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About Ewing Tumors

Overview and Types

If you or your child have just been diagnosed with a Ewing tumor or are worried about it, you likely have a lot of questions. Learning some basics is a good place to start.

- [What Is the Ewing Family of Tumors?](#)

Research and Statistics

See the latest estimates for new cases of Ewing tumors in the US and what research is currently being done.

- [Key Statistics for Ewing Tumors](#)
 - [What's New in Ewing Tumor Research and Treatment?](#)
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What Is the Ewing Family of Tumors?

Cancer starts when cells in the body begin to grow out of control. Cells in nearly any part of the body can become cancer, and can spread to other areas of the body. To learn more about how cancers start and spread, see [What Is Cancer?](#)¹ For information about the differences between childhood cancers and adult cancers, see [Cancer in Children](#)².

The Ewing family of tumors is a group of cancers that start in the bones or nearby soft

tissues that share some common features. These tumors can develop at any age, but they are most common in the early teen years.

The main types of Ewing tumors are:

- **Ewing sarcoma of bone:** Ewing sarcoma that starts in a bone is the most common tumor in this family. This type of tumor was first described by Dr. James Ewing in 1921, who found it was different from the more common bone tumor, [osteosarcoma](#)³. Seen under a microscope, its cells looked different from osteosarcoma cells. It was also more likely to respond to radiation therapy.
- **Extrasosseous Ewing tumor (EOE):** Extrasosseous Ewing tumors start in soft tissues around bones, but they look and act very much like Ewing sarcomas in bones. They are also known as *extraskkeletal* Ewing sarcomas.
- **Peripheral primitive neuroectodermal tumor (PPNET):** This rare childhood cancer also starts in bone or soft tissue and shares many features with Ewing sarcoma of bone and EOE. Peripheral PNETs that start in the chest wall are known as *Askin tumors*.

Researchers have found that the cells that make up Ewing sarcoma, EOE, and PPNET are very similar. They tend to have the same DNA (gene) abnormalities and share similar proteins, which are rarely found in other types of cancers. That's why these 3 cancers are thought to develop from the same type of cells in the body. There are slight differences among these tumors, but they're all [treated](#)⁴ the same way.

Most Ewing tumors occur in the bones. The most common sites are:

- The pelvis (hip bones)
- The chest wall (such as the ribs or shoulder blades)
- The legs, mainly in the middle of the long bones

In contrast, osteosarcoma usually occurs at the ends of the long bones, especially around the knees. Extrasosseous Ewing tumors can occur almost anywhere.

Most Ewing tumors occur in children and teens, but they can also occur in adults. **This information focuses on the Ewing family of tumors in children and teens, but most of the information here (including much of the treatment information) applies to Ewing tumors in adults as well.**

Other types of bone cancers

Several other types of cancers can start in the bones.

Osteosarcomas are the most common bone cancer in children and teens. They are described in [Osteosarcoma](#)⁵.

Most other types of bone cancers are usually found in adults and are rare in children. These include:

- Chondrosarcoma (cancer that develops from cartilage)
- Malignant fibrous histiocytoma
- Fibrosarcoma
- Chordoma
- Malignant giant cell tumor of bone

For more information on these cancers, see [Bone Cancer](#)⁶.

Many types of cancer that start in other organs of the body can spread to the bones. These are sometimes referred to as *metastatic bone cancers*, but they are not true bone cancers. For example, if a [rhabdomyosarcoma](#)⁷ (a cancer that starts in muscle cells) spreads to the bones, it is still rhabdomyosarcoma and is treated like rhabdomyosarcoma. For more information, see [Advanced Cancer, Metastatic Cancer, and Bone Metastasis](#)⁸.

Hyperlinks

1. www.cancer.org/cancer/cancer-basics/what-is-cancer.html
2. www.cancer.org/cancer/cancer-in-children.html
3. www.cancer.org/cancer/osteosarcoma.html
4. www.cancer.org/cancer/ewing-tumor/treating.html
5. www.cancer.org/cancer/osteosarcoma.html
6. www.cancer.org/cancer/bone-cancer.html
7. www.cancer.org/cancer/rhabdomyosarcoma.html
8. www.cancer.org/treatment/understanding-your-diagnosis/advanced-cancer.html

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Key Statistics for Ewing Tumors

About 1% of all childhood cancers are Ewing tumors. About 200 children and teens are diagnosed with Ewing tumors in the United States each year.

Most Ewing tumors occur in teens, but they can also affect younger children, as well as adults (mainly in their 20s and 30s).

Slightly more males than females develop these cancers. These tumors are much more common among whites, either non-Hispanic or Hispanic. This disease is very rare among African Americans, and it also seldom occurs in other racial groups.

Survival statistics for these tumors are discussed in [Survival Rates for Ewing Tumors, by Stage](#)¹.

Visit the [American Cancer Society's Cancer Statistics Center](#)² for more key statistics.

Hyperlinks

1. www.cancer.org/cancer/ewing-tumor/detection-diagnosis-staging/survival-rates.html
2. <https://cancerstatisticscenter.cancer.org/>

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What's New in Ewing Tumor Research and Treatment?

Research on Ewing tumors is being done at many medical centers, university hospitals, and other institutions across the world.

Understanding and diagnosing Ewing tumors

Scientists are developing new techniques to more accurately diagnose Ewing tumors. New [lab tests](#)¹ of tumor samples are being studied to see if they can help identify Ewing tumors and give more information on how well treatments might cure that particular tumor.

As researchers learn more about the changes inside Ewing tumor cells that make them different from normal cells, they hope to develop new treatments that take advantage of these changes (see below).

Treatment

Researchers are looking to develop better treatments for Ewing tumors, as well as to find less toxic treatments for those that can be cured.

Radiation therapy

Ewing tumors are very sensitive to [radiation therapy](#)², but because of its possible side effects, it's most often used only if [surgery](#)³ can't be done for some reason. Newer, more focused types of radiation therapy can help doctors treat tumors while lowering the dose of radiation to nearby healthy body tissues.

Chemotherapy

The Children's Oncology Group, as well as many cancer centers and children's hospitals, are studying new chemotherapy combinations, which often include drugs such as topotecan, irinotecan, temozolomide, gemcitabine, docetaxel, and mithramycin (plicamycin).

Doctors are also trying to make the [currently used drugs](#)⁴ more effective by changing the way they are given. For example, they have found that giving the standard VAC/IE (VDC/IE) chemo regimen more often – that is, every 2 weeks instead of every 3 weeks – seems to lower the chance of localized Ewing tumors coming back, without increasing the risk of serious side effects. This is often called *compressed chemotherapy*.

Researchers are also studying [high-dose chemotherapy with stem cell transplants](#)⁵ in those with Ewing tumors that are unlikely to be cured with current treatments.

Targeted therapy

As noted in [What Causes Ewing Tumors?](#)⁶, great progress is being made in understanding the changes in genes and chromosomes that cause Ewing tumors to form.

This knowledge has already been used to develop very sensitive lab tests to detect this cancer, and doctors are now studying how to best use these tests to guide the choice of treatment. It might also lead to new drugs that target these changes in Ewing tumor cells.

Some new drugs that target specific changes in Ewing tumor cells are already being tested. For example, TK216 is a drug that targets the main fusion protein in Ewing

tumor cells that is thought to help these cells grow. Early studies of this drug in people with Ewing tumors are now under way.

Also being studied in [clinical trials](#)⁷ are drugs that target the insulin-like growth factor receptor-1 (IGF-1R), a protein on some cancer cells that causes them to grow. Early studies have found that drugs like this, such as ganitumab, can shrink some Ewing tumors and slow down the growth of others. So far, this benefit has been temporary in most cases. These drugs may work best when combined with other drugs.

Other newer drugs being studied for use against Ewing tumors include:

- Drugs that affect a tumor's ability to make new blood vessels, such as bevacizumab (Avastin)
- Drugs that target the mTOR protein, such as temsirolimus (Torisel) and everolimus (Afinitor)
- Drugs that target the PARP protein, such as olaparib (Lynparza) and niraparib (Zejula)
- Drugs called HDAC inhibitors, such as vorinostat (Zolinza)

Immune therapy

A newer approach to treatment is to try to get the body's own immune system to recognize and attack the tumor cells. Some newer types of immune therapies, such as [checkpoint inhibitors](#)⁸, have shown a great deal of promise in treating other types of cancer, and some of these approaches are now being looked at for Ewing tumors. These treatments are still in the early stages of testing at this time.

Hyperlinks

1. www.cancer.org/cancer/ewing-tumor/detection-diagnosis-staging/how-diagnosed.html
2. www.cancer.org/cancer/ewing-tumor/treating/radiation-therapy.html
3. www.cancer.org/cancer/ewing-tumor/treating/surgery.html
4. www.cancer.org/cancer/ewing-tumor/treating/chemotherapy.html
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[types/immunotherapy/immune-checkpoint-inhibitors.html](https://www.cancer.org/types/immunotherapy/immune-checkpoint-inhibitors.html)

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Causes, Risk Factors, and Prevention of Ewing Tumors

Risk Factors

A risk factor is anything that affects your chance of getting a disease such as cancer. Learn more about the risk factors for Ewing tumors.

- [Risk Factors for Ewing Tumors](#)
- [What Causes Ewing Tumors?](#)

Prevention

The only known risk factors for Ewing tumors (age, gender, and race/ethnicity) can't be changed. There are no known lifestyle-related or environmental causes of Ewing tumors, so [at this time there is no way to protect against these cancers](#).

Risk Factors for Ewing Tumors

A risk factor is anything that affects a person's chance of getting a disease such as cancer. Different cancers have different risk factors.

Lifestyle-related risk factors such as body weight, physical activity, diet, and using tobacco play a major role in many adult cancers. But these factors usually take many years to influence cancer risk, and they are not thought to play much of a role in cancers that tend to affect children and teens, including Ewing tumors.

Studies of children with Ewing tumors have not found links to radiation, chemicals, or any other environmental exposures.

Some types of cancer tend to run in some families. But genetic changes passed along within families are not an important risk factor for Ewing tumors. Although the gene changes that cause most Ewing tumors are known (see [What Causes Ewing Tumors?](#)), these changes are not inherited from a parent.

Race/ethnicity

Ewing tumors are rare overall, but they are much more common among whites (either non-Hispanic or Hispanic) than among Asian Americans or African Americans. The reason for this is not known.

Gender

These cancers are slightly more common in males than in females.

Age

Ewing tumors can occur at any age, but they are most common in teens and are less common among young adults and young children. They are rare in older adults.

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What Causes Ewing Tumors?

The cause of Ewing tumors is not fully understood, but researchers are learning how certain changes in a cell's DNA can cause the cell to become cancerous. DNA is the chemical in each of our cells that makes up our **genes**. Genes tell our cells how to function. They are packaged in chromosomes, which are long strands of DNA in each cell. We normally have 23 pairs of chromosomes in each cell (one set of chromosomes comes from each parent). We usually look like our parents because they are the source of our DNA. But DNA affects more than how we look.

Some genes control when our cells grow, divide into new cells, and die:

- Genes that help cells grow, divide, or stay alive are called **oncogenes**.
- Genes that slow down cell division or make cells die at the right time are called **tumor suppressor genes**.

Cancers can be caused by changes in the cell's DNA that turn on oncogenes or turn off tumor suppressor genes.

Researchers have found chromosome changes that lead to Ewing tumors, but these changes are not inherited. Instead, they develop in a single cell after a child is born, for unknown reasons.

Nearly all Ewing tumor cells have changes that involve the *EWSR1* gene, which is found on chromosome 22. Most often, the change is a swapping of pieces of DNA (called a *translocation*) between chromosomes 22 and 11. Less often, the swap is between chromosomes 22 and 21, or rarely, between 22 and another chromosome. The translocation moves a certain piece of chromosome 11 (or another chromosome) just next to the *EWSR1* gene on chromosome 22, causing the *EWSR1* gene to be turned on all the time. Activation of the *EWSR1* gene leads to overgrowth of the cells and to the development of this cancer, but the exact way in which this happens is not yet clear.

In a very small portion of Ewing tumors, the cells have translocations that involve the *FUS* gene (on chromosome 16) instead of the *EWSR1* gene.

Lab tests can be used to find chromosome translocations in Ewing tumor cells (see [Tests for Ewing Tumors¹](#)). If doctors are not sure if a tumor belongs to the Ewing family, they can use these tests on tumor samples to look for translocations and confirm the diagnosis.

The gene changes that lead to Ewing tumors are now fairly well known, but it's still not clear what causes these changes. It might just be a random event that sometimes happens inside a cell, without having an outside cause. There are no known lifestyle-related or environmental causes of Ewing tumors, so it is important to remember that at this time, nothing could have been done to prevent these cancers.

Hyperlinks

1. www.cancer.org/cancer/ewing-tumor/detection-diagnosis-staging/how-diagnosed.html

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Can Ewing Tumors Be Prevented?

The risk of many adult cancers can be reduced with certain lifestyle changes (such as staying at a healthy weight or quitting smoking), but at this time there are no known ways to prevent most cancers in children and teens.

The only known **risk factors** for Ewing tumors (age, gender, and race/ethnicity) can't be changed. There are no known lifestyle-related or environmental causes of Ewing tumors, so at this time there is no known way to protect against these cancers.

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Early Detection, Diagnosis, and Staging of Ewing Tumors

Detection and Diagnosis

Catching cancer early often allows for more treatment options. Some early cancers may have signs and symptoms that can be noticed, but that is not always the case.

- [Can Ewing Tumors Be Found Early?](#)
- [Signs and Symptoms of Ewing Tumors](#)
- [Tests for Ewing Tumors](#)

Stages and Outlook (Prognosis)

After a cancer diagnosis, staging provides important information about the extent of cancer in the body and anticipated response to treatment.

- [Ewing Tumor Stages](#)
- [Survival Rates for Ewing Tumors](#)

Questions to Ask About Ewing Tumors

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

- [Questions to Ask the Doctor About Ewing Tumors](#)
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Can Ewing Tumors Be Found Early?

Ewing tumors are uncommon, and there are no widely recommended screening tests for these cancers. (Screening is testing for cancer in people without any symptoms.) Still, Ewing tumors sometimes cause [symptoms](#) that allow them to be found early (before they have clearly spread to other parts of the body).

The most common symptom of a Ewing tumor is pain in the area of the tumor. Sometimes the tumor shows up as a lump or swelling on an arm or leg, or on the chest. Sometimes the lump feels warmer than the rest of the body, and sometimes the child has other symptoms like a fever or not feeling well.

Of course, children and teens often get sore or have lumps and bumps from normal activities. But pains or lumps that don't go away (or that get worse) should be checked by a doctor. The same is true if a lump feels warm and/or the child has a fever. These symptoms are more likely to have other causes, such as an infection, but they need to be checked by a doctor so that the cause can be found and treated, if needed.

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Signs and Symptoms of Ewing Tumors

Ewing tumors are often found because of the symptoms they cause.

Pain

Most children and teens with Ewing tumors will have pain in the area of the tumor. Ewing tumors occur most often in the pelvis (hip bones), the chest wall (such as the ribs or shoulder blades), and the legs (mainly in the middle of the long bones), but they can also start in other parts of the body.

Bone pain can be caused by the tumor spreading under the outer covering of the bone (periosteum), or the pain can be from a break (fracture) in a bone that has been weakened by the tumor.

Lump or swelling

Over time, most Ewing bone tumors and almost all non-bone (soft tissue) Ewing tumors cause a lump or swelling, which is more likely to be noticed in tumors in the arms or legs. The lump is often soft and feels warm. Tumors in the chest wall or pelvis might not be noticed until they have grown quite large.

Other symptoms

Ewing tumors can also cause other symptoms, some of which are more common in tumors that have spread:

- Fever
- Feeling tired
- Weight loss

Rarely, tumors near the spine can cause back pain, as well as weakness, numbness, or paralysis in the arms or legs. Tumors that have spread to the lungs can cause shortness of breath.

Many of the signs and symptoms of Ewing tumors are more likely to be caused by something else. Still, if your child has any of these symptoms, see a doctor so that the cause can be found and treated, if needed.

Because many of these signs and symptoms can be confused with normal bumps and bruises or bone infections, Ewing tumors might not be recognized right away. For example, the doctor might try giving antibiotics first if an infection is suspected. The correct diagnosis might not be made until the signs and symptoms don't go away (or get worse) and the bone is then x-rayed.

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Tests for Ewing Tumors

Ewing tumors are usually found because of [signs or symptoms](#) a person is having. If the doctor suspects a tumor, exams and tests will be needed to find out for sure.

Medical history and physical exam

If you or your child has signs or symptoms that could be from a tumor, the doctor will want to get a complete **medical history** to find out more about the symptoms and how long they have been present.

The doctor will also do a complete **physical exam**, paying special attention to any areas causing pain or swelling.

If a doctor suspects a bone tumor (or another type of tumor), more tests will be done to find out. These might include imaging tests, biopsies, and/or lab tests.

Imaging tests

Imaging tests (such as x-rays, MRI scans, CT scans, bone scans, and PET scans) create pictures of the inside of the body. Imaging tests might be done for many reasons,

including:

- To help find out if a suspicious area might be cancer
- To determine the extent of a tumor or learn how far a cancer may have spread
- To help determine if treatment is working

Patients who have or might have a Ewing tumor will have one or more of these tests.

X-rays

If a bone lump doesn't go away or the doctor suspects a bone tumor for some other reason, an [x-ray](#)¹ of the area will probably be the first test done. A radiologist (doctor who specializes in reading imaging tests) can usually spot a bone tumor on an x-ray and can often tell if it is likely to be a Ewing tumor. But other imaging tests might be needed as well.

Even if an x-ray strongly suggests a Ewing bone tumor, a biopsy (described below) is still needed to confirm that it is cancer rather than some other problem, such as an infection.

Magnetic resonance imaging (MRI) scan

[MRI scans](#)² create detailed images using radio waves and strong magnets instead of x-rays, so there is no radiation involved. A contrast material called *gadolinium* may be injected into a vein before the scan to help see details better.

An MRI scan is often done to get a better look an abnormal area seen on an x-ray. MRI scans usually can show if it is likely to be a tumor, an infection, or some type of bone damage from other causes. MRIs can also help determine the extent of a tumor, as they show the detail inside bones as well as the muscle, fat, and connective tissue around the tumor. Knowing the extent of the tumor is very important when planning surgery or radiation therapy.

MRI scans might also be done to see if the cancer has spread to other areas, such as the spine or pelvis (hip area). MRI scans can also be used during and after treatment to see how well the tumor is responding.

Computed tomography (CT) scan

A [CT scan](#)³ combines many x-ray pictures to make detailed cross-sectional images of

parts of the body, including soft tissues such as muscles. A contrast material may be injected into a vein before the scan to help see details better.

CT scans of the chest are often used to see if a Ewing tumor has spread to the lungs. MRI scans are usually a bit better at defining the extent of the main tumor itself, but a CT scan of the tumor may be done as well.

Bone scan

For a [bone scan](#)⁴, a small amount of low-level radioactive material is injected into the blood and travels to the bones. A special camera can detect the radioactivity and creates a picture of the skeleton.

Areas of active bone changes appear as “hot spots” on the skeleton because they attract the radioactivity. These areas may suggest the presence of cancer, but other bone diseases can also cause the same pattern. To be sure, other tests such as plain x-rays or MRI scans, or even a bone biopsy, might be needed.

A bone scan can help show if a cancer has spread to bones in other parts of the body, and might be part of the workup for a Ewing tumor. This test is useful because it can show the entire skeleton at once. (A positron emission tomography [PET] scan can often provide similar information, so a bone scan might not be needed if a PET scan is done.)

Positron emission tomography (PET) scan

For a [PET scan](#)⁵, a form of radioactive sugar (known as *FDG*) is injected into the blood. Because cancer cells are growing quickly, they absorb large amounts of the sugar. A special camera can then create a picture of areas of radioactivity in the body. The picture is not detailed like a CT or MRI scan, but it provides helpful information about the whole body.

PET scans can be very helpful in showing the spread of Ewing tumors and in finding out whether abnormal areas seen on other imaging tests (such as a bone scan or CT scan) are tumors. PET scans can also be repeated during treatment to see how well it is working.

Some newer machines can do a PET and CT scan at the same time (PET/CT scan). This lets the doctor compare areas of higher radioactivity on the PET scan with the more detailed appearance of that area on the CT scan.

Biopsy of the tumor

The results of imaging tests might strongly suggest a Ewing tumor, but a **biopsy** (removing some of the tumor for viewing under a microscope and other lab testing) is the only way to be certain.

If the tumor is in a bone, it is very important that an orthopedic surgeon experienced in treating bone tumors does the biopsy. Whenever possible, the biopsy and the surgery to treat the cancer should be planned together, and the same surgeon should do both. Proper planning of the biopsy can help prevent later complications and might reduce the amount of surgery needed later on.

There are a few ways to get a sample of the tumor to diagnose Ewing tumors.

Incisional biopsy

For most suspected Ewing tumors, an incisional biopsy (taking out only a piece of the tumor) is done. This can be done in a couple of ways:

- **Surgical (open) biopsy:** The surgeon cuts away a piece of the tumor through an opening on the skin.
- **Needle (closed) biopsy:** The surgeon puts a large, hollow needle through the skin and into the tumor to remove a piece of it.

Incisional biopsies are often done while the patient is under general anesthesia (in a deep sleep), but in older teens and adults they are sometimes done with just sedation and a local anesthetic (numbing medicine).

Excisional biopsy

In very rare cases, if the tumor is small enough and in a good location, the surgeon can completely remove it while the patient is under general anesthesia (asleep). This is called an *excisional biopsy*.

If general anesthesia is going to be used for the biopsy, the surgeon may also plan other procedures while the patient is asleep to avoid having to do them as separate operations later on. For example, if the tumor is thought to have spread to the chest or elsewhere, the surgeon may take biopsy samples of these suspected tumors. The doctor might also do a bone marrow biopsy (see below) at this time to see if the cancer has spread to the bone marrow.

During the biopsy (while the patient is still asleep), the biopsy samples can be checked quickly under a microscope for cancer. If it looks like a Ewing tumor, the patient will very likely need [chemotherapy](#)⁶ as part of treatment, so the surgeon may place a small flexible tube, known as a [central venous catheter](#)⁷, into a large vein in the chest area during the same operation. The catheter end lies just under or outside on the skin. It can stay in place for several months during treatment. The catheter gives doctors and nurses easier access to the vein, so not as many needle sticks are needed to give chemotherapy or do blood draws later.

Bone marrow aspiration and biopsy

These tests are used to see if the cancer cells have spread into the bone marrow, the soft inner parts of certain bones. The tests might be done once a Ewing tumor has been diagnosed because it is important to know if the tumor has spread to the bone marrow.

Bone marrow aspiration and biopsy are usually done at the same time. In most cases the marrow samples are taken from the back of both of the pelvic (hip) bones. These tests may be done during the surgery to biopsy or treat the main tumor (while the patient is still under anesthesia), or they may be done as a separate procedure.

If the bone marrow **aspiration** is being done as a separate procedure, the patient lies on a table (on his or her side or belly). The area over the hip is cleaned, and the skin and the surface of the bone are numbed with a local anesthetic, which may cause a brief stinging or burning sensation. Children may also be given other medicines to make them sleepy, or they might even be asleep during the procedure. A thin, hollow needle is then inserted into the bone, and a syringe is used to suck out a small amount of liquid bone marrow.

A bone marrow **biopsy** is usually done just after the aspiration. A small piece of bone and marrow is removed with a slightly larger needle that is pushed down into the bone. Once the biopsy is done, pressure is applied to the site to help stop any bleeding.

Samples from the bone marrow are sent to a pathology lab, where they are looked at and tested for cancer cells.

Testing biopsy samples

A doctor called a *pathologist* looks at all biopsy specimens under a microscope to see if they contain cancer cells. If cancer is found, the specific type of cancer can often be determined as well. But because cells from Ewing tumors share many of the same features as cells from other types of cancer, more lab tests are often needed.

Immunohistochemistry

For this test, a portion of the biopsy sample is treated with special proteins (antibodies) that attach to substances found on Ewing tumor cells but not on other cancers. Chemicals (stains) are then added so that cells containing these substances change color and can be seen under a microscope. This lets the pathologist know that the cells are from a Ewing tumor.

Chromosome tests

Normal human cells have 23 pairs of chromosomes (strands of DNA), each of which is a certain size and looks a certain way under the microscope. Ewing tumor cells almost always have chromosome translocations, where 2 chromosomes swap pieces of their DNA. In most cases, the cells have translocations between chromosomes 22 and 11. Less often, the translocation is between other chromosomes. Finding these changes can help doctors tell Ewing tumors from other types of cancer. Other types of chromosome changes can also be found in some Ewing tumors.

Cytogenetics: In this lab test, the cells are looked at under a microscope to see if the chromosomes have any abnormalities. A drawback of this test is that it usually takes about 2 to 3 weeks because the cells must grow in lab dishes for a couple of weeks before their chromosomes are ready to be viewed under the microscope.

Fluorescent in situ hybridization (FISH): This test looks more closely at tumor cell DNA using special fluorescent dyes that only attach to specific genes or parts of chromosomes. FISH can find most chromosome changes (such as translocations) that can be seen in standard cytogenetic tests, as well as some gene changes too small to be seen with cytogenetic testing. FISH is very accurate and can usually provide results within a couple of days.

Polymerase chain reaction (PCR): PCR is a very sensitive test that is often able to detect very small numbers of cells with translocations, which wouldn't be detected by cytogenetics.

PCR is also useful in looking for cancer remaining or coming back after treatment. For example, if PCR testing of a bone marrow sample after treatment finds cells with a typical Ewing tumor translocation, it's likely that the cancer hasn't been cured, and that more treatment is needed.

Blood tests

No blood test can be used to diagnose Ewing tumors. But certain [blood tests](#)⁸ may be helpful once a diagnosis has been made.

A **complete blood count (CBC)** measures the levels of white blood cells, red blood cells, and platelets in the blood. An abnormal CBC result at the time of diagnosis might suggest the cancer has spread to the bone marrow, where these blood cells are made.

A blood test for levels of an enzyme called **lactate dehydrogenase (LDH)** is typically done at diagnosis. A high LDH level is often a sign that there is more cancer in the body.

Standard blood tests are done often to check a patient's general health both before treatment (especially before [surgery](#)⁹) and during treatment (such as [chemotherapy](#)¹⁰) to look for possible problems or side effects. These tests often include a **CBC** to monitor bone marrow function and **blood chemistry tests** to measure how well the liver and kidneys are working.

Hyperlinks

1. www.cancer.org/treatment/understanding-your-diagnosis/tests/x-rays-and-other-radiographic-tests.html
2. www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html
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Ewing Tumor Stages

Once a Ewing tumor has been diagnosed, tests are done to determine the **stage** (extent of spread) of the cancer. The stage of a Ewing tumor describes how much cancer is in the body. It helps determine how serious the cancer is and how best to [treat](#)¹ it. Doctors also use a cancer's stage when talking about survival statistics.

The stage is based on results of imaging tests and biopsies of the main tumor and other tissues, which are described in [Tests for Ewing Tumors](#).

A staging system is a standard way for the cancer care team to sum up the extent of the cancer. The formal (and more detailed) staging system for Ewing tumors is the American Joint Committee on Cancer (AJCC) system for bone cancer. It is described below to help you understand it, in case your doctor refers to it. But for treatment purposes, doctors often use a simpler system, dividing Ewing tumors into 2 groups: localized or metastatic.

Staging can be confusing. If you have any questions about the stage of the cancer, ask someone on the health care team to explain it to you in a way you understand.

Localized vs. metastatic stages

When determining how best to treat a Ewing tumor, doctors typically classify them as

either localized or metastatic.

Localized Ewing tumors

Doctors call a Ewing tumor "localized" if they believe it's only in the area where it started or in nearby tissues such as muscle or tendons. A Ewing tumor is considered localized only after all of the imaging tests (x-rays, CT or MRI scans, and PET or bone scans) and the bone marrow biopsy and aspirate (if done) do not find it has spread to distant parts of the body.

Even when imaging tests do not show that the cancer has spread to distant areas, most patients are likely to have *micrometastases* (very small areas of cancer spread that can't be detected with tests). This is why [chemotherapy](#)², which can reach all parts of the body, is an important part of treatment for all Ewing tumors.

Metastatic Ewing tumors

A metastatic Ewing tumor has clearly spread from where it started to distant parts of the body. Most of the time, it spreads to the lungs or to other bones or the bone marrow. Less commonly, it spreads to the liver or lymph nodes.

About 1 in 5 patients will have obvious spread that is found by imaging tests. But as mentioned above, many other patients are likely to have small amounts of cancer spread to other parts of the body that can't be seen on imaging tests.

AJCC staging system for bone cancer

The AJCC uses one system to describe all bone cancers, including Ewing tumors that start in bone.

Extraosseous Ewing (EOE) tumors (Ewing tumors that don't start in bones) are staged differently. They are staged like soft tissue sarcomas. Information about soft tissue sarcoma staging can be found in [Sarcoma - Adult Soft Tissue Cancer](#)³.

The AJCC staging system for bone cancers is based on 4 key pieces of information:

- **T** describes the size of the main (primary) **tumor** and whether it appears in different areas of the bone.
- **N** describes the extent of spread to nearby (regional) lymph **nodes** (small bean-sized collections of immune system cells). Bone tumors rarely spread to the lymph

nodes.

- **M** indicates whether the cancer has **metastasized** (spread) to other organs of the body. (The most common sites of spread are to the lungs or other bones.)
- **G** stands for the **grade** of the tumor, which describes how the cells from biopsy samples look. Low-grade tumor cells look more like normal cells and are less likely to grow and spread quickly, while high-grade tumor cells look more abnormal. (All Ewing tumors are considered high-grade tumors.)

Numbers or letters after T, N, M, and G provide more details about each of these factors.

T categories of bone cancer*

- T0: There is no evidence of a main (primary) tumor.
- T1: The tumor is no more than 8 cm (around 3 inches) across.
- T2: The tumor is larger than 8 cm across.
- T3: The tumor is in more than one site in the same bone.

*The T categories are slightly different if the main tumor is in the pelvis (hip bone) or spine.

N categories of bone cancer

- N0: There is no spread to nearby lymph nodes.
- N1: The cancer has spread to nearby lymph nodes.

M categories of bone cancer

- M0: There is no spread (metastasis) to distant organs.
- M1a: The cancer has spread only to the lungs.
- M1b: The cancer has spread to other distant parts of the body.

Grades of bone cancer

- GX: Grade can't be assessed
- G1: Low grade

- G2-G3: High grade

(All Ewing tumors are considered G3.)

Stage grouping

Once the T, N, and M categories and the grade of the bone cancer have been determined, the information is combined and expressed as an overall stage. The process of assigning a stage number is called *stage grouping*. The stages are described in Roman numerals from I to IV (1-4), and are sometimes divided further.

Stage IA*

T1, N0, M0, G1 (or GX): The tumor is no more than 8 cm across (T1) and is low grade (or the grade can't be assessed). The cancer has not spread to nearby lymph nodes (N0) or to distant parts of the body (M0).

Stage IB*

T2 or T3, N0, M0, G1 (or GX): The tumor is either larger than 8 cm across (T2) or it is in more than one place in the same bone (T3). It is low grade (or the grade can't be assessed). The cancer has not spread to nearby lymph nodes (N0) or to distant parts of the body (M0).

Stage IIA

T1, N0, M0, G2 to G3: The tumor is no more than 8 cm across (T1) and is high grade (G2 or G3). The cancer has not spread to nearby lymph nodes (N0) or to distant parts of the body (M0).

Stage IIB

T2, N0, M0, G2 to G3: The tumor is larger than 8 cm across (T2) and is high grade (G2 or G3). The cancer has not spread to nearby lymph nodes (N0) or to distant parts of the body (M0).

Stage III

T3, N0, M0, G2 to G3: The tumor is in more than one place in the same bone (T3). It is high grade (G2 or G3). The cancer has not spread to nearby lymph nodes (N0) or to distant parts of the body (M0).

Stage IVA

Any T, N0, M1a, any G: The tumor has spread only to the lungs (M1a). It has not spread to the lymph nodes (N0) or to other parts of the body. (It can be any size or grade.)

Stage IVB (if either of these applies)

Any T, N1, any M, any G: The tumor has spread to nearby lymph nodes (N1). It can be any size or grade, and may or may not have spread to other parts of the body.

Any T, any N, M1b, any G: The tumor has spread to distant parts of the body other than the lungs (M1b). It can be any size or grade.

*All Ewing tumors are classified as G3 (high grade), so they are never stage I bone cancers.

Hyperlinks

1. www.cancer.org/cancer/ewing-tumor/treating.html
2. www.cancer.org/cancer/ewing-tumor/treating/chemotherapy.html
3. www.cancer.org/cancer/soft-tissue-sarcoma.html

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Survival Rates for Ewing Tumors

Survival rates can give you an idea of what percentage of people with the same type and stage of cancer are still alive a certain amount of time (usually 5 years) after they were diagnosed. They can't tell you how long a person will live, but they may help give you a better understanding of how likely it is that treatment will be successful.

Keep in mind that survival rates are estimates and are often based on previous outcomes of large numbers of people who had a specific cancer, but they can't predict what will happen in any particular person's case. These statistics can be confusing and may lead you to have more questions. Talk with your doctor about how these numbers may apply to you (or your child), as he or she is familiar with your situation.

What is a 5-year relative survival rate?

A **relative survival rate** compares people with the same type and stage of cancer to people in the overall population. For example, if the **5-year relative survival rate** for a specific stage of Ewing tumor is 80%, it means that people who have that cancer are, on average, about 80% as likely as people who don't have that cancer to live for at least 5 years after being diagnosed.

Where do these numbers come from?

The American Cancer Society relies on information from the SEER* database, maintained by the National Cancer Institute (NCI), to provide survival statistics for different types of cancer.

The SEER database tracks 5-year relative survival rates for Ewing tumors in the United States, based on how far the cancer has spread. The SEER database, however, does not group cancers by [AJCC TNM stages](#) (stage 1, stage 2, stage 3, etc.). Instead, it groups cancers into localized, regional, and distant stages:

- **Localized:** There is no sign that the cancer has spread outside of the bone (or

other area) where it started.

- **Regional:** The cancer has spread outside the bone (or other area) and into nearby structures, or it has reached nearby lymph nodes.
- **Distant:** The cancer has spread to distant parts of the body, such as to the lungs or to bones in other parts of the body.

5-year relative survival rates for Ewing tumors

(Based on people diagnosed with Ewing tumors between 2008 and 2014.)

SEER stage	5-year relative survival rate
Localized	83%
Regional	69%
Distant	37%
All SEER stages combined	62%

Understanding the numbers

- **These numbers apply only to the stage of the cancer when it is first diagnosed.** They do not apply later on if the cancer grows, spreads, or comes back after treatment.
- **These numbers don't take everything into account.** Survival rates are grouped based on how far the cancer has spread. But other factors, such as those listed below, can also affect a person's outlook.
- **People now being diagnosed with Ewing tumors may have a better outlook than these numbers show.** Treatments improve over time, and these numbers are based on people who were diagnosed and treated at least 5 years earlier.

Other factors that can affect prognosis (outlook)

Factors other than the stage of the cancer can also affect survival rates. Factors that have been linked with a better prognosis include:

- Smaller tumor size
- Main tumor is on an arm or leg (as opposed to chest wall or pelvis)
- Normal **blood LDH** level
- Good tumor response to [chemotherapy](#)¹
- Age younger than 10 years

Even when taking these other factors into account, survival rates are at best rough estimates. Your cancer care team is your best source of information on this topic.

*SEER = Surveillance, Epidemiology, and End Results

Hyperlinks

1. www.cancer.org/cancer/ewing-tumor/treating/chemotherapy.html

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Questions to Ask the Doctor About Ewing Tumors

It's important to have honest, open discussions with your cancer care team. Ask any question, no matter how minor it might seem. For instance, consider these questions:

Before getting a bone biopsy

- How much experience do you have doing this type of biopsy?
- Are you part of a team that treats bone cancers?
- What will happen during the biopsy?
- How long will it take to get the results from the biopsy?

If a Ewing tumor has been diagnosed

- What kind of Ewing tumor do I (does my child) have?
- Where exactly is the tumor?
- Has the cancer spread beyond where it started?
- What is the [stage](#) of the cancer and what does that mean?
- Do we need any other [tests](#) before we can decide on treatment?
- How much experience do you have treating this type of cancer?
- Who else will be on the treatment team, and what do they do?

When deciding on a treatment plan

- What are our [treatment options](#)¹?
- What do you recommend and why?
- Are there any [clinical trials](#)² we should consider? How can we find out more about them?
- What's the goal of treatment?
- Should we get a [second opinion](#)³? How do we do that? Can you recommend someone?
- How soon do we need to start treatment?
- What should I (we) do to be ready for treatment?
- How long will treatment last? What will it be like? Where will it be done?

- How will treatment affect our daily lives?
- What are the risks and side effects of the suggested treatments?
- Which side effects start shortly after treatment and which ones might develop later on?
- Will treatment affect my child's ability to grow and develop?
- Will treatment affect my child's future ability to have children?

During and after treatment

Once treatment begins, you'll need to know what to expect and what to look for. Not all of these questions may apply, but getting answers to the ones that do may be helpful.

- How will we know if the treatment is working?
- Is there anything we can do to help manage side effects?
- What symptoms or side effects should we tell you about right away?
- How can we reach you or someone on your team on nights, weekends, or holidays?
- Who can we talk to if we have questions about costs, insurance coverage, or social support?
- What are the chances of the cancer coming back after treatment? What might our options be if this happens?
- What type of [follow up](#)⁴ and rehab will be needed after treatment?
- Are there nearby support groups or other families who have been through this that we could talk to?

Along with these sample questions, be sure to write down some of your own. For instance, you might want more information about recovery times so that you can plan your work or school schedules.

Keep in mind that doctors aren't the only ones who can give you information. Other health care professionals, such as nurses and social workers, can answer some of your questions. To find more about speaking with your health care team, see [The Doctor-Patient Relationship](#)⁵.

Hyperlinks

1. www.cancer.org/cancer/ewing-tumor/treating.html
2. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html

3. www.cancer.org/treatment/finding-and-paying-for-treatment/choosing-your-treatment-team/seeking-a-second-opinion.html
4. www.cancer.org/cancer/ewing-tumor/follow-up.html
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Treating Ewing Tumors

If you or your child has been diagnosed with a Ewing tumor, your 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 are Ewing tumors treated?

The main goals of treatment for Ewing tumors are:

- To try to cure the patient
- To keep as much function in affected parts of the body as possible
- To limit the long-term complications of treatment as much as possible

Common types of treatment for Ewing tumors include:

- [Chemotherapy for Ewing Tumors](#)
- [Surgery for Ewing Tumors](#)
- [Radiation Therapy for Ewing Tumors](#)
- [High-dose Chemotherapy and Stem Cell Transplant for Ewing Tumors](#)

Common treatment approaches

Treatment will depend on the stage of the cancer and other factors.

Chemotherapy is almost always the first treatment. Localized therapy (surgery and/or radiation therapy) is next, often followed by more chemotherapy. A stem cell transplant might be an option for some patients with Ewing tumors that are unlikely to be cured with other treatments.

- [Treatment of Ewing Tumors by Stage](#)

Who treats Ewing tumors?

Treating Ewing tumors requires a team approach that includes different types of specialists. For children and teens, treatment is best done at a children's cancer center. For adults with Ewing tumors, treatment is typically done at a major cancer center. Doctors on the treatment team might include:

- An **orthopedic surgeon** (a surgeon who specializes in muscles and bones) who is experienced in treating bone tumors
- A **medical or pediatric oncologist** (a doctor who treats cancer with chemotherapy and other drugs)
- A **radiation oncologist** (a doctor who treats cancer with radiation therapy)
- A **pathologist** (a doctor specializing in lab tests to diagnose and classify diseases)
- A **physiatrist** (a doctor who directs a person's rehabilitation and physical therapy)

For both adults and children, the team might also include other doctors, physician assistants (PAs), nurse practitioners (NPs), nurses, psychologists, social workers, physical therapists and other rehabilitation specialists, and other health professionals.

- [Health Professionals Associated With Cancer Care¹](#)
- [How to Find the Best Cancer Treatment for Your Child²](#)
- [Navigating the Health Care System When Your Child Has Cancer³](#)

Making treatment decisions

The treatment for Ewing tumors is often effective, but it can also cause serious side effects. It's important to discuss all treatment options as well as their possible side effects with the cancer care team so you can make an informed decision. It's also very important to ask questions if you're not sure about anything.

The treatment team will also help you take care of side effects and can help you work closely with nutritionists, psychologists, social workers, and other professionals to understand and deal with medical problems, stress, and other issues related to the treatment.

For cancer in children and teens, many of these issues can be more complex. As a parent, taking care of a child with cancer can be a very big job. It's important to

remember that you will have a lot of help. Many people will be involved in your child's overall care. It's also important to know that the health professionals who treat children with Ewing Tumors are using the experience and knowledge gained from many decades of studying the treatment of this disease.

If time allows, getting a second opinion from another doctor experienced with Ewing tumors 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 the Doctor About Ewing Tumors](#)⁴
- [How to Talk to Your Child's Cancer Care Team](#)⁵
- [Seeking a Second Opinion](#)⁶

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 (studies of promising new therapies). Children's cancer centers often conduct many clinical trials at any one time, and in fact most children treated at these centers take part in a clinical trial as part of their treatment.

Adults with cancer also typically have the option to participate in a clinical trial. 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 might not be right for everyone. Talk to your treatment team to learn about possible clinical trials, and ask about the pros and cons of enrolling in one of them.

If you would like to learn more about clinical trials, start by asking the treatment team if your clinic or hospital conducts clinical trials.

- [Clinical Trials](#)⁷

Considering complementary and alternative methods

You may hear about alternative or complementary methods that the doctor hasn't mentioned. 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* standard medical treatment. Although some of these methods might be helpful in relieving symptoms or helping people feel better, many have not been proven to work. Some might even be harmful.

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.

- [Complementary and Alternative Medicine](#)⁸

Preparing for treatment

Before treatment, the doctors and other members of the team will help you understand the tests that will need to be done. The team's social worker will also counsel you about some of the issues that might come up during and after treatment, and might be able to help you find housing and financial aid if needed.

- [When Your Child Has Cancer](#)⁹

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 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](#)¹⁰
- [Find Support Programs and Services in Your Area](#)¹¹

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 Ewing Tumors

Chemotherapy (chemo) is the use of anti-cancer drugs delivered through a vein (IV) or, rarely, by mouth in the form of pills. These drugs enter the bloodstream and affect cancer cells in all parts of the body, which makes this treatment useful for cancers that are likely to have spread.

Chemo is an important part of treatment for almost all patients with Ewing tumors. It is typically the first treatment given, followed by [surgery](#) and/or [radiation therapy](#). Then more chemo is often given after the surgery and/or radiation.

As noted in [Ewing Tumor Stages](#)¹, even patients with localized Ewing tumors, who have no obvious cancer spread in bone marrow biopsy samples or on imaging tests, are likely to have areas of cancer spread that are too small to be found with these tests. If these patients do not get chemotherapy, these small metastases would eventually develop into larger tumors.

How is chemo given?

Doctors give chemo in cycles, with a period of treatment (often a few days in a row) followed by a rest period to give the body time to recover. A combination of several chemo drugs is used to treat patients with Ewing tumors.

In the United States, the most common regimen is known as **VDC/IE** (or **VAC/IE**). It alternates between 2 combinations of drugs given every 2 to 3 weeks:

- The first set of drugs includes vincristine, doxorubicin (Adriamycin), and cyclophosphamide.
- Once the patient recovers, a combination of ifosfamide and etoposide is given.

Some doctors may use slightly different combinations of drugs.

Most patients will get chemo for at least 9 weeks before surgery or radiation, and then will get more chemo afterward as well. Usually a total of about 14 to 15 cycles of chemo

are given, which can take from about 6 months to close to a year to complete, depending on the schedule. If the tumor has spread, these same drugs may be given at higher doses.

Soon after the Ewing tumor is diagnosed (but before starting chemo), the doctor may suggest surgery to put a catheter (a thin, soft tube) into a large vein in the patient's chest. This is sometimes called a [venous access device \(VAD\) or central venous catheter \(CVC\)](#)². One end of the catheter stays in the vein, while the other end lies just under or outside the skin. This lets the healthcare team give chemo and other drugs and to draw blood samples without having to stick needles into the veins each time. The catheter usually stays in place for several months, and can make having chemo less painful. If you or your child gets such a device, the health care team will teach you how to care for it to reduce the risk of problems such as infections.

Possible side effects of chemo

Chemo drugs can affect cells in the body other than cancer cells, which can lead to side effects. The side effects depend on the type and doses of drugs, and the length of time they are given.

Children tend to have less severe side effects from chemo than adults and often recover from side effects more quickly. This is why doctors can often give them higher doses of chemo to kill the tumor.

General side effects: Side effects common to many chemo drugs include:

- Hair loss
- Mouth sores
- Loss of appetite
- Nausea and vomiting
- Diarrhea
- Increased chance of infections (from having too few white blood cells)
- Easy bruising or bleeding (from having too few blood platelets)
- Fatigue (from having too few red blood cells)

Most of these side effects tend to go away after treatment is finished. There are often ways to lessen them. For example, drugs can be given to help prevent or reduce nausea and vomiting, or to help get blood cell counts back to normal levels. Be sure to discuss any questions you have about side effects with the cancer care team.

Side effects of certain drugs: Along with the effects listed above, certain chemo drugs can have specific side effects:

- **Cyclophosphamide** and **ifosfamide** can damage the bladder, which can cause blood in the urine. The risk of this happening can be lowered by giving the drugs with plenty of fluids and with a drug called *mesna*, which helps protect the bladder.
- **Doxorubicin** can damage the heart. This risk goes up as the total dose of the drug goes up. Doctors try to limit this risk as much as possible by not giving more than the recommended doses of doxorubicin and by checking the heart with a test called an *echocardiogram* during treatment.
- **Vincristine** can damage [nerves](#)³. Some patients may notice tingling and numbness, particularly in the hands and feet. This often goes away or gets better once treatment is stopped, but it may last a long time in some people.
- Some chemo drugs can affect your (child's) ability to have children later in life. Talk to the cancer care team about the risks of infertility with treatment, and ask if there are options for preserving fertility, such as sperm banking or ovarian tissue banking.
- Some drugs used to treat Ewing tumors, such as **etoposide**, can increase the risk of developing leukemia later on, although this is not common.

For more on the possible late or long-term side effects of chemo, including infertility and second cancers, see [Living as a Ewing Tumor Survivor](#)⁴.

Tests to check for chemo side effects: Before each treatment, lab tests will be done to be sure the liver, kidney, and bone marrow are working well. If not, chemo may need to be delayed or the doses reduced.

- The **complete blood count (CBC)** includes counts of white blood cells, red blood cells, and blood platelets. Chemo can lower the numbers of these blood cells, so blood counts will be watched closely during and after chemo. The white blood cells and platelets usually reach their lowest point about 2 weeks after chemo is given, though this can occur earlier with high-dose regimens.
- **Blood chemistry tests** measure certain chemicals in the blood that tell doctors how well the liver and the kidneys are working. Some chemo drugs can damage the kidneys and liver.
- If doxorubicin (Adriamycin) is to be given, tests such as an **echocardiogram** (an ultrasound of the heart) may be done to check heart function before and during treatment.

More information about chemotherapy

For more general information about how chemotherapy is used to treat cancer, see [Chemotherapy](#)⁵.

To learn about some of the side effects listed here and how to manage them, see [Managing Cancer-related Side Effects](#)⁶.

Hyperlinks

1. www.cancer.org/cancer/ewing-tumor/detection-diagnosis-staging/staging.html
2. www.cancer.org/treatment/treatments-and-side-effects/central-venous-catheters.html
3. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/peripheral-neuropathy.html
4. www.cancer.org/cancer/ewing-tumor/follow-up.html
5. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/chemotherapy.html
6. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html

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Surgery for Ewing Tumors

Surgery is an important part of treatment for most Ewing tumors. Surgery is usually done for two reasons:

- To diagnose the cancer (with a [biopsy](#)¹)
- To remove the tumor(s)

Whenever possible, it's very important that the biopsy and surgical treatment be planned together, and that the same orthopedic surgeon at a cancer center does both the biopsy and the surgery to remove the tumor. The biopsy needs to be done in a certain way to give the best chance that less extensive surgery will be needed later on.

The main goal of surgery is to remove all of the cancer. If even a small number of cancer cells are left behind, they might grow and multiply to make a new tumor. To lower the risk of this happening, surgeons remove the tumor plus some of the normal tissue that surrounds it. This is known as *wide excision*.

Using a microscope, a doctor called a pathologist will look at the removed tissue to see if the margins (outer edges) have cancer cells.

- If cancer cells are seen at the edges of the tissue, the margins are called *positive*. Positive margins can mean that some cancer was left behind.
- When no cancer cells are seen at the edges of the tissue, the margins are said to be *negative*, *clean*, or *clear*. A wide excision with clean margins helps limit the risk that the cancer will grow back in the place where it started.

Types of surgery for Ewing tumors

Many types of surgery can be used for Ewing tumors. The choice depends on the tumor's size and location, the age of the patient, how likely it is that surgery can remove the tumor with clean margins, and how surgery would change the function of the affected part of the body.

Tumors in some soft tissues and certain bones can be removed without causing major disability or deformity. Other tumors, such as those in the bones of the arms and legs, might not be able to be removed completely without affecting the limb's function.

Although all operations to remove Ewing sarcomas are complex, tumors in the arms or legs are generally not as hard to remove as those in other parts of the body, such as the base of the skull, the chest wall, the spine, or the pelvis (hip bones).

Tumors in the arms or legs

For most tumors in an arm or leg, surgery can remove part or all of the affected bone while leaving the arm or leg basically intact. This is known as **limb-sparing surgery**. The bone that is removed is replaced either with a bone graft (a piece of bone from another part of the body or from another person) or with an internal prosthesis (a rod-shaped device made of metal and other materials that replaces part or all of a bone). Some newer devices combine a graft and a prosthesis.

If the tumor is in the upper part of the leg, the femur (upper leg bone), including the knee, can be removed and replaced with a prosthesis for the bone and knee, which is connected to the lower leg. Tumors in the lower part of the leg are harder to treat this way, because it is harder to remove and reconstruct parts of the lower leg. The humerus (upper arm bone) is also suitable for limb-sparing surgery.

Limb-sparing surgery is a very complex operation. The surgeons who do this type of operation must have special skills and experience. The challenge for the surgeon is to be sure to remove the entire tumor while still saving the nearby tendons, nerves, and blood vessels to keep as much of the limb's function and appearance as possible. If the tumor has grown into these structures, they will need to be removed as well. In such cases, [radiation therapy](#) or **amputation** (removal of part or all of the limb) may sometimes be the best option to treat the tumor.

Using an internal prosthesis in a growing child is especially challenging. In the past, it often required several operations over time to replace the prosthesis with a longer one as the child grew. Newer prostheses have become very sophisticated. Some can be made longer without any extra surgery. They have tiny devices in them that can lengthen the prosthesis when needed to make room for a child's growth. But even these prostheses may need to be replaced with a stronger adult prosthesis once the child's body stops growing.

Some children may not be able to have limb-sparing surgery because their tumors are in parts of bones that are hard to replace or because the tumors also extend into vital nerves or blood vessels that can't be removed without severely damaging the limb. These children usually get radiation therapy instead of surgery. In rare cases, amputating the affected limb may be the best option.

Tumors in the chest wall or pelvis (hip bones)

For a Ewing tumor in the chest wall, the surgeon often must remove the diseased area and also remove nearby ribs. The ribs might then be replaced with a man-made material. If the tumor has spread to the lungs, the chest can be opened and the lung tumors removed during an operation called a *thoracotomy*. Often these patients also get [radiation therapy](#) to the chest.

Pelvic tumors can be hard to treat with surgery, and in many cases radiation therapy may be the preferred treatment. But if the tumor responds well to initial [chemotherapy](#), surgery (sometimes followed by radiation therapy) may be an option. Pelvic bones can sometimes be reconstructed after surgery, but in some cases pelvic bones and the leg they are attached to might need to be removed.

Tumors in the spine

Tumors in or right next to the spine can often be hard to remove completely, so [radiation therapy](#) is sometimes a better option. If surgery is done, radiation is often given afterward to try to kill any remaining tumor cells.

Possible side effects of surgery

Short-term risks and side effects: Surgery to remove a Ewing tumor is often a long and complex operation. Serious short-term side effects are not common, but they can include reactions to anesthesia, excess bleeding, blood clots, and infections. Pain is common after the operation, and strong pain medicines might be needed for a while after surgery as the site heals.

Long-term side effects: The long-term side effects of surgery depend mainly on where the tumor is and what type of operation is done.

Complications of limb-sparing surgery can include bone grafts or prostheses that might break or become loose. This is more likely than with bone surgery done for other reasons because the [chemo](#) used before and after surgery can increase the risk of [infection](#)² and affect wound healing. Infections in the area can be very serious because they can be hard to treat, and might require further surgery. Infections are also a concern in people who have had amputations, especially of part of a leg, because the pressure placed on the skin at the site of the amputation can cause the skin to break down over time.

Rehabilitation after surgery

This might be the hardest part of treatment, and can't be described here completely because it will be different for each patient. Whenever possible, patients and parents should meet with a rehabilitation specialist before surgery to learn about their options and what might be required after surgery.

Physical therapy and rehabilitation are very important for patients who have had surgery for Ewing tumors. Following the recommended rehab program offers the best chance for good long-term limb function. Even with proper rehab, people might still have to adjust to long-term issues such as changes in how they walk or do other tasks, and changes in appearance. Physical, occupational, and other therapies can often help people adjust and cope with these challenges.

Rehab after limb-sparing surgery

Even when only the tumor and part of the bone is removed in a limb-sparing operation, the situation can still be complicated, especially in growing children. Children who have had limb-sparing surgery may need more surgery in the coming years to replace the internal prosthesis with one more suited to their growing body size, and some may eventually need an amputation.

It takes about a year, on average, for patients to learn to walk after limb-sparing surgery on a leg. Physical rehabilitation after limb-sparing surgery is extremely important. If the patient doesn't actively take part in the rehabilitation program, the salvaged arm or leg can become useless.

Rehab after amputation

If a limb is amputated, the patient must learn to adjust to new ways of doing some things, often with the use of a prosthetic limb. This can be particularly hard for growing children if the prosthetic limb needs changing to keep up with their growth. With proper physical therapy, patients are often able to walk on their own about 3 to 6 months after a leg amputation.

Considering your options

Both limb-sparing surgery and amputation can have pros and cons. For example, limb-sparing surgery, although often preferred by patients over amputation, tends to lead to more complications because of its complexity. Growing children who have limb-sparing surgery are also more likely to need further surgery later on.

When researchers have looked at the results of the different surgeries in terms of quality of life, there has been little difference between them. Perhaps the biggest problem has been for teens, who may worry about the social effects of their operation. Emotional issues can be very important, and all patients will need support and encouragement. See [Living as a Ewing Tumor Survivor](#)³.

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/ewing-tumor/detection-diagnosis-staging/how-diagnosed.html
2. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/infections/infections-in-people-with-cancer.html
3. www.cancer.org/cancer/ewing-tumor/follow-up.html
4. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/surgery.html
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Radiation Therapy for Ewing Tumors

Radiation therapy focuses high-energy beams at the tumor from a machine outside the body to kill the cancer cells.

Ewing tumors are very sensitive to radiation, so radiation therapy can sometimes be helpful in treating them. It may be used with [surgery](#), or it may be used instead of surgery, especially if it would be hard to remove the entire tumor. In either case, [chemotherapy](#) is usually given before, during, and afterward.

How radiation therapy is done

This type of treatment is given by a doctor called a *radiation oncologist*. Before treatments start, the radiation team takes careful measurements with imaging tests such as [MRI scans](#)¹ to determine the correct angles for aiming the beams and the proper dose of radiation. This planning session is called *simulation*. Patients may also be fitted with a plastic mold resembling a body cast to keep them in the same position each time so that the radiation can be aimed more accurately.

Most often, radiation treatments are given 5 days a week for several weeks. Each treatment is much like getting an x-ray, but the dose of radiation is much higher. The treatment is not painful. For each session, the patient lies on a special table while a machine delivers the radiation from precise angles.

Each treatment lasts only a few minutes, but the setup time – getting the patient into place for treatment – usually takes longer. Some younger children may be given medicine before each treatment to make them sleep so they won't move during treatment.

Types of radiation therapy

Modern radiation therapy techniques let doctors focus the radiation more precisely than in the past. These include:

Three-dimensional conformal radiation therapy (3D-CRT): 3D-CRT uses the results of imaging tests such as MRI and special computers to precisely map the location of the tumor. Several radiation beams are then shaped and aimed at the tumor from different directions. Each beam alone is fairly weak, which makes it less likely to damage normal body tissues, but the beams converge at the tumor to give a higher dose of radiation there.

Intensity modulated radiation therapy (IMRT): IMRT is an advanced form of 3D therapy that can be especially useful for tumors near the spine. Along with shaping the beams and aiming them at the tumor from several angles, the intensity (strength) of the beams is adjusted to limit the dose reaching the most sensitive normal tissues. This lets the doctor deliver a higher dose to the tumor. Many major hospitals and cancer centers now use IMRT, especially for tumors in hard-to-treat areas such as the spine or pelvis (hip bones).

Conformal proton beam radiation therapy: Proton beam therapy is another type of 3D therapy. But instead of using x-rays, it focuses proton beams on the tumor. Unlike x-rays, which release energy both before and after they hit their target, protons cause little damage to tissues they pass through and then release their energy after traveling a certain distance. Doctors can use this property to deliver more radiation to the tumor and do less damage to nearby normal tissues.

This approach may be helpful for hard-to-treat tumors, such as those on the spine, skull, or pelvic bones. The machines needed to make protons are expensive, and there are a limited number of them being used in the United States at this time.

Possible side effects of radiation therapy

Because of the possible side effects of radiation therapy (especially in growing children), surgery is often preferred if it is possible. But improvements in the way radiation therapy is given now allow children with Ewing tumors to be treated with lower doses than were used in the past, helping to reduce some of these side effects.

The side effects of radiation therapy depend mainly on the dose of radiation and where it is aimed. Some effects may be short term, while others may have a longer lasting impact.

Short-term problems include effects on the skin in areas that receive radiation, which

can range from mild sunburn-like changes and hair loss to more severe skin reactions. Radiation might also lower blood cell counts. Radiation to the abdomen or pelvis can cause nausea, diarrhea, and urinary problems.

Long-term side effects can be more serious, especially in growing children, so doctors try to limit them as much as possible.

A serious effect of radiation therapy in children is **slowed bone growth**, especially in younger children. For example, radiation to the bones in one leg may result in it being much shorter than the other. Radiation of facial bones may cause uneven growth, which might affect how a child looks. But if a child is fully or almost fully grown, this is less likely to be an issue.

Depending on where the radiation is aimed, it can also damage other organs:

- **Radiation to the chest wall or lungs** can affect lung and heart function.
- **Radiation to the pelvis** can damage the bladder or intestines, which can lead to problems with urination or bowel movements. It can also damage reproductive organs, which could affect [fertility](#)² later in life, so doctors do their best to protect these organs by shielding them from the radiation or moving them out of the way whenever possible.
- Side effects of **radiation therapy to the spinal cord or skull** may include nerve damage, headaches, and trouble thinking, which usually become most serious 1 or 2 years after treatment. Fortunately, Ewing tumors rarely spread to the brain, but they can sometimes extend into the brain from nearby bones of the skull.

Another major concern with radiation therapy is that it might cause a [new cancer](#)³ to form in the part of the body that was treated with the radiation. This is most often a different type of bone cancer called [osteosarcoma](#)⁴. This small risk should not keep children who need radiation from getting it. Still, it's important to continue follow-up visits with your child's doctor so that if problems come up they can be found and treated as early as possible.

More information about radiation therapy

To learn more about how radiation is used to treat cancer, see [Radiation Therapy](#)⁵.

To learn about some of the side effects listed here and how to manage them, see [Managing Cancer-related Side Effects](#)⁶.

Hyperlinks

1. www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html
2. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/fertility-and-sexual-side-effects.html
3. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/second-cancers-in-adults.html
4. www.cancer.org/cancer/osteosarcoma.html
5. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/radiation.html
6. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html

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High-dose Chemotherapy and Stem Cell Transplant for Ewing Tumors

This type of treatment is being studied for Ewing tumors that are hard to cure with other treatments, such as tumors that have spread (metastasized) to other parts of the body or that have come back after standard treatment. So far, it's not clear if a stem cell transplant is better than other treatments (such as standard chemotherapy), so many doctors recommend it be done only as part of a [clinical trial](#)¹.

What is a stem cell transplant?

The doses of [chemotherapy](#) (chemo) drugs that can be given safely are normally limited by the side effects these drugs can cause. One of the most serious is damage to the stem cells in bone marrow, which is where new blood cells are made. Even though higher doses of chemo might be more effective in treating Ewing tumors, they can't be given because they would severely damage these bone marrow cells, leading to life-threatening shortages of blood cells.

To try to get around this problem, high-dose chemo (sometimes along with radiation therapy) can be followed by a stem cell transplant to “rescue” the bone marrow, giving the person new blood stem cells to replace those that were destroyed.

In the past, this type of treatment was often called a *bone marrow transplant*.

If a stem cell transplant is considered as part of the initial treatment plan for a Ewing tumor, the person first gets standard doses of chemo, then local treatment of the tumor ([surgery](#) and/or [radiation therapy](#)), followed by high-dose chemo and a stem cell transplant.

How a stem cell transplant is done

The first step in a stem cell transplant is done before the treatment with high-dose chemo. The patient's own blood-producing stem cells are collected (harvested) to use later. This type of transplant, where the stem cells are taken from the patient, is known as an **autologous transplant**. (Another type of stem cell transplant, called **allogeneic transplant**, uses stem cells from a donor. This type is not used often for treating Ewing tumors.)

The stem cells are usually collected from the bloodstream using a procedure similar to a blood donation. But instead of going into a collecting bag, the blood goes into a special machine that filters out the stem cells and returns the other parts of the blood to the person's body. The stem cells are then frozen until the transplant. This may need to be done more than once.

Once the stem cells have been frozen and stored, the person gets high-dose chemo, sometimes along with radiation therapy. When the treatment is finished, the patient's stem cells are thawed and returned to the body in a blood transfusion. The stem cells travel through the bloodstream and settle in the bone marrow. Over the next few weeks, they start to make new, healthy blood cells.

Side effects of stem cell transplants

A stem cell transplant is a complex treatment that can cause serious or even life-threatening side effects. If the doctors think a person might benefit from a transplant, it should be done at a cancer center where the staff has experience in doing the procedure and managing the recovery period.

Some side effects of a stem cell transplant might last a long time, or might not show up until years after the transplant, which is an especially important concern in children and teens. If a stem cell transplant is recommended for your child, be sure to talk to the cancer care team before the transplant to learn about possible long-term effects your child might have.

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](#)².

For more general information about side effects and how to manage them, see [Managing Cancer-related Side Effects](#)³.

Hyperlinks

1. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html
2. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/stem-cell-transplant.html
3. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html

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Treatment of Ewing Tumors by Stage

Treatment of a Ewing tumor is based mainly on where it is in the body and [how far it has spread](#)¹ when it's first found.

Localized Ewing tumors

A localized Ewing tumor is one that still appears to be confined to the area where it started (and maybe also nearby tissues such as muscle or tendons), based on [imaging test and biopsy results](#)². But even people with localized Ewing tumors often still have cancer spread to other parts of the body that is too small to be seen with imaging tests. If these people do not get chemotherapy, these small areas of cancer cells would eventually become larger tumors. This is why chemotherapy, which can reach all parts of the body, is an important part of treatment for localized Ewing tumors.

Once the Ewing tumor has been diagnosed and staged, the first treatment is [chemotherapy](#). It's called *neoadjuvant* chemotherapy because it's given before any [surgery](#) or [radiation therapy](#). In the United States, treatment is usually a regimen known as VDC/IE (or VAC/IE), which is a combination of vincristine, doxorubicin (Adriamycin), and cyclophosphamide, alternated with ifosfamide and etoposide, although other combinations of the same drugs are also effective.

After at least 9 weeks of chemotherapy, imaging tests such as CT, MRI, PET, or bone scans are done to see if the tumor is shrinking and can be surgically removed.

If so, surgery is done at this point. If cancer cells are found at or near the edges of the surgery specimen (meaning cancer cells may have been left behind), radiation therapy

and chemotherapy (for several months) are used. If there are no cancer cells at or near the edges of the surgery specimen, chemotherapy can be used without radiation therapy.

If surgery is not an option after the initial chemotherapy (because of the tumor location or some other reason), but the tumor is not growing, radiation therapy (along with chemotherapy) is usually the next treatment given. In some cases this might shrink the tumor enough so that surgery can then be done. This would then be followed by more chemotherapy, possibly with more radiation as well. In other cases where surgery is still not an option, radiation therapy and chemotherapy are the main treatments.

If the Ewing tumor continues to grow despite the initial chemotherapy, a second type of chemotherapy (using different drugs) may be tried. Surgery or radiation therapy may also be tried to help keep the tumor under control. This may be followed by more chemotherapy.

Metastatic Ewing tumors

Patients who clearly have metastatic disease when they are first diagnosed are harder to treat than patients with localized disease. The outlook tends to be better when the cancer has only spread to the lungs, as opposed to when the cancer has spread to other bones or to the bone marrow.

Treating metastatic disease is similar in many ways to treating localized disease. [Chemotherapy](#) is the first treatment, but it often requires a more intense regimen than would be used if the cancer was localized. After a few months, tests such as CT or MRI scans, bone or PET scans, and/or bone marrow biopsies are done to see how the cancer has responded to treatment.

If the cancer has only spread to a few small areas, the main (primary) tumor and all known areas of metastases may be removed with [surgery](#) at this point. Other options, such as surgery plus radiation therapy (before and/or after surgery) or [radiation therapy](#) alone to all known metastatic sites, might also be tried. During and after these treatments, chemotherapy is given for several months as well.

Doctors at several cancer centers are now studying giving very intensive chemotherapy followed by a [stem cell transplant](#) to try to improve the outcome for these patients.

Because these tumors can be hard to treat, [clinical trials](#)³ of newer treatments may be a good option in many cases.

Ewing tumors that recur (come back) after treatment

Recurrence of Ewing tumors after treatment is less likely now than in the past, but it can happen. If the tumor does come back, treatment depends on a number of factors, including:

- The size and location of the tumor
- Whether it has spread to different parts of the body
- What types of treatment were used before
- How long it has been since treatment

[Chemotherapy](#), [surgery](#), [radiation therapy](#), or some combination of these may be used to treat recurrent tumors, depending on the situation. Doctors are also studying the use of [high-dose chemotherapy followed by a stem cell transplant](#)⁴, as well as the use of [targeted drugs and immune therapies](#)⁵, but it is not yet clear how useful these are. These tumors can be hard to treat, so [clinical trials](#)⁶ of newer treatments may be a good option.

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

Hyperlinks

1. www.cancer.org/cancer/ewing-tumor/detection-diagnosis-staging/staging.html
2. www.cancer.org/cancer/ewing-tumor/detection-diagnosis-staging/how-diagnosed.html
3. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html
4. www.cancer.org/cancer/ewing-tumor/about/new-research.html
5. www.cancer.org/cancer/ewing-tumor/about/new-research.html
6. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html

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Living as a Ewing Tumor Survivor

During [treatment](#)¹ for a Ewing tumor, the main concerns for most people and their families are the daily aspects of getting through treatment and beating the cancer. After treatment, the concerns tend to shift toward the short- and long-term effects of the cancer and its treatment, and concerns about the cancer coming back.

It's certainly normal to want to put the tumor and its treatment behind you and to get back to a life that doesn't revolve around cancer. But it's important to realize that follow-up care is a central part of this process that offers the best chance for recovery and long-term survival.

Follow-up visits and tests

Once treatment is finished, the health care team will discuss a follow-up schedule with you, including which tests should be done and how often. It's very important to go to all follow-up appointments. Follow-up visits are needed to check for cancer recurrence, as well as possible side effects of treatment.

Physical exams, along with [x-rays, and other imaging tests \(CT, MRI, PET, and/or bone scans\)](#)² are often done every 2 to 3 months for the first couple of years following treatment, and then less often over time if there are no issues. If Ewing tumors come back, it is usually within the first 2 years after treatment, but they can sometimes come back even many years later, so continued follow-up visits are important.

Physical therapy and rehabilitation are typically a very important part of recovery after treatment, and your doctors and other health providers will continue to monitor your (child's) progress as time goes on.

Blood tests and other tests might be done as well. For example, the chemotherapy drug doxorubicin (Adriamycin) can affect the heart, so tests to measure heart function (such

as echocardiograms) will probably be done as well.

During this time, it is very important to report any new symptoms to the doctor right away so that any problems can be found early, when they can be treated most effectively.

Ask the cancer care team for a survivorship care plan

Talk with the treatment team about developing a [survivorship care plan](#)³. This plan might include:

- A summary of the diagnosis, tests done, and treatment given
- A suggested schedule for follow-up exams and tests
- A schedule for other tests that might be needed in the future, such as early detection (screening) tests for other types of cancer, or tests to look for long-term health effects from the cancer or its treatment
- A list of possible late- or long-term side effects from treatment, including what to watch for and when to contact the doctor

Keeping health insurance and copies of medical records

As much as you might want to put the experience behind you once treatment is completed, it's also very important to keep good records of your (child's) medical care during this time. Gathering these details soon after treatment may be easier than trying to get them at some point in the future. This can be very helpful later on if you (or your child) change doctors. Learn more about this in [Keeping Copies of Important Medical Records](#)⁴.

It's also very important to keep [health insurance](#)⁵ coverage. Tests and doctor visits can cost a lot, and even though no one wants to think of the tumor coming back, this could happen.

Possible late and long-term effects of cancer treatment

Treatment for a Ewing tumor might affect a person's health later in life. Young people in particular are at risk for possible late effects of their treatment. This risk depends on many factors, such as the size and location of the cancer, the treatments received, doses of cancer treatment, and the person's age when treated.

For example, the after-effects of [surgery](#)⁶ for Ewing tumors can range from small scars to the loss of a limb, which would require both physical rehabilitation and emotional adjustment.

Other late effects of cancer treatment can include:

- Heart or lung problems (caused by certain [chemo](#)⁷ drugs or [radiation therapy](#)⁸ to the chest)
- Slowed growth and development (in the bones or overall)
- Changes in sexual development and [ability to have children](#)⁹
- Learning problems in younger children
- Development of [second cancers](#)¹⁰

Other possible complications might come up as well. Your child's doctor should carefully review any possible problems with you before your child starts treatment. For more information, see [Late Effects of Childhood Cancer Treatment](#)¹¹.

Long-term follow-up care for children and teens

To help increase awareness of late effects and improve follow-up care for childhood cancer survivors throughout their lives, the Children's Oncology Group (COG) has developed long-term follow-up guidelines for survivors of childhood cancers. These guidelines can help you know what to watch for, what types of screening tests should be done to look for problems, and how late effects can be treated.

It's very important to discuss possible long-term complications with your child's health care team, and to make sure there is a plan in place to watch for these problems and treat them, if needed. To learn more, ask your child's doctors about the COG survivor guidelines. You can also read them on the COG website:

www.survivorshipguidelines.org.¹² The guidelines are written for health care professionals. Patient versions of some of the guidelines are available (as "Health Links") on the site as well, but we urge you to discuss them with your doctor.

Social and emotional issues

Most Ewing tumors develop during the teenage or young adult years, a very sensitive time in a person's life. Ewing tumors and their treatment can have a profound effect on how a person looks and how they view themselves and their body. It can also affect how they do some everyday tasks, including certain school, work, or recreational activities. These effects are often greatest during the first year of treatment, but they can

be long-lasting in some people. It's important that the treating center assess the family situation as soon as possible, so that any areas of concern can be addressed.

These types of issues can often be addressed with support and encouragement. Doctors and other members of the health care team can also often recommend special support programs and services to help children and teens after cancer treatment. For more information, see [When Your Child's Treatment Ends](#)¹³.

No one chooses to have a Ewing tumor, but for many people, the experience can eventually be positive, helping to establish strong self-values. Other people may have a harder time recovering, adjusting to life after cancer, and moving on. It is normal to have some anxiety or other emotional reactions after treatment, but feeling overly worried, depressed, or angry can affect many parts of a young person's growth. It can get in the way of relationships, school, work, and other aspects of life.

With support from family, friends, other survivors, mental health professionals, and others, many people who have survived cancer can thrive in spite of the challenges they've had to face. If needed, doctors and other members of the health care team can often recommend special support programs and services to help after cancer treatment.

Although Ewing tumors and their treatment can have social and emotional effects on children and teens (and their families), adults with this disease face many of the same challenges, and are also encouraged to take advantage of the cancer center's physical therapy, occupational therapy, and counseling services.

Hyperlinks

1. www.cancer.org/cancer/ewing-tumor/treating.html
2. www.cancer.org/cancer/ewing-tumor/detection-diagnosis-staging/how-diagnosed.html
3. www.cancer.org/treatment/survivorship-during-and-after-treatment/survivorship-care-plans.html
4. www.cancer.org/treatment/survivorship-during-and-after-treatment/be-healthy-after-treatment/keeping-copies-of-important-medical-records.html
5. www.cancer.org/treatment/finding-and-paying-for-treatment/understanding-health-insurance.html
6. www.cancer.org/cancer/ewing-tumor/treating/surgery.html
7. www.cancer.org/cancer/ewing-tumor/treating/chemotherapy.html
8. www.cancer.org/cancer/ewing-tumor/treating/radiation-therapy.html
9. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/physical-side-effects.html

- [effects/fertility-and-sexual-side-effects.html](#)
10. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/second-cancers-in-adults.html
 11. www.cancer.org/treatment/children-and-cancer/when-your-child-has-cancer/late-effects-of-cancer-treatment.html
 12. <http://www.survivorshipguidelines.org/>
 13. www.cancer.org/treatment/children-and-cancer/when-your-child-has-cancer/after-treatment.html

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