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Treating Acute Lymphocytic Leukemia (ALL)

If you've been diagnosed with acute lymphocytic leukemia (ALL), your cancer care team will discuss your treatment options with you. Your options may be affected by the ALL subtype, as well as certain other prognostic factors, as well as your age and overall

[Leukemia \(ALL\)](#).

- [Typical Treatment of Acute Lymphocytic Leukemia \(ALL\)](#)

Who treats ALL?

Based on your treatment options, you may have different types of doctors on your treatment team. These doctors could include:

- A **hematologist**: a doctor who treats disorders of the blood
- A **medical oncologist**: a doctor who treats cancer with medicines

You might have many other specialists on your treatment team as well, including physician assistants, nurse practitioners, nurses, nutrition specialists, social workers,

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.

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.

- [Clinical Trials](#)

Considering complementary, integrative, and alternative methods

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

Complementary and integrative methods are treatments that are used **along with** your regular medical care. **Alternative** treatments are used **instead of** standard medical treatment. Although some complementary and integrative methods might be

Different types of programs and support services may be helpful, and they can be 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 Cancer Knowledge Hub at 1-800-227-2345 and speak with one of our caring, trained cancer helpline specialists. Or, if you prefer, you can use our chat feature on cancer.org to connect with one of our specialists.

- [Palliative Care](#)
- [Programs & Services](#)

Choosing to stop treatment or choosing no treatment at all

For some people, when treatments have been tried and are no longer controlling the cancer, it could be time to weigh the benefits and risks of continuing to try new treatments. Whether or not you continue treatment, there are still things you can do to help maintain or improve your quality of life.

Some people, especially if the cancer is advanced, might not want to be treated at all. There are many reasons you might decide not to get cancer treatment, but it's important to talk to your doctors as you make that decision. Remember that even if you choose not to treat the cancer, you can still get supportive care to help with pain or other symptoms.

People who have advanced cancer and who are expected to live less than 6 months may want to consider hospice care. Hospice care is designed to provide the best possible quality of life for people who are near the end of life. You and your family are encouraged to talk with your doctor or a member of your supportive care team about hospice care options, which include hospice care at home, a special hospice center, or other health care locations. Nursing care and special equipment can make staying at home a workable option for many families.

- [If Cancer Treatments Stop Working](#)
- [Hospice Care](#)

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 your cancer care team any questions you may have about your treatment options.

Chemotherapy for Acute Lymphocytic Leukemia (ALL)

- [How is chemo given?](#)
- [Which chemo drugs are used to treat ALL?](#)
- [Possible side effects](#)
- [More information about chemotherapy](#)

(Note: This information is about treating acute lymphocytic leukemia (ALL) in adults. To learn about ALL in children, see [Leukemia in Children](#)¹.)

Chemotherapy (chemo) is the use of drugs to treat cancer. Chemo 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.

Chemo is the main treatment for just about all people with acute lymphocytic leukemia (ALL). Because of its potential side effects, chemo might not be recommended for patients in poor health, but advanced age by itself is not a barrier to getting chemo.

How is chemo given?

Chemo treatment for ALL is typically divided into 3 phases:

- **Induction**, which is short and intensive, usually lasts about a month.
- **Consolidation (intensification)**, which is also intensive, typically lasts for a few months.
- **Maintenance (post-consolidation)**, which is less intensive, typically lasts for about 2 years.

During the more intensive phases of treatment, people can often have serious side effects from chemo, so they might need to spend time in the hospital. For more on the different phases of treatment, see [Typical Treatment of Acute Lymphocytic Leukemia](#).

Chemo is typically given in cycles, with each period of treatment followed by a rest period to allow the body time to recover.

Chemo drugs also affect the normal cells in bone marrow, which can lower blood cell counts. This can lead to:

- Increased risk of infections (from having too few normal white blood cells)
- Easy bruising or bleeding (from having too few blood platelets)
- Fatigue and shortness of breath (from having too few red blood cells)

Most side effects from chemo go away once treatment is finished. Low blood cell counts can last weeks, but then should return to normal. There are often ways to lessen chemo side effects. For example, drugs can be given to help prevent or reduce nausea and vomiting. Be sure to ask your cancer care team about medicines to help reduce side effects, and let your doctor or nurse know when you do have side effects so they can be managed effectively.

Low white blood cell counts: Some of the most serious side effects of chemo are caused by low white blood cell counts.

You may get **antibiotics** and drugs that help prevent fungal and viral infections before you have signs of infection or at the earliest sign that an infection may be developing (such as a fever).

Drugs known as **growth factors**, such as filgrastim (Neupogen), pegfilgrastim (Neulasta), and sargramostim (Leukine), are sometimes given to increase the white blood cell counts after chemo, to help lower the chance of infection. However, it's not clear if they have an effect on treatment success.

There are also steps that you can take to lower your risk of infection, such as washing your hands often. These are discussed in [Infections in People With Cancer](#)³.

Low platelet counts: If your platelet counts are low, you may be given drugs or platelet transfusions to help protect against bleeding.

Low red blood cell counts: Shortness of breath and extreme fatigue caused by low red blood cell counts (anemia) may be treated with drugs or with red blood cell transfusions.

Decisions about when a patient can leave the hospital are often influenced by their blood counts. Some people find it helpful to keep track of their counts. If you are interested in this, ask your doctor or nurse about your blood cell counts and what these numbers mean.

Side effects of specific drugs: Certain drugs might cause specific side effects. For example:

- **Cytarabine** (ara-C), especially when used at high doses, can cause dryness in the eyes and can affect certain parts of the brain, which can lead to problems with coordination and balance.
Vincristine can damage nerves, which can lead to numbness, tingling, or weakness in hands or feet.

Hyperlinks

1. www.cancer.org/cancer/types/leukemia-in-children.html
2. www.cancer.org/cancer/types/acute-lymphocytic-leukemia/detection-diagnosis-staging/how-diagnosed.html
3. www.cancer.org/cancer/managing-cancer/side-effects/infections.html
4. www.cancer.org/cancer/types/acute-myeloid-leukemia.html
5. www.cancer.org/cancer/types/non-hodgkin-lymphoma.html
6. www.cancer.org/cancer/survivorship/long-term-health-concerns/second-cancers-in-adults.html
7. www.cancer.org/cancer/managing-cancer/treatment-types/chemotherapy.html
8. www.cancer.org/cancer/managing-cancer/side-effects.html

References

Appelbaum FR. Chapter 98: Acute Leukemias in Adults. In: Niederhuber JE, Armitage JO, Dorshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 5th ed. Philadelphia, Pa. Elsevier: 2014.

Jain N, Gurbuxani S, Rhee C, Stock W. Chapter 65: Acute Lymphoblastic Leukemia in Adults. In: Hoffman R, Benz EJ, Silberstein LE, Heslop H, Weitz J, Anastasi J, eds. *Hematology: Basic Principles and Practice*. 6th ed. Philadelphia, Pa: Elsevier; 2013.

National Comprehensive Cancer Network. NCCN Practice Guidelines in Oncology: Acute Lymphoblastic Leukemia. V.1.2018. Accessed at www.nccn.org/professionals/physician_gls/pdf/all.pdf on July 23, 2018.

Terwilliger T, Abdul-Hay M. Acute lymphoblastic leukemia: A comprehensive review and 2017 update. *Blood Cancer J*. 2017;7(6):e577.

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Targeted Therapy Drugs for Acute Lymphocytic Leukemia (ALL)

Targeted therapy drugs work by attacking specific parts of cancer cells. They are different from standard [chemotherapy \(chemo\)](#) drugs. They sometimes work when chemo doesn't, and they often have different side effects. Some of these drugs can be useful in certain cases of acute lymphocytic leukemia (ALL).

(Note: This information is about treating acute lymphocytic leukemia (ALL) in adults. To learn about ALL in children, see [Leukemia in Children](#)¹.)

- [Targeted drugs for ALL with the Philadelphia chromosome \(Ph+ ALL\)](#)
- [Targeted drugs for ALL with a KTM2A gene change](#)
- [Immunotherapy drugs for ALL](#)
- [More information about targeted therapy](#)

Targeted drugs for ALL with the Philadelphia chromosome (Ph+ ALL)

In about 1 out of 4 adults with ALL, the leukemia cells have the **Philadelphia chromosome**. This is an abnormal chromosome formed by the swapping of genetic material between chromosomes 9 and 22, which creates a new gene called *BCR-ABL*. Cells with the *BCR-ABL* gene make an abnormal protein that helps the cells grow.

Drugs called **tyrosine kinase inhibitors (TKIs)** have been developed to attack this protein. Examples include:

- Imatinib (Gleevec)
- Dasatinib (Sprycel)
- Nilotinib (Tasigna)
- Ponatinib (Iclusig)
- Bosutinib (Bosulif)

In people with Ph+ ALL, adding a TKI to chemo helps increase the chance that the leukemia will go into remission. Continuing on one of these drugs can also help keep the leukemia from coming back. If one TKI doesn't work (or is no longer working), another one might be tried.

These drugs are taken daily as pills or capsules. Imatinib is also available as an oral solution (under the name Imkeldi).

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 can get worse at higher than usual doses of the drug. Other, more serious side effects can occur as well, depending on which drug is used.

Targeted drugs for ALL with a *KMT2A* gene change

In a small number of people with ALL, the leukemia cells have a type of change known as a translocation in the *KMT2A* gene. This causes the cells to make an abnormal *KMT2A* protein, which can combine with another protein called **menin** to help the cells grow.

Revumenib (Revuforj) is a menin inhibitor. It stops menin from combining with the *KMT2A* protein. This drug can be used to treat people with ALL whose leukemia cells have a *KMT2A* translocation, if the ALL is no longer responding to treatment or has come back (relapsed) after other treatments. Your blood or bone marrow can be tested to see if your leukemia cells have this gene change.

This drug is taken by mouth as pills, typically twice a day.

Common side effects of this drug can include nausea, vomiting, bleeding, diarrhea or constipation, fatigue, muscle pain, increased risk of infection, swelling in the arms and legs, and loss of appetite.

This drug may cause serious **heart rhythm problems**. This might lead to an irregular heartbeat, which could be life threatening. Your doctor will check your blood mineral levels and get electrocardiograms (EKGs) to test your heart rhythm before and during treatment with this drug.

An important possible side effect of this drug is **differentiation syndrome**. This occurs when the leukemia cells release certain chemicals into the blood. It most often occurs shortly after starting treatment, but sometimes it can happen weeks or months later. Symptoms can include fever, coughing or breathing problems (from fluid buildup in the lungs and around the heart), dizziness or lightheadedness (from low blood pressure), urinating less often (from damage to the kidneys), and severe fluid buildup elsewhere in the body. It can often be treated by stopping the drug for a while and giving other

medicines (such as dexamethasone or hydroxyurea).

Immunotherapy drugs for ALL

Some of the immunotherapy drugs used to treat ALL might also be considered forms of targeted therapy, because they work by attaching to specific parts of leukemia cells. Examples include:

- Blinatumomab (Blincyto)
- Inotuzumab ozogamicin (Besponsa)

For more information on these drugs, see [Immunotherapy for Acute Lymphocytic Leukemia \(ALL\)](#).

More information about targeted therapy

To learn more about how targeted drugs are used to treat cancer, see [Targeted Cancer Therapy](#)².

To learn about some of the side effects listed here and how to manage them, see [Managing Cancer-related Side Effects](#)³.

Hyperlinks

1. www.cancer.org/cancer/types/leukemia-in-children.html
2. www.cancer.org/cancer/managing-cancer/treatment-types/targeted-therapy.html
3. www.cancer.org/cancer/managing-cancer/side-effects.html

References

Appelbaum FR. Chapter 98: Acute Leukemias in Adults. In: Niederhuber JE, Armitage JO, Dorshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 5th ed. Philadelphia, Pa. Elsevier; 2014.

Jain N, Gurbuxani S, Rhee C, Stock W. Chapter 65: Acute Lymphoblastic Leukemia in Adults. In: Hoffman R, Benz EJ, Silberstein LE, Heslop H, Weitz J, Anastasi J, eds. *Hematology: Basic Principles and Practice*. 6th ed. Philadelphia, Pa: Elsevier; 2013.

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Terwilliger T, Abdul-Hay M. Acute lymphoblastic leukemia: A comprehensive review and 2017 update. *Blood Cancer J.* 2017;7(6):e577.

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Immunotherapy for Acute Lymphocytic Leukemia (ALL)

(Note: This information is about treating acute lymphocytic leukemia (ALL) in adults. To learn about ALL in children, see [Leukemia in Children](#)¹.)

Immunotherapy is the use of medicines to help a person's own immune system recognize and destroy cancer cells more effectively. Some types of immunotherapy are now being used to treat acute lymphocytic leukemia (ALL) in certain situations.

- [Monoclonal antibodies](#)
- [CAR T-cell therapy](#)
- [More information about immunotherapy](#)

Monoclonal antibodies

Antibodies are proteins made by the body's immune system to help fight infections. Man-made versions of these proteins, called [monoclonal antibodies](#)², can be designed to attack a specific target, such as a protein on the surface of leukemia cells.

Blinatumomab (Blincyto)

Blinatumomab is a special kind of monoclonal antibody known as a **bispecific T-cell engager (BiTE)**. 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 on immune cells called T cells. By binding to both of these proteins, this drug brings the leukemia cells

and immune cells together, which helps the immune system attack the leukemia cells.

This drug is used to treat some types of B-cell ALL. For example:

- It might be used as part of the second (consolidation) phase of treatment in some people with ALL.
- It might be used to treat ALL that comes back or that is no longer responding to other treatments.

Doctors are also looking at using this drug as part of the first (induction) phase of treatment for some people with ALL.

Blinatumomab 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, a person 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 **nervous system problems**, such as seizures, trouble speaking or slurred speech, passing out, confusion, and loss of balance.

Some people have serious [infusion reactions](#)³ while getting 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 is an **antibody-drug conjugate (ADC)**, made up of 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 device, 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](#)

responding to treatment.

Obecabtagene autoleucel (Aucatzyl, also known as obe-cel) is approved to treat adults with B-cell ALL that has come back or is no longer responding to other treatments.

Side effects of CAR T-cell therapy

This treatment can have serious or even life-threatening side effects, which is why it needs to be given in a medical center that has special training in its use.

Cytokine release syndrome (CRS): CRS happens when T cells release chemicals (cytokines) that ramp up the immune system. This can happen within a few days to weeks after treatment, and it can be life-threatening. Symptoms can include:

- High fever and chills
- Trouble breathing
- Severe nausea, vomiting, and/or diarrhea
- Severe muscle or joint pain
- Feeling dizzy or lightheaded

Nervous system problems: This drug can have serious effects on the nervous system, leading to a condition known as **immune effector cell-associated neurotoxicity syndrome (ICANS)**. This can result in symptoms such as:

- Headaches
- Changes in consciousness
- Confusion or agitation
- Seizures
- Shaking or twitching (tremors)
- Trouble speaking and understanding
- Loss of balance

Other serious side effects: Other possible side effects can include:

- Serious infections
- Low blood cell counts, which can increase the risk of infections, fatigue, and bruising or bleeding
- Increased risk of another type of blood cancer

Surgery for Acute Lymphocytic Leukemia (ALL)

- [Placement of a central venous catheter](#)
- [Placement of an Ommaya reservoir](#)

(Note: This information is about treating acute lymphocytic leukemia (ALL) in adults. To learn about ALL in children, see [Leukemia in Children](#)¹.)

Surgery has a very limited role in the treatment of acute lymphocytic leukemia (ALL). Because leukemia cells are spread widely throughout the bone marrow and blood, it isn't possible to cure this type of cancer with surgery. Aside from a possible [lymph node biopsy](#)², surgery rarely has a role even in the diagnosis of ALL, as this is typically done with a [bone marrow aspiration and biopsy](#)³.

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Radiation Therapy for Acute Lymphocytic Leukemia (ALL)

- [Side effects](#)
- [More information about radiation therapy](#)

(Note: This information is about treating acute lymphocytic leukemia (ALL) in adults. To learn about ALL in children, see [Leukemia in Children](#)¹.)

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

treatments you get depends on the reason radiation therapy is being used.

Side effects

The **possible sideeffects** of radiation therapy depend on 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 (if the head or belly is being treated)
- Diarrhea (if the belly or pelvis is being treated)
- Mouth sores and trouble swallowing (if the head and neck area are being treated)
- Headaches (if the head is being treated)
- Lowered blood cell counts, which can lead to fatigue and shortness of breath (from low red blood cell counts), bleeding or bruising (from low platelet counts), and an increased risk of infection (from low white blood cell counts)

More information about radiation therapy

To learn more about how radiation is used to treat cancer, see [Radiation Therapy](#)³.

To learn about some of the side effects listed here and how to manage them, see [Managing Cancer-related Side Effects](#)⁴.

Hyperlinks

1. www.cancer.org/cancer/types/leukemia-in-children.html
2. www.cancer.org/cancer/diagnosis-staging/tests/imaging-tests/imaging-radiology-tests-for-cancer.html
3. www.cancer.org/cancer/managing-cancer/treatment-types/radiation.html
4. www.cancer.org/cancer/managing-cancer/side-effects.html

References

Appelbaum FR. Chapter 98: Acute Leukemias in Adults. In: Niederhuber JE, Armitage

Stem Cell Transplant for Acute Lymphocytic Leukemia (ALL)

blood are used.

Types of stem cell transplants

The main types of stem cell transplants are:

- **Allogeneic** stem cell transplant, in which the stem cells **come from someone else**. This is the preferred type of transplant when treating ALL.
- **Autologous** stem cell transplant, in which the patient **gets back their own cells**

Allogeneic transplant: A donor's tissue type (also known as the HLA type) needs to closely match the patient's tissue type to help prevent the risk of major problems with the transplant. The best donor is often a close relative, such as 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 use 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 SCT 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.

Autologous transplant: A patient's own stem cells are removed from their bone marrow or blood. They are frozen and stored while the person gets treatment (high-dose chemotherapy and/or radiation). A process called **purging** may be used in the lab to try to remove any leukemia cells in the samples. The stem cells are then put back (reinfused) into the patient's blood after treatment.

An autologous transplant may be an option for patients who can't have an allogeneic transplant because they don't have a matched donor, or for some other reason. One problem with autologous transplants is that leukemia is a disease of the bone marrow and blood, so even after purging, there is a danger of giving the patient back leukemia cells with the stem cells.

Another reason that allogeneic transplants are preferred is because of the **graft-versus-leukemia** effect. When the donor immune cells are infused into the body, they

may recognize any remaining leukemia cells as being foreign to them and attack them. This effect doesn't happen with an autologous SCT.

Practical points

A stem cell transplant is an intensive and 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.

More information about stem cell transplant

To learn more about stem cell transplants, including how they are done and their potential side effects, see [Stem Cell Transplant for Cancer](#)³.

For more general information about side effects and how to manage them, see [Managing Cancer-related Side Effects](#)⁴.

Hyperlinks

1. www.cancer.org/cancer/types/leukemia-in-children.html
2. www.cancer.org/cancer/managing-cancer/treatment-types/stem-cell-transplant.html
3. www.cancer.org/cancer/managing-cancer/treatment-types/stem-cell-transplant.html
4. www.cancer.org/cancer/managing-cancer/side-effects.html

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Appelbaum FR. Chapter 98: Acute Leukemias in Adults. In: Niederhuber JE, Armitage

Typical Treatment of Acute Lymphocytic Leukemia (ALL)

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](#)².

ALL can spread to the area around the brain and spinal cord. Sometimes this has already occurred by the time ALL is first diagnosed. This spread is found when the doctor does a [lumbar puncture](#)³ (spinal tap) and leukemia cells are found in the cerebrospinal fluid (CSF), the liquid that surrounds the brain and spinal cord. The treatment of this is discussed below.

Even if leukemia cells aren't found in the CSF at diagnosis, it's possible that they might spread there later on. This is why an important part of treatment for ALL is **central nervous system (CNS) prophylaxis** – treatment that lowers the risk of the leukemia spreading to the area around the brain or spinal cord. This is also described in more detail below.

Induction

The goal of induction chemo is to get the leukemia into [remission \(complete remission\)](#)⁴. This means that leukemia cells are no longer found in bone marrow samples (on a [bone marrow biopsy](#)⁵), the normal marrow cells return, and the blood counts return to normal levels. But a remission is not necessarily a cure, as leukemia cells may still be hiding somewhere in the body.

Induction chemo usually lasts for a month or so. Different combinations of chemo drugs might be used, but they typically include:

- Vincristine
- Dexamethasone or prednisone
- An anthracycline drug such as doxorubicin (Adriamycin) or daunorubicin

Based on a person's [prognostic factors](#)⁶, some regimens may also include other drugs such as cyclophosphamide, L-asparaginase (or pegaspargase), and/or high doses of methotrexate or cytarabine (ara-C) as part of the induction phase.

For people with ALL whose leukemia cells have the **Philadelphia chromosome**, a [targeted drug](#) such as imatinib (Gleevec) or dasatinib (Sprycel) is often included as well.

For people who are older (typically over 65) or who have other serious health conditions, many of the same drugs are used for induction, although the doses of the drugs might need to be reduced.

This first month of treatment is 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's very important to take all medicines as prescribed. Sometimes complications can be serious enough to be life-threatening, but with recent

Instead of standard chemo, 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 pros and cons of a stem cell transplant need to be weighed carefully for each person, as it's not clear that they are helpful for everyone. People considering this procedure should think about having it done at a center that has done a lot of stem cell transplants.

Maintenance

After consolidation, people generally get maintenance chemotherapy with methotrexate and 6-mercaptopurine (6-MP). In some cases, this may be combined with other drugs such as vincristine and prednisone.

For people with ALL 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/treatment is typically continued at this time.

Response rates to ALL treatment

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

brain or spinal fluid will be the first place it recurs.

It is sometimes possible to put the leukemia into remission again with more chemotherapy (chemo), although this remission tends to be shorter than the first one.

The approach to treatment may depend on how soon the leukemia returns after the first treatment. If the relapse occurs after a long time, the same or similar treatment may be used to try for a second remission. If the time to relapse is shorter, more aggressive chemo with other drugs may be needed.

[Immunotherapy](#) might be another option for some people. For example, a monoclonal antibody or CAR T-cell therapy might be an option for some people with B-cell ALL.

People with ALL that has the Philadelphia chromosome who were taking a targeted drug like imatinib are often switched to a different targeted drug.

If the leukemia cells have a *KTM2A* gene mutation, treatment with a targeted drug called a menin inhibitor, such as revumenib (Revuforj), might be an option.

For patients with T-cell ALL, 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 treatment with more chemo is unlikely to be helpful. If a stem cell transplant is not an option, a clinical trial testing newer treatments might still be an option for some people.

Palliative treatment

At some point, it may become clear that further treatment, even in clinical trials, is extremely unlikely to cure the leukemia. At this time, the focus of treatment may shift to controlling the leukemia and its symptoms for as long as possible, rather than trying to cure it. This may be called [palliative treatment](#)¹¹ 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's 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](#)¹². Medicines or [blood transfusions](#)¹³ may be needed to help with these problems. [Nausea](#)¹⁴ and loss of appetite can be treated with medicines and high-calorie food supplements. [Infections](#)¹⁵ that occur may be treated with antibiotics.

Hyperlinks

1. www.cancer.org/cancer/types/leukemia-in-children.html
www.cancer.org/cancer/types/acute-lymphocytic-leukemia/detection-diagnosis-

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