

## Philadelphia chromosome- positive and Ph-Like ALL



### WHAT YOU NEED TO KNOW

You or your loved one has been diagnosed with:

- Philadelphia chromosome-positive ALL (Ph+ALL)
- or
- Philadelphia chromosome-like ALL (Ph-like ALL)

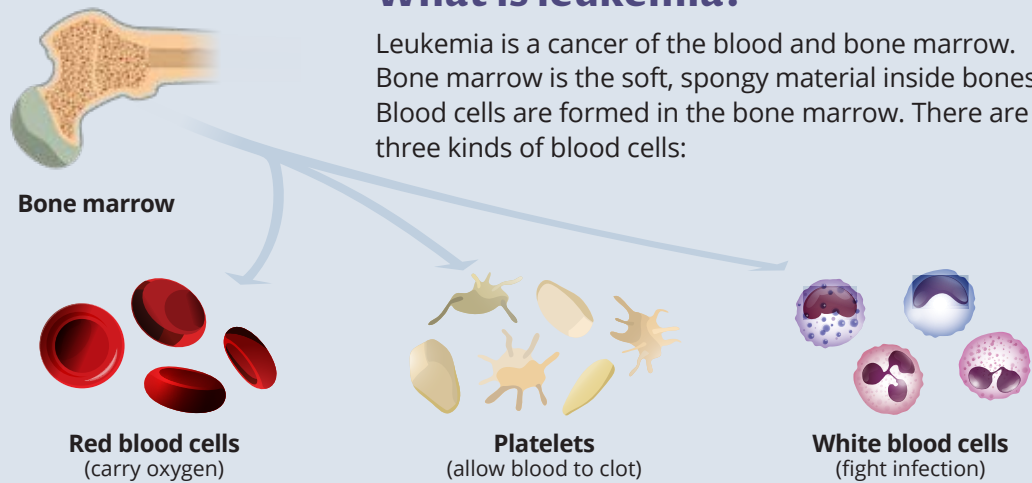
What does it mean and how will it affect you? This fact sheet will help you:

- Learn about ALL and the subtypes Ph+ALL and Ph-like ALL
- Find out how they are diagnosed
- Get an overview of treatment options
- Understand what happens next



## What is leukemia?

Leukemia is a cancer of the blood and bone marrow. Bone marrow is the soft, spongy material inside bones. Blood cells are formed in the bone marrow. There are three kinds of blood cells:



When you have leukemia, cancerous blood cells form and push out healthy blood cells.

### About ALL

- One of four main types of leukemia
- Affects immature white blood cells (lymphoblasts)
- Progresses quickly without treatment
- Can happen at any age but most often appears in youth under age 20

To diagnose ALL, your testing must show that at least 20% of your bone marrow contains lymphoblasts. Identifying the subtype of your disease is an important step to planning your treatment. Doctors can identify ALL cells through a unique set of proteins found on the surface of those cells.

### Subtype: Ph+ALL

- About 25% of adults with ALL have a specific subtype known as Ph-positive ALL
- The Philadelphia chromosome is an abnormality or rearrangement of chromosomes 9 and 22, creating the BCR-ABL1 fusion gene
- The abnormal gene produces a protein called tyrosine kinase that causes leukemia cells to grow and divide out of control
- About 2% to 4% of children with ALL have the subtype known as Philadelphia chromosome-positive ALL (Ph+ALL)

### Subtype: Ph-like ALL

- About 10% to 30% of adults with subtype B-cell ALL have genetic features similar to Ph+ALL, but without the BCR-ABL1 fusion gene
- This subtype has genetic changes that activate tyrosine kinase (enzymes)
- These enzymes are involved in cell signalling, growth, and division and may become too active
- About 15% of children with ALL have a subtype of B-cell ALL called Ph-like ALL
- Ph-like ALL is more common in males and in children with Down syndrome

## Signs and symptoms

**The prognosis for Ph+ALL, a subtype of acute lymphoblastic leukemia (ALL), has improved over time.**

With ALL, you will probably feel ill because your body is not making enough normal blood cells.

You may experience:

- Fatigue, shortness of breath during normal physical activities, dizziness, and pale complexion
  - When your red blood cell count is low (anemia)
- Ongoing infections and fever
  - When your white blood cell count is low
- Bruising easily, ongoing bleeding from minor cuts, pinhead-sized red spots on your skin, frequent or severe nose bleeds, bleeding gums, and blood in your urine
  - When your platelet count is low
- Night sweats
  - Possibly a response from your immune system
- Bone or joint discomfort
  - When your white blood cells accumulate and cause your bone marrow to expand
- Pain or fullness below the ribs
  - When leukemia cells build up in your liver or spleen, causing your abdomen to swell
- Weight loss
  - When you are eating less or using more energy



## After your diagnosis

With your diagnosis, your doctor can determine the right treatment for you. Your test results help your doctor predict how ALL will likely progress and how you may respond to treatment.

Name of test	Description
<b>Medical history and physical exam</b>	The doctor reviews past illnesses, injuries, and symptoms. They examine your lungs, heart, and other organs.
<b>Blood and bone marrow tests</b>	These two tests are usually done at the same time to look for anything unusual with chromosomes in the blood and bone marrow cells.
<b>Blood chemistry profile</b>	A blood test will measure any substance released into your blood to determine how well your kidney, liver, and other organs are working.
<b>Complete blood count (CBC) with differential</b>	This test measures the number of red blood cells, white blood cells, and platelets in a sample of blood to find out if your counts are high or low. It also measures the levels of hemoglobin (a protein that transports oxygen) in your red blood cells.
<b>Computed tomography (CT) scan</b>	A CT scan uses a computer linked to an x-ray machine to make a series of detailed pictures of areas inside your body.
<b>Cytogenetic analysis</b>	This test looks for changes in chromosomes to help identify your ALL subtype. It can help diagnose Ph+ALL.
<b>Flow cytometry</b>	During this test, examiners take cells from your blood or tissue biopsy to determine which proteins or markers (antigens) are in your leukemia cells.
<b>Fluorescence in situ hybridization (FISH)</b>	This lab test looks at the genes and chromosomes in your cells to find ALL cells.
<b>Lumbar puncture</b>	A lumbar puncture (spinal tap) uses a needle inserted between two vertebrae in your back to remove a sample of cerebrospinal fluid (CSF). This test can determine if the leukemia has spread to your CSF.
<b>Magnetic resonance imaging (MRI) scan</b>	An MRI scan uses magnetic fields and radio waves to create images of your organs and tissue. Examiners may also scan your head and/or spinal cord.

## Ph+ALL and Ph-like ALL treatment

Your treatment is focused on destroying as many leukemia cells as possible and stopping cancer cells from growing. When you no longer have evidence of leukemia cells in your body, you are said to be **in remission**.

### Types of treatment

The standard form of care for Ph+ALL includes tyrosine kinase inhibitors (TKIs), combined with chemotherapy. **Chemotherapy** uses medicine (chemicals) to kill cancer cells.

#### TKIs:

- Are a type of therapy that targets and attacks specific cancer cells
- Are less likely to harm normal cells
- Block (inhibit) the BCR-ABL protein from sending signals that cause leukemia cells to form
- Are taken by mouth

The TKI types used to treat Ph+ALL include Imatinib, Dasatinib, and Ponatinib. Researchers are working to understand better ways to determine whether specific TKIs and other targeted therapies can be effective to treat Ph-like ALL.

### Factors that affect treatment

Discuss your treatment options with your doctor to make sure you understand the benefits and risks of each approach. Your treatment plan is based on:

- Age
- Health and medical history
- Chromosome and/or genetic changes
- Leukemia cells in your brain and spinal cord fluid
- Number of white blood cells
- Response to the first phase of chemotherapy

## Treatment side effects

When you begin your treatment for Ph+ALL or Ph-like ALL, you may experience mild to severe side effects, depending on your age, your overall health, and your treatment plan. Most side effects disappear once your treatment ends. New drugs and therapies can help control most side effects. Speak to your doctor if you are having side effects.

### Common side effects

You may experience side effects such as:

- Low blood counts, abnormal bleeding, and pain from TKIs
- Muscle, bone, and joint pain from TKIs
- Fluid retention from TKIs
- Change in heart rhythm, narrow blood vessels, and blood clots from TKIs
- Itchy skin, headaches, and fatigue
- Nausea, vomiting, and loss of appetite from chemotherapy
- Infection from a decrease in white blood cells
- Fever, chills, coughing, sore throat, frequent/loose bowel movements, mouth sores, hair loss, and rashes from a decrease in white blood cells
- Neuropathy, or nerve damage from treatment, that can make your fingers and toes feel numb or tingle
- Tumour lysis syndrome (TLS), when many cancer cells die quickly

### Long-term or late effects of treatment

Medical follow-up is important after treatment for Ph+ALL or Ph-like ALL. You may need blood tests, bone marrow tests, or molecular tests to determine if you need to adjust your treatment plan.

For Ph+ALL, it is important to test the BCR-ABL1 gene for mutations periodically. Your medical team should provide you with a care plan listing the frequency of follow-up visits and the tests you will have at those visits.

- **Long-term side effects** are common and can last for months or years after treatment. One example is fatigue
- **Late effects** are medical problems that do not show up until years after treatment. See your doctor to get follow-up care for possible early detection of heart disease, other cancers, and neurological or cognitive issues
- **Children** can experience side effects that affect learning, growth, cognitive (brain) development, and social and psychological development

Researchers are working to understand better ways to determine whether specific TKIs and other targeted therapies can be effective to treat Ph-like ALL.



Living with Ph+ALL or Ph-like ALL can be overwhelming. Seek medical help if you feel “down” or “blue” or don’t want to do anything – and your mood does not improve over time. These could be signs of depression, an illness that should be treated even when you’re undergoing treatment for ALL. Treatment for depression has important benefits for people living with cancer.

This fact sheet was reviewed by:

Kareem Jamani, MD, MPH, FRCPC  
Clinical Assistant Professor  
Division of Hematology &  
Hematologic Malignancies  
University of Calgary

This publication was made possible thanks to the support of:



LEUKEMIA &  
LYMPHOMA  
SOCIETY  
OF CANADA

**Never hesitate to contact us, we’re here to help!**

1 833 222-4884 • [info@bloodcancers.ca](mailto:info@bloodcancers.ca) • [bloodcancers.ca](http://bloodcancers.ca)