

## ***Polycythemia***

**Polycythemia** : is an increased number of red blood cells in the blood. In polycythemia, the levels of hemoglobin , hematocrit , or the red blood cell (RBC) count may be elevated when measured in the complete blood count (CBC), as compared to normal. Hemoglobin levels greater than 16.5 g/dL in women and greater than 18.5 g/dL in men suggest polycythemia. In terms of hematocrit, a value greater than 48 in women and 52 in men is indicative of polycythemia.

Polycythemia can result from internal problems with the production of red blood cells. This is termed primary polycythemia. If polycythemia is caused due to another underlying medical problem, it is referred to as secondary polycythemia.

Most cases of polycythemia are secondary and are caused by another medical condition. Primary polycythemias are relatively rare.

### **Polycythemia Primary Causes:**

In primary polycythemia, inherent or acquired problems with red blood cell production lead to polycythemia. Two main conditions that belong to this category are polycythemia vera (PV) or polycythemia rubra vera [PRV].

1. **Polycythemia vera (PV)**: is related to a genetic mutation in the JAK2 gene, which is thought to increase the sensitivity of bone marrow cells to Epo, resulting in increased red blood cell production. Levels of other types of blood cells (white blood cells and platelets) are also often increased in this condition.
2. **Primary familial and congenital polycythemia (PFCP)**: is a condition related to a mutation in the EPOR gene and causes increased production of red blood cells in response to Epo.

### **Polycythemia Secondary Causes:**

Contrary to primary polycythemia in which overproduction of red blood cell results from increased sensitivity or responsiveness to Epo (often with lower than normal levels of Epo), in secondary polycythemia, more red cells are produced because of high levels of circulating Epo. The main reasons for higher than normal Epo are chronic hypoxia (poor blood oxygen levels over the long-term), poor oxygen delivery due to abnormal red blood cell structure, and tumors releasing incorrectly high amounts of Epo.

**Some of the common conditions that can result in elevated erythropoietin due to chronic hypoxia or poor oxygen supply include:**

- 1- chronic Obstructive Pulmonary Disease (COPD), emphysema, chronic bronchitis).
- 2- pulmonary hypertension.
- 3- hypoventilation syndrome.
- 4- congestive heart failure.
- 5- obstructive sleep apnea.
- 6- poor blood flow to the kidneys.
- 7- living in high altitudes.

**Certain tumors have a tendency to secrete inappropriately high amounts of Epo, leading to polycythemia. The common Epo-releasing tumors are:**

1. liver cancer (hepatocellular carcinoma),
2. kidney cancer (renal cell carcinoma),
3. adrenal adenoma or adenocarcinoma, and
4. uterine cancer.

### **Polycythemia Symptoms:**

Symptoms of polycythemia can vary widely. In some people with polycythemia, there may be no symptoms at all.

In secondary polycythemia, most of the symptoms are related to the underlying condition responsible for polycythemia.

**Symptoms of polycythemia vera** can be vague and quite general. Some of the important symptoms include:

- 1- easy bruising.
- 2- easy bleeding.
- 3- blood clot formation (potentially leading to heart attacks, strokes .
- 4- blood clots in the lungs [pulmonary embolism].
- 5- bone and joint pain (hip pain or rib pain).
- 6- headache.
- 7- itching.
- 8- itching after taking a shower or bath (post-bath pruritus).
- 9- fatigue.
- 10- dizziness.
- 11- abdominal pain.

## Diagnosis :

In the majority of instances, polycythemia may be detected incidentally in routine blood work ordered by a physician for an unrelated medical reason. This may then prompt advance search to find the cause of polycythemia.

In evaluating a patient with polycythemia, a complete medical history, physical examination, family history, and social and work-related history are very important. In the physical exam, special attention may be paid to the heart and lung exam. An **enlarged spleen** (splenomegaly) is one of the famous features of polycythemia vera; therefore, a careful abdominal exam to evaluate for an enlarged spleen is important.

Routine blood work including a complete blood count (CBC), clotting profile, and metabolic panel are basic components of laboratory tests in assessing the cause of polycythemia. Other typical tests to determine the potential causes of polycythemia include **chest X-rays, electrocardiogram (ECG)**, echocardiogram, hemoglobin analysis, and carbon monoxide measurement.

**In polycythemia vera**, usually other blood cells are also affected, represented by an abnormally high number of white blood cells (leukocytosis) and platelets (thrombocytosis). Bone marrow examinations (bone marrow aspiration or biopsy) are sometimes necessary to examine blood cell production in the bone marrow. Guidelines also recommend checking for the JAK2 gene mutation as a diagnostic standard for polycythemia vera.

Checking Epo levels are not required, but these can sometimes provide helpful information. In primary polycythemia, the Epo level is typically low, while in Epo-secreting tumors, the level may be higher than normal. The results need to be interpreted carefully as the Epo level may be appropriately high in response to chronic hypoxia, if that is the underlying cause of polycythemia.