



Leukemia: Chronic Myelomonocytic

What is cancer?

The body is made up of trillions of living cells. Normal body cells grow, divide into new cells, and die in an orderly way. During the early years of a person's life, normal cells divide faster to allow the person to grow. After the person becomes an adult, most cells divide only to replace worn-out or dying cells or to repair injuries.

Cancer begins when cells in a part of the body start to grow out of control. There are many kinds of cancer, but they all start because of out-of-control growth of abnormal cells.

Cancer cell growth is different from normal cell growth. Instead of dying, cancer cells continue to grow and form new, abnormal cells. Cancer cells can also invade (grow into) other tissues, something that normal cells cannot do. Growing out of control and invading other tissues are what makes a cell a cancer cell.

Cells become cancer cells because of damage to DNA. DNA is in every cell and directs all its actions. In a normal cell, when DNA gets damaged the cell either repairs the damage or the cell dies. In cancer cells, the damaged DNA is not repaired, but the cell doesn't die like it should. Instead, this cell goes on making new cells that the body does not need. These new cells will all have the same damaged DNA as the first cell does.

People can inherit damaged DNA, but most DNA damage is caused by mistakes that happen while the normal cell is reproducing or by something in our environment. Sometimes the cause of the DNA damage is something obvious, like cigarette smoking. But often no clear cause is found.

In most cases the cancer cells form a tumor. Some cancers, like leukemia, rarely form tumors. Instead, these cancer cells involve the blood and blood-forming organs and circulate through other tissues where they grow.

Cancer cells often travel to other parts of the body, where they begin to grow and form new tumors that replace normal tissue. This process is called *metastasis*. It happens when the cancer cells get into your bloodstream or lymph vessels.

No matter where a cancer may spread, it is always named for the place where it started. For example, breast cancer that has spread to the liver is still called breast cancer, not liver cancer. Likewise, prostate cancer that has spread to the bone is metastatic prostate cancer, not bone cancer.

Different types of cancer can behave very differently. For example, lung cancer and breast cancer are very different diseases. They grow at different rates and respond to different treatments. That is why people with cancer need treatment that is aimed at their particular kind of cancer.

Not all tumors are cancerous. Tumors that aren't cancer are called *benign*. Benign tumors can cause problems – they can grow very large and press on healthy organs and tissues. But they cannot grow into (invade) other tissues. Because they can't invade, they also can't spread to other parts of the body (metastasize). These tumors are almost never life threatening.

What is chronic myelomonocytic leukemia?

Chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) is a type of cancer that starts in blood-forming cells of the bone marrow and invades the blood.

Normal bone marrow

Bone marrow is found inside certain bones such as the skull, ribs, pelvis, and spine. It is made up of blood-forming cells, fat cells, and supporting tissues that help the blood-forming cells grow. A small fraction of the blood-forming cells are a special type of cell known as *stem cells*. Stem cells are needed to make new cells. When a stem cell divides, it makes 2 cells: one cell that stays a stem cell and another cell that can keep changing and dividing to make blood cells.

There are 3 types of blood cells: red blood cells, white blood cells, and platelets.

Red blood cells pick up oxygen in the lungs and carry it to the rest of the body. These cells also bring carbon dioxide back to the lungs. Having too few red blood cells is called *anemia*. People with anemia can appear pale and feel tired and weak. Severe anemia can cause shortness of breath.

White blood cells (also known as *leukocytes*) are important in defending you against infection. The 2 major types of white blood cells are lymphocytes and granulocytes.

Lymphocytes are immune cells in the bone marrow, the blood, and in lymph nodes. Some kinds of lymphocytes make the antibodies that help your body fight germs. Other kinds directly kill invading germs by producing toxic substances that damage the cells.

Granulocytes are a group of white blood cells that destroy bacteria. They are called *granulocytes* because they contain granules that can be seen under the microscope. These granules are made up of enzymes and other substances which can destroy germs that cause infections.

In the bone marrow, granulocytes develop from young cells called *myeloblasts*. The most common type of granulocyte is the neutrophil; which is crucial in fighting bacteria. Other types of granulocytes are basophils, and eosinophils. When the number of neutrophils in the blood is low, it is called *neutropenia*. This can lead to severe infections.

Monocytes are related to the granulocyte family. They also help protect you against bacteria. The early cells in the bone marrow that turn into monocytes are called *monoblasts*. When monocytes leave your bloodstream and go into tissue, they become macrophages. Macrophages can destroy germs by surrounding and digesting them. They are also important in helping lymphocytes recognize germs and begin producing antibodies to fight them.

Platelets are thought of as a type of blood cell, but they are actually small pieces of a cell. They start as a large cell in the bone marrow cell called the *megakaryocyte*. Pieces of this cell break off and enter your bloodstream as platelets, which you need for your blood to clot. Platelets plug up damaged areas of blood vessels caused by cuts or bruises. If you have a shortage of platelets, called *thrombocytopenia*, you can bleed and bruise a lot.

Chronic myelomonocytic leukemia

CMML patients have a high number of monocytes in their blood (at least 1,000 per mm^3). Often, the monocyte count is much higher, causing their total white blood cell count to become very high as well. Usually there are abnormal cells in the bone marrow, but the amount of blasts (very early/immature cells) is below 20%. Many patients have enlarged spleens (an organ that lies just below the left rib cage). About 15% to 30% of CMML patients go on to develop acute myeloid leukemia.

Because CMML patients have abnormal-looking (dysplastic) cells in their bone marrow, for a long time CMML was considered to be a type of myelodysplastic syndrome. Still, it didn't fit in well with other diseases in that category because the major characteristic of myelodysplastic syndromes is having too few blood cells.

Patients with CMML may have shortages of some blood cells, but a main problem is too many of a certain type of white blood cell (the monocyte). In this way CMML is more like a *myeloproliferative disease* (*myelo* -- bone marrow, *proliferative* -- excessive growth). Chronic myeloid leukemia is an example of a myeloproliferative disease where there is an overproduction of white blood cells. Since CMML has features of both myelodysplastic syndrome and myeloproliferative disorder, experts created a new category for it: myelodysplastic/myeloproliferative diseases. CMML is the most common disease in this group. Much less common diseases in this group are *atypical chronic myeloid leukemia* and *juvenile myelomonocytic leukemia*. All of these diseases produce a lot of abnormal blood cells.

What are the key statistics about chronic myelomonocytic leukemia?

Chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) is rare, only occurring in 4 of every million people in the United States each year. That works out to about 1,100 cases each year.

This disease is rare in young people. Almost 9 of 10 of cases are diagnosed in people 60 and older. CMML occurs more often in men than in women.

What are the risk factors for chronic myelomonocytic leukemia?

A risk factor is anything that changes your chance of getting a disease such as cancer. Different cancers have different risk factors. For example, exposing skin to strong sunlight is a risk factor for skin cancer. Smoking is a risk factor for lung cancer and many other cancers. But people without any risk factors can still get the disease. And having a risk factor, or even several, does not mean that you will get the disease. Because chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) is rare, it has been hard to study. For a long time it was grouped with myelodysplastic syndromes. As a result, only a few risk factors are known for this disease.

Age

The risk of CMML increases with age. This disease is rare in those younger than 40, with most cases found in people 60 and older.

Sex

CMML is about twice as common in men as in women.

Cancer treatment

Prior treatment with chemotherapy seems to increase the risk of CMML. The risk of CMML after cancer chemotherapy, however, is not as high as the risk of other blood problems, such as myelodysplastic syndromes and acute myeloid leukemia.

Do we know what causes chronic myelomonocytic leukemia?

Some cases of chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) are linked to cancer treatment, but in most cases the cause is unknown.

Over the past few years, scientists have made progress in understanding how certain changes in the DNA of bone marrow cells may cause CMML to develop. DNA is the chemical that carries the instructions for nearly everything our cells do. We usually look like our parents because they are the source of our DNA. However, DNA affects more than the way we look.

Some genes (parts of DNA) control a cell's growth and division process. Genes that promote cell division are called *oncogenes*. Other genes called *tumor suppressor genes* can slow down cell division or even make cells die at an appropriate time. Cancers can be caused by DNA mutations (gene defects) that turn on oncogenes or turn off tumor suppressor genes.

In some diseases, mutations may be passed down from a parent. Inherited mutations do not seem to cause CMML. Instead, the mutations are acquired during the person's lifetime. Exposure to radiation or cancer-causing chemicals can cause mutations that lead to CMML. Sometimes these gene changes occur for no apparent reason. Every time a cell prepares to divide into 2 new cells, it must copy its DNA. This process is not perfect, and copying errors can occur. Fortunately, cells have repair enzymes that read and fix DNA. However, some errors may slip past, especially if the cells are growing rapidly.

Human DNA is packaged in 23 pairs of chromosomes. In up to half of patients, CMML cells contain altered chromosomes. Sometimes part of one chromosome attaches to a different chromosome. This is called a *translocation*. Like mutations, translocations can turn on oncogenes or turn off tumor suppressor genes. Acquired translocations are seen in some cases of CMML. Another chromosome abnormality that can be seen in CMML is called a deletion. This involves the loss of all or part of a chromosome. Another type of chromosome abnormality is called a *duplication*. This is when there is an extra copy of all or part of a chromosome.

Can chronic myelomonocytic leukemia be prevented?

Since most cases of chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) have no known cause, this disease can rarely be prevented.

Treating cancer with chemotherapy and radiation may cause CMML. Doctors are studying ways to minimize the risk of CMML developing in patients receiving these treatments. In some cancers, doctors may try to avoid using the chemotherapy drugs that are more likely to lead to CMML. For certain cancers, however, these drugs may be needed. Often, the obvious benefits of treating life-threatening cancers with chemotherapy and radiation therapy must be balanced against the small chance of developing CMML several years later.

Signs and symptoms of chronic myelomonocytic leukemia

The most common sign of chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) is having too many monocytes (on a blood test).

Having too many monocytes also causes many of the symptoms of CMML. These monocytes can settle in the spleen or liver, enlarging these organs. An enlarged spleen (called *splenomegaly*) can cause pain in the upper left part of the abdomen. It can also cause people to complain of feeling full too fast when they eat. If the liver gets too large (called *hepatomegaly*), it mainly causes discomfort in the upper right part of the abdomen.

Low numbers of other types of blood cells cause many of the signs and symptoms of CMML:

- A shortage of red blood cells (anemia) can lead to feeling very tired, with shortness of breath and pale skin.
- Not having enough normal white blood cells (leukopenia) can lead to frequent or severe infections.
- A shortage of blood platelets (thrombocytopenia) can lead to problems with easy bruising and bleeding. Some people notice frequent or severe nosebleeds or bleeding from the gums.

Other symptoms can include weight loss, fever, and loss of appetite. Of course, these problems occur not only with CMML but are more often caused by something other than cancer. Still, if you are having symptoms, you should tell your doctor so a cause can be found.

How is chronic myelomonocytic leukemia diagnosed?

If signs and symptoms suggest you may have chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML), the doctors will look at cells from your blood and bone marrow to confirm this diagnosis.

Blood tests

The complete blood count (CBC) measures different cells in the blood, such as the red blood cells, the white blood cells, and the platelets. The CBC is often done with a *differential count* (or “diff”), which is a count of the different types of white blood cells in the blood sample. In a blood *smear*, some of the blood is put on a slide to see how the cells look under the microscope.

Patients with CMML have higher numbers of monocytes, with a monocyte count of at least 1,000 (per mm³). Sometimes they have low numbers of other white blood cells. They may have shortages of red blood cells and blood platelets as well.

Some patients may have a small number of monoblasts in the blood. Monoblasts are the early, immature cells that grow and divide to make mature monocytes. Normally, these cells are only found in the bone marrow. It is never normal to see blasts in the blood, and it often signals a bone marrow problem.

Blood cells from CMML patients may also have certain abnormalities in size, shape, or other features that can be seen under the microscope. Blood abnormalities may suggest CMML, but the doctor cannot make an exact diagnosis without examining a sample of bone marrow cells.

Other tests

The doctor may also order tests to check for other possible causes of low blood counts, such as low levels of vitamin B12 and folate. Tests may also be done to look for other causes of a high white blood cell count, such as infection.

Bone marrow tests

Bone marrow samples are obtained from *bone marrow aspiration and biopsy*, procedures that are usually done at the same time. The samples are usually taken from the back of the pelvic (hip) bone. These tests are used first for diagnosis and classification and may be repeated later to tell if the CMML is responding to therapy or is transforming into an acute leukemia.

For bone marrow aspiration, you lie on a table (either on your side or on your belly). After cleaning the area, the skin over the hip and the surface of the bone is numbed with local anesthetic, which may cause a brief stinging or burning sensation. A thin, hollow needle is then inserted into the bone and a syringe is used to suck out a small amount of liquid bone marrow (about 1 teaspoon). Even with the anesthetic, most patients still have some brief pain when the marrow is removed.

A bone marrow biopsy is usually done just after the aspiration. A small piece of bone and marrow (about 1/16 inch in diameter and 1/2 inch long) is removed with a slightly larger needle that is twisted as it is pushed down into the bone. The biopsy may also cause some brief pain. Once the biopsy is done, pressure will be applied to the site to help prevent bleeding.

A pathologist (a doctor specializing in the diagnosis of diseases using laboratory tests) examines the bone marrow samples under a microscope. A hematologist (a doctor specializing in medical treatment of diseases of the blood and blood-forming tissues) or an oncologist (a doctor specializing in medical treatment of cancer) usually reviews these as well.

What doctors look for in the bone marrow

The doctors will look at the bone marrow aspirate and biopsy to evaluate the types and amount of blood-forming cells and to determine if the bone marrow shows evidence of infections, cancer cells, or other disorders. They will examine the size and shape of the cells and determine whether the red cells contain iron particles or the other cells contain granules (microscopic collections of enzymes and other chemicals that help white blood cells to fight infections). The percentage of marrow cells that are blasts is particularly important. Blasts are very early (immature) cells that are produced by bone marrow stem cells. Blasts eventually mature into normal blood cells. In CMML, some of the blasts do not mature properly, so there may be too many blasts and not enough mature cells. For a diagnosis of CMML, a patient must have less than 20% blasts in the bone marrow. A patient who has more than 20% blasts in the bone marrow is considered to have acute leukemia.

Additional tests are done on the bone marrow to help the doctor diagnose CMML and exclude other blood diseases:

Immunocytochemistry

Cells from the bone marrow sample are treated with special antibodies that cause certain types of cells to change color. The color change can be seen only under a microscope. This testing is helpful in distinguishing CMML from other types of leukemia and from other diseases.

Flow cytometry

This technique is sometimes used to examine the cells from bone marrow and blood samples. It can be very helpful in diagnosing leukemia and lymphoma. A sample of cells is treated with special antibodies and passed in front of a laser beam. Each antibody sticks only to certain types of cells. If the sample contains those cells, the laser will cause them to give off light. The instrument detects the light, and a computer counts the cells. This test may not be needed for all patients.

Cytogenetics

This test looks at the chromosomes inside the cells. DNA in human cells is packed into chromosomes. Each cell should have 46 chromosomes (23 pairs). Chromosome abnormalities are fairly common in CMML. Sometimes pieces of chromosomes or even whole chromosomes are missing. CMML cells may also have extra copies of all or part of some chromosomes. Chromosome translocations may also be seen. This is where portions of chromosomes may trade places with each other. Chromosome testing can also help the doctors be sure that the problem isn't a different chronic leukemia, called chronic myeloid leukemia or CML. The leukemia cells in CML often contain an abnormal chromosome caused by a certain translocation (translocation (9;22)). This is called the *Philadelphia chromosome*. If the Philadelphia chromosome is present, the diagnosis is CML, not CMML.

Cytogenetic testing can take several weeks because the bone marrow cells need time to grow in laboratory dishes before their chromosomes can be viewed under the microscope. The results of cytogenetic testing are written in a shorthand form that describes which chromosome changes are present. For example:

- A minus sign (-) or the abbreviation del is used to mean a deletion. For example, if a copy of chromosome 7 is missing, it can be written as -7 or del(7). Often, only a part of the chromosome is lost. There are 2 parts to a chromosome, called p and q. Thus the loss of the q part of chromosome 5 is called 5q- or del(5q).
- A plus sign is used when there is an extra copy of all or part of a chromosome. For example, +8 means that chromosome 8 has been duplicated and too many copies of it are found within the cell.
- The letter t is used to indicate a translocation, which is when a piece of one chromosome breaks off and becomes part of another chromosome.

Molecular genetic studies

This is another type of test that can be used to find chromosome and gene abnormalities.. An example of this is *fluorescent in situ hybridization*, more commonly called *FISH*. In FISH, specific gene sequences are stained with a fluorescent dye. These sequences may correspond to a certain area of a chromosome or even a certain translocation. An advantage of FISH is that it doesn't require actively dividing cells. This allows the testing to go a bit faster.

FISH is very good for finding translocations; it can even find some that may be too small to be seen with usual cytogenetic testing. Another molecular genetic test that can be used to find specific genetic abnormalities is called polymerase chain reaction (PCR). These tests are not needed to make a diagnosis of CMML, but they may be used in some cases. It is sometimes used to look for certain gene or chromosome changes, such as the Philadelphia chromosome, which is associated with CML.

These tests can be done on cells besides bone marrow cells, such as cells from the blood.

How is chronic myelomonocytic leukemia staged?

Doctors often group cancers into different stages based on the size of the tumor and how far the cancer has spread from the original site in the body. The stage of a cancer can help predict the outlook for a cancer. Often, the stage of a cancer is used to decide which treatment is needed.

Chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) is a disease of the bone marrow. It cannot be staged by looking at the size of a tumor like some other cancers. Instead, CMML is split into 2 groups based on cell counts in the blood and bone marrow:

- **CMML-1:** Blasts make up less than 5% of white cells in the blood and less than 10% of the cells in the bone marrow.
- **CMML-2:** Blasts make up 5% to 20% of the white cells in the blood, or they make up 10% to 20% of the cells in the bone marrow.

Survival rates for chronic myelomonocytic leukemia

Survival rates are often used by doctors as a standard way of discussing a person's prognosis (outlook). Some patients with cancer may want to know the survival statistics for people in similar situations, while others may not find the numbers helpful, or may even not want to know them. If you don't want to know them, stop reading here and skip to the next section.

There is more than one way to describe a person's likely prognosis (outlook). The statistics below talk about median survival. Median survival is the amount of time for half the patients in a group to die. This is a middle value -- half the patients live longer than this, and half do not live this long.

In order to get median survival estimates, doctors have to look at people who were treated several years ago. Improvements in treatment since then may result in a more favorable outlook for people now being diagnosed with chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML).

Median survival estimates are based on previous outcomes of large numbers of people who had the disease, but they cannot predict what will happen in any particular person's case. Many other factors may affect a person's outlook, such as their age and overall health. Your doctor can tell you how the numbers below may apply to you, as he or she is familiar with the aspects of your particular situation.

Patients with CMML-1 tend to live longer than those with CMML-2. In one study of CMML patients diagnosed between 1975 and 2005, the median survival times with CMML-1 and CMML-2 were 20 months and 15 months, respectively. However, some patients lived much longer. About 20 percent of CMML-1 patients and about 10 percent of CMML-2 patients survived longer than 5 years. Also, patients with CMML-2 are more likely to go on to develop acute leukemia than patients with CMML-1. In the same study, 18 percent of CMML-1 patients and 63 percent of CMML-2 patients developed acute myeloid leukemia within 5 years of their CMML diagnosis.

In addition to the type of CMML, other factors may be helpful in predicting survival. These include blood cell counts, certain chromosome changes, and blood levels of LDH (lactate dehydrogenase).

How is chronic myelomonocytic leukemia treated?

This information represents the views of the doctors and nurses serving on the American Cancer Society's Cancer Information Database Editorial Board. These views are based on their interpretation of studies published in medical journals, as well as their own professional experience.

The treatment information in this document is not official policy of the Society and is not intended as medical advice to replace the expertise and judgment of your cancer care team. It is intended to help you and your family make informed decisions, together with your doctor.

Your doctor may have reasons for suggesting a treatment plan different from these general treatment options. Don't hesitate to ask him or her questions about your treatment options.

General treatment information about chronic myelomonocytic leukemia

Treatment of chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) is based on how severe the disease is, as well as the patient's age and health. Patients with CMML are treated by specialists such as hematologists or oncologists.

Treatment for CMML may include:

- Supportive therapy
- Chemotherapy
- Growth factors
- Radiation therapy
- Surgery
- Stem cell transplant

See the "Additional resources" section for a list of other, more detailed materials on the different types of cancer treatments and their side effects.

Supportive therapy for the patient with chronic myelomonocytic leukemia

For many patients with chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML), the main goal of treatment is to prevent the problems caused by low blood cell counts. For example, low red blood cell counts (anemia) can cause severe fatigue. Treating the anemia with red blood cell transfusions and/or erythropoietin can help patients feel better and allow them to be more active. (More information about erythropoietin can be found in the section, "Growth factors for the treatment of chronic myelomonocytic leukemia," more information about transfusions can be found in our document *Blood Transfusion and Donation*.)

Some people are concerned about a slight risk of infection (hepatitis or HIV) spread by blood transfusion. This possibility is very unlikely, and the benefits of the transfused cells greatly outweigh this risk.

Blood transfusions can cause excess iron to build up in the body. This extra iron can deposit in the liver and heart, causing the organs to function poorly. This iron build up is usually seen only in people who receive many transfusions over a period of years. Drugs called *chelating agents* (substances that bind with iron so that the body can get rid of it) can be used to treat and prevent iron overload from transfusions. The most commonly used drug is desferoxamine. This drug can be given intravenously or as an injection under the skin. It is inconvenient because the injection must be given slowly (over several hours) 5 to 7 times per week. In some patients, treatment continues for years. Deferasirox (Exjade[®]) is a newer drug that is taken by mouth once a day to treat iron overload. It has been used more for patients with certain congenital anemias (like thalassemia), but it can also be used to treat iron overload in patients with CMML.

CMML patients with bleeding problems resulting from a shortage of platelets may benefit from platelet transfusions.

Patients with CMML are susceptible to infections. They should be especially careful to avoid cuts and scrapes and to care for any that occur right away. They should tell their doctors immediately about any fever, signs of pneumonia (cough, shortness of breath), urinary infection (burning when urinating), or other symptoms of an infection. Doctors will treat any known or suspected infections with antibiotics. Our document *Infections in People with Cancer* has more detailed information about this topic.

Chemotherapy for chronic myelomonocytic leukemia

Chemotherapy (chemo) is the use of drugs for treating a disease such as cancer. The drugs can be swallowed as pills, or they can be injected by needle into a vein or muscle. Chemo is considered systemic treatment because these drugs enter the bloodstream and reach most areas of the body. This type of treatment is useful for diseases such as chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) that are not localized to one part of the body. The purpose of the chemo is to eliminate the abnormal bone marrow cells and allow normal ones to grow back.

Hydroxyurea

Hydroxyurea (hydroxycarbamate, Hydrea[®]) is a chemo drug that has helped some patients with CMML live longer. This drug comes as a capsule and is taken by mouth daily. It can lower the counts of white blood cells and monocytes to normal. It may also help shrink an enlarged spleen. Because the main effect of hydroxyurea is to lower blood counts, anyone taking this drug will have their blood counts checked regularly. Other side effects are usually mild and easily tolerated. Some patients have stayed on this drug for years without ill effects.

Hypomethylating agents

These drugs are actually a form of chemo that affects the way genes are controlled. Examples of this type of drug include azacytidine (Vidaza[®]) and decitabine (Dacogen[®]). These drugs have been studied best in the treatment of myelodysplastic syndromes, where they seem to help stop abnormal cells in the bone marrow from dividing to make new cells. This lets the normal cells grow again, often leading to improved blood counts and less need for transfusions. Fewer patients with CMML were treated with these drugs in studies, but they had similar benefits in terms of blood counts.

Side effects are usually mild and rarely lead to stopping treatment, but these drugs can have some of the same side effects as regular chemotherapy, including:

- Nausea/vomiting
- Diarrhea
- Fatigue and weakness
- Low blood counts (most often the white blood cells or platelets)

Conventional chemotherapy

For a long time, CMML was grouped with myelodysplastic syndromes, and so it was treated with the same chemo drugs. Some of the chemo regimens that have been used include:

- Cytarabine (ara-C) with idarubicin,
- Cytarabine with topotecan
- Cytarabine with fludarabine

Sometimes, topotecan is given by itself.

This type of treatment can help some patients, but it is very toxic. Side effects can be severe and may even hasten death. This treatment is generally only used in young and otherwise healthy CMML patients. Most patients with CMML are older and have other health problems. They are less likely to benefit from this intense type of chemo. Still, this may be an option for some patients with advanced CMML.

Another option is to use lower doses of chemo drugs. This approach can lower the chance of serious side effects.

Chemo drugs can cause many side effects. The side effects depend on the type and dose of the drugs that are given and the length of time they are taken. Common side effects include:

- Hair loss
- Mouth sores

- Loss of appetite
- Nausea and vomiting
- Low blood counts

Chemotherapy often slows blood production, leading to low blood counts. In CMML, this problem is usually made worse before it gets better. It can lead to:

- Lowered resistance to infection (due to low white blood cell counts)
- Easy bruising and bleeding (due to low platelet counts)
- Fatigue (due to low red blood cell counts).

When platelet counts get very low, patients may receive platelet transfusions to prevent or stop bleeding. Likewise, fatigue caused by low red blood cell counts can be treated with red blood cell transfusions.

Most side effects are temporary and will go away after treatment is finished. Your health care team often can suggest ways to lessen side effects. For example, other drugs can be given along with the chemo to prevent or reduce nausea and vomiting.

Chemo drugs can also damage organs such as the kidneys, liver, testes, ovaries, brain, heart, and lungs. With careful monitoring, such side effects are rare. If serious side effects occur, the chemo treatments may have to be reduced or stopped, at least temporarily.

Carefully monitoring and adjusting drug doses are important because some of these side effects can be permanent.

Our document, *Understanding Chemotherapy: A Guide for Patients and Families* has more information about chemo and its side effects. If you'd like more information on a drug used in your treatment or a specific drug mentioned in this section, see our [Guide to Cancer Drugs](#) , or call us with the names of the medicines you're taking.

Growth factors for treating chronic myelomonocytic leukemia

Hematopoietic growth factors are hormone-like substances that stimulate bone marrow to produce blood cells. These substances occur naturally in the body, but scientists have found a way to make them in large amounts. This lets patients receive these factors in larger doses than would be produced by their own body.

Shortages of blood cells cause many of the symptoms in people with chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML), and growth factors can help the blood counts become more normal.

Erythropoietin (Epo[®] or Procrit[®]), a growth factor that promotes red blood cell production, can help avoid transfusions of red blood cells in some patients. Recently it has been found that combining erythropoietin with a growth factor for white blood cells (G-CSF, Neupogen[®], or filgrastim) improves the patient's response to the erythropoietin.

Darbepoetin (Aranesp[®]) is a long-acting form of erythropoietin. It works in the same way but can be given less often.

A drug called oprelvekin (Neumega[®], interleukin-11, or IL-11) can be used to stimulate platelet production after chemotherapy and in some other diseases. This drug can help increase the platelet counts of some CMML patients for a time, but then the counts go back down again. For most patients, this drug is not very helpful.

More studies are being done to find the best way to predict which patients will benefit from growth factors and the best way to combine growth factors with each other and with other treatments, such as chemotherapy or hormones. Patients usually receive the growth factors through subcutaneous (under the skin) injections. Your health care team can give the injections, or you or your family members can learn to give them.

Radiation therapy for chronic myelomonocytic leukemia

Radiation therapy is treatment with high-energy rays or particles to destroy cancer cells. The most common form of radiation therapy, external beam radiation therapy, aims x-rays from a machine outside the patient's body. The treatment is much like getting an x-ray, but the radiation is more intense. The procedure itself is painless. Before your treatments start, the radiation team will take careful measurements to determine the correct angles for aiming the radiation beams and the proper dose of radiation. Each treatment lasts only a few minutes, but the setup time -- getting you into place for treatment -- usually takes longer.

If someone who has chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) is having problems from a very enlarged spleen, radiation therapy may be used to shrink it. Shrinking the spleen can improve symptoms like abdominal (belly) pain and trouble eating, but there are some risks. Treating the spleen with radiation can affect the way it works. Since the spleen helps protect against infection, this can increase the risk of severe infections. If you are considering treatment with radiation for an enlarged spleen, you should talk about the risks and benefits with your doctor. You may also need to get certain vaccines before radiation starts.

For more information about radiation therapy, see our document [*Understanding Radiation Therapy: A Guide for Patients and Families.*](#)

Surgery for chronic myelomonocytic leukemia

Surgery is rarely used to treat chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML). Sometimes, though, surgery to remove the spleen may be an option if the patient is having problems from an enlarged spleen. Like all surgeries, this has risks related to anesthesia and wound infection. Also, since the spleen helps protect against infection, removing it can increase the risk of severe infections. If you are considering having your spleen removed, discuss the risks and benefits with your doctor.

General information about surgery in the treatment of cancer can be found in our document *Understanding Cancer Surgery: A Guide for Patients and Families.*

Stem cell transplant for chronic myelomonocytic leukemia

Stem cell transplant (SCT) is the only treatment that can cure chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML). In this treatment, the patient receives high-dose chemotherapy often along with radiation to the entire body to kill the cells in the bone marrow (including the abnormal bone marrow cells). Then the patient receives new, functioning blood-forming stem cells. There are 2 main types of SCT: allogeneic and autologous.

In an autologous stem cell transplant, after the bone marrow is destroyed, the patient gets back their own stem cells. This type of transplant is not a standard treatment for patients with CMML because their bone marrow contains abnormal stem cells.

For an allogeneic stem cell transplant, the patient receives blood-forming stem cells from another person - the donor. The best results are when the donor's cells are closely matched to the patient's cell type and the donor is closely related to the patient, such as a brother or sister. Less often, the donor is matched to the patient, but is not related.

Allogeneic stem cell transplant can have serious, even fatal, side effects and so is rarely used in elderly patients. Because of these side effects, some doctors restrict this treatment to people younger than a certain age.

A special type of allogeneic transplant, called *non-myeloablative allogeneic stem cell transplant* may be an option for older patients. This type of transplant is sometimes called a mini-transplant or a mini-allo. For this kind of transplant, the doses of chemotherapy and/or radiation that are given are lower than those used for a standard allogeneic transplant. These doses are not high enough to kill all the bone marrow cells, but they are just enough to allow the donor cells to take hold and grow in the bone marrow. The lower doses of chemotherapy and/or radiation cause fewer side effects, which makes this type of transplant easier for older patients to tolerate. Still, some serious side effects remain.

Transplant side effects

The early side effects from a SCT are similar to the side effects expected from chemotherapy and radiation, only more severe. One of the most serious side effects is low blood counts, which can lead to risks of serious infections and bleeding.

The most serious side effect from allogeneic transplants is called *graft-versus-host disease* (or GVHD). This occurs when the new immune cells (from the donor) see the patient's tissues as foreign and so attack them. This can affect any part of the body and can be life threatening.

Allogeneic SCT is currently the only treatment that can cure some patients with CMML, but not all patients who get a transplant are cured. And many patients may die from complications of this treatment.

For more information about stem cell transplants, see our document *Stem Cell Transplant (Peripheral Blood, Bone Marrow, and Cord Blood Transplants)*.

Clinical trials for chronic myelomonocytic leukemia

You may have had to make a lot of decisions since you've been told you have cancer. One of the most important decisions you will make is choosing which treatment is best for you. You may have heard about clinical trials being done for your type of cancer. Or maybe someone on your health care team has mentioned a clinical trial to you.

Clinical trials are carefully controlled research studies that are done with patients who volunteer for them. They are done to get a closer look at promising new treatments or procedures.

If you would like to take part in a clinical trial, you should start by asking your doctor if your clinic or hospital conducts clinical trials. You can also call our clinical trials matching service for a list of clinical trials that meet your medical needs. You can reach this service at 1-800-303-5691 or on our Web site at www.cancer.org/clinicaltrials. You can also get a list of current clinical trials by calling the National Cancer Institute's Cancer Information Service toll-free at 1-800-4-CANCER (1-800-422-6237) or by visiting the NCI clinical trials Web site at www.cancer.gov.

There are requirements you must meet to take part in any clinical trial. If you do qualify for a clinical trial, it is up to you whether or not to enter (enroll in) it.

Clinical trials are one way to get state-of-the-art cancer treatment. In some cases they may be the only way to get access to newer treatments. They are also the only way for doctors to learn better methods to treat cancer. Still, they are not right for everyone.

You can get a lot more information on clinical trials in our document called *Clinical Trials: What You Need to Know*. You can read it on our website or call our toll-free number (1-800-227-2345) and have it sent to you.

Complementary and alternative therapies for chronic myelomonocytic leukemia

When you have cancer you are likely to hear about ways to treat your cancer or relieve symptoms that your doctor hasn't mentioned. Everyone from friends and family to Internet groups and websites may offer ideas for what might help you. These methods can include vitamins, herbs, and special diets, or other methods such as acupuncture or massage, to name a few.

What exactly are complementary and alternative therapies?

Not everyone uses these terms the same way, and they are used to refer to many different methods, so it can be confusing. We use *complementary* to refer to treatments that are used *along with* your regular medical care. *Alternative* treatments are used *instead of* a doctor's medical treatment.

Complementary methods: Most complementary treatment methods are not offered as cures for cancer. Mainly, they are used to help you feel better. Some methods that are

used along with regular treatment are meditation to reduce stress, acupuncture to help relieve pain, or peppermint tea to relieve nausea. Some complementary methods are known to help, while others have not been tested. Some have been proven not to be helpful, and a few have even been found harmful.

Alternative treatments: Alternative treatments may be offered as cancer cures. These treatments have not been proven safe and effective in clinical trials. Some of these methods may pose danger, or have life-threatening side effects. But the biggest danger in most cases is that you may lose the chance to be helped by standard medical treatment. Delays or interruptions in your medical treatments may give the cancer more time to grow and make it less likely that treatment will help.

Finding out more

It is easy to see why people with cancer think about alternative methods. You want to do all you can to fight the cancer, and the idea of a treatment with few or no side effects sounds great. Sometimes medical treatments like chemotherapy can be hard to take, or they may no longer be working. But the truth is that most of these alternative methods have not been tested and proven to work in treating cancer.

As you consider your options, here are 3 important steps you can take:

- Look for “red flags” that suggest fraud. Does the method promise to cure all or most cancers? Are you told not to have regular medical treatments? Is the treatment a “secret” that requires you to visit certain providers or travel to another country?
- Talk to your doctor or nurse about any method you are thinking about using.
- Contact us at 1-800-227-2345 to learn more about complementary and alternative methods in general and to find out about the specific methods you are looking at. You can also check them out on the *Complementary and Alternative Medicine* page of our website.

The choice is yours

Decisions about how to treat or manage your cancer are always yours to make. If you want to use a non-standard treatment, learn all you can about the method and talk to your doctor about it. With good information and the support of your health care team, you may be able to safely use the methods that can help you while avoiding those that could be harmful.

General approach to treatment of chronic myelomonocytic leukemia

Stem cell transplant (SCT) is the only way to cure patients with chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML). It may be the treatment of choice

for younger patients when a matched donor is available. This may also be an option for some older patients.

If SCT is not an option, CMML is not curable. In that case, the goal is to relieve symptoms while avoiding the complications and reducing side effects of treatment. Supportive care, such as transfusions, blood cell growth factors, and antibiotics to treat infections, is given to all patients.

If treatment is needed, either of the drugs azacytidine (Vidaza) or decitabine (Dacogen) is often the first choice for CMML. Azacytidine is injected under the skin for 7 days in a row every month. Decitabine is also injected, either once every 8 hours for 3 days, or once a day for 5 days. These drugs may make blood counts drop for a time after treatment is started. Then, if the drug is successful, blood counts rise to levels above those seen before treatment was started.

A major benefit for patients receiving azacytidine or decitabine is a lessened need for transfusions and an improved quality of life. In particular, if their disease responds, the patients have less fatigue and are able to function more normally. Finally, the drugs may increase life span, although this isn't certain.

Treatment with hydroxyurea can help some patients who have high white blood cell counts. This drug can help lower monocyte counts and decrease the need for transfusions. It can also shrink the spleen to help the patient feel more comfortable.

Conventional chemotherapy using drug combinations used to treat acute myeloid leukemia can be an option for patients who are younger and otherwise healthy, but it is rarely used.

More treatment information about chronic myelomonocytic leukemia

For more details on treatment options -- including some that may not be addressed in this document -- the National Comprehensive Cancer Network (NCCN) and the National Cancer Institute (NCI) are good sources of information.

The NCCN, made up of experts from many of the nation's leading cancer centers, develops cancer treatment guidelines for doctors to use when treating patients. Those are available on the NCCN website (www.nccn.org).

The NCI provides treatment information via Toll-free number (1-800-4-CANCER) and its website (www.cancer.gov). Information for patients as well as more detailed information intended for use by cancer care professionals is also available on www.cancer.gov.

What happens after treatment for chronic myelomonocytic leukemia?

Since chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) is rarely cured, most patients never actually complete treatment. Patients may go through a series of treatments with rest in-between. Some people stop active treatment in favor of supportive care. Learning to live with cancer that does not go away can be difficult and very stressful. Our document, *When Cancer Doesn't Go Away*, talks more about this.

Follow-up care

Even if you have stopped treatment for your CMML, it is still very important to keep all follow-up appointments. During these visits, your doctors will ask about symptoms, physically examine you, and order blood tests. They will continue to watch for signs of infection and progression to leukemia, as well as for short-term and long-term side effects for treatment. This is the time for you to ask your health care team any questions you need answered and to discuss any concerns you might have.

Almost any cancer treatment can have side effects. Some may last for a few weeks or months, but others can be permanent. Don't hesitate to tell your cancer care team about any symptoms or side effects that bother you so they can help you manage them.

It is also important to keep your medical insurance. With a chronic disease like CMML, your treatment may never really be over. You will not want to have to worry about paying for it. Many people have been bankrupted by medical costs.

Seeing a new doctor

At some point after your cancer diagnosis and treatment, you may find yourself seeing a new doctor who does not know your medical history. It is important that you be able to give your new doctor the details of your diagnosis and treatment. . Gathering these details soon after treatment may be easier than trying to get them at some point in the future. Make sure you have this information handy

- A copy of your pathology report(s) from any biopsies or surgeries
- If you had surgery, a copy of your operative report (s)
- If you were in the hospital, a copy of the discharge summary that doctors prepare when patients are sent home from the hospital
- If you had radiation, a copy of the treatment summary
- Since some drugs can have long-term side effects, a list of your drugs, drug doses, and when you took them

The doctor may want copies of this information for his records, but always keep copies for yourself.

Lifestyle changes after treatment for chronic myelomonocytic leukemia

You can't change the fact that you have had cancer. What you can change is how you live the rest of your life -- making choices to help you stay healthy and feel as well as you can. This can be a time to look at your life in new ways. Maybe you are thinking about how to improve your health over the long term. Some people even start during cancer treatment.

Making healthier choices

For many people, a diagnosis of cancer helps them focus on their health in ways they may not have thought much about in the past. Are there things you could do that might make you healthier? Maybe you could try to eat better or get more exercise. Maybe you could cut down on the alcohol, or give up tobacco. Even things like keeping your stress level under control may help. Now is a good time to think about making changes that can have positive effects for the rest of your life. You will feel better and you will also be healthier.

You can start by working on those things that worry you most. Get help with those that are harder for you. For instance, if you are thinking about quitting smoking and need help, call your American Cancer Society at 1-800-227-2345 for information and support. This tobacco cessation and coaching service can help increase your chances of quitting for good.

Eating better

Eating right can be hard for anyone, but it can get even tougher during and after cancer treatment. Treatment may change your sense of taste. Nausea can be a problem. You may not feel like eating and lose weight when you don't want to. Or you might have gained weight that you can't seem to lose. All of these things can be very frustrating.

If treatment caused weight changes or eating or taste problems, do the best you can and keep in mind that these problems usually get better over time. You may find it helps to eat small portions every 2 to 3 hours until you feel better. You may also want to ask your cancer team about seeing a dietitian, an expert in nutrition, who can give you ideas on how to deal with these treatment side effects.

One of the best things you can do after cancer treatment is put healthy eating habits into place. You may be surprised at the long-term benefits of some simple changes, like increasing the variety of healthy foods you eat. Try to eat 5 or more servings of vegetables and fruits each day. Choose whole grain foods instead of those made with white flour and sugars. Try to limit meats that are high in fat. Cut back on processed

meats like hot dogs, bologna, and bacon. Better yet, don't eat any of these, if you can. If you drink alcohol, limit yourself to 1 or 2 drinks a day at the most.

For more information about nutrition, see our document [*Nutrition for the Person With Cancer During Treatment: A Guide for Patients and Families*](#). The section called "[Additional resources for chronic myelomonocytic leukemia](#)" lists some other documents that you might find helpful.

Rest, fatigue, work, and exercise

Extreme tiredness, called *fatigue*, is very common in people treated for cancer. This is not a normal tiredness, but a "bone-weary" exhaustion that doesn't get better with rest. For some people, fatigue lasts a long time after treatment, and can make it hard for them to exercise and do other things they want to do. But exercise can help reduce fatigue. Studies have shown that patients who follow an exercise program tailored to their personal needs feel better physically and emotionally and can cope better, too.

If you were sick and not very active during treatment, it is normal for your fitness, endurance, and muscle strength to decline. Any plan for physical activity should fit your own situation. A person who has never exercised will not be able to take on the same amount of exercise as someone who plays tennis twice a week. If you haven't exercised in a few years, you will have to start slowly -- maybe just by taking short walks.

Talk with your health care team before starting anything. Get their opinion about your exercise plans. Then, try to find an exercise buddy so you're not doing it alone. Having family or friends involved when starting a new exercise program can give you that extra boost of support to keep you going when the push just isn't there.

If you are very tired, you will need to balance activity with rest. It is OK to rest when you need to. Sometimes it's really hard for people to allow themselves to rest when they are used to working all day or taking care of a household, but this is not the time to push yourself too hard. Listen to your body and rest when you need to. For more information on dealing with fatigue, please see *Fatigue in People With Cancer* and *Anemia in People With Cancer*. A list of some other documents about treatment side effects can be found in the section, "Additional resources for chronic myelomonocytic leukemia."

Keep in mind exercise can improve your physical and emotional health.

- It improves your cardiovascular (heart and circulation) fitness.
- Along with a good diet, it will help you get to and stay at a healthy weight.
- It makes your muscles stronger.
- It reduces fatigue and helps you have more energy.
- It can help lower anxiety and depression.
- It can help make you feel happier.

- It can help you feel better about yourself.

And long term, we know that exercise plays a role in helping to lower the risk of some cancers. In the American Cancer Society guidelines on physical activity for cancer prevention, we recommend that adults take part in at least 30 minutes of moderate to vigorous physical activity, above usual activities, on 5 or more days of the week; 45 to 60 minutes of intentional physical activity are even better.

How does having chronic myelomonocytic leukemia affect your emotional health?

At some point you may find yourself overwhelmed by emotions. This happens to a lot of people. Now it may feel like a lot of other issues are catching up with you.

You may find yourself thinking about death and dying. Or maybe you're more aware of the effect the cancer has on your family, friends, and career. You may take a new look at your relationship with those around you. Unexpected issues may also cause concern. For instance, if you start to feel better and have fewer doctor visits, you will see your health care team less often and have more time on your hands. These changes can make some people anxious.

Almost everyone who has been through cancer can benefit from getting some type of support. You need people you can turn to for strength and comfort. Support can come in many forms: family, friends, cancer support groups, church or spiritual groups, online support communities, or one-on-one counselors. What's best for you depends on your situation and personality. Some people feel safe in peer-support groups or education groups. Others would rather talk in an informal setting, such as church. Others may feel more at ease talking one-on-one with a trusted friend or counselor. Whatever your source of strength or comfort, make sure you have a place to go with your concerns.

The cancer journey can feel very lonely. It is not necessary or good for you to try to deal with everything on your own. And your friends and family may feel shut out if you do not include them. Let them in, and let in anyone else who you feel may help. If you aren't sure who can help, call your American Cancer Society at 1-800-227-2345 and we can put you in touch with a group or resource that may work for you.

If treatment for chronic myelomonocytic leukemia stops working

If your chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) does not improve with the first treatment, it is often possible to try something else to help you live longer and feel better. But after many different treatments, the cancer may no longer respond well to treatment. If this happens, it's important to weigh the possible limited benefits of a new treatment against the possible downsides. Everyone has their own way of looking at this.

This is likely to be the hardest part of your battle with cancer -- when you have been through many medical treatments and nothing's working anymore. Your doctor may offer you new options, but at some point you may need to consider that treatment is not likely to improve your health or change your outcome or survival.

If you want to continue to get treatment for as long as you can, you need to think about the odds of treatment having any benefit and how this compares to the possible risks and side effects. In many cases, your doctor can estimate how likely it is the cancer will respond to treatment you are considering. No matter what you decide to do, you need to feel as good as you can. Make sure you are asking for and getting treatment for any symptoms you might have, such as nausea or pain. This type of treatment is called *palliative care*.

Palliative care helps relieve symptoms, but is not expected to cure the disease. It can be given along with cancer treatment, or can even be cancer treatment. The difference is its purpose - the main purpose of palliative care is to improve the quality of your life, or help you feel as good as you can for as long as you can. Sometimes this means using drugs to help with symptoms like pain or nausea. Sometimes, though, the treatments used to control your symptoms are the same as those used to treat cancer. For instance, radiation might be used to help relieve bone pain caused by cancer that has spread to the bones. Or chemo might be used to help shrink a tumor and keep it from blocking the bowels. But this is not the same as treatment to try to cure the cancer.

At some point, you might benefit from hospice care. This is special care that treats the person rather than the disease; it focuses on quality rather than length of life. Most of the time, it is given at home. Your cancer may be causing problems that need to be managed, and hospice focuses on your comfort. You should know that while getting hospice care often means the end of treatments such as chemo and radiation, it doesn't mean you can't have treatment for the problems caused by your cancer or other health conditions. In hospice the focus of your care is on living life as fully as possible and feeling as well as you can at this difficult time. You can learn more about hospice in our documents *Hospice Care* and *Nearing the End of Life*.

Staying hopeful is important, too. Your hope for a cure may not be as bright, but there is still hope for good times with family and friends -- times that are filled with happiness and meaning. Pausing at this time in your cancer treatment gives you a chance to refocus on the most important things in your life. Now is the time to do some things you've always wanted to do and to stop doing the things you no longer want to do. Though the cancer may be beyond your control, there are still choices you can make.

What should you ask your doctor about chronic myelomonocytic leukemia?

It is important to have frank, open, and honest discussions with your doctor about your condition. Your doctor and the rest of the health care team want to answer all of your questions. For instance, consider these questions:

- What treatment choices do I have?
- Which treatment, if any, do you recommend, and why?
- What are the side effects of the treatments that you recommend?
- How can I help reduce the side effects I may have from the treatment?
- What is the outlook for my survival?
- Should I seek a second opinion, and who do you recommend as an expert in this disease?

What's new in chronic myelomonocytic leukemia research and treatment?

Genetics

Research on the causes, diagnosis, and treatment of chronic myelomonocytic (MY-eh-loh-MAH-noh-SIH-tik) leukemia (CMML) is being done at many cancer research centers. Scientists are making progress in understanding how changes in a person's DNA and RNA can cause normal bone marrow cells to develop into leukemia cells.

Studies have found that changes in the structure or activity of certain genes in CMML cells may help predict patients' prognosis and how likely the patient is to develop acute leukemia. This information may eventually be used to help guide treatment decisions.

As more information from this research unfolds, it may be used in designing new drugs or eventually in developing gene therapy. This approach replaces the abnormal DNA of cancer cells with normal DNA to restore normal control of cell growth.

Chemotherapy

Studies are in progress to find the most effective combination of chemotherapy drugs while still avoiding unnecessary side effects. New drugs are continually being developed and tested. An oral (by mouth) form of azacitidine is being tested. Research is underway to determine whether patients with certain unfavorable prognostic features will benefit from more intensive chemotherapy.

Stem cell transplant

Scientists continue to refine this procedure to increase its effectiveness, reduce complications, and determine which patients are likely to be helped by this treatment.

Additional resources for chronic myelomonocytic leukemia

More information from your American Cancer Society

Here is more information you might find helpful. You also can order free copies of our documents from our toll-free number, 1-800-227-2345, or read them on our website, www.cancer.org.

Dealing with diagnosis and treatment

[Health Professionals Associated With Cancer Care](#)

[Talking With Your Doctor](#) (also in Spanish)

After Diagnosis: A Guide for Patients and Families (also available in Spanish)

[Nutrition for the Person With Cancer During Treatment: A Guide for Patients and Families](#) (also in Spanish)

[Coping With Cancer in Everyday Life](#) (also in Spanish)

When Cancer Doesn't Go Away

Family and caregiver concerns

[Talking With Friends and Relatives About Your Cancer](#) (also in Spanish)

[Helping Children When A Family Member Has Cancer: Dealing With Diagnosis](#) (also in Spanish)

[What It Takes to Be a Caregiver](#)

Insurance and financial issues

[In Treatment: Financial Guidance for Cancer Survivors and Their Families](#) (also in Spanish)

[Health Insurance and Financial Assistance for the Cancer Patient](#) (also in Spanish)

More on cancer treatments

[Understanding Cancer Surgery: A Guide for Patients and Families](#) (also in Spanish)

[Understanding Chemotherapy: A Guide for Patients and Families](#) (also in Spanish)

[Understanding Radiation Therapy: A Guide for Patients and Families](#) (also in Spanish)

[Clinical Trials: What You Need to Know](#)

Stem Cell Transplant (Peripheral Blood, Bone Marrow, and Cord Blood Transplants)
(also available in Spanish)

Cancer treatment side effects

Caring for the Patient With Cancer at Home: A Guide for Patients and Families (also available in Spanish)

Infections in People With Cancer

[Distress in People With Cancer](#)

[Anxiety, Fear, and Depression](#)

[Nausea and Vomiting](#)

[Guide to Controlling Cancer Pain](#) (also in Spanish)

[Pain Diary](#)

[Anemia in People With Cancer](#)

[Fatigue in People With Cancer](#)

Your American Cancer Society also has books that you might find helpful. Call us at 1-800-227-2345 or visit our bookstore online at cancer.org/bookstore to find out about costs or to place an order.

National organizations and websites*

Along with the American Cancer Society, other sources of information and support include:

Leukemia & Lymphoma Society

Toll-free number: 1-800-955-4572

Website: www.lls.org

Has a variety of service programs and resources available throughout the US and Canada including: the Information Resource Center, staffed by health care professionals, available via the toll-free number; free publications on all forms of leukemia and related topics; First Connection, a telephone-based peer support network for patients and survivors; family support groups; education teleconferences and webcasts – a schedule is on the website.

National Cancer Institute (NCI)

Toll-free number: 1-800-422-6237 (1-800-4-CANCER)

TTY: 1-800-332-8615

Website: www.cancer.gov

Their “Cancer Information Service” offers a wide variety of free, accurate, up-to-date information about cancer to patients, their families, and the general public; also can help people find clinical trials in their area.

National Coalition for Cancer Survivorship (NCCS)

Toll-free number: 1-888-650-9127

Website: www.canceradvocacy.org

Has publications on many cancer-related topics; also offers the Cancer Survival Toolbox – a free program that teaches skills that can help people with cancer meet the challenges of their illness.

Bone marrow and peripheral blood stem cell transplants

National Bone Marrow Transplant Link (nbmtLINK)

Toll-free number: 1-800-546-5268 (1-800-LINK-BMT)

Website: www.nbmtlink.org

Programs and services include: information and referrals to meet a wide range of needs; support via one-on-one conversations with trained peer support volunteers who are transplant survivors, caregivers, and donors; telephone support groups, facilitated by a clinical social worker, that link patients and families together to offer mutual support and coping strategies; and the nbmtLINK Online Resource Library – a comprehensive, searchable library giving access to the latest transplant information.

Be the Match (formerly the National Marrow Donor Program and merged with the Caitlin Raymond International Registry)

Toll-free number: 1-800-627-7692 (1-800-MARROW-2)

Website: www.bethematch.org

Provides a registry of volunteer bone marrow donors and cord blood units (the largest listing in the world), as well as a searchable listing of transplant centers that can be accessed directly at www.marrow.org/access. This listing contains information that may help a patient choose a transplant center. Also supports patients and their doctors throughout the transplant process, from diagnosis through survivorship; matches patients with the best donor or cord blood unit using innovative science and technology; has free educational materials; and offers financial assistance to eligible underinsured patients through the Patient Assistance Program.

**Inclusion on this list does not imply endorsement by the American Cancer Society.*

No matter who you are, we can help. Contact us anytime, day or night, for information and support. Call us at **1-800-227-2345** or visit www.cancer.org.

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For additional assistance please contact your American Cancer Society
1-800-227-2345 or www.cancer.org