary Polycythemia:**

In secondary polycythemia, the increase in RBC production is a response to systemic hypoxia or other external factors (like high altitude or lung diseases). Erythropoietin levels are high, stimulating bone marrow to produce more RBCs. However, the process is regulated, and there is no abnormal proliferation of blood cells as seen in primary polycythemia. The spleen doesn't become overloaded with abnormal cells, so splenomegaly is typically absent.