Polycythemia Vera

Subjects: Genetics
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Definition

Polycythemia vera is a condition characterized by an increased number of red blood cells in the bloodstream. Affected individuals may also have excess white blood cells and blood clotting cells called platelets. These extra cells and platelets cause the blood to be thicker than normal. As a result, abnormal blood clots are more likely to form and block the flow of blood through arteries and veins. Individuals with polycythemia vera have an increased risk of deep vein thrombosis (DVT), a type of blood clot that occurs in the deep veins of the arms or legs. If a DVT travels through the bloodstream and lodges in the lungs, it can cause a life-threatening clot known as a pulmonary embolism (PE). Affected individuals also have an increased risk of heart attack and stroke caused by blood clots in the heart and brain.

1. Introduction

Polycythemia vera typically develops in adulthood, around age 60, although in rare cases it occurs in children and young adults. This condition may not cause any symptoms in its early stages. Some people with polycythemia vera experience headaches, dizziness, ringing in the ears (tinnitus), impaired vision, or itchy skin. Affected individuals frequently have reddened skin because of the extra red blood cells. Other complications of polycythemia vera include an enlarged spleen (splenomegaly), stomach ulcers, gout (a form of arthritis caused by a buildup of uric acid in the joints), heart disease, and cancer of blood-forming cells (leukemia).

2. Frequency

The prevalence of polycythemia vera varies worldwide. The condition affects an estimated 44 to 57 per 100,000 individuals in the United States. For unknown reasons, men develop polycythemia vera more frequently than women.

3. Causes

Mutations in the *JAK2* and *TET2* genes are associated with polycythemia vera. Although it remains unclear exactly what initiates polycythemia vera, researchers believe that it begins when mutations occur in the DNA of a hematopoietic stem cell. These stem cells are located in the bone marrow and have the potential to develop into red blood cells, white blood cells, and platelets. *JAK2* gene mutations seem to be particularly important for the development of polycythemia vera, as nearly all affected individuals have a mutation in this gene. The *JAK2* gene provides instructions for making a protein that promotes the growth and division (proliferation) of cells. The JAK2 protein is especially important for controlling the production of blood cells from hematopoietic stem cells.

JAK2 gene mutations result in the production of a JAK2 protein that is constantly turned on (constitutively activated), which increases production of blood cells and prolongs their survival. With so many extra cells in the bloodstream, abnormal blood clots are more likely to form. Thicker blood also flows more slowly throughout the body, which prevents organs from receiving enough oxygen. Many of the signs and symptoms of polycythemia vera are related to a shortage of oxygen in body tissues.

The function of the *TET2* gene is unknown. Although mutations in the *TET2* gene have been found in approximately 16 percent of people with polycythemia vera, it is unclear what role these mutations play in the development of the condition.

The Genes Associated with Polycythemia Vera

- JAK2
- TET2

4. Inheritance

Most cases of polycythemia vera are not inherited. This condition is associated with genetic changes that are somatic, which means they are acquired during a person's lifetime and are present only in certain cells.

In rare instances, polycythemia vera has been found to run in families. In some of these families, the risk of developing polycythemia vera appears to have an autosomal dominant pattern of inheritance. Autosomal dominant inheritance means that one copy of an altered gene in each cell is sufficient to increase the risk of developing polycythemia vera, although the cause of this condition in familial cases is unknown. In these families, people seem to inherit an increased risk of polycythemia vera, not the disease itself.

5. Other Names for This Condition

- Osler-Vaquez disease
- polycythemia ruba vera
- primary polycythemia
- PRV
- PV

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Keywords

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