



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

Treating Childhood Leukemia

If your child has been diagnosed with leukemia, your child's treatment team will discuss the options with you. It's important to weigh the benefits of each treatment option against the possible risks and side effects.

How is childhood leukemia treated?

The main treatment for most childhood leukemias is chemotherapy. For some children with higher risk leukemias, high-dose chemotherapy may be given along with a stem cell transplant. Other treatments might also be used in special circumstances.

- [Surgery for Childhood Leukemia](#)
- [Radiation Therapy for Childhood Leukemia](#)
- [Chemotherapy for Childhood Leukemia](#)
- [Targeted Therapy Drugs for Childhood Leukemia](#)
- [Immunotherapy for Childhood Leukemia](#)
- [High-dose Chemotherapy and Stem Cell Transplant for Childhood Leukemia](#)

Common treatment approaches

After leukemia is diagnosed and [tests](#) have been done to determine its [type](#) and [subtype](#), your child's cancer care team will discuss the treatment options with you. The most important factor in choosing a treatment is the type of leukemia, but [other factors](#) also play a role.

Treatment of acute forms of childhood leukemia (ALL or AML) is usually very intensive, so it's important that it takes place in a center that specializes in treating childhoodso i been dlay i c.3

- [Immediate Treatment for Childhood Leukemia](#)
- [Treatment of Children with Acute Lymphocytic Leukemia \(ALL\)](#)
- [Treatment of Children with Acute Myeloid Leukemia \(AML\)](#)
- [Treatment of Children with Acute Promyelocytic Leukemia \(APL\)](#)
- [Treatment of Children with Juvenile Myelomonocytic Leukemia \(JMML\)](#)
- [Treatment of Children with Chronic Myeloid Leukemia \(CML\)](#)

Who treats leukemia in children?

Children and teens with leukemia and their families have special needs. These needs can be met best by cancer centers for children and teens, working closely with the child's primary care doctor. These centers offer the advantage of being treated by teams of specialists who know the differences between cancers in adults and those in children and teens, as well as the unique needs of younger people with cancer.

For childhood leukemias, this team is typically led by a **pediatric oncologist**, a doctor who treats children's cancers. Many other health professionals may be involved in your child's care as well, including other doctors, nurses, nurse practitioners (NPs), physician assistants (PAs), psychologists, social workers, rehabilitation specialists, and others.

- [How to Find the Best Cancer Treatment for Your Child](#)
- [Navigating the Health Care System When Your Child Has Cancer](#)

Making treatment decisions

After leukemia is diagnosed and tests have been done to determine its type, your child's cancer care team will discuss the treatment options with you.

It's important to discuss your child's treatment options as well as their possible side effects with the treatment team to help make the decision that's the best fit for your child. If there is anything you don't understand, ask to have it explained.

If time allows, getting a second opinion from another doctor experienced with your child's type of cancer is often a good idea. This can give you more information and help you feel more confident about the treatment plan you choose. If you aren't sure where to go for a second opinion, ask your doctor for help.

- [Questions to Ask About Childhood Leukemia](#)
- [How to Talk to Your Child's Cancer Care Team](#)
- [Seeking a Second Opinion](#)

[Thinking about taking part in a clinical trial](#)

Today, most children and teens with cancer are treated at specialized children's cancer centers. These centers offer the most up-to-date-treatment by conducting clinical trials

Your child's 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 can also be an important part of your care. These might include nursing or social work services, financial aid, nutritional advice, rehab, or spiritual help. For children and teens with cancer and their families, other specialists can be an important part of care as well. 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.

- [Finding Help and Support When Your Child Has Cancer](#)
- [Programs & Services](#)

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.

Immediate Treatment for Childhood Leukemia

Some children are critically ill when they are first diagnosed with leukemia. For example:

- They might have a shortage of normal white blood cells, which might lead to very serious [infections](#)¹.
- They might have low levels of platelets or clotting factors in the blood, which can cause severe bleeding.

These problems must often be addressed before treatment of the leukemia can begin. Antibiotics, blood growth factors, and [transfusions of platelets and red blood cells](#),² or procedures to lower white blood cell counts (for leukostasis) might be needed to treat or help prevent some of these conditions.

Hyperlinks

1. www.cancer.org/cancer/managing-cancer/side-effects/infections.html
2. www.cancer.org/cancer/managing-cancer/treatment-types/blood-transfusion-and-donation.html

References

Horton TM, Steuber CP. Overview of the treatment of acute lymphoblastic leukemia in children and adolescents. UpToDate. 2018. Accessed at www.uptodate.com/contents/overview-of-the-treatment-of-acute-lymphoblastic-leukemia-in-children-and-adolescents on December 29, 2018.

Tarlock K, Cooper TM. Acute myeloid leukemia in children and adolescents. UpToDate. 2018. Accessed at www.uptodate.com/contents/acute-myeloid-leukemia-in-children-and-adolescents on December 29, 2018.

Last Revised: February 12, 2019

Surgery for Childhood Leukemia

- [Placing a central venous catheter](#)
- [More information about Surgery](#)

Surgery has a very limited role in treating childhood leukemia. Because leukemia cells

of cancer with surgery. Aside from a possible [lymph node biopsy](#)¹, surgery rarely has any role even in diagnosing leukemia, since this is usually done with a bone marrow aspirate and biopsy can usually diagnose leukemia.

Placing a central venous catheter

Often before [chemotherapy](#) is about to start, surgery is needed to insert a small plastic tube, called a [central venous catheter \(CVC\) or venous access²device \(VAD\)](#)³, into a large blood vessel. The end of the tube stays just under the skin or sticks out in the chest area or upper arm.

The CVC is left in place during treatment (often for many months) to give intravenous (IV) drugs such as chemotherapy and to take blood samples. This lowers the number of needle sticks needed during treatment. It's very important for parents to learn how to care for the catheter to keep it from getting infected.

More information about Surgery

For more general information about surgery as a treatment for cancer, see [Cancer Surgery](#)⁴.

To learn about some of the side effects listed here and how to manage them, see [Managing Cancer-related Side Effects](#)⁵.

Hyperlinks

1. www.cancer.org/cancer/types/leukemia-in-children/detection-diagnosis-staging/how-diagnosed.html
2. www.cancer.org/cancer/managing-cancer/making-treatment-decisions/tubes-lines-ports-catheters.html
3. www.cancer.org/cancer/managing-cancer/making-treatment-decisions/tubes-lines-ports-catheters.html
4. www.cancer.org/cancer/managing-cancer/treatment-types/surgery.html
5. www.cancer.org/cancer/managing-cancer/side-effects.html

References

children and adolescents. UpToDate. 2018. Accessed at www.uptodate.com/contents/overview-of-the-treatment-of-acute-lymphoblastic-leukemia-in-children-and-adolescents on December 29, 2018.

Radiation Therapy for Childhood Leukemia

- Radiation to the whole body is often an important part of treatment before a stem cell transplant (see [High-Dose Chemotherapy and Stem Cell Transplant](#)).

How is radiation therapy given?

Chemotherapy for Childhood Leukemia

- [Possible side effects of chemo](#)
- [More information about chemotherapy](#)

Chemotherapy (chemo) is the main treatment for most childhood leukemias. This is treatment with anti-cancer drugs that are given in a vein (IV), in a muscle, in the cerebrospinal fluid (CSF) around the brain and spinal cord, or are taken by mouth. Except when given in the CSF, chemo drugs enter the bloodstream and reach all areas of the body, making this treatment very useful for cancers such as leukemia.

Leukemia is treated with combinations of several chemo drugs. Doctors give chemo in cycles, with each period of treatment followed by a rest period to give the body time to recover.

In general, [treatment for acute myeloid leukemia \(AML\)](#) uses higher doses of chemo over a shorter period of time (usually less than a year), and [treatment for acute lymphocytic leukemia \(ALL\)](#) uses lower doses of chemo over a longer period of time (usually 2 to 3 years).

Some of the chemo drugs used to treat childhood leukemia include:

- Vincristine
- Daunorubicin, (daunomycin)
- Doxorubicin (Adriamycin)
- Idarubicin
- Cytarabine (cytosine arabinoside or ara-C)
- L-asparaginase, PEG-L-asparaginase (pegaspargase)
- Etoposide
- 6-mercaptopurine (6-MP)
- 6-thioguanine (6-TG)
- Methotrexate
- Mitoxantrone
- Cyclophosphamide

Cort35 292.5 Tm 324.5 Tm t1 0 0 1 95.35 291 0 0f0o4.5 Tm t1 0 Tm /F3 Sbis5.3r07.5 Tm /F2 12 1

Chemo drugs can affect some normal cells in the body, which can lead to side effects.

The side effects of chemo depend on the type and dose of drugs given and the length of treatment. These side effects can include:

- Hair loss
- Mouth sores
- Loss of appetite
- Diarrhea
- Nausea and vomiting

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)
- Bruising and bleeding easily (from having too few blood platelets)
- Fatigue (from having too few red blood cells)

The problems with blood cell counts are often caused by the leukemia itself at first. They might get worse during the first part of treatment because of the chemo, but they will probably improve as the leukemia cells are killed off and the normal cells in the bone marrow recover.

Most side effects usually go away when treatment is finished. There are often ways to reduce these side effects. For instance, drugs can be given to help prevent or reduce nausea and vomiting. Other drugs known as **growth factors** can be given to help keep the blood cell counts higher.

Tumor lysis syndrome: This side effect of chemo can happen in children who had large numbers of leukemia cells in the body before treatment. 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. Too much of certain minerals can also affect the heart and nervous system. This problem can be prevented by making sure the child gets lots of fluids during treatment and certain drugs, such as bicarbonate, allopurinol, and rasburicase, which help the body get rid of these substances.

Some chemo drugs can also have other specific side effects. For example:

- Vincristine can damage nerves, which can lead to numbness, tingling, or weakness

in hands or feet (known as *peripheral neuropathy*).

- L-asparaginase and PEG-L-asparaginase can increase the risk of blood clots.

Some chemo drugs can also cause **late or long-term side effects**, such as effects on growth and development, effects on fertility later in life, or an increased risk of getting a second cancer (often AML). For more on this, see [Living as a Childhood Leukemia Survivor](#)¹.

Be sure to ask your child's doctor or nurse about any specific side effects you should watch for and about what you can do to help reduce these side effects.

Chemo given directly into the cerebrospinal fluid (CSF) around the brain and spinal cord (known as **intrathecal chemotherapy**) can have its own side effects, although these are not common. Intrathecal chemo may cause trouble thinking or even seizures in some children.

More information about chemotherapy

For more general information about how chemotherapy is used to treat cancer, see [Chemotherapy](#)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/after-treatment/follow-up.html
2. www.cancer.org/cancer/managing-cancer/treatment-types/chemotherapy.html
3. www.cancer.org/cancer/managing-cancer/side-effects.html

References

Horton TM, Steuber CP. Overview of the treatment of acute lymphoblastic leukemia in children and adolescents. UpToDate. 2018. Accessed at www.uptodate.com/contents/overview-of-the-treatment-of-acute-lymphoblastic-leukemia-in-children-and-adolescents on December 29, 2018.

National Cancer Institute. Childhood Acute Lymphoblastic Leukemia Treatment

(PDQ®)—Health Professional Version. Accessed at <https://www.cancer.gov/types/leukemia/hp/child-all-treatment-pdq> on December 29, 2018.

National Cancer Institute. Childhood Acute Myeloid Leukemia/Other Myeloid Malignancies Treatment (PDQ®)—Health Professional Version. Accessed at <https://www.cancer.gov/types/leukemia/hp/child-aml-treatment-pdq> on December 29, 2018.

Tarlock K, Cooper TM. Acute myeloid leukemia in children and adolescents. UpToDate. 2018. Accessed at www.uptodate.com/contents/acute-myeloid-leukemia-in-children-and-adolescents on December 29, 2018.

Last Revised: February 12, 2019

Targeted Therapy Drugs for Childhood Leukemia

In recent years, new drugs that target specific parts of cancer cells have been developed. These targeted drugs work differently from standard [chemotherapy](#) drugs. They can be used instead of or along with chemo in some situations, and they have side effects that are different from those of chemo. Some targeted drugs can be useful in certain childhood leukemias.

- [BCR-ABL inhibitors for CML \(and some cases of ALL\)](#)
- [Gemtuzumab ozogamicin \(Mylotarg\) for AML](#)
- [Inotuzumab ozogamicin \(Besponsa\) for ALL](#)
- [Menin inhibitor for some children with AML or ALL](#)
- [Differentiation agents for APL](#)
- [More information about targeted therapy](#)

BCR-ABL inhibitors for CML (and some cases of ALL)

Nearly all children with [chronic myeloid leukemia \(CML\)](#) have an abnormal chromosome in their leukemia cells known as the [Philadelphia chromosome](#)¹. These chromosomes have a specific gene mutation known as *BCR-ABL*, which helps the leukemia cells

grow.

Targeted drugs known as tyrosine kinase inhibitors (TKIs), such as **imatinib (Gleevec)**, **dasatinib (Sprycel)**, **nilotinib (Tasigna)**, and **bosutinib (Bosulif)**, attack cells that have the *BCR-ABL* gene mutation. These drugs are very effective at controlling the leukemia for long periods of time in most children, although it's not yet clear if the drugs can help cure CML.

A small number of children with [acute lymphocytic leukemia \(ALL\)](#) also have the Philadelphia chromosome in their leukemia cells. Studies have shown that their outcome is improved when one of these targeted drugs is given along with chemotherapy.

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

Possible **side effects** of these drugs 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, which may be caused b

The most common **side effects** are fever, nausea and vomiting, low levels of blood cells (with increased risks of infection, bleeding, and fatigue), swelling and sores in the mouth, constipation, rash, and headaches.

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](#)² (similar to an allergic reaction). Your child likely will 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 heart rhythm

Many other targeted drugs are now being used to treat AML in adults, and some of these are now being tested in [clinical trials](#)³ for use in children as well. (See [What's New in Childhood Leukemia Research?](#)⁴)

Inotuzumab ozogamicin (Besponsa) for ALL


This drug is also 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 can be used to treat children with some types of B-cell ALL that have come back or are still growing after other treatments have been tried. It is given as an infusion into a vein (IV), typically once a week.

The most common **side effects** are low levels of blood ly have the

- Serious or life-threatening infections, especially in people who have already had a stem cell transplant
- Changes in the rhythm of the heart

important ways. The leukemia cells in APL (called blasts), have certain gene changes that stop them from maturing into normal white blood cells. Drugs called **differentiation agents**



feet

ATO can also cause problems with heart rhythm, which can sometimes be serious.

Both of these drugs can cause a serious side effect known as **differentiation syndrome** (previously called retinoic acid syndrome). This occurs when the leukemia cells release certain chemicals into the blood. It is most often seen during the first couple of weeks of treatment, and in patients with a high white blood cell count.

Symptoms can include fever, breathing problems due to fluid buildup in the lungs and around the heart, low blood pressure, kidney damage, and severe fluid buildup elsewhere in the body. While differentiation syndrome can be serious, it can often be treated by stopping the drugs for a while and giving a steroid such as dexamethasone.

More information about targeted therapy

To learn more about how targeted drugs are used to treat cancer, see [Targeted Cancer Therapy](#)⁶.

To learn about some of the side effects listed here and how to manage them, see [Managing Cancer-related Side Effects](#)⁷.

Hyperlinks

1. www.cancer.org/cancer/types/leukemia-in-children/causes-risks-prevention/what-causes.html
2. www.cancer.org/cancer/managing-cancer/side-effects/infusion-immune-reactions.html
3. www.cancer.org/cancer/managing-cancer/making-treatment-decisions/clinical-trials.html
4. www.cancer.org/cancer/types/leukemia-in-children/about/new-research.html
5. www.cancer.org/cancer/managing-cancer/side-effects/infusion-immune-reactions.html
6. www.cancer.org/cancer/managing-cancer/treatment-types/targeted-therapy.html
7. www.cancer.org/cancer/managing-cancer/side-effects.html

References

Horton TM, Steuber CP. Overview of the treatment of acute lymphoblastic leukemia in children and adolescents. UpToDate. 2018. Accessed at

Immunotherapy for Childhood Leukemia

receptors, or CARs) on their surface. These receptors can attach to proteins on leukemia cells. The T cells are then multiplied in the lab and given back into the child's blood, where they can seek out the leukemia cells and attack them.

Tisagenlecleucel (Kymriah)

This is a type of CAR T-cell therapy that targets the CD19 protein on certain leukemia cells. It can be used to treat childhood acute lymphoblastic leukemia (ALL) that has come back after treatment or that is no longer responding to treatment.

To make this treatment, T cells are removed from the child's blood during a process called **leukapheresis**. Blood is removed through an IV line (leukapheresis) and T cells are isolated and grown in the lab. The T cells are then reinfused into the child's blood.

- It might be used earlier in the course of treatment for some infants with ALL.

Blinatumomab is given into a vein (IV) as a continuous infusion over 28 days. This may be repeated after 2 weeks off. Because of certain serious side effects that occur more often during the first few times it is given, the child usually needs stay in the hospital for the first few days 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 children might have serious [infusion reactions](#)¹ (similar to an allergic reaction) 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. Your child will be given medicines before each infusion to help prevent this.

Antibody-drug conjugates (ADCs)

These are monoclonal antibodies attached to chemo drugs. The antibody part acts like a homing device, bringing the chemo drug directly to the leukemia cells.

- **Gemtuzumab ozogamicin (Mylotarg)** can be used to treat some children with acute myeloid leukemia (AML).
- **Inotuzumab ozogamicin (Besponsa)** can be used to treat children with some types of B-cell ALL.

These medicines are described in more detail in [Targeted Therapy Drugs for Childhood Leukemia](#).

Other types of immunotherapy are also being studied for use against leukemia.

More information about immunotherapy

To learn more about how drugs that work on the immune system are used to treat cancer, see [Cancer Immunotherapy](#)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/managing-cancer/side-effects/infusion-immune-reactions.html
2. www.cancer.org/cancer/managing-cancer/treatment-types/immunotherapy.html
3. www.cancer.org/cancer/managing-cancer/side-effects.html

References

Horton TM, Steuber CP. Overview of the treatment of acute lymphoblastic leukemia in children and adolescents. UpToDate. 2018. Accessed at www.uptodate.com/contents/overview-of-the-treatment-of-acute-lymphoblastic-leukemia-in-children-and-adolescents on December 29, 2018.

National Cancer Institute. Childhood Acute Lymphoblastic Leukemia Treatment

High-dose Chemotherapy and Stem Cell Transplant for Childhood Leukemia

[Cancer](#)¹.

When a stem cell transplant might be used

Acute lymphocytic leukemia (ALL): In ALL, SCT might be used in children in some [high-risk groups](#)², whose leukemia is more likely to come back after the [initial \(induction\) chemo](#). In this case, the transplant is done after the induction chemo puts the leukemia into remission.

SCT might also be an option if the leukemia doesn't respond well to initial treatment, or if it relapses (comes back) soon after going into remission. It's less clear if SCT should be used for children whose ALL relapses later (such as more than 6 months or a year) after finishing the initial chemo. These children will often do well with another round of standard dose chemo.

SCT may also be recommended for children with some less common forms of ALL, such as those whose leukemias have the Philadelphia chromosome or those with T-cell ALL that don't respond well to initial treatment.

Acute myelogenous leukemia (AML): Because AML relapses more often than ALL, SCT might be recommended right after the AML has gone into remission (after the [initial chemo treatment](#)), if the child has a brother or sister with the same tissue type who can donate stem cells for the transplant. This is especially true if there is a very high risk of relapse (as with some subtypes of AML or when there are certain gene or chromosome changes in the leukemia cells). There is still some debate about which children with AML need this type of intensive treatment.

A stem cell transplant is a complex treatment that can cause life-threatening [side effects](#)³. If the doctors think your child can benefit from a transplant, the best place to have this done is at a cancer center where the staff has experience with the procedure and with managing the recovery period.

A stem cell transplant often requires a long hospital stay and can be very expensive. Even if the transplant is covered by your insurance, your co-pays or other costs could easily amount to many thousands of dollars. It's important to find out what your insurer will cover before the transplant to get an idea of what you might have to pay.

Be sure to talk to your child's doctor before the transplant to learn about possible long-term side effects your child might have. More information on long-term effects can be found in [Living as a Childhood Leukemia Survivor](#)⁴.

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](#)⁵.

For more general information about side effects and how to manage them, see [Managing Cancer-related Side Effects](#)⁶.

Hyperlinks

1. www.cancer.org/cancer/managing-cancer/treatment-types/stem-cell-transplant.html

Treatment of Children with Acute

The entire length of treatment is typically about 2 to 3 years, with the most intense treatment in the first few months.

Children with ALL are typically classified by [risk group](#)¹ to make sure that the correct types and doses of drugs are given. Treatment may be more or less intense, depending on the risk group.

Induction

The goal of induction chemotherapy is to achieve 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. (A remission is not necessarily a cure.) More than 95% of children with ALL enter remission after 1 month of induction treatment.

This first month is intense and requires prolonged hospital stays for treatment and frequent visits to the doctor. Your child may spend some or much of this time in the hospital, because serious [infections](#)² or other complications can occur. It is very important to take all medicines as prescribed. Sometimes complications can be serious enough to be life-threatening, but in recent years, advances in supportive care (nursing care, nutrition, antibiotics, red blood cell and platelet transfusions as needed, etc.) have made these much less common than in the past.

Children with standard-risk ALL often receive 3 drugs for the first month of treatment. These include the chemotherapy drugs L-asparaginase and vincristine, and a steroid drug (such as dexamethasone). For children in high-risk groups, a fourth chemo drug in the anthracycline class (most often daunorubicin) is typically added. Other drugs that may be given early are methotrexate and/or 6-mercaptopurine.

Children with Philadelphia chromosome-positive ALL may be given a [targeted drug](#) such as imatinib (Gleevec) as well. (See below.)

Intrathecal chemotherapy: All children also get chemo into the cerebrospinal fluid (CSF) to kill any leukemia cells that might have spread to the brain and spinal cord. This treatment, known as intrathecal chemotherapy, is given through a [lumbar puncture \(spinal tap\)](#)³. It is usually given twice (or more if the leukemia is high risk or leukemia cells have been found in the CSF) during the first month and several times during the next 1 or 2 months. It is then repeated less often during the rest of treatment.

Usually, methotrexate is the drug used for intrathecal chemo. Hydrocortisone (a steroid)

and cytarabine (ara-C) may be added, particularly in high-risk children.

Along with intrathecal chemo, some high-risk patients (for example, those with T-cell ALL) and those with many leukemia cells in their CSF when the leukemia is diagnosed may be given [radiation therapy](#) to the brain. This was more common in the past, but recent studies have found that many children even with high-risk ALL may not need radiation therapy if they are given more intensive chemo. Doctors try to avoid giving radiation to the brain if possible, especially in younger children, because no matter how low the dose is kept, it can cause problems with thinking, growth, and development.

A possible side effect of intrathecal chemo is seizures during treatment, which happen

1. www.cancer.org/cancer/types/leukemia-in-children/detection-diagnosis-staging/prognostic-factors.html
2. www.cancer.org/cancer/managing-cancer/side-effects/infections.html
3. www.cancer.org/cancer/types/leukemia-in-children/detection-diagnosis-staging/how-diagnosed.html
4. www.cancer.org/cancer/types/leukemia-in-children/detection-diagnosis-staging/how-diagnosed.html

Last Revised: December 5, 2024

Treatment of Children with Acute Myeloid Leukemia (AML)

Treatment of most children with acute myeloid leukemia (AML) is divided into 2 main phases of [chemotherapy](#):

- Induction
- Consolidation (intensification)

Because of the intensity of treatment and the risk of serious complications, children with AML need to be treated in [cancer centers](#)¹ or hospitals that have experience with this disease.

Induction

The chemo drugs most often used to treat AML are daunorubicin (daunomycin) and cytarabine (ara-C), which are each given for several days in a row. The treatment schedule may be repeated in 10 days or 2 weeks, depending on how intense doctors want the treatment to be. A shorter time between treatments can be more effective in killing leukemia cells, but it can also cause more severe side effects.

Some children with AML may get a dose of the [targeted drug](#) gemtuzumab ozogamicin (Mylotarg) along with chemo as part of their induction treatment.

If the doctors think that the leukemia might not respond to just 2 chemo drugs alone, they may add another chemo drug such as etoposide or 6-thioguanine. Children with very high numbers of white blood cells or whose leukemia cells have certain chromosome abnormalities may fall into this group.

Treatment with these chemo drugs is repeated until the bone marrow shows no more leukemia cells. This usually occurs after 2 or 3 cycles of treatment.

Preventing relapse in the central nervous system: Most children with AML will also get intrathecal chemotherapy (given directly into the cerebrospinal fluid, or CSF) to help prevent leukemia from relapsing in the brain or spinal cord. [Radiation therapy](#) to the brain is used less often.

Consolidation (intensification)

About 85% to 90% of children with AML go into remission after induction therapy. This means no signs of leukemia are detected using standard lab tests, but it does not necessarily mean that the leukemia has been cured.

Consolidation (intensification) begins after the induction phase. The purpose is to kill any remaining leukemia cells by using more intensive treatment.

Some children have a brother or sister who would be a good stem cell donor. For these children, a [stem cell transplant](#) might be recommended once the leukemia is in remission, especially if the AML has some poorer [prognostic factors](#)². Most studies have found this improves the chance for long-term survival over chemo alone, but it is also more likely to cause serious complications. For children with good prognostic factors, some doctors may recommend just giving intensive [chemotherapy](#), and reserving the stem cell transplant in case the AML relapses.

For most children without a good stem cell donor, consolidation consists of the chemo drug cytarabine (ara-C) in high doses. Daunorubicin may also be added. It is usually given for at least several months.

If the [targeted drug](#) gemtuzumab ozogamicin (Mylotarg) was given during induction, a dose of this drug will likely be given during this phase of treatment as well.

Intrathecal chemo (into the CSF) is usually given every 1 to 2 months for as long as intensification continues.

2. www.cancer.org/cancer/types/leukemia-in-children/detection-diagnosis-staging/prognostic-factors.html
3. www.cancer.org/cancer/managing-cancer/side-effects/infections.html
4. www.cancer.org/cancer/managing-cancer/treatment-types/blood-transfusion-and-donation.html
5. www.cancer.org/cancer/managing-cancer/making-treatment-decisions/clinical-trials.html

References

National Cancer Institute. Childhood Acute Myeloid Leukemia/Other Myeloid Malignancies Treatment (PDQ®)—Health Professional Version. Accessed at <https://www.cancer.gov/types/leukemia/hp/child-aml-treatment-pdq> on December 29, 2018.

Tarlock K, Cooper TM. Acute myeloid leukemia in children and adolescents. UpToDate. 2018. Accessed at www.uptodate.com/contents/acute-myeloid-leukemia-in-children-and-adolescents on December 29, 2018.

Last Revised: December 5, 2024

Treatment of Children with Acute Promyelocytic Leukemia (APL)

Treatment of acute promyelocytic leukemia (APL), a subtype of acute myeloid leukemia (AML), differs from the usual AML treatment. This leukemia usually responds well to treatment, which is given in 3 phases:

- Induction
- Consolidation (also called intensification)
- Maintenance

References

National Cancer Institute. Childhood Acute Myeloid Leukemia/Other Myeloid

Treatment of Children with Juvenile Myelomonocytic Leukemia (JMML)

Caywood EH, Kolb EA. Juvenile myelomonocytic leukemia. UpToDate. 2018. Accessed at www.uptodate.com/contents/juvenile-myelomonocytic-leukemia on November 29, 2018.

National Cancer Institute. Childhood Acute Myeloid Leukemia/Other Myeloid Malignancies Treatment (PDQ®)—Health Professional Version. Accessed at <https://www.cancer.gov/types/leukemia/hp/child-aml-treatment-pdq> on December 29, 2018.

Last Revised: February 12, 2019

Treatment of Children with Chronic Myeloid Leukemia (CML)

Chronic myeloid (myelogenous) leukemia (CML) is rare in children, but it does occur. Treatment in children is similar to what is used for adults.

Targeted drugs called tyrosine kinase inhibitors (TKIs), such as **imatinib (Gleevec)**, **dasatinib (Sprycel)**, **nilotinib (Tasigna)**, and **bosutinib (Bosulif)**, attack cells with the Philadelphia chromosome, which is the key gene abnormality in CML cells. These drugs are usually very good at controlling CML, often for long periods of time and with less severe side effects than chemotherapy drugs. However, it's not yet clear if these drugs can cure CML when used alone, and they must be taken every day.

Imatinib is usually the drug tried first. If it doesn't work or if it becomes less effective over time, another drug may be tried.

If targeted drugs are no longer helpful, high-dose chemotherapy with a **stem cell transplant** offers the best chance for a cure. Doctors are now studying whether adding targeted drugs to stem cell transplant regimens can help increase cure rates.

1. www.cancer.org/cancer/types/chronic-myeloid-leukemia.html

References

National Cancer Institute. Childhood Acute Myeloid Leukemia/Other Myeloid Malignancies Treatment (PDQ®)—Health Professional Version. Accessed at <https://www.cancer.gov/types/leukemia/hp/child-aml-treatment-pdq> on December 29, 2018.

Last Revised: September 28, 2023

Written by

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

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

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

cancer.org | 1.800.227.2345