



[cancer.org](https://www.cancer.org) | 1.800.227.2345

Chronic Myeloid Leukemia Early Detection, Diagnosis, and Staging

Detection and Diagnosis

Finding cancer early, before it has spread, often allows for more treatment options. Some early cancers may have signs and symptoms that can be noticed, but that's not always the case.

- [Can Chronic Myeloid Leukemia Be Found Early?](#)
- [Signs and Symptoms of Chronic Myeloid Leukemia](#)
- [Tests for Chronic Myeloid Leukemia](#)

Phases and Outlook (Prognosis)

After diagnosis, determining the phase of CML provides important information about the likely response to treatment.

- [Phases of Chronic Myeloid Leukemia](#)

Questions to Ask About CML

Here are some questions you can ask your cancer care team to help you better understand your CML diagnosis and treatment options.

- [Questions To Ask About Chronic Myeloid Leukemia](#)
-

Can Chronic Myeloid Leukemia Be Found Early?

The American Cancer Society recommends screening tests for certain cancers in people who have no symptoms because these cancers are easier to treat if found early. But at this time, no screening tests are routinely recommended to find chronic myeloid leukemia (CML) early.

CML can sometimes be found when routine blood tests are done for other reasons, like a routine physical. Test results might show that a person's white blood cell count is very high, even though he or she doesn't have any symptoms.

It's important to report any [symptoms](#) that could be caused by CML to a doctor right away.

References

See all references for Chronic Myeloid Leukemia (www.cancer.org/cancer/chronic-myeloid-leukemia/references.html)

Jabbour E, Kantarjian H. Chronic myeloid leukemia: 2018 update on diagnosis, therapy and monitoring. *Am J Hematol*. 2018;93(3):442-459.

Last Medical Review: June 19, 2018 Last Revised: June 19, 2018

Signs and Symptoms of Chronic Myeloid Leukemia

The symptoms of chronic myeloid leukemia (CML) are often vague and are more often caused by other things. They include:

- Weakness

- [Fatigue](#)¹
- Night sweats
- Weight loss
- Fever
- Bone pain (caused by leukemia cells spreading from the marrow cavity to the surface of the bone or into the joint)
- An enlarged spleen (felt as a mass under the left side of the ribcage)
- Pain or a sense of "fullness" in the belly
- Feeling full after eating even a small amount of food

But these aren't just symptoms of CML. They can happen with other cancers, as well as with many conditions that aren't cancer.

Problems caused by a shortage of blood cells

Many of the signs and symptoms of CML occur because the leukemia cells replace the bone marrow's normal blood-making cells. As a result, people with CML don't make enough red blood cells, properly functioning white blood cells, and platelets.

- [Anemia](#)² is a **shortage of red blood cells**. It can cause weakness, tiredness, and shortness of breath.
- **Leukopenia is a shortage of normal white blood cells**. This shortage increases the risk of infections. Although patients with leukemia may have very high white blood cell counts, the leukemia cells don't protect against infection the way normal white blood cells do.
- **Neutropenia means that the level of normal neutrophils is low**. Neutrophils, a type of white blood cell, are very important in fighting infection from bacteria. People who are neutropenic have a high risk of getting very serious bacterial [infections](#)³.
- **Thrombocytopenia is a shortage of blood platelets**. It can lead to easy bruising or bleeding, with frequent or severe nosebleeds and bleeding gums. Some patients with CML actually have too many platelets (thrombocytosis). But those platelets often don't work the way they should, so these people often have problems with bleeding and bruising as well.

The most common sign of CML is an abnormal white blood cell count. (Blood counts are discussed further in [Tests for Chronic Myeloid Leukemia](#).)

Hyperlinks

1. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/fatigue.html
2. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/low-blood-counts.html
3. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/infections/infections-in-people-with-cancer.html

References

See all references for Chronic Myeloid Leukemia (www.cancer.org/cancer/chronic-myeloid-leukemia/references.html)

American Society of Clinical Oncology. Leukemia - Chronic Myeloid - CML: Symptoms and Signs. 11/2016. Accessed at www.cancer.net/cancer-types/leukemia-chronic-myeloid-cml/symptoms-and-signs on May 14, 2018.

National Cancer Institute. Chronic Myelogenous Leukemia Treatment (PDQ®)—Patient Version. March 30, 2018. Accessed at www.cancer.gov/types/leukemia/patient/cml-treatment-pdq on May 14, 2018.

Last Medical Review: June 19, 2018 Last Revised: June 19, 2018

Tests for Chronic Myeloid Leukemia

Many people with chronic myeloid leukemia (CML) don't have symptoms when it's diagnosed. The leukemia is often found when their doctor orders blood tests for an unrelated health problem or during a routine check-up. Even when symptoms are present, they're often vague and non-specific.

Lab tests

If signs and symptoms suggest you may have leukemia, the doctor will need to check

your blood and bone marrow to be certain of this diagnosis. Blood is usually taken from a vein in your arm. A small amount of bone marrow is removed with a [bone marrow aspiration and biopsy](#)¹. These samples are sent to a lab, where they're checked under a microscope for leukemia cells.

Blood cell counts

The [complete blood count \(CBC\)](#)² is a test that measures the levels of different cells, like red blood cells, white blood cells, and platelets, in your blood. The CBC often includes a differential (diff), which is a count of the different types of white blood cells in your blood sample. In a blood smear, some of your blood is put on a slide to see how the cells look under the microscope.

Most people with CML have too many white blood cells with a lot of early (immature) cells called myeloblasts or blasts. Doctors will look at the size and shape of the cells and whether they contain granules (small spots seen in some types of white blood cells). An important factor is whether the cells look mature (like normal circulating blood cells) or immature (lacking features of normal circulating blood cells). Sometimes CML patients have low numbers of red blood cells or blood platelets. Even though these findings may suggest leukemia, this diagnosis usually needs to be confirmed by another blood test or a test of the bone marrow.

Bone marrow test

An important feature of a bone marrow sample is how much of it is blood-forming cells. This is known as cellularity. Normal bone marrow contains both blood-forming cells and fat cells.

If your bone marrow has **more** blood-forming cells than expected, it's said to be **hypercellular**. If too **few** of these cells are found, the marrow is called **hypocellular**.

In people with CML, the bone marrow is often hypercellular because it's full of leukemia cells. These tests may also be done after treatment to see if the leukemia is responding to treatment.

Blood chemistry tests

These [tests](#)³ measure the amount of certain chemicals in your blood, but they're not used to diagnose leukemia. They can help find liver or kidney problems caused by the spread of leukemia cells or by the side effects of certain drugs. These tests also help determine if you need to be treated to correct low or high blood levels of certain

minerals.

Genetic tests

Some sort of gene testing will be done to look for the Philadelphia chromosome and/or the *BCR-ABL* gene. This type of test is used to confirm a CML diagnosis and learn more about your CML cells.

Conventional cytogenetics

This test looks at chromosomes (pieces of DNA) under a microscope to find any changes. It's also called a **karyotype**. Because chromosomes can best be seen when the cell is dividing, a sample of your blood or bone marrow has to be grown (in the lab) so that the cells start to divide. This takes time, and doesn't always work.

Normal human cells have 23 pairs of chromosomes, each of which is a certain size. The leukemia cells in many CML patients contain an abnormal chromosome called the **Philadelphia (Ph) chromosome**, which looks like a shortened version of chromosome 22. It's caused by swapping pieces (translocation) between chromosomes 9 and 22. (See [What Causes Chronic Myeloid Leukemia?](#)⁴ for more on this.) Finding a Ph chromosome is helpful in diagnosing CML. But even when the Ph chromosome can't be seen, other tests can often find the *BCR-ABL* gene. Other chromosome changes can be found with cytogenetic testing, too.

Fluorescent in situ hybridization (FISH)

FISH is another way to look at chromosomes. This test uses special fluorescent dyes that only attach to specific genes or parts of chromosomes. In CML, FISH can be used to look for specific pieces of the *BCR-ABL* gene on chromosomes. It can be used on regular blood or bone marrow samples without growing the cells first, so you get the results more quickly than with conventional cytogenetics.

Polymerase chain reaction (PCR)

This is a super-sensitive test that can be used to look for the *BCR-ABL* gene in leukemia cells and measure how much is there. It can be done on blood or bone marrow samples and can detect very small amounts of *BCR-ABL*, even when doctors can't find the Philadelphia chromosome in bone marrow cells with cytogenetic testing.

PCR can be used to help diagnose CML. It's also useful after treatment to see if copies

of the *BCR-ABL* gene are still there. If copies of this gene are found it means that the leukemia is still present, even when the cells can't be seen with a microscope.

Imaging tests

[Imaging tests](#)⁵ are used to get pictures of the inside of your body. They aren't needed to diagnose CML, but are sometimes used to look for the cause of symptoms or to see if the spleen or liver are enlarged.

Computed tomography (CT) scan

A [CT scan](#)⁶ can show if any [lymph nodes](#)⁷ or organs in your body are enlarged. It isn't needed to diagnose CML, but it may be done if your doctor suspects the leukemia is growing in an organ, like your spleen.

In some cases, a CT can be used to guide a biopsy needle precisely into a suspected abnormality, such as an abscess. For this procedure, called a CT-guided needle biopsy, you remain on the CT scanning table while a radiologist moves a biopsy needle through your skin and toward the mass. CT scans are repeated until the needle is in the mass. A sample is then removed and looked at with a microscope. This is rarely needed in CML.

Magnetic resonance imaging (MRI)

[MRIs](#)⁸ are very helpful in looking at the brain and spinal cord.

Ultrasound

[Ultrasound](#)⁹ can be used to look at lymph nodes near the surface of your body or to look for enlarged organs inside your abdomen (belly) such as the kidneys, liver, and spleen.

Hyperlinks

1. www.cancer.org/treatment/understanding-your-diagnosis/tests/testing-biopsy-and-cytology-specimens-for-cancer.html
2. www.cancer.org/treatment/understanding-your-diagnosis/tests/understanding-your-lab-test-results.html
3. www.cancer.org/treatment/understanding-your-diagnosis/tests/understanding-your-lab-test-results.html
4. www.cancer.org/cancer/chronic-myeloid-leukemia/causes-risks-prevention/what-

[causes.html](#)

5. www.cancer.org/treatment/understanding-your-diagnosis/tests/imaging-radiology-tests-for-cancer.html
6. www.cancer.org/treatment/understanding-your-diagnosis/tests/ct-scan-for-cancer.html
7. www.cancer.org/cancer/cancer-basics/lymph-nodes-and-cancer.html
8. www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html
9. www.cancer.org/treatment/understanding-your-diagnosis/tests/ultrasound-for-cancer.html

References

See all references for Chronic Myeloid Leukemia (www.cancer.org/cancer/chronic-myeloid-leukemia/references.html)

American Society of Clinical Oncology. Leukemia - Chronic Myeloid - CML: Diagnosis. 11/2016. Accessed at www.cancer.net/cancer-types/leukemia-chronic-myeloid-cml/diagnosis on May 15, 2018.

National Cancer Institute. Chronic Myelogenous Leukemia Treatment (PDQ®)—Patient Version. March 30, 2018. Accessed at www.cancer.gov/types/leukemia/patient/cml-treatment-pdq on May 15, 2018.

National Comprehensive Cancer Network, Clinical Practice Guidelines in Oncology (NCCN Guidelines®), Chronic Myeloid Leukemia, Version 4.2018 -- January 24, 2018. Accessed at www.nccn.org/professionals/physician_gls/pdf/cml.pdf on May 15, 2018.

Jabbour E, Kantarjian H. Chronic myeloid leukemia: 2018 update on diagnosis, therapy and monitoring. *Am J Hematol*. 2018;93(3):442-459.

Last Medical Review: June 19, 2018 Last Revised: June 19, 2018

Phases of Chronic Myeloid Leukemia

Most types of cancer are assigned a stage based on the size of the tumor and the

extent of cancer spread. Stages can be helpful in making treatment decisions and predicting prognosis (outlook).

But because chronic myeloid leukemia (CML) is a disease of the bone marrow, it isn't staged like most cancers. The outlook for someone with CML depends on the phase of the disease and the amount of blasts in the bone marrow, as well as other factors like the age of the patient, blood counts, and if the spleen is enlarged.

Phases of chronic myeloid leukemia

CML is classified into 3 groups that help predict outlook. Doctors call these groups **phases** instead of stages. The phases are based mainly on the number of immature white blood cells (blasts) in the blood or bone marrow. Different groups of experts have suggested slightly different cutoffs to define the phases, but a common system (proposed by the World Health Organization) is described below. Not all doctors may agree with or follow these cutoff points for the different phases. If you have questions about what phase your CML is in, be sure to have your doctor explain it to you in a way that you understand.

Chronic phase

Patients in the chronic phase typically have less than 10% blasts in their blood or bone marrow samples. These patients usually have fairly mild symptoms (if any) and usually respond to standard treatments. Most patients are diagnosed in the chronic phase.

Accelerated phase

Patients are considered to be in accelerated phase if any of the following are true:

- The blood samples have 15% or more, but fewer than 30% blasts
- Basophils make up 20% or more of the blood
- Blasts and promyelocytes combined make up 30% or more of the blood
- Very low platelet counts ($100 \times 1,000/\text{mm}^3$ or less) that are not caused by treatment
- New chromosome changes in the leukemia cells with the Philadelphia chromosome

Patients whose CML is in an accelerated phase may have symptoms such as fever, poor appetite, and weight loss. CML in the accelerated phase doesn't respond as well to treatment as CML in the chronic phase.

Blast phase (also called acute phase or blast crisis)

Bone marrow and/or blood samples from a patient in this phase have 20% or more blasts. Large clusters of blasts are seen in the bone marrow. The blast cells have spread to tissues and organs beyond the bone marrow. These patients often have fever, poor appetite, and weight loss. In this phase, the CML acts a lot like an [acute leukemia](#)¹.

Prognostic factors for chronic myeloid leukemia

Along with the phase of CML, there are other factors that may help predict the outlook for survival. These factors are sometimes helpful when choosing treatment. Factors that tend to be linked with shorter survival time are called **adverse prognostic factors**.

Adverse prognostic factors:

- Accelerated phase or blast phase
- Enlarged spleen
- Areas of bone damage from growth of leukemia
- Increased number of basophils and eosinophils (certain types of granulocytes) in blood samples
- Very high or very low platelet counts
- Age 60 years or older
- Multiple chromosome changes in the CML cells

Many of these factors are taken into account in the **Sokal system**, which develops a score used to help predict prognosis. This system considers the person's age, the percentage of blasts in the blood, the size of the spleen, and the number of platelets. These factors are used to divide patients into low-, intermediate-, or high-risk groups. Another system, called the **Euro score**, includes the above factors, as well as the percentage of blood basophils and eosinophils. Having more of these cells indicates a poorer outlook.

The Sokal and Euro models were helpful in the past, before the newer, more effective drugs for CML were developed. It's not clear how helpful they are at this time in predicting a person's outlook. [Targeted therapy](#)² drugs like imatinib (Gleevec[®]) have changed the treatment of CML dramatically. These models haven't been tested in people who are being treated with these drugs.

Survival Rates for Chronic Myeloid Leukemia

Drugs that are highly effective in treating most cases of chronic myeloid leukemia (CML) first became available in 2001. There's no accurate information yet on how long patients treated with these drugs may live. All that's known is that most patients who have been treated with these drugs, starting in 2001 (or even before), are still alive.

One large study of CML patients treated with imatinib (Gleevec[®]) found that about 90% of them were still alive 5 years after starting treatment. Most of these patients had normal white blood cells and chromosome studies after 5 years on the drug.

References

See all references for Chronic Myeloid Leukemia (www.cancer.org/cancer/chronic-myeloid-leukemia/references.html)

Last Medical Review: June 19, 2018 Last Revised: June 19, 2018

Questions To Ask About Chronic Myeloid Leukemia

As you cope with cancer and cancer treatment, you need to have honest, open talks with your cancer care team. You should be able to ask any question, no matter how small it might seem. Here are some you might want to ask. Nurses, social workers, and other members of the treatment team may also be able to answer many of your questions.

- What [phase](#) is my chronic myeloid leukemia (CML) in?
- What are my [treatment choices](#)¹?
- Which treatment do you recommend, and why?

- How long will treatment last and what will it be like?
- Will my insurance cover treatment? How much will I have to pay?
- How often will you test my blood or bone marrow to see how treatment is working?
- What side effects are there to the treatments that you recommend?
- What can I do to be ready for treatment?
- Should I consider a [stem cell transplant](#)² at this time?
- What are the chances that my leukemia will come [back once](#)³ I am in remission?
- What type of follow-up will I need after treatment?

Be sure to write down any questions that occur to you that are not on this list. For instance, you might want information about how you'll feel during treatment so you can plan your work schedule. Or you may want to ask about [second opinions](#)⁴ or taking part in a [clinical trial](#)⁵.

Taking another person with you and/or recording your talks with the doctor can be helpful. Getting copies of your medical records, including pathology and radiology reports, may be useful in case you decide to seek a second opinion later.

Hyperlinks

1. www.cancer.org/cancer/chronic-myeloid-leukemia/treating.html
2. www.cancer.org/cancer/chronic-myeloid-leukemia/treating/bone-marrow-stem-cell.html
3. www.cancer.org/treatment/survivorship-during-and-after-treatment/understanding-recurrence.html
4. www.cancer.org/treatment/finding-and-paying-for-treatment/choosing-your-treatment-team/seeking-a-second-opinion.html
5. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html

References

See all references for Chronic Myeloid Leukemia (www.cancer.org/cancer/chronic-myeloid-leukemia/references.html)

Last Medical Review: June 19, 2018 Last Revised: June 19, 2018

Written by

The American Cancer Society medical and editorial content team
(www.cancer.org/cancer/acs-medical-content-and-news-staff.html)

Our team is made up of doctors and oncology certified nurses with deep knowledge of cancer care as well as journalists, editors, and translators with extensive experience in medical writing.

American Cancer Society medical information is copyrighted material. For reprint requests, please see our Content Usage Policy (www.cancer.org/about-us/policies/content-usage.html).

cancer.org | 1.800.227.2345