Causes, Risk Factors, and Prevention

Risk Factors

A risk factor is anything that affects your chance of getting a disease such as cancer. Learn more about the risk factors for chronic myeloid leukemia.

- What Are the Risk Factors for Chronic Myeloid Leukemia?
- Do We Know What Causes Chronic Myeloid Leukemia?

Prevention

There is no known way to prevent most cases of chronic myeloid leukemia. Many types of cancer can be prevented by lifestyle changes to avoid certain risk factors, but this is not true for most cases of CML. The only potentially avoidable risk factor for CML is exposure to high doses of radiation, which is seen in only a few patients.

What Are the Risk Factors for Chronic Myeloid Leukemia?

A risk factor is something that affects a person's chance of getting a disease such as cancer. For example, exposing skin to strong sunlight is a risk factor for skin cancer. Smoking is a risk factor for a number of cancers. But risk factors are rarely absolute. Having a risk factor, or even several risk factors, does not mean that you will get the disease. And many people who get the disease may not have had any known risk factors.

The only risk factors for CML are:

- Radiation exposure: Being exposed to high-dose radiation (such as being a survivor of an atomic bomb blast or nuclear reactor accident)
increases the risk of getting CML

- **Age**: The risk of getting CML increases with age
- **Gender**: This disease is slightly more common in males than females, but it's not known why

There are no other proven risk factors for CML. The risk of getting CML does not seem to be affected by smoking, diet, exposure to chemicals, or infections. And CML does not run in families.

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**Do We Know What Causes Chronic Myeloid Leukemia?**

Normal human cells grow and function based mainly on the information contained in each cell's chromosomes. Chromosomes are long molecules of DNA in each cell. DNA is the chemical that carries our genes, the instructions for how our cells function. We look like our parents because they are the source of our DNA. But our genes affect more than the way we look.

Each time a cell prepares to divide into 2 new cells, it must make a new copy of the DNA in its chromosomes. This process is not perfect, and errors can occur that may affect genes within the DNA.

Some genes control when our cells grow and divide. Certain genes that promote cell growth and division are called **oncogenes**. Others that slow down cell division or cause cells to die at the right time are called **tumor suppressor genes**. Cancers can be caused by changes in DNA (mutations) that turn on oncogenes or turn off tumor suppressor genes.

During the past few years, scientists have made great progress in understanding how certain changes in DNA can cause normal bone marrow cells to become leukemia cells. In no cancer is this better understood than in chronic myeloid leukemia (CML).

Each human cell contains 23 pairs of chromosomes. Most cases of CML start when a "swapping" of chromosomal material (DNA) occurs between chromosomes 9 and 22 during cell division. Part of chromosome 9 goes to 22 and part of 22 goes to 9. This is known as a **translocation** and gives rise to a
chromosome 22 that is shorter than normal. This new abnormal chromosome is known as the Philadelphia chromosome. The Philadelphia chromosome is found in the leukemia cells of almost all patients with CML.

The swapping of DNA between the chromosomes leads to the formation of a new gene (an oncogene) called BCR-ABL. This gene then produces the BCR-ABL protein, which is the type of protein called a tyrosine kinase. This protein causes CML cells to grow and reproduce out of control.

In a very small number of CML patients, the leukemia cells have the BCR-ABL oncogene but not the Philadelphia chromosome. It is thought that the BCR-ABL gene must form in a different way in these people. In a very small number of people who seem to have CML, neither the Philadelphia chromosome nor the BCR-ABL oncogene can be found. They might have other, unknown oncogenes causing their disease and are not considered to truly have CML.

Sometimes people inherit DNA mutations from a parent that greatly increase their risk of getting certain types of cancer. But inherited mutations do not cause CML. DNA changes related to CML occur during the person's lifetime, rather than having been inherited before birth.

Can Chronic Myeloid Leukemia Be Prevented?

There is no known way to prevent most cases of chronic myeloid leukemia (CML). Many types of cancer can be prevented by lifestyle changes to avoid certain risk factors, but this is not true for most cases of CML. The only potentially avoidable risk factor for CML is exposure to high doses of radiation, which is seen in only a few patients.