



Treating Acute Lymphocytic Leukemia

General treatment information

Adult acute lymphocytic leukemia (ALL) is not a single disease. It is really a group of related diseases, and patients with different subtypes of ALL may have different outlooks and responses to treatment.

After your cancer is diagnosed and staged, your cancer care team will discuss your treatment options with you. Choosing a treatment plan is an important decision, so it is important to take time and think about your choices. Treatment options for each patient are based on the leukemia subtype as well as certain prognostic features (described in [How Is Acute Lymphocytic Leukemia Classified?](#)).

The main types of treatment used for ALL are:

- [Chemotherapy](#)
- [Targeted therapy](#)
- [Stem cell transplant](#)

Other treatments such as [surgery](#), [radiation therapy](#), or [monoclonal antibodies](#), may be used in special circumstances.

Treatment of ALL typically lasts for about 2 years. It is often intense, especially in the first few months of treatment, so it is important that you are treated in a center that has experience with this disease. See [Typical Treatment of Acute Lymphocytic Leukemia](#) for information about common treatment plans.

You may have different types of doctors on your treatment team. The doctor in charge or your team will most likely be a hematologist, a doctor who specializes in treating blood diseases, including leukemia. Many other specialists may be involved in your care as well, including nurse practitioners, nurses, nutrition specialists, social workers, and other health professionals.

It is important to discuss all of your treatment options, including their goals and possible side effects, with your doctors to help make the decision that best fits your needs. It's also very important to ask questions if there is anything you're not sure about. You can find some good questions to ask in [What Should You Ask Your Doctor About Acute Lymphocytic Leukemia?](#)

Treatment for ALL usually needs to start very soon after it is diagnosed, but if time permits, it is often a good idea to seek a second opinion. A second opinion might give you more information and help you feel confident about your chosen treatment plan.

Thinking about taking part in a clinical trial

Clinical trials are carefully controlled research studies that are done to get a closer look at promising new treatments or procedures. 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 best way for doctors to learn better methods to treat cancer. Still, they are not right for everyone.

If you would like to learn more about clinical trials that might be right for you, start by asking your doctor if your clinic or hospital conducts clinical trials. See [Clinical Trials](#) to learn more.

Considering complementary and alternative methods

You may hear about alternative or complementary methods that your doctor hasn't mentioned to treat your cancer or relieve symptoms. These methods can include vitamins, herbs, and special diets, or other methods such as acupuncture or massage, to name a few.

Complementary methods refer to treatments that are used along with your regular medical care. Alternative treatments are used instead of a doctor's medical treatment. Although some of these methods might be helpful in relieving symptoms or helping you feel better, many have not been proven to work. Some might even be dangerous.

Be sure to talk to your cancer care team about any method you are thinking about using. They can help you learn what is known (or not known) about the method, which can help you make an informed decision. See the [Complementary and Alternative Medicine](#) section to learn more.

Help getting through cancer treatment

Your cancer care team will be your first source of information and support, but there are other resources for help when you need it. Hospital- or clinic-based support services are an important part of your care. These might include nursing or social work services, financial aid, nutritional advice, rehab, or spiritual help.

The American Cancer Society also has [programs and services](#) – including rides to treatment, lodging, and more – to help you get through treatment. Call our National Cancer Information Center at 1-800-227-2345 and speak with one of our trained specialists.

The treatment information given here is not official policy of the American Cancer 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.

Chemotherapy for Acute Lymphocytic Leukemia

[Chemotherapy \(chemo\)](#) is the use of drugs to treat cancer. Most often, these drugs are injected into a vein, into a muscle, under the skin, or taken by mouth. The drugs travel through the bloodstream to reach cancer cells all over the body. This makes chemo useful for cancers such as leukemia that has spread throughout the body. Most chemo doesn't reach the area around the brain and spinal cord well, so it may need to be injected into the cerebrospinal fluid to kill cancer cells in that area. This is called *intrathecal chemo*.

Doctors give chemo in cycles, with each period of treatment followed by a rest period to allow the body time to recover. Because of its potential side effects, chemo is sometimes not recommended if you are in poor health, but older age by itself should not stop someone from getting chemo if they need it and are healthy.

Chemo for acute lymphocytic leukemia (ALL) uses a combination of anti-cancer drugs. They are given in 3 phases, usually over the course of about 2 years (see [Typical Treatment of Acute Lymphocytic Leukemia](#)).

The most commonly used drugs include:

- Vincristine (Oncovin[®]) or liposomal vincristine (Marqibo[®])

- Daunorubicin (daunomycin or Cerubidine[®]) or doxorubicin (Adriamycin[®])
- Cytarabine (cytosine arabinoside, ara-C, or Cytosar[®])
- L-asparaginase (Elspar[®]) or PEG-L-asparaginase (pegaspargase or Oncaspar[®])
- Etoposide (VP-16)
- Teniposide (Vumon[®])
- 6-mercaptopurine (6-MP or Purinethol[®])
- Methotrexate
- Cyclophosphamide (Cytosan[®])
- Prednisone
- Dexamethasone (Decadron[®])

People typically get several of these drugs at different times during the course of treatment, but they do not get all of them.

Possible side effects

Chemo drugs attack cells that are dividing quickly, which is why they work against cancer cells. But other cells in the body, such as those in the bone marrow (where new blood cells are made), the lining of the mouth and intestines, and the hair follicles, also divide quickly. These cells are also likely to be affected by chemo, which can lead to side effects.

The [side effects of chemo](#) depend on the type and dose of drugs given and the length of time they are taken. Common side effects may include:

- Hair loss
- Mouth sores
- Loss of appetite
- [Nausea and vomiting](#)
- Diarrhea
- Increased risk of infections (due to low white blood cell counts)
- Easy bruising or bleeding (due to low blood platelet counts)
- [Fatigue](#) (due to low red blood cell counts)
- [Numbness, tingling, or weakness in hands or feet](#) (from nerve damage)

These side effects are usually short-term and go away once treatment is finished. There are often ways to lessen these side effects. For example, drugs can be given to help prevent or reduce nausea and vomiting. Be sure to ask your doctor or nurse about medicines to help reduce side effects, and let him or her know when you do have side effects so they can be managed effectively.

Many of the side effects of chemo are caused by low white blood cell counts. Drugs known as growth factors (G-CSF and GM-CSF, for example) may be given to speed the recovery of white blood cell counts during chemo to reduce the chance for serious infections.

Antibiotics and drugs that help prevent fungal and viral infections may be given before there are signs of infection or at the earliest sign that an infection may be developing. There are also steps that you can take to lower your risk of infection. These are discussed in [Infections in People With Cancer](#).

Because white blood cell counts are so important during treatment, some people find it helpful to keep track of them. If you are interested in this, ask your doctor or nurse about your [blood cell counts](#) and what these numbers mean.

If your platelet counts are low, you may be given drugs or platelet transfusions to help protect against bleeding. Likewise, shortness of breath and extreme fatigue caused by low red blood cell counts may be treated with drugs or with red blood cell [transfusions](#).

Certain drugs might cause specific side effects. For example, cytarabine (ara-C) can cause certain problems, especially when used at high doses. These can include dryness in the eyes and effects on certain parts of the brain, which can lead to problems with coordination and balance.

Other organs that could be directly damaged by certain chemo drugs include the kidneys, liver, testicles, ovaries, brain, heart, and lungs. Doctors and nurses carefully monitor treatment to reduce the risk of these side effects as much as possible. If serious side effects occur, the chemo may have to be reduced or stopped, at least for a time.

One of the most serious side effects of ALL therapy is an increased risk of getting [acute myelogenous leukemia](#) (AML) at a later time. This occurs in a small portion of patients after they have received chemo drugs such as etoposide, teniposide, cyclophosphamide, or chlorambucil. Less often, people cured of leukemia may later develop [non-Hodgkin lymphoma](#) or other cancers. Of course, the risk of getting these [second cancers](#) must be balanced against the obvious benefit of treating a life-threatening disease such as leukemia with chemotherapy.

Tumor lysis syndrome is another possible side effect of chemo. It is most common in patients who have large numbers of leukemia cells, so it is seen most often in people getting chemo for the first time. When chemo kills these cells, they break open and release their contents into the bloodstream. This can overwhelm the kidneys, which aren't able to get rid of all of these substances at once. Excess amounts of certain minerals may also affect the heart and nervous system. This can often be prevented by

giving extra fluids during treatment and by giving certain drugs, such as allopurinol and rasburicase, which help the body get rid of these substances.

- [References](#)

[See all references for Acute Lymphocytic Leukemia](#)

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Targeted Therapy for Acute Lymphocytic Leukemia

In recent years, new drugs that target specific parts of cancer cells have been developed. These drugs work differently than standard chemotherapy (chemo) drugs. They often have different (and less severe) side effects. These drugs are often referred to as targeted therapy. Some of these drugs can be useful in certain cases of acute lymphocytic leukemia (ALL).

About 1 out of 4 adult patients with ALL have leukemia cells with the *Philadelphia chromosome*. This is an abnormal chromosome formed by the swapping of material between chromosomes 9 and 22. This forms a new gene called *BCR-ABL*. The Philadelphia chromosome and *BCR-ABL* gene are also found in the cells of a different leukemia – [chronic myeloid leukemia](#) (CML). Cells with the *BCR-ABL* gene make an abnormal protein that helps the cells grow. Drugs have been developed to attack this protein. These drugs are called *tyrosine kinase inhibitors* (or TKIs), and include imatinib (Gleevec[®]), dasatinib (Sprycel[®]), nilotinib (Tasigna[®]), bosutinib (Bosulif[®]), and ponatinib (Iclusig[®]). Although these drugs were originally aimed at treating CML, some of them have been found to be helpful in treating patients with ALL that has the Philadelphia chromosome.

In studies of patients whose ALL cells contain the Philadelphia chromosome, adding one of these drugs to chemo helps more patients go into remission after treatment. Continuing on these drugs can also help keep the leukemia from coming back.

These drugs are taken daily as pills. Common side effects include diarrhea, [nausea](#),

muscle pain, [fatigue](#), and skin rashes. These are generally mild. A common side effect is swelling around the eyes or in the hands or feet. Other possible side effects include lower red blood cell and platelet counts at the start of treatment. All of these side effects get worse at higher than usual doses of the drug. Other more serious side effects can occur, as well, which differ depending on which drug is used.

More information about side effects of targeted therapy drugs can be found in [Targeted Cancer Therapy](#).

- [References](#)

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Monoclonal Antibodies to Treat Acute Lymphocytic Leukemia

Antibodies are proteins made by the body's immune system to help fight infections. Man-made versions, called monoclonal antibodies, can be designed to attack a specific target, such as a protein on the surface of lymphocytes.

Blinatumomab (Blincyto)

Blinatumomab is a special kind of monoclonal antibody because it can attach to 2 different proteins at the same time. One part of blinatumomab attaches to the CD19 protein, which is found on B cells, including some leukemia and lymphoma cells. Another part attaches to CD3, a protein found on immune cells called T cells. By binding to both of these proteins, this drug brings the cancer cells and immune cells together, which is thought to cause the immune system to attack the cancer cells.

This drug is used to treat some types of B-cell ALL, typically after chemotherapy has been tried. It is given into a vein (IV) as a continuous infusion over 28 days. It may be repeated again for more cycles with 2 weeks off in between. Because of certain serious

side effects that occur more often during the first few times it is given, the patient usually needs to be treated in a hospital or clinic for the beginning of at least the first 2 cycles.

The most common side effects are fever, headache, swelling of the feet and hands, nausea, tremor, rash, constipation, and low blood potassium levels. It can also cause low white blood cell counts, which increase the risk of serious infection.

This drug can also cause neurologic problems, such as seizures, difficulty in speaking or slurred speech, passing out, confusion, and loss of balance.

Some patients have serious reactions during the infusion of this drug. Symptoms can include feeling lightheaded or dizzy (due to low blood pressure), headache, nausea, fever or chills, shortness of breath, and/or wheezing. Let your healthcare team know if you develop any of these symptoms, as this reaction can be life-threatening. If you do have a reaction, the drug will be stopped while the reaction is treated.

Inotuzumab ozogamicin (Besponsa)

This drug is an anti-CD22 antibody linked to a chemotherapy drug. B cells (including some leukemia cells) usually have the CD22 protein on their surface. The antibody acts like a homing signal, bringing the chemo drug to the leukemia cells, where it enters the cells and kills them when they try to divide into new cells.

This drug is used to treat some types of B-cell ALL, typically after chemotherapy has been tried. It is given as an infusion into a vein (IV), once a week for 3 or 4 weeks in a row. This may be repeated for more cycles.

The most common side effects are low levels of blood cells (with increased risks of infection, bleeding, and fatigue), fever, nausea, headache, abdominal (belly) pain, and high blood levels of bilirubin (a substance in bile).

Less common but more serious side effects can include:

- Severe liver damage, including veno-occlusive disease (blockage of veins in the liver)
- Reactions during the infusion (similar to an allergic reaction). You will likely be given medicines before each infusion to help prevent this.
- Serious or life-threatening infections, especially in people who have already had a [stem cell transplant](#)
- Changes in the rhythm of the heart

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- [References](#)

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Surgery for Acute Lymphocytic Leukemia

[Surgery](#) has a very limited role in the treatment of acute lymphocytic leukemia (ALL). Because leukemia cells spread widely throughout the bone marrow and to many other organs through the blood, it is not possible to cure this type of cancer by surgery. Aside from a possible lymph node biopsy, surgery rarely has any role even in the diagnosis of ALL, since a bone marrow aspirate and biopsy can usually diagnose leukemia.

Often before [chemotherapy](#) (chemo) is about to start, surgery is needed to insert a small plastic tube, called a [central venous catheter](#) or venous access device (VAD), into a large vein. The end of the tube stays just under the skin or sticks out in the chest area or upper arm. The VAD is left in place during treatment to give intravenous (IV) drugs such as chemo and to take blood samples. This lowers the number of needle sticks needed during treatment. It is very important to learn how to care for the device to keep it from getting infected.

Ommaya reservoir

Giving chemo directly into the fluid that surrounds the brain and spinal cord (cerebrospinal fluid or CSF) is often a part of the treatment of ALL. In this treatment, called *intrathecal chemo*, the medicines can be given through a lumbar puncture (spinal tap) or through an Ommaya reservoir. An Ommaya reservoir is a dome-like device attached to a catheter. The dome part sits under the skin of the scalp, with the catheter going through a hole in the skull and into one of the cavities of the brain (a ventricle). Intrathecal chemo can be given by placing a needle through the skin and into the dome. The chemo goes through the catheter and into the CSF in the ventricle. The CSF in the ventricle circulates through the other ventricles and into the area around the brain and spinal cord. An Ommaya reservoir allows you to get intrathecal chemo without having to

get repeated spinal taps. CSF can also be withdrawn from the Ommaya reservoir to check for leukemia cells and signs of infection (instead of a spinal tap).

- [References](#)

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Radiation Therapy for Acute Lymphocytic Leukemia

[Radiation therapy](#) uses high-energy radiation to kill cancer cells. It is not usually part of the main treatment for people with acute lymphocytic leukemia (ALL), but it is used in certain situations:

- Radiation is sometimes used to treat leukemia that has spread to the brain and spinal fluid or to the testicles.
- Radiation to the whole body is often an important part of treatment before a bone marrow or peripheral blood stem cell transplant (see [High-dose Chemotherapy and Stem Cell Transplant for Acute Lymphocytic Leukemia](#)).
- Radiation is used (rarely) to help shrink a tumor if it is pressing on the trachea (windpipe) and causing breathing problems. But [chemotherapy](#) is often used instead, as it may work more quickly.
- Radiation can also be used to reduce pain in an area of bone invaded by leukemia, if chemotherapy hasn't helped.

External beam radiation therapy, in which a machine delivers a beam of radiation to a specific part of the body, is the type of radiation used most often for ALL. Before your treatment starts, the radiation team will take careful measurements to determine the correct angles for aiming the radiation beams and the proper dose of radiation. Radiation therapy is much like getting an x-ray, but the radiation is more intense. The procedure itself is painless. Each treatment lasts only a few minutes, although the setup time – getting you into place for treatment – usually takes longer.

The possible sideeffects of radiation therapy depend on the dose given and where the radiation is aimed. They include:

- [Fatigue](#) (tiredness)
- Skin changes in the treated area, which can range from mild redness to burning and peeling
- Hair loss in the area being treated
- [Nausea and vomiting](#) (more common if the abdomen/belly is being treated)
- Diarrhea (more common if the belly or pelvis is being treated)
- Lowered blood cell counts, which can lead to fatigue and shortness of breath (from low red blood cell counts) and an increased [risk of infection](#) (from low white blood cell counts)
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High-dose Chemotherapy and Stem Cell Transplant for Acute Lymphocytic Leukemia

Standard doses of [chemotherapy](#) aren't always able to cure acute lymphocytic leukemia (ALL). Even though higher doses of chemo drugs might be more effective, they are not given because they could lead to long-term severe bone marrow damage. Because the bone marrow is where new blood cells are formed, this could lead to life-threatening infections, bleeding, and other problems due to low blood cell counts.

A [stem cell transplant](#) (SCT) allows doctors to use higher doses of chemo (sometimes along with radiation) to kill the cancer cells. After these treatments are finished, the patient receives a transplant of blood-forming stem cells to restore the bone marrow.

Blood-forming stem cells used for a transplant are obtained either from the blood (for a

peripheral blood stem cell transplant, or PBSCT), from the bone marrow (for a bone marrow transplant, or BMT), or from umbilical cord blood. Most often, stem cells from the blood are used.

Types of transplants

There are 2 main types of stem cell transplants:

- Allogeneic stem cell transplant – in which the stem cells come from someone else. This is the preferred type of transplant in treating ALL.
- Autologous stem cell transplant – in which the patient gets back his or her own cells

For an allogeneic transplant, the donor's tissue type (also known as the HLA type) needs to match the patient's tissue type as closely as possible to help prevent the risk of major problems with the transplant. Usually this donor is a brother or sister if they have the same tissue type as the patient. If there are no siblings with a good match, the cells may come from an HLA-matched, unrelated donor – a stranger who has volunteered to donate their cells. Some patients cannot have this kind of transplant because a matching donor isn't available. The use of allogeneic transplant is also limited by its side effects, which are often too severe for people who are older or who have other health problems.

One option that may help patients who can't have an allogeneic transplant because of age or health issues is to have a stem cell transplant that uses lower doses of chemo and radiation that don't completely destroy the cells in their bone marrow. This is known as a non-myeloablative or reduced-intensity transplant. This kind of stem cell transplant relies on the donor cells to kill the leukemia cells, instead of the chemo and radiation. This is not a standard treatment for ALL, and is being studied to determine how useful it may be.

An autologous transplant may be an option for patients who can't have an allogeneic transplant because they don't have a matched donor. The trouble with this is that leukemia is a disease of the bone marrow and blood, so there is a danger of giving the patient back leukemia cells with the stem cells. A process called *purging* may be done in the lab to try to remove leukemia cells in the samples and lower this risk.

Practical points

Bone marrow or peripheral blood SCT is a complex treatment that can cause life-threatening side effects. If your doctor thinks you might benefit from a transplant, you should discuss what kind you will have, the possible side effects, and how long it may

take for you to recover. Stem cell transplants should be done at a hospital where the staff has experience with the procedure and with managing the recovery phase. Some bone marrow transplant programs may not have experience in certain types of transplants, especially transplants from unrelated or mismatched donors.

For more information on stem cell transplants, see [Stem Cell Transplant \(Peripheral Blood, Bone Marrow, and Cord Blood Transplants\)](#).

- [References](#)

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Typical Treatment of Acute Lymphocytic Leukemia

The main treatment for acute lymphocytic leukemia (ALL) in adults involves the long-term use of [chemotherapy](#) (chemo). In the past several years, doctors have begun to use more intensive chemo regimens, which has led to more responses to treatment. But these regimens are also more likely to cause side effects, such as low white blood cell counts. Patients may need to take other drugs to help prevent or treat these side effects.

Treatment typically takes place in 3 phases:

- Induction (or remission induction)
- Consolidation (intensification)
- Maintenance

The total treatment usually takes about 2 years, with the maintenance phase taking up most of this time. Treatment may be more or less intense, depending on the subtype of ALL and other [prognostic factors](#).

ALL can spread to the area around the brain and spinal cord. Sometimes this has already occurred at the time the ALL is first diagnosed. This spread is found when the

doctor does a lumbar puncture (spinal tap) and leukemia cells are seen when the fluid is looked at under the microscope. The treatment of this is discussed below.

Even if leukemia cells are not found in the spinal fluid at diagnosis, it is possible that there were too few leukemia cells for these tests to recognize or that they could start growing on the surface of the brain and spinal cord later on. That's why an important part of treatment for ALL is *central nervous system (CNS) prophylaxis* – treatment that is meant to ensure the leukemia does not spread to the area around the brain or spinal cord. This is also described in more detail below.

Induction

The goal of induction chemo is a remission. This means that leukemia cells are no longer found in bone marrow samples, the normal marrow cells return, and the blood counts become normal. But a remission is not necessarily a cure, as leukemia cells may still be hiding somewhere in the body.

This is a phase of intensive chemo that usually lasts for a month or so. Different combinations of chemo drugs may be used, but they typically include:

- Vincristine
- Dexamethasone or prednisone
- Doxorubicin (Adriamycin), daunorubicin, or a similar anthracycline drug

Based on the patient's prognostic factors, some regimens may also include cyclophosphamide (Cytoxan), L-asparaginase, etoposide (VP-16), and/or high doses of methotrexate or cytarabine (ara-C) as part of the induction phase.

For ALL patients whose leukemia cells have the Philadelphia chromosome, a targeted drug such as imatinib (Gleevec) is often included as well.

This first month of treatment is quite intensive and requires frequent visits to the doctor. You may spend some or much of this time in the hospital, because serious infections or other complications can occur. It is very important to take all medicines prescribed. Sometimes complications can be serious enough to be life-threatening, but with advances in supportive care (nursing care, nutrition, antibiotics, growth factors, red blood cell and platelet transfusions as needed, etc.) in recent years, these are much less common than in the past.

Most often, leukemia goes into remission with induction chemotherapy. But because leukemia cells may still be hiding somewhere in the body, further treatment is needed.

CNS treatment or prophylaxis: Treatment to keep the leukemia cells from spreading to the CNS (prophylaxis) is similar to what is used to treat leukemia that has spread to the CNS. This is often started during induction and continued through the other phases of treatment. It may include one or more of the following:

- Chemo injected directly into the spinal fluid (called *intrathecal chemotherapy*). The drug used most often is methotrexate, but sometimes cytarabine or a steroid such as prednisone may be used as well. Intrathecal chemo can be given during a lumbar puncture (spinal tap) or through an Ommaya reservoir (this was discussed in the [surgery](#) section).
- High-dose IV methotrexate or cytarabine
- [Radiation therapy](#) to the brain and spinal cord

Consolidation (intensification)

If the leukemia goes into remission, the next phase often consists of another fairly short course of chemo, using many of the same drugs that were used for induction therapy. This typically lasts for a few months. Usually the drugs are given in high doses so that the treatment is still fairly intense. CNS prophylaxis may be continued at this time. A targeted drug like imatinib is also continued for patients whose leukemia cells have the Philadelphia chromosome.

Some patients in remission, such as those who have certain subtypes of ALL or other poor prognostic factors, are still at high risk for relapse (the leukemia coming back). Doctors may suggest an allogeneic [stem cell transplant](#) (SCT) at this time, especially for those who have a brother or sister who would be a good donor match. An autologous SCT may be another option. The possible risks and benefits of a stem cell transplant need to be weighed carefully for each patient based on their own case, as it's not clear that they are helpful for every patient. Patients considering this procedure may best be served by having it done at a center that has done a lot of stem cell transplants, and should ask about having it done as a part of a [clinical trial](#).

Maintenance

After consolidation, the patient is generally put on a maintenance chemotherapy program of methotrexate and 6-mercaptopurine (6-MP). In some cases, this may be combined with other drugs such as vincristine and prednisone.

For ALL patients whose leukemia cells have the Philadelphia chromosome, a targeted drug like imatinib is often included as well.

Maintenance usually lasts for about 2 years. CNS prophylaxis may be continued at this time.

Some doctors feel that maintenance therapy may not be needed for some leukemias such as T-cell ALL and mature B-cell ALL (Burkitt leukemia).

Response rates to treatment for acute lymphocytic leukemia

In general, about 80% to 90% of adults will have complete remissions at some point during these treatments. This means leukemia cells can no longer be seen in their bone marrow. Unfortunately, about half of these patients relapse, so the overall cure rate is around 40%. Again, these rates vary depending on the subtype of acute lymphocytic leukemia (ALL) and other prognostic factors. For example, cure rates tend to be higher in younger patients and lower in older patients.

What if the leukemia doesn't respond or comes back after treatment?

If the leukemia is **refractory** – that is, if it doesn't go away with the first treatment (which happens in about 10% to 20% of patients) – then newer or more intensive doses of chemo drugs may be tried, although they are less likely to work. [Monoclonal antibodies](#) such as blinatumomab (Blinicyto) or inotuzumab ozogamicin (Besponsa) may be an option for patients with B-cell ALL. A [stem cell transplant](#) may be tried if the leukemia can be put into at least partial remission. [Clinical trials](#) of new treatment approaches may also be considered.

If leukemia goes into remission with the initial treatment but then comes back (**recurs**), it will most often do so in the bone marrow and blood. Occasionally, the brain or spinal fluid will be the first place it recurs.

In these cases, it is sometimes possible to put the leukemia into remission again with more [chemotherapy](#) (chemo), although this remission is not likely to last. The approach to treatment may depend on how soon the leukemia returns after the first treatment. If the relapse occurs after a long interval, the same or similar treatment may be used to try for a second remission. If the time interval is shorter, more aggressive chemo with other drugs may be needed. A monoclonal antibody such as blinatumomab (Blinicyto) or inotuzumab ozogamicin (Besponsa) may be an option for patients with B-cell ALL.

ALL patients with the Philadelphia chromosome who were taking a targeted drug like imatinib (Gleevec) are often switched to another targeted drug.

For patients with T cell leukemia, the chemo drug nelarabine (Arranon) may be helpful.

If a second remission can be achieved, most doctors will advise some type of stem cell transplant if possible.

If the leukemia doesn't go away or keeps coming back, eventually chemo treatment will not be very helpful. If a stem cell transplant is not an option, a patient may want to consider taking part in a clinical trial of newer treatments.

Palliative treatment

At some point, it may become clear that further treatment, even in clinical trials, is extremely unlikely to cure the leukemia. At that time, the focus of treatment may shift to controlling symptoms caused by the leukemia, rather than attempting to cure the leukemia. This may be called [palliative treatment](#) or *supportive care*. For example, the doctor may advise less intensive chemo to try to slow the leukemia growth instead of trying to cure it.

As the leukemia grows in the bone marrow it may cause pain. It is important that you be as comfortable as possible. Treatments that may be helpful include radiation and appropriate pain-relieving medicines. If medicines such as aspirin and ibuprofen don't help with the pain, stronger opioid medicines such as morphine are likely to be helpful.

Other common symptoms from leukemia are low blood counts and [fatigue](#). Medicines or blood transfusions may be needed to help correct these problems. [Nausea](#) and loss of appetite can be treated with medicines and high-calorie food supplements. [Infections](#) that occur may be treated with antibiotics.

For more information on palliative treatment, see [If Treatment for Acute Lymphocytic Leukemia Stops Working](#).

- [References](#)

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