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## About Bone Cancer

### Overview and Types

If you have been diagnosed with bone cancer or are worried about it, you likely have a lot of questions. Learning some basics is a good place to start.

- [What Is Bone Cancer?](#)

### Research and Statistics

See the latest estimates for new cases of bone cancer and deaths in the US and what research is currently being done.

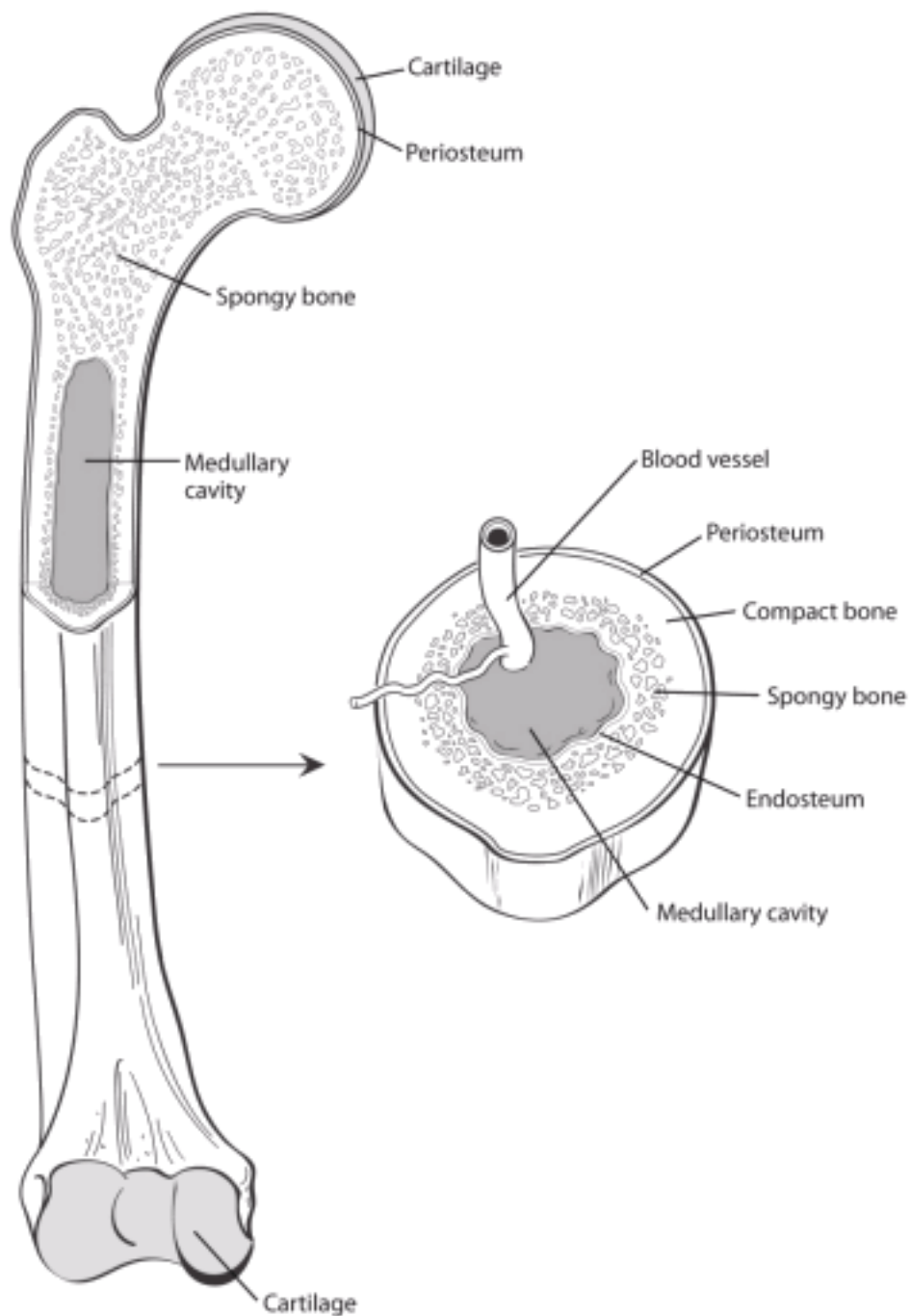
- [Key Statistics About Bone Cancer](#)
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- 

## What Is Bone Cancer?

Bone cancer is very rare in adults. It starts in the cells that make up the bone. Cancer starts when cells begin to grow out of control. Cells in nearly any part of the body can become cancer, and can spread to other parts of the body. To learn more about how cancers start and spread, see [What Is Cancer?](#)<sup>1</sup>

### Normal bone tissue

To understand bone cancer, it helps to understand a little about normal bone tissue.



Bone is the supporting framework of your body. Most bones are hollow. The hard outer layer of bones is made of compact (cortical) bone, which covers the lighter spongy

(trabecular) bone inside. The outside of the bone is covered with fibrous tissue called **periosteum**. Hollow bones have a space called the **medullary cavity** which contains the soft, spongy tissue called **bone marrow** (discussed below). The tissue lining the medullary cavity is called **endosteum**.

At each end of the bone is a zone of a softer form of bone-like tissue called **cartilage**. Cartilage is softer than bone but more firm than most tissues. It's made of a fibrous tissue matrix mixed with a gel-like substance that doesn't contain much calcium. Most bones start out as cartilage. The body then lays calcium down onto the cartilage to form bone. After the bone is formed, cartilage may remain at the ends to act as a cushion between bones. This cartilage, along with ligaments and other tissues connect bones to form a joint. In adults, cartilage is mainly found at the end of some bones that are part of a joint.

Cartilage is also in the chest where the ribs meet the sternum (breastbone) and in parts of the face. The trachea (windpipe), larynx (voice box), and the outer part of the ear are other structures that contain cartilage.

Bone is very hard and strong. Some bone is able to support as much as 12,000 pounds of pressure per square inch. It takes as much as 1,200 to 1,800 pounds of pressure to break the femur (thigh bone).

Bone itself contains 2 kinds of cells.

- The **osteoblast** is the cell that lays down new bone
- The **osteoclast** is the cell that dissolves old bone.

Bone often looks as if it doesn't change much, but it's actually very active. New bone is always forming while old bone is dissolving.

In some bones the marrow is only fatty tissue. In other bones it's a mixture of fat cells and blood-forming cells. The blood-forming cells make red blood cells, white blood cells, and blood platelets. There are other cells in the bone marrow, too, such as plasma cells and fibroblasts.

Any of these bone cells can develop into cancer.

## Types of bone tumors

### Bone tumors that are not cancer

Some tumors that start in the bone are benign (not cancer). Benign tumors do not spread to other tissues and organs and are not usually life threatening. They often can be cured with surgery. Types of benign bone tumors include:

- Osteoid osteoma
- Osteblastoma
- Osteochondroma
- Enchondroma
- Chondromyxoid fibroma.

Benign tumors are not discussed further here.

### **Bone metastases**

Most of the time when someone with cancer is told they have cancer in the bones, the doctor is talking about a cancer that has spread to the bones from somewhere else. This is called **metastatic cancer**. It can happen with many different types of [advanced cancer](#)<sup>2</sup>, like [breast](#)<sup>3</sup> cancer, [prostate](#)<sup>4</sup> cancer, and [lung](#)<sup>5</sup> cancer. When the cancer cells in the bone are looked at under a microscope, they look just like the tissue they came from.

So, if someone has lung cancer that has spread to bone, the cancer cells in the bone look and act like lung cancer cells. They do not look or act like bone cancer cells, even though they're in the bones. Because these cancer cells still act like lung cancer cells, they need to be treated with drugs that are used for lung cancer.

To learn more about this, see [Bone Metastasis](#)<sup>6</sup>.

### **Blood cancers**

Other kinds of cancers that are sometimes called “bone cancers” start in the blood-forming cells of the bone marrow not in the bone itself.

The most common cancer that starts in the bone marrow and causes bone tumors is called [multiple myeloma](#)<sup>7</sup>. Another cancer that starts in the bone marrow is [leukemia](#)<sup>8</sup>. Sometimes [lymphomas](#)<sup>9</sup>, which more often start in [lymph nodes](#)<sup>10</sup>, can start in bone marrow. These blood cancers are not discussed here.

### **Bone cancers**

**True (or primary) bone tumors start in the bone itself and are called sarcomas.**

These are malignant tumors, which means they're cancer.

Sarcomas start in bone, muscle, fibrous tissue, blood vessels, fat tissue, as well as some other tissues. They can develop anywhere in the body. They're covered below.

**Malignant bone tumors**

There are many different kinds of primary bone cancer. They're named based on the part of the bone or nearby tissue that's affected and the kind of cells forming the tumor. Some are quite rare.

**Osteosarcoma**

**Osteosarcoma (also called osteogenic sarcoma) is the most common primary bone cancer.** It starts in the bone cells. It most often occurs in young people between the ages of 10 and 30, but about 10% of osteosarcoma cases develop in people in their 60s and 70s. It's rare in middle-aged people, and is more common in males than females. These tumors develop most often in bones of the arms, legs, or pelvis. This type of bone cancer is covered in [Osteosarcoma](#)<sup>11</sup>.

**Chondrosarcoma**

Chondrosarcoma starts in cartilage cells. It's the second most common primary bone cancer. It's rare in people younger than 20. After age 20, the risk of getting a chondrosarcoma goes up until about age 75. Women get this cancer as often as men.

Chondrosarcomas can start anywhere there's cartilage. Most develop in bones like the pelvis, legs, or arms. Sometimes chondrosarcoma starts in the trachea, larynx, or chest wall. Other sites are the scapula (shoulder blade), ribs, or skull.

Benign (not cancer) tumors are more common in the cartilage than malignant ones. These are called enchondromas. Another type of benign cartilage tumor is a bony projection capped by cartilage called an osteochondroma. These benign tumors rarely turn into cancer. People who have many of these tumors have a slightly higher chance of developing cancer, but this isn't common.

**Chondrosarcomas are classified by grade, which measures how fast they grow.**

The grade is assigned by the pathologist (a doctor specially trained to examine and diagnose tissue samples with a microscope). The lower the grade, the slower the cancer grows. When a cancer is slow growing, the chance that it will spread is lower, so

the outlook is better. Most chondrosarcomas are either low grade (grade I) or intermediate grade (grade II). High-grade (grade III) chondrosarcomas, which are the most likely to spread, are less common.

Some chondrosarcomas have distinctive features which can be seen with a microscope. These sub-types of chondrosarcoma often have a different prognosis (outlook):

- **Dedifferentiated chondrosarcomas** start out as typical chondrosarcomas but then some parts of the tumor change into cells like those of a high-grade sarcoma (such as high grade forms of malignant fibrous histiocytoma, osteosarcoma, or fibrosarcoma). This type of chondrosarcoma tends to develop in older patients and grows faster than usual chondrosarcomas.
- **Clear cell chondrosarcomas** are rare and grow slowly. They seldom spread to other parts of the body unless they have already come back several times in the original location.
- **Mesenchymal chondrosarcomas** can grow rapidly, but are sensitive to treatment with [radiation](#)<sup>12</sup> and [chemotherapy](#)<sup>13</sup>.

## Ewing tumor

Ewing tumor is the third most common primary bone cancer, and the second most common in children, teens, and young adults. It's rare in adults older than 30. This cancer (also called **Ewing sarcoma**) is named after Dr. James Ewing, who first described it in 1921. Most Ewing tumors develop in bones, but they can start in other tissues and organs. The most common sites for this cancer are the pelvis, the chest wall (such as the ribs or shoulder blades), and the long bones of the legs or arms. Ewing tumors occur most often in white people and are very rare among African Americans and Asian Americans. More information can be found in [Ewing Family of Tumors](#)<sup>14</sup>.

## Malignant fibrous histiocytoma

Malignant fibrous histiocytoma (MFH) most often starts in soft tissue (connective tissues such as ligaments, tendons, fat, and muscle); it's rare in bones. This cancer is also known as **pleomorphic undifferentiated sarcoma**, especially when it starts in soft tissues. When MFH occurs in bones, it usually affects the legs (often around the knees) or arms. This cancer most often occurs in elderly and middle-aged adults. It's quite rare in children. MFH mostly tends to grow locally, but it can spread to distant sites, like the lungs.

## **Fibrosarcoma**

This is another type of cancer that develops more often in soft tissues than it does in bones. Fibrosarcoma usually occurs in elderly and middle-aged adults. Bones in the legs, arms, and jaw are most often affected.

## **Giant cell tumor of bone**

This type of primary bone tumor has benign (not cancer) and malignant forms. The benign form is most common. Giant cell bone tumors typically affect the legs (usually near the knees) or arms of young and middle-aged adults. They don't often spread to distant sites, but after surgery tend to come back where they started. (This is called local recurrence.) This can happen many times. With each recurrence, the tumor becomes more likely to spread to other parts of the body. Rarely, a malignant giant cell bone tumor spreads to other parts of the body without first recurring locally.

## **Chordoma**

This primary tumor of bone usually occurs in the base of the skull and bones of the spine. It develops most often in adults older than 30. It's about twice as common in men as in women. Chordomas tend to grow slowly and often do not spread to other parts of the body. They often come back in the same area if they are not removed completely. The lymph nodes, the lungs, and the liver are the most common areas for tumor spread.

## **Other cancers that develop in bones**

Other cancers can be found in the bones, but they don't start in the actual bone cells. They are not treated like primary bone cancer.

## **Non-Hodgkin lymphomas**

Non-Hodgkin lymphoma generally develops in lymph nodes but sometimes starts in the bone. Primary non-Hodgkin lymphoma of the bone is often a widespread disease because many bones are usually involved. The outlook is similar to other non-Hodgkin lymphomas of the same subtype and stage. Primary lymphoma of the bone is given the same treatment as lymphomas that start in lymph nodes. It's not treated like a primary bone sarcoma. For more information see [Non-Hodgkin Lymphoma](#)<sup>15</sup>.

## **Multiple myelomas**

Multiple myeloma almost always develops in bones, but it's not a primary bone cancer because it starts in the plasma cells of the bone marrow (the soft inner part of some bones). Although it causes bone destruction, it's no more a bone cancer than leukemia is. It's treated as a widespread disease. At times, myeloma can be first found as a single tumor (called a **plasmacytoma**) in a single bone, but most of the time it will spread to the marrow of other bones. See [Multiple Myeloma](#)<sup>16</sup>.

## Hyperlinks

1. [www.cancer.org/cancer/cancer-basics/what-is-cancer.html](http://www.cancer.org/cancer/cancer-basics/what-is-cancer.html)
2. [www.cancer.org/treatment/understanding-your-diagnosis/advanced-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/advanced-cancer.html)
3. [www.cancer.org/cancer/breast-cancer.html](http://www.cancer.org/cancer/breast-cancer.html)
4. [www.cancer.org/cancer/prostate-cancer.html](http://www.cancer.org/cancer/prostate-cancer.html)
5. [www.cancer.org/cancer/lung-cancer.html](http://www.cancer.org/cancer/lung-cancer.html)
6. [www.cancer.org/treatment/understanding-your-diagnosis/advanced-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/advanced-cancer.html)
7. [www.cancer.org/cancer/multiple-myeloma.html](http://www.cancer.org/cancer/multiple-myeloma.html)
8. [www.cancer.org/cancer/leukemia.html](http://www.cancer.org/cancer/leukemia.html)
9. [www.cancer.org/cancer/lymphoma.html](http://www.cancer.org/cancer/lymphoma.html)
10. [www.cancer.org/cancer/cancer-basics/lymph-nodes-and-cancer.html](http://www.cancer.org/cancer/cancer-basics/lymph-nodes-and-cancer.html)
11. [www.cancer.org/cancer/osteosarcoma.html](http://www.cancer.org/cancer/osteosarcoma.html)
12. [www.cancer.org/cancer/bone-cancer/treating/radiation.html](http://www.cancer.org/cancer/bone-cancer/treating/radiation.html)
13. [www.cancer.org/cancer/bone-cancer/treating/chemotherapy.html](http://www.cancer.org/cancer/bone-cancer/treating/chemotherapy.html)
14. [www.cancer.org/cancer/ewing-tumor.html](http://www.cancer.org/cancer/ewing-tumor.html)
15. [www.cancer.org/cancer/non-hodgkin-lymphoma.html](http://www.cancer.org/cancer/non-hodgkin-lymphoma.html)
16. [www.cancer.org/cancer/multiple-myeloma.html](http://www.cancer.org/cancer/multiple-myeloma.html)

## References

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

National Cancer Institute. Bone Cancer. March 13, 2008. Accessed at [www.cancer.gov/types/bone/bone-fact-sheet](http://www.cancer.gov/types/bone/bone-fact-sheet) on December 4, 2017.

National Cancer Institute. Osteosarcoma and Malignant Fibrous Histiocytoma of Bone Treatment (PDQ®)—Patient Version. September 1, 2017. Accessed at [www.cancer.gov/types/bone/patient/osteosarcoma-treatment-pdq](http://www.cancer.gov/types/bone/patient/osteosarcoma-treatment-pdq) on December 4, 2017.



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## Key Statistics About Bone Cancer

The American Cancer Society's estimates for cancer of the bones and joints for 2019 are:

- About 3,500 new cases will be diagnosed
- About 1,660 deaths from these cancers are expected

Primary cancers of bones account for less than 0.2% of all cancers.

In adults, over 40% of primary bone cancers are chondrosarcomas. This is followed by osteosarcomas (28%), chordomas (10%), Ewing tumors (8%), and malignant fibrous histiocytoma/fibrosarcomas (4%). The remainder of cases are several rare types of bone cancers.

In children and teenagers (those younger than 20 years), [osteosarcoma](#)<sup>1</sup> (56%) and [Ewing tumors](#)<sup>2</sup> (34%) are much more common than chondrosarcoma (6%).

Chondrosarcomas develop most often in adults, with an average age at diagnosis of 51. Less than 5% of cases occur in patients younger than 20.

Chordomas are also more common in adults. Less than 5% of cases occur in patients younger than 20.

Both osteosarcomas and Ewing tumors occur most often in children and teens.

Visit the [American Cancer Society's Cancer Statistics Center](#)<sup>3</sup> for more key statistics.

### Hyperlinks

1. [www.cancer.org/cancer/osteosarcoma.html](http://www.cancer.org/cancer/osteosarcoma.html)
2. [www.cancer.org/cancer/ewing-tumor.html](http://www.cancer.org/cancer/ewing-tumor.html)
3. <https://cancerstatisticscenter.cancer.org/>

## References

American Cancer Society. *Facts & Figures 2019*. American Cancer Society. Atlanta, Ga. 2019.

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

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# What's New in Bone Cancer Research?

Research on [bone cancer](#) is now being done at many medical centers, university hospitals, and other institutions around the world. There are many [clinical trials](#)<sup>1</sup> focusing on bone cancer.

Because primary bone cancer is rare in adults, it's been hard to study well. Most experts agree that treatment in a clinical trial should be considered, especially for people with [advanced](#)<sup>2</sup> bone cancers (those that come back after treatment, don't respond to treatment, and/or spread to other parts of the body). This way people can get the best treatment available now and may also get the treatments that are thought to be even better.

## Treatment

Some clinical trials are looking into ways to combine [surgery](#)<sup>3</sup>, [radiation therapy](#)<sup>4</sup>, and [chemotherapy](#)<sup>5</sup> (chemo), and drugs known as [targeted therapy](#)<sup>6</sup> to treat these cancers.

## Chemotherapy

Some studies are testing new chemo drugs. Researchers are also looking for new, and maybe better, ways to use the drugs we have. For instance, doctors are studying whether adding a bisphosphonate called zoledronic acid (Zometa) to the bone cement used to fill in the space left after removing a giant cell tumor might decrease the chance that the tumor will come back in that place.

Another area of interest is long-term chemotherapy side effects. Bone cancers are some of the more common cancers in young people, and doctors are trying to learn more about how the chemo drugs used might affect the way the brain develops and works as survivors grow older.

## Targeted therapy

[Targeted therapy](#)<sup>7</sup> drugs work differently from standard chemo. These drugs target certain genes and proteins in cancer cells.

A huge area of primary bone cancer research is learning more about the genetic changes in these cancer cells. Researchers are using existing drugs and developing new targeted drugs that focus on these gene changes. It's hoped that these drugs can change the cancer's ability to grow and spread, providing a new and better way to treat these tumors.

For instance, researchers have found that some giant cell tumors that have low levels of certain genes (called microRNA genes) are able to grow and spread faster. MicroRNA changes have also been found in chondrosarcomas. Tests that find these microRNA changes may be helpful in diagnosing these tumors. Finding drugs that target these genes might also prove to be a possible treatment.

One targeted therapy drug, nivolumab (Opdivo), is already used to treat other kinds of cancer. Doctors are trying to find out the best dose to use. They are looking at whether combining it with other treatments might slow tumor growth and help people with advanced sarcomas live longer.

The targeted therapy drug dasatinib (Sprycel) is also used to treat other cancers. Early studies have suggested it may help treat chondrosarcomas, both alone and combined with chemo. Chondrosarcomas seldom respond to chemo or radiation, so targeted therapy drugs may lead to new treatments for these hard-to-treat cancers.

Denosumab (Prolia or Xgeva) is another targeted therapy being tested to see if it can help control giant cell tumor of the bone and/or keep it from coming back after treatment. It's also been shown to help keep giant cell tumors from coming back after surgery.

Overall, results of targeted therapy research are not yet clear. More research is needed in this area, and many clinical trials are testing these treatments.

## Radiation

The most common type of radiation used to treat cancer uses beams of x-rays. Doctors are looking for better types of radiation. Proton beam radiation uses particles made up of protons. (Protons are small positively charged particles that are part of atoms.) Proton radiation is already used to treat bone tumors near very sensitive organs, like the brain or the spine. It's being tested on tumors in other parts of the body, too. And as advances make this treatment even more precise and more widely available, it may be found to work better in treating bone tumors.

Another much less common form of particle radiation that has been used to treat chordomas and chondrosarcomas is carbon ion radiation. This may be helpful in treating tumors that do not respond to available treatments, but a lot more research is needed. This treatment is only available in 10 centers worldwide, and there are no carbon ion radiation facilities in North America as of 2017.

## Genetics

In addition to [clinical trials](#)<sup>8</sup>, researchers are making progress in learning about the causes of bone tumors. For example, changes to the T gene have been found in a few families where more than one member has a chordoma. This might help doctors find specific gene changes that might put a person at higher risk for this type of bone cancer.

Other gene changes found in giant cell tumors may help doctors find better ways to both diagnose and treat these tumors.

Scientists hope that learning more about the DNA changes that cause bone cancers will also lead to better treatments that might be aimed at these gene defects.

## Hyperlinks

1. [www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html](http://www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html)
2. [www.cancer.org/treatment/understanding-your-diagnosis/advanced-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/advanced-cancer.html)
3. [www.cancer.org/cancer/bone-cancer/treating/surgery.html](http://www.cancer.org/cancer/bone-cancer/treating/surgery.html)
4. [www.cancer.org/cancer/bone-cancer/treating/radiation.html](http://www.cancer.org/cancer/bone-cancer/treating/radiation.html)
5. [www.cancer.org/cancer/bone-cancer/treating/chemotherapy.html](http://www.cancer.org/cancer/bone-cancer/treating/chemotherapy.html)
6. [www.cancer.org/cancer/bone-cancer/treating/targeted-therapy.html](http://www.cancer.org/cancer/bone-cancer/treating/targeted-therapy.html)
7. [www.cancer.org/cancer/bone-cancer/treating/targeted-therapy.html](http://www.cancer.org/cancer/bone-cancer/treating/targeted-therapy.html)
8. [www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html](http://www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html)

## References

Frisch S, Timmermann B. The Evolving Role of Proton Beam Therapy for Sarcomas. *Clin Oncol (R Coll Radiol)*. 2017;29(8):500-506.

Imai R, Kamada T, Araki N, et al. Clinical Efficacy of Carbon Ion Radiotherapy for Unresectable Chondrosarcomas. *Anticancer Res*. 2017;37(12):6959-6964.

Müller DA, Beltrami G, Scoccianti G, et al. Risks and benefits of combining denosumab and surgery in giant cell tumor of bone—a case series. *World J Surg Oncol*. 2016;14(1):281.

Mohamad O, Sishc BJ, Saha J, et al. Carbon Ion Radiotherapy: A Review of Clinical Experiences and Preclinical Research, with an Emphasis on DNA Damage/Repair. *Cancers (Basel)*. 2017;9(6).

Ni LY, Zhao JD, Lu YH, et al. MicroRNA-30c suppressed giant-cell tumor of bone cell metastasis and growth via targeting HOXA1. *Eur Rev Med Pharmacol Sci*. 2017;21(21):4819-4827.

Palmini G, Marini F, Brandi ML. What Is New in the miRNA World Regarding Osteosarcoma and Chondrosarcoma? *Molecules*. 2017;22(3).

Polychronidou G, Karavasilis V, Pollack SM, et al. Novel therapeutic approaches in chondrosarcoma. *Future Oncol*. 2017;13(7):637-648.

Zhang L, Yang M, Mayer T, et al. Use of MicroRNA biomarkers to distinguish enchondroma from low-grade chondrosarcoma. *Connect Tissue Res*. 2017;58(2):155-161.

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

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# Bone Cancer Causes, Risk Factors, and Prevention

## 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 bone cancer.

- [Risk Factors for Bone Cancer](#)
- [What Causes Bone Cancer?](#)

## Prevention

At this time there is no way to prevent this cancer.

- [Can Bone Cancer Be Prevented?](#)

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# Risk Factors for Bone Cancer

A risk factor is anything that affects your chance of getting a disease such as cancer. Different cancers have different risk factors. For example, exposing skin to strong sunlight is a risk factor for skin cancer. Smoking is a risk factor for cancers of the lung, mouth, larynx, bladder, kidney, and several other organs. But having a risk factor, or even several, does not mean that you will get the disease. Most people with bone cancers do not have any apparent risk factors.

## Genetic disorders

A very small number of bone cancers (especially [osteosarcomas](#)<sup>1</sup>) appear to be hereditary and are caused by defects (mutations) in certain [genes](#)<sup>2</sup>. **Retinoblastoma** is a rare eye cancer in children that can be hereditary. The inherited form of [retinoblastoma](#)<sup>3</sup> is caused by a mutation (abnormal copy) of the *RB1* gene. Those with this mutation also have an increased risk of developing bone or [soft tissue sarcomas](#)<sup>4</sup>. Also, if radiation therapy is used to treat the retinoblastoma, the risk of osteosarcoma in the bones around the eye is even higher.

Finally, there are families with several members who have developed osteosarcoma without inherited changes in any of the known genes. The gene defects that may cause cancers in these families haven't been discovered yet.

## Chondrosarcomas

Multiple exostoses (sometimes called **multiple osteochondromas**) syndrome is an inherited condition that causes many bumps on a person's bones. These bumps are made mostly of cartilage. They can be painful and deform and/or fracture bones. This disorder is caused by a mutation in any one of the 3 genes *EXT1*, *EXT2*, or *EXT3*. Patients with this condition have an increased risk of chondrosarcoma.

An enchondroma is a benign cartilage tumor that grows into the bone. People who get many of these tumors have a condition called **multiple enchondromatosis**. They have an increased risk of developing chondrosarcomas.

## Chordomas

Chordomas seem to run in some families. The genes responsible have not yet been found, but familial chordoma has been linked to changes on chromosome 7.

Patients with the inherited syndrome **tuberous sclerosis**, which can be caused by defects (mutations) in either of the genes *TSC1* and *TSC2*, seem to have a high risk of chordomas during childhood.

## Paget disease

Paget disease is a benign (non-cancerous) but pre-cancerous condition that affects one or more bones. It results in formation of abnormal bone tissue and occurs mostly in people older than 50. Affected bones are heavy, thick, and brittle. They are weaker than normal bones and more likely to fracture (break). Most of the time, Paget disease is not



life threatening. Bone cancer (usually osteosarcoma) develops in about 1% of those with Paget disease, usually when many bones are affected.

## Radiation

Bones that have been exposed to ionizing radiation may also have a higher risk of developing bone cancer. A typical x-ray of a bone is not dangerous, but exposure to large doses of radiation does pose a risk. For example, radiation therapy to treat cancer can cause a new cancer to develop in one of the bones in the treatment area. Being treated when you are younger and/or being treated with higher doses of radiation (usually over 60 Gy) increases your risk of developing bone cancer.

Exposure to radioactive materials such as radium and strontium can also cause bone cancer because these minerals build up in bones.

Non-ionizing radiation, like microwaves, electromagnetic fields from power lines, cellular phones, and household appliances, does not increase bone cancer risk.

## Bone marrow transplantation

Osteosarcoma has been reported in a few patients who have undergone [bone marrow \(stem cell\) transplantation](#)<sup>5</sup>.

## Injuries

People have wondered if injury to a bone can cause cancer. This has never been proven. Many people with bone cancer remember having hurt that part of their bone. Most doctors believe that these injuries did not cause the cancer. Instead, the cancer caused people to remember the incident or that the injury drew their attention to that bone, making them notice a problem that had already been present for some time.

## Hyperlinks

1. [www.cancer.org/cancer/osteosarcoma.html](http://www.cancer.org/cancer/osteosarcoma.html)
2. [www.cancer.org/cancer/cancer-causes/genetics/genes-and-cancer.html](http://www.cancer.org/cancer/cancer-causes/genetics/genes-and-cancer.html)
3. [www.cancer.org/cancer/retinoblastoma.html](http://www.cancer.org/cancer/retinoblastoma.html)
4. [www.cancer.org/cancer/soft-tissue-sarcoma.html](http://www.cancer.org/cancer/soft-tissue-sarcoma.html)

5. [www.cancer.org/treatment/treatments-and-side-effects/treatment-types/stem-cell-transplant.html](http://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/stem-cell-transplant.html)

## References

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# What Causes Bone Cancer?

The exact cause of most [bone cancers](#)<sup>1</sup> is not known. Still, scientists have found that bone cancers are linked to a number of other conditions, which are described in the section on [risk factors](#). Still, most people with bone cancers do not have any known risk factors. Research is underway to learn more about the causes of these cancers.

Scientists have made great progress in understanding how certain changes in a person's DNA can cause normal cells to become cancer. DNA carries the instructions for nearly everything our cells do. We usually look like our parents because they are the source of our DNA. But DNA affects more than just the way we look. It may influence our risks for developing certain diseases, including some kinds of cancer.

DNA is divided into units called [genes](#)<sup>2</sup>. Genes carry the recipes for making proteins, the molecules that determine all cell functions. Some genes contain instructions to control when our cells grow and divide.

- Genes that promote cell division 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 DNA mutations (defects) that activate oncogenes or inactivate tumor suppressor genes. Some people with cancer have DNA mutations that they inherited from a parent. These mutations increase their risk for the disease.

The DNA mutations that cause some inherited forms of bone cancers are known. (See [Risk Factors for Bone Cancer](#)) In many cases, [genetic testing](#)<sup>3</sup> can be used to see if someone has one of these mutations.

**Most bone cancers are not caused by inherited DNA mutations.** They're the result of mutations during the person's lifetime. These mutations may result from exposure to radiation or cancer-causing chemicals, but most often they occur for no apparent reason. These mutations are present only in the cancer cells, so they cannot be passed on to the person's children.

Scientists are making progress in understanding this process, but there are still some points that are not completely understood. As they learn more, they hope to find ways to better prevent and treat bone cancers.

## Hyperlinks

1. [www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html](http://www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html)
2. [www.cancer.org/cancer/cancer-causes/genetics.html](http://www.cancer.org/cancer/cancer-causes/genetics.html)
3. [www.cancer.org/cancer/cancer-causes/genetics.html](http://www.cancer.org/cancer/cancer-causes/genetics.html)

## References

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

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# Can Bone Cancer Be Prevented?

At this time, there is no known way to prevent bone cancer.

## References

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

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# Bone Cancer Early Detection, Diagnosis, and Staging

## Detection and Diagnosis

Finding cancer early -- while it's small and before it has spread -- often allows for more treatment options. Some early cancers may have signs and symptoms that can be noticed, but that's not always the case.

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

## 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.

- [Bone Cancer Stages](#)
- [Survival Rates for Bone Cancer](#)

## Questions to Ask About Bone Cancer

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 About Bone Cancer](#)
-

# Can Bone Cancer Be Found Early?

There are tests that can be used to find some cancers early (such as [breast](#)<sup>1</sup>, [cervical](#)<sup>2</sup>, [colorectal](#)<sup>3</sup>, and [skin](#)<sup>4</sup>), before they cause symptoms. At this time, no special tests are available to find bone cancers early. The best way to find these cancers early is to see a health care provider right away if you have [signs and symptoms](#) of this disease.

## Hyperlinks

1. [www.cancer.org/cancer/breast-cancer/screening-tests-and-early-detection.html](http://www.cancer.org/cancer/breast-cancer/screening-tests-and-early-detection.html)
2. [www.cancer.org/cancer/cervical-cancer/detection-diagnosis-staging.html](http://www.cancer.org/cancer/cervical-cancer/detection-diagnosis-staging.html)
3. [www.cancer.org/cancer/colon-rectal-cancer/detection-diagnosis-staging.html](http://www.cancer.org/cancer/colon-rectal-cancer/detection-diagnosis-staging.html)
4. [www.cancer.org/cancer/skin-cancer/prevention-and-early-detection.html](http://www.cancer.org/cancer/skin-cancer/prevention-and-early-detection.html)

## References

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

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# Signs and Symptoms of Bone Cancer

## Pain

Pain in the affected bone is the most common sign of bone cancer. At first, the pain is not constant. It may be worse at night or when the bone is used, for instance, leg pain when walking. As the cancer grows, the pain will be there all the time, and get worse with activity.

## Swelling

Swelling in the area of the pain may not occur until weeks later. It might be possible to

feel a lump or mass depending on where the tumor is.

Cancers in the bones of the neck can cause a lump in the back of the throat that can lead to trouble swallowing or make it hard to breathe.

## Fractures

Bone cancer can weaken the bone it's in, but most of the time the bones do not fracture (break). People with a fracture next to or through a bone tumor usually describe sudden severe pain in a bone that had been sore for a few months.

## Other symptoms

Cancer in the bones of the spine can press on nerves, causing numbness and tingling or even weakness.

Cancer can cause weight loss and fatigue. If the cancer spreads to internal organs it may cause other symptoms, too. For instance, if the cancer spreads to the lungs, it can cause trouble breathing.

**These symptoms are more often due to conditions other than cancer, such as injuries or arthritis. Still, if these problems go on for a long time without a known reason, you should see your doctor.**

## References

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

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# Tests for Bone Cancer

Symptoms, a physical exam, and the results of [imaging tests](#)<sup>1</sup>, and [blood tests](#)<sup>2</sup> might

suggest that a person has [bone cancer](#)<sup>3</sup>. But in most cases, doctors must confirm this by testing a tissue or cell sample and checking it with a microscope (a procedure known as a [biopsy](#)<sup>4</sup>).

**Accurate diagnosis of a bone tumor often depends on combining information about what bone is affected and which part of the bone is involved, how it looks on x-rays, and what the cells look like under a microscope.**

Other diseases, like bone infections, can cause symptoms and imaging results that might be confused with bone cancer.

[Bone metastasis](#)<sup>5</sup> can also look like primary bone cancer. Bone tumors are more often caused by cancer that has spread to the bone from some other part of the body. This is a bone metastasis. A single bone metastasis can have the same signs and symptoms as a primary bone tumor, so many doctors require a biopsy to diagnose a patient's first bone metastasis. After that, new bone metastases can usually be diagnosed based on x-rays and other imaging tests.

## Imaging tests

### X-rays

Most bone cancers show up on [x-rays](#)<sup>6</sup> of the bone. The bone at the site of the cancer may look “ragged” instead of solid. The cancer can also appear as a hole in the bone. Sometimes doctors can see a tumor around the defect in the bone that might extend into nearby tissues (such as muscle or fat). The radiologist (doctor who specializes in reading x-rays) can often tell if a tumor is malignant by the way it appears on the x-ray, but only a biopsy can tell for sure.

A chest x-ray is often done to see if bone cancer has spread to the lungs.

### Computed tomography (CT) scans

[CT scans](#)<sup>7</sup> are helpful in [staging cancer](#)<sup>8</sup>. They help show if the bone cancer has spread to your lungs, liver, or other organs. The scans show the [lymph nodes](#)<sup>9</sup> and distant organs where there might be cancer spread.

CT scans can also be used to guide a biopsy needle into a tumor. This is called a CT-guided needle biopsy. For this test, you stay on the CT scanning table while a radiologist moves a biopsy needle toward the tumor. CT scans are repeated until the tip of the needle is within the mass. (See Needle biopsy below.)



## Magnetic resonance imaging (MRI) scans

[MRI scans](#)<sup>10</sup> are often the best test for outlining a bone tumor. They are very helpful for looking at the brain and spinal cord.

## Radionuclide bone scans

[Bone scans](#)<sup>11</sup> can show if a cancer has spread to other bones. It can find smaller areas of metastasis than regular x-rays. Bone scans also can show how much damage the cancer has caused in the bone.

Areas of diseased bone will be seen on the bone scan as dense, gray to black areas, called “hot spots.” These areas suggest cancer is present, but arthritis, infection, or other bone diseases can also cause hot spots. Other imaging tests or a bone biopsy may be needed to know what's causing the change.

## Positron emission tomography (PET or PET) scans

[PET scans](#)<sup>12</sup> use glucose (a form of sugar) that's attached to a radioactive atom. A special camera can detect the radioactivity. Cancer cells absorb a lot of the radioactive sugar because of their high rate of metabolism. PET scans are useful in looking for cancer throughout your entire body. It can sometimes help tell if a tumor is cancer or not cancer (benign). It's often combined with CT scans to better pinpoint some kinds of cancer.

## Biopsy

A [biopsy](#)<sup>13</sup> takes a piece of tissue from a tumor so that it can be looked at with a microscope and tested in the lab. This is the only way to know that the tumor is cancer and not another bone disease.

If it is cancer, the biopsy can tell the doctor if it's a primary bone cancer or cancer that started somewhere else and spread to the bone (metastasis). Many types of tissue and cell samples are used to diagnose bone cancer. It's very important that your biopsy be done by a surgeon with experience in diagnosing and treating bone tumors.

The type of biopsy done is based on whether the tumor looks benign (not cancer) or malignant (cancer) and exactly what type of tumor it most likely is (based on x-rays, the patient's age, and where the tumor is). Some kinds of bone tumors can be diagnosed from needle biopsy samples, but larger samples (from a surgical biopsy) are often needed to diagnose other types.

Whether the surgeon plans to remove the entire tumor during the biopsy will also impact the type of biopsy done. Sometimes the wrong kind of biopsy can make it hard for the surgeon to later remove all of the cancer without having to also remove all or part of the arm or leg containing the tumor. It also may cause the cancer to spread.

## Needle biopsy

There are 2 types of needle biopsies: **fine (aspiration)** and **core**. For both types, a drug is first used to numb the area for the biopsy.

For **fine needle aspiration** (FNA), the doctor uses a very thin needle and a syringe to take out a small amount of fluid and some cells from the tumor. Sometimes, the doctor can aim the needle by feeling the tumor if it's near the surface of the body. If the tumor is too deep to feel, the doctor can guide the needle while looking a CT scan. This is called a CT guided needle biopsy and it is often done by an x-ray specialist known as an interventional radiologist.

In a **core needle biopsy**, the doctor uses a larger needle to remove a small cylinder of tissue (about 1/16 inch in diameter and 1/2 inch long). Many experts feel that a core needle biopsy is better than FNA to diagnose a primary bone cancer.

## Surgical bone biopsy

In this procedure, a surgeon needs to cut through the skin to reach the tumor to remove a small piece of tissue. This is also called an **incisional biopsy**. If the entire tumor is removed (not just a small piece), it's called an **excisional biopsy**.

These biopsies are often done with the patient under general anesthesia (drugs are used to put you into a deep asleep). They can also be done using a nerve block, which numbs a large area. If this type of biopsy is needed, it's important that the surgeon who will later remove the cancer also be the one to do the biopsy.

## Hyperlinks

1. [www.cancer.org/treatment/understanding-your-diagnosis/tests/imaging-radiology-tests-for-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests/imaging-radiology-tests-for-cancer.html)
2. [www.cancer.org/treatment/understanding-your-diagnosis/tests.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests.html)
3. [www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html](http://www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html)
4. [www.cancer.org/treatment/understanding-your-diagnosis/tests/testing-biopsy-and-cytology-specimens-for-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests/testing-biopsy-and-cytology-specimens-for-cancer.html)

5. [www.cancer.org/treatment/understanding-your-diagnosis/advanced-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/advanced-cancer.html)
6. [www.cancer.org/treatment/understanding-your-diagnosis/tests/x-rays-and-other-radiographic-tests.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests/x-rays-and-other-radiographic-tests.html)
7. [www.cancer.org/treatment/understanding-your-diagnosis/tests/ct-scan-for-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests/ct-scan-for-cancer.html)
8. [www.cancer.org/treatment/understanding-your-diagnosis/staging.html](http://www.cancer.org/treatment/understanding-your-diagnosis/staging.html)
9. [www.cancer.org/cancer/cancer-basics/lymph-nodes-and-cancer.html](http://www.cancer.org/cancer/cancer-basics/lymph-nodes-and-cancer.html)
10. [www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html)
11. [www.cancer.org/treatment/understanding-your-diagnosis/tests/nuclear-medicine-scans-for-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests/nuclear-medicine-scans-for-cancer.html)
12. [www.cancer.org/treatment/understanding-your-diagnosis/tests/nuclear-medicine-scans-for-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests/nuclear-medicine-scans-for-cancer.html)
13. [www.cancer.org/treatment/understanding-your-diagnosis/tests/testing-biopsy-and-cytology-specimens-for-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests/testing-biopsy-and-cytology-specimens-for-cancer.html)

## References

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# Bone Cancer Stages

After someone is diagnosed with bone cancer, doctors will try to figure out if it has spread, and if so, how far. This process is called **staging**. The stage of a cancer describes how much cancer is in the body. It helps determine how serious the cancer is and [how best to treat it](#)<sup>1</sup>. Doctors also use a cancer's stage when talking about survival statistics.

Bone cancers are staged I (1) through IV (4). As a rule, the lower the number, the less the cancer has spread. A higher number, such as stage IV, means cancer has spread more. And within a stage, an earlier letter means a lower stage. Although each person's

cancer experience is unique, cancers with similar stages tend to have a similar outlook and are often treated in much the same way.

## How is the stage determined?

The staging system most often used for bone cancer is the American Joint Committee on Cancer (AJCC) **TNM** system, which is based on 4 key pieces of information:

- The extent (size) of the **tumor (T)**: How large is the cancer? Is it in more than one spot in the bone?
- The spread to nearby lymph **nodes (N)**: Has the cancer spread to nearby lymph nodes?
- The spread (**metastasis**) to distant sites (**M**): Has the cancer spread to the lungs only or to distant sites such as other bones or the liver?
- The **grade of the cancer (G)**: How abnormal do the cells look when seen under a microscope?

The scale used for grading bone cancer is from 1 to 3. Low-grade cancers (G1) tend to grow and spread more slowly than high-grade (G2 or G3) cancers.

- Grade 1 (G1) means the cancer looks much like normal bone tissue.
- Grade 3 (G3) means the cancer looks very abnormal.
- Grade 2 (G2) falls somewhere in between.

The staging system described below is the most recent AJCC system effective January 2018 and applies to bone cancers of the appendicular skeleton (such as bones in the arms and legs), trunk, skull, and facial bones. Bone cancers of the pelvis and spine use different T categories and it is best to speak with your doctor about your stage for these specific cancers.

Numbers or letters after T, N, and M provide more details about each of these factors. Higher numbers mean the cancer is more advanced. Once a person's T, N, and M categories have been determined, this information is combined in a process called **stage grouping** to assign an overall stage. For more information see [Cancer Staging](#)<sup>2</sup>.

The staging system in the table below uses the **pathologic stage** (also called the surgical stage). It is determined by examining tissue removed during [an operation](#)<sup>3</sup>. Sometimes, if surgery is not possible right away or at all, the cancer will be given a **clinical stage** instead. This is based on the results of a [physical exam, biopsy, and](#)

[imaging tests](#). The clinical stage will be used to help plan treatment. Sometimes, though, the cancer has spread further than the clinical stage estimates, and may not predict the patient's outlook as accurately as a pathologic stage.

Cancer staging can be complex, so ask your doctor to explain it to you in a way you understand.

<b>AJCC stage</b>	<b>Stage grouping</b>	<b>Stage description*</b>
<b>IA</b>	<b>T1</b> <b>N0</b> <b>M0</b> <b>G1 or GX</b>	The cancer is 8 centimeters (cm) across (about 3 inches) or smaller (T1). It has not spread to nearby lymph nodes (N0) or to distant sites (M0). The cancer is low grade (G1) or the grade cannot be determined (GX).
	<b>T2</b> <b>N0</b> <b>M0</b> <b>G1 or GX</b>	The cancer is larger than 8 cm (3 inches) across (T2). It has not spread to nearby lymph nodes (N0) or to distant sites (M0). The cancer is low grade (G1) or the grade cannot be determined (GX).
<b>IB</b>	OR	
	<b>T3</b> <b>N0</b> <b>M0</b> <b>G1 or GX</b>	The cancer is in more than one place on the same bone (T3). It has not spread to nearby lymph nodes (N0) or to distant sites (M0). The cancer is low grade (G1) or the grade cannot be determined (GX).
<b>IIA</b>	<b>T1</b> <b>N0</b> <b>M0</b> <b>G2 or G3</b>	The cancer is 8 centimeters (cm) across (about 3 inches) or less (T1). It has not spread to nearby lymph nodes (N0) or to distant sites (M0). The cancer is high grade (G2 or G3).
<b>IIB</b>	<b>T2</b>	The cancer is larger than 8 cm (3 inches) across (T2). It has not spread to nearby lymph nodes (N0) or to distant sites (M0). The

	<b>N0</b> <b>M0</b> <b>G2 or G3</b>	cancer is high grade (G2 or G3).
<b>III</b>	<b>T3</b> <b>N0</b> <b>M0</b> <b>G2 or G3</b>	The cancer is in more than one place on the same bone (T3). It has not spread to nearby lymph nodes (N0) or to distant sites (M0). The cancer is high grade (G2 or G3).
<b>IVA</b>	<b>Any T</b> <b>N0</b> <b>M1a</b> <b>Any G</b>	The cancer can be any size and may be in more than one place in the bone (Any T) <b>AND</b> has not spread to nearby lymph nodes (N0). It has spread only to the lungs (M1a). The cancer can be any grade (Any G).
<b>IVB</b>	<b>Any T</b> <b>N1</b> <b>Any M</b> <b>Any G</b>	The cancer can be any size and may be in more than one place in the bone (Any T) <b>AND</b> it has spread to nearby lymph nodes (N1). It may or may not have spread to distant organs like the lungs or other bones (Any M). The cancer can be any grade (Any G).
	<b>OR</b> <b>Any T</b> <b>Any N</b> <b>M1b</b> <b>Any G</b>	The cancer can be any size and may be in more than one place in the bone (Any T) and it might or might not have spread to nearby lymph nodes (Any N). It has spread to distant sites like other bones, the liver or brain (M1b). The cancer can be any grade (Any G).

\* The following additional categories are not listed on the table above:

- **TX:** Main tumor cannot be assessed due to lack of information.
- **T0:** No evidence of a primary tumor.
- **NX:** Regional lymph nodes cannot be assessed due to lack of information.

## Hyperlinks

1. [www.cancer.org/cancer/bone-cancer/treating.html](http://www.cancer.org/cancer/bone-cancer/treating.html)
2. [www.cancer.org/treatment/understanding-your-diagnosis/staging.html](http://www.cancer.org/treatment/understanding-your-diagnosis/staging.html)
3. [www.cancer.org/cancer/bone-cancer/treating/surgery.html](http://www.cancer.org/cancer/bone-cancer/treating/surgery.html)

## References

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

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# Survival Rates for Bone Cancer

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 you will live, but they may help give you a better understanding of how likely it is that your 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, 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 often stage) of cancer to people in the overall population. For example, if the **5-year relative survival rate** for a specific type and stage of bone cancer 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 different types of bone cancer 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 where it started.
- **Regional:** The cancer has grown outside the bone and into nearby bones or other 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 bone cancer

These numbers are based on people diagnosed with certain types of bone cancer between 2008 and 2014. For rates for some of the other more common types of bone cancer, see [Survival Rates for Osteosarcoma](#)<sup>1</sup> or [Survival Rates for Ewing Tumors](#)<sup>2</sup>.

### *Chondrosarcoma*

SEER stage	5-year relative survival rate
Localized	91%
Regional	75%
Distant	33%
All SEER stages combined	80%

### *Chordoma*

SEER stage	5-year relative survival rate
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Localized	84%
Regional	81%
Distant	55%
All SEER stages combined	79%

Some types of bone cancers are so rare that survival rates are only available for all stages combined, instead of for individual SEER stages. For example, the 5-year relative survival rate for **giant cell tumor of bone** for all stages combined is 78%.

### 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 your age and overall health, the type and location of the cancer, and how well the cancer responds to treatment, can also affect your outlook.
- **People now being diagnosed with bone cancer 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.

\*SEER = Surveillance, Epidemiology, and End Results

### Hyperlinks

1. [www.cancer.org/cancer/osteosarcoma/detection-diagnosis-staging/survival-rates.html](http://www.cancer.org/cancer/osteosarcoma/detection-diagnosis-staging/survival-rates.html)
2. [www.cancer.org/cancer/ewing-tumor/detection-diagnosis-staging/survival-rates.html](http://www.cancer.org/cancer/ewing-tumor/detection-diagnosis-staging/survival-rates.html)

### References

Noone AM, Howlader N, Krapcho M, Miller D, Brest A, Yu M, Ruhl J, Tatalovich Z, Mariotto A, Lewis DR, Chen HS, Feuer EJ, Cronin KA (eds). SEER Cancer Statistics Review, 1975-2015, National Cancer Institute. Bethesda, MD,

[https://seer.cancer.gov/csr/1975\\_2015/](https://seer.cancer.gov/csr/1975_2015/), based on November 2017 SEER data submission, posted to the SEER web site, April 2018.

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## Questions to Ask About Bone Cancer

As you cope with cancer and cancer treatment, you need to have honest, open discussions with your doctor. You should be able to ask any question no matter how small it might seem. Nurses, social workers, and other members of the treatment team may also be able to answer many of your questions.

- What [kind](#)<sup>1</sup> of bone cancer do I have?
- Has my cancer spread?
- What is the [stage](#) of my cancer and what does that mean?
- What are my [treatment](#)<sup>2</sup> choices?
- What do you recommend and why?
- What risks or side effects are there to the treatments you suggest?
- What are the chances of my cancer coming back with these treatment plans?
- What should I do to be ready for treatment?
- Based on what you've learned about my cancer, how long do you think I'll survive?

In addition to 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 schedule. Or you might want to ask about second opinions or about clinical trials. You can find more information about communicating with your health care team in [The Doctor-Patient Relationship](#)<sup>3</sup>.

### Hyperlinks

1. [www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html](http://www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html)
2. [www.cancer.org/cancer/bone-cancer/treating.html](http://www.cancer.org/cancer/bone-cancer/treating.html)
3. [www.cancer.org/treatment/understanding-your-diagnosis/talking-about-cancer/the-doctor-patient-relationship.html](http://www.cancer.org/treatment/understanding-your-diagnosis/talking-about-cancer/the-doctor-patient-relationship.html)

## References

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# Treating Bone Cancer

## How is bone cancer treated?

The main ways to treat bone cancer are:

- [Surgery for Bone Cancer](#)
- [Radiation Therapy for Bone Cancer](#)
- [Chemotherapy for Bone Cancer](#)
- [Targeted Therapy for Bone Cancer](#)

## Common treatment approaches

Often, more than one type of treatment is used to treat bone cancer. Your treatment plan will depend on the type of bone cancer and its stage.

- [Treating Specific Bone Cancers](#)

## Who treats bone cancer?

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

- An **orthopedic surgeon**: a doctor who uses surgery to treat bone and joint problems
- An **orthopedic oncologist**: an orthopedic surgeon that specializes in treating cancer of the bones and joints
- A **radiation oncologist**: a doctor who uses radiation to treat cancer
- A **medical oncologist**: a doctor who uses chemotherapy and other medicines to treat cancer

Many other specialists may be involved in your care as well, including nurse practitioners, nurses, psychologists, social workers, rehabilitation specialists, and other health professionals.

- [Health Professionals Associated With Cancer Care<sup>1</sup>](#)

### **Making treatment decisions**

It's important to discuss all of your treatment options, including treatment goals and possible side effects, with your doctors to help make the decision that best fits your needs. It's also very important to ask questions if there's anything you're not sure about.

If time permits, it is often a good idea to seek a second opinion. A second opinion can give you more information and help you feel more confident about the treatment plan you choose.

- [Questions to Ask About Bone Cancer<sup>2</sup>](#)
- [Seeking a Second Opinion<sup>3</sup>](#)

### **Thinking about taking part in a clinical trial**

Clinical trials are carefully controlled research studies that are done to get a closer look at promising new treatments or procedures. Clinical trials are one way to get state-of-the-art cancer treatment. In some cases they may be the only way to get access to newer treatments. They are also the best way for doctors to learn better methods to treat cancer. Still, they're not right for everyone.

If you would like to learn more about clinical trials that might be right for you, start by asking your doctor if your clinic or hospital conducts clinical trials.

- [Clinical Trials<sup>4</sup>](#)

### **Considering complementary and alternative methods**

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

Complementary methods refer to treatments that are used along with your regular medical care. Alternative treatments are used instead of a doctor's medical treatment. Although some of these methods might be helpful in relieving symptoms or helping you feel better, many have not been proven to work. Some might even be 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](#)<sup>5</sup>

### **Help getting through cancer treatment**

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

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

- [Find Support Programs and Services in Your Area](#)<sup>6</sup>

### **Choosing to stop treatment or choosing no treatment at all**

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

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

- [If Cancer Treatments Stop Working](#)<sup>7</sup>
- [Palliative or Supportive Care](#)<sup>8</sup>

*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.*

## Surgery for Bone Cancer

**Surgery is the primary (main) treatment for most [kinds of bone cancer](#)<sup>1</sup>.** Surgery may also be needed to do a [biopsy](#)<sup>2</sup> of the cancer (take out some of the tumor so it can be tested in the lab). The biopsy and the surgical treatment are separate operations, but it's very important that the doctor plans both together. It's best if the same surgeon does both the biopsy and the main surgery. A biopsy taken from the wrong place can lead to problems when the surgeon does the operation to remove the cancer. Sometimes a poorly done biopsy can make it impossible to remove the cancer without cutting off the limb.

**The main goal of surgery is to remove all of the cancer.** If even a few cancer cells are left behind, they can grow and make a new tumor. To try to be sure that this doesn't happen, surgeons remove the tumor plus some of the normal tissue around it. This is called **wide-excision**. Taking out some normal tissue helps ensure that all of the cancer is removed.

After surgery, a pathologist will look at the tissue that was removed 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 is seen at the edges of the tissue, the margins are said to be negative, clean, or clear. A wide-excision with clean margins minimizes the risk that the cancer will grow back where it started.

### Tumors in the arms or legs

Sometimes the entire limb needs to be removed in order to do a good wide-excision and remove all of the cancer. This operation is called an **amputation**. But most of the time the surgeon can remove the cancer without amputation. This is called **limb-salvage** or **limb-sparing surgery**.

When taking about treatment options, it's important to discuss the advantages and disadvantages with either type of surgery. For example, most people prefer limb-salvage over amputation, but it's a more complex operation and can have more complications. Both operations have the same overall survival rates when done by expert surgeons. Studies looking at quality of life have shown little difference in how people react to the final result of the different procedures. Still, emotional issues can be very important and support and encouragement are needed for all patients.

No matter which type of surgery is done, rehabilitation will be needed afterward. This can be the hardest part of treatment. If possible, the patient should meet with a rehab specialist before surgery to understand what will be involved.

## **Amputation**

Amputation is surgery to remove part or all of a limb (an arm or leg). When used to treat cancer, amputation removes the part of the limb with the tumor, some healthy tissue above it, and everything below it. In the past, amputation was the main way to treat bone cancers in the arms or legs. Now, this operation is only needed if there's a reason not to do limb-salvage surgery. For example, an amputation may be needed if removing all of the cancer also means removing key nerves, arteries, or muscles that would leave the limb without good function.

MRI scans and examination of the tissue by the pathologist at the time of surgery can help the surgeon decide how much of the arm or leg needs to be removed. Surgery is planned so that muscles and the skin will form a cuff around the amputated bone. This cuff fits into the end of an artificial limb (or prosthesis). After surgery, a person must learn how to use the prosthesis in rehabilitation. With proper physical therapy, people are often walking again 3 to 6 months after leg amputation.

## **Limb-salvage surgery**

The goal of limb-salvage surgery is to remove all of the cancer and still leave a working leg or arm. Most patients with bone cancer in a limb are able to have their limb spared. This type of surgery is very complex and requires surgeons with special skills and experience. The challenge for the surgeon is to remove the entire tumor while still saving the nearby tendons, nerves, and vessels. This is not always possible. If a cancer has grown into these structures, they will need to be removed along with the tumor. This can sometimes result in a limb that's painful or can't be used. In that case, amputation may be the best option.

In limb-salvage surgery, a wide-excision is done to remove the tumor. A bone graft or



an **endoprosthesis** ( meaning internal prosthesis) is used to replace the bone that's lost. Endoprostheses are made of metal and other materials. Some used in growing children can be made longer without any extra surgery as the child grows.

Further surgery could be needed if the bone graft or endoprosthesis becomes infected, loose, or broken. Limb-salvage surgery patients may need more surgery over the next 5 years, and at some point may need an amputation.

Rehab is much more intense after limb-salvage surgery than it is after amputation. It takes about a year for patients to learn to walk again after limb-salvage of a leg. If the patient does not take part in the rehabilitation program, the salvaged arm or leg could become useless.

### **Reconstructive surgery**

After amputation, surgery can be done to rebuild or reconstruct a new limb. For instance, if the leg must be amputated mid-thigh, the lower leg and foot can be rotated and attached to the thigh bone. The old ankle joint then becomes the new knee joint. This surgery is called **rotationplasty**. A prosthesis is used to make the new leg the same length as the other (healthy) leg.

If the bone tumor is located in the upper arm, the tumor may be removed and then the lower arm attached again. This leaves the patient with an arm that works but is much shorter.

### **Tumors in other areas**

Bone cancer in the pelvis is treated with a wide-excision when possible. If needed, bone grafts can be used to rebuild the pelvic bones.

For a tumor in the lower jaw bone, the entire lower half of the jaw may be removed and later replaced with bones from other parts of the body.

For tumors in areas like the spine or the skull, it may not be possible to safely do a wide-excision. Cancers in these bones may require a combination of treatments such as curettage, cryosurgery, and radiation.

### **Curettage**

In curettage, the doctor scrapes out the tumor without removing a section of the bone. This leaves a hole in the bone. In some cases, after most of the tumor has been

removed, the surgeon will treat the nearby bone tissue to kill any remaining tumor cells. This can be done with cryosurgery or by using bone cement.

### **Cryosurgery**

For this treatment, liquid nitrogen is poured into the hole that's left in the bone after the tumor was removed. This extreme cold kills tumor cells by freezing them. This treatment is also called **cryotherapy**. After cryosurgery, the hole in the bone can be filled by bone grafts or with bone cement.

### **Bone cement**

The bone cement PMMA (polymethylmethacrylate) starts out as a liquid and hardens over time. It's put into the hole in the bone in liquid form. As it hardens, it gives off a lot of heat. The heat helps kill any remaining tumor cells. This allows PMMA to be used without cryosurgery for some types of bone tumors.

## **Surgical treatment of metastasis**

To be able to cure a bone cancer, it and any existing [metastases](#)<sup>3</sup> must be removed completely with surgery. The lungs are the most common site of distant spread for bone cancer. Surgery to remove bone cancer metastases to the lungs must be planned very carefully. Before the operation, the surgeon will consider the number of tumors, where they are (in one lung or both lungs), their size, and the person's overall health.

The chest [CT scan](#)<sup>4</sup> might not show all the tumors. The surgeon will have a treatment plan ready just in case more tumors are found during the operation than can be seen on the chest CT scan.

Removing all the lung metastases is probably the only chance for a cure. Still, not all lung metastases can be removed. Some tumors are too big or are too close to important structures in the chest (such as large blood vessels) to be removed safely. People whose general health is not good (due to poor nutritional status or problems with the heart, liver, or kidneys) may not be able to deal with the stress of anesthesia and surgery to remove metastases.

For more information, see [Cancer Surgery](#)<sup>5</sup>.

## **Hyperlinks**

1. [www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html](http://www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html)
2. [www.cancer.org/treatment/understanding-your-diagnosis/tests/testing-biopsy-and-cytology-specimens-for-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests/testing-biopsy-and-cytology-specimens-for-cancer.html)
3. [www.cancer.org/treatment/understanding-your-diagnosis/advanced-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/advanced-cancer.html)
4. [www.cancer.org/treatment/understanding-your-diagnosis/tests/ct-scan-for-cancer.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests/ct-scan-for-cancer.html)
5. [www.cancer.org/treatment/treatments-and-side-effects/treatment-types/surgery.html](http://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/surgery.html)

## References

Gutowski CJ, Basu-Mallick A, Abraham JA. Management of Bone Sarcoma. *Surg Clin N Am*. 2016;2016:1077–1106.

National Cancer Institute. Osteosarcoma and Malignant Fibrous Histiocytoma of Bone Treatment (PDQ®)—Patient Version. September 1, 2017. Accessed at [www.cancer.gov/types/bone/patient/osteosarcoma-treatment-pdq](http://www.cancer.gov/types/bone/patient/osteosarcoma-treatment-pdq) on December 5, 2017.

National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology. Bone Cancer. Version 1.2018 -- August 29, 2017.

Van Gompel JJ, Janus JR. Chordoma and Chondrosarcoma. *Otolaryngol Clin N Am*. 2015;48:501–514.

Zheng K, Yu X, Hu Y, et al. Surgical treatment for pelvic giant cell tumor: a multi-center study. *World J Surg Onc*. 2016;14:104.

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

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# Radiation Therapy for Bone Cancer

Radiation therapy uses high-energy rays or particles to kill cancer cells. **External beam radiation therapy** is radiation delivered from outside the body that's focused on the cancer. This is the type of radiation therapy used to treat [bone cancer](#)<sup>1</sup>.

Most bone cancers are not easily killed by radiation, and high doses are needed. High doses, however, can damage nearby healthy tissues, as well as key structures (like nerves and blood vessels) in the area. This is why radiation therapy is not used as a main treatment for most types of bone tumors. (It is often used for [Ewing tumors](#).<sup>2</sup>)

Most of the time, radiation is used to treat bone cancers that are **unresectable**. This means they cannot be completely removed with surgery.

Radiation may also be used after surgery if cancer cells were found in the edges (margin) of the removed tissue. Another term for this is **positive margins**. (This is discussed in the section about [surgery](#).) In this case, radiation may be given to kill any cancer that may have been left behind.

If bone cancer comes back after treatment, radiation can help control symptoms like pain and swelling.

## Types of radiation therapy

Special types of radiation are most commonly used to treat bone cancer. These types give doctors the best control over the size and strength of the radiation beams so that higher doses get to the tumor and spare the nearby tissues.

### Intensity-modulated radiation therapy

Intensity-modulated radiation therapy (IMRT) is an advanced form of external beam radiation therapy. With this technique, a computer matches the radiation beams to the shape of the tumor and can adjust the intensity (strength) of the beams. The radiation is delivered to the tumor from many directions to reduce the amount of radiation that goes through any one area of normal tissue. This makes it possible to reduce radiation damage to normal tissues while increasing the radiation dose to the cancer.

### Proton-beam radiation

Proton-beam radiation is a special form of radiation that uses protons instead of regular

x-rays to kill cancer cells. Protons are positively charged particles that are found inside all atoms. They cause little damage to the tissues they pass through but are very good at killing cells at the end of their path. This allows a high dose of radiation to be given to the tumor without hurting the normal tissue around it. Proton-beam radiation therapy requires highly specialized equipment and is not available at all medical centers. This form of radiation is very helpful in treating skull, spine, rib, or sternum (breast bone) chondrosarcomas and chordomas.

### **Extracorporeal radiation**

Though not commonly used, another option is extracorporeal radiation. This may be used when trying to save a limb as part of [limb-salvage surgery](#). It involves taking the bone with cancer out of the body, treating it with radiation, and then putting it back in.

Side effects linked to this include wound healing problems, loss of joint movement, change in limb length, and fractures (breaks) in the treated piece of bone.

### **Side effects**

Side effects of radiation therapy depend on what area of the body is being treated and how much radiation is used. Common [side effects](#)<sup>3</sup> include:

- Fatigue (tiredness)
- Loss of appetite
- Skin changes in the area being treated, ranging from redness and hair loss to blistering and peeling
- Low blood counts
- Nausea, vomiting, and diarrhea (these are more common if radiation is given to the belly)

You can learn more in the [radiation section](#)<sup>4</sup> of our website.

### **Hyperlinks**

1. [www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html](http://www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html)
2. [www.cancer.org/cancer/ewing-tumor.html](http://www.cancer.org/cancer/ewing-tumor.html)
3. [www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html](http://www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html)
4. [www.cancer.org/treatment/treatments-and-side-effects/treatment-types/radiation.html](http://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/radiation.html)

## References

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

Chauhan S, Manoj K, Rastogi S, Khan SA, Prasad A. Biomechanical investigation of the effect of extracorporeal irradiation on resected human bone. *J Mech Behav Biomed Mater*. 2017;65:791-800.

Gutowski CJ, Basu-Mallick A, Abraham JA. Management of Bone Sarcoma. *Surg Clin N Am*. 2016;2016:1077–1106.

Hong AM, Millington S, Ahern V, et al. Limb preservation surgery with extracorporeal irradiation in the management of malignant bone tumor: the oncological outcomes of 101 patients. *Ann Oncol*. 2013;24(10):2676-2680.

National Cancer Institute. Bone Cancer. March 13, 2008. Accessed at [www.cancer.gov/types/bone/bone-fact-sheet](http://www.cancer.gov/types/bone/bone-fact-sheet) on December 5, 2017.

National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology. Bone Cancer. Version 1.2018 -- August 29, 2017.

Van Gompel JJ, Janus JR. Chordoma and Chondrosarcoma. *Otolaryngol Clin N Am*. 2015;48:501–514.

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## Chemotherapy for Bone Cancer

Chemotherapy (chemo) is the use of drugs to treat cancer. Chemo is **systemic** treatment. This means that the drugs go into the bloodstream and circulate to reach and destroy cancer cells all over the body.

Chemo is often a part of treatment for [Ewing sarcoma](#)<sup>1</sup> and [osteosarcoma](#)<sup>2</sup>.

It isn't used often for other [bone cancers](#)<sup>3</sup>, like giant cell tumors, chordomas, and chondrosarcomas. These types aren't very sensitive to chemo, so it doesn't work well. It can be useful for a certain type of chondrosarcoma called mesenchymal and high-grade dedifferentiated chordomas. It may be used along with [targeted therapy](#) for some giant cell tumors.

Chemo is sometimes used for bone cancer that has spread through the bloodstream to the lungs and/or other organs.

## Commonly used chemo drugs

The drugs mainly used to treat bone cancer include:

- Doxorubicin (Adriamycin<sup>®</sup>)
- Cisplatin
- Etoposide (VP-16)
- Ifosfamide (Ifex<sup>®</sup>)
- Cyclophosphamide (Cytosan<sup>®</sup>)
- Methotrexate
- Vincristine (Oncovin<sup>®</sup>)

In most cases, several drugs (2 or 3) are given together.

## Side effects of chemotherapy

Chemo kills cancer cells, but it also damages some normal cells. You will be closely watched during treatment and your team will try to prevent or limit side effects. The [side effects](#)<sup>4</sup> of chemo depend on the type of drugs, the doses used, and the length of time they're taken.

Some common short-term side effects include:

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

It's important to tell your cancer care team about any side effects you have so they can be treated.

Chemotherapy can damage the blood-producing cells in the bone marrow, so you may have low blood cell counts. Low blood cell counts can result in:

- Increased chance of infection (too few white blood cells)
- Easy bleeding or bruising after minor cuts or injuries (too few platelets)
- Fatigue or shortness of breath (too few red blood cells)

While you're getting chemo, your doctor will order [lab tests](#)<sup>5</sup> to be sure your blood cell counts are at safe levels.

Some side effects are linked to certain drugs. For example:

- **Ifosfamide** and **cyclophosphamide** can damage the lining of the bladder and cause bloody urine. This is called **hemorrhagic cystitis**. It can be prevented by giving a drug called mesna along with the chemo.
- **Cisplatin** may cause nerve damage (called [peripheral neuropathy](#)<sup>6</sup>) leading to problems with numbness, tingling, and even pain in the hands and feet. Kidney damage (called nephropathy) can also occur after treatment with cisplatin. Giving lots of fluid before and after the drug is infused can help prevent this. Cisplatin can sometimes cause problems with hearing (known as ototoxicity). Most often patients with this problem notice they have trouble hearing high-pitched sounds. Your doctor may have you get a hearing test (called an audiogram) before giving cisplatin.
- Over time, **doxorubicin** can damage the heart. The risk of this goes up as the total amount of the drug given goes up. Before giving doxorubicin, your doctor may test your heart function to make sure that it's safe to give you this drug.

It's important to note that many of the serious side effects are rare, but they can happen. Talk with your cancer care team so you know what to expect from the chemo you're getting.

The doctors and nurses will watch closely for side effects. There are treatments for most side effects, but preventing them is important. Most side effects, if not all of them, will go away over time after treatment is over. Do not hesitate to ask your cancer care team any questions about side effects.

To learn more, see the [chemotherapy section](#)<sup>7</sup> of our website.

## Hyperlinks



1. [www.cancer.org/cancer/ewing-tumor.html](http://www.cancer.org/cancer/ewing-tumor.html)
2. [www.cancer.org/cancer/osteosarcoma.html](http://www.cancer.org/cancer/osteosarcoma.html)
3. [www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html](http://www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html)
4. [www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html](http://www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html)
5. [www.cancer.org/treatment/understanding-your-diagnosis/tests.html](http://www.cancer.org/treatment/understanding-your-diagnosis/tests.html)
6. [www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/peripheral-neuropathy.html](http://www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/peripheral-neuropathy.html)
7. [www.cancer.org/treatment/treatments-and-side-effects/treatment-types/chemotherapy.html](http://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/chemotherapy.html)

## References

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

Benjamin RS, Wagner MJ, Livingston JA, Ravi V, Patel SR. Chemotherapy for Bone Sarcomas in Adults: The MD Anderson Experience. *Am Soc Clin Oncol Educ Book*. 2015:e656-e660.

George B, Bresson D, Herman P, Froelich S. Chordomas: A Review. *Neurosurg Clin N Am*. 2015;26(3):437-452.

Gutowski CJ, Basu-Mallick A, Abraham JA. Management of Bone Sarcoma. *Surg Clin N Am*. 2016;2016:1077–1106.

National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology. Bone Cancer. Version 1.2018 -- August 29, 2017.

Van Gompel JJ, Janus JR. Chordoma and chondrosarcoma. *Otolaryngol Clin North Am*. 2015;48(3):501-514.

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# Targeted Therapy for Bone Cancer

As researchers have learned more about the molecular and genetic changes in cells that cause cancer, they have been able to develop newer drugs that specifically target some of these changes. These drugs, called [targeted therapy](#)<sup>1</sup> drugs, work differently from standard chemotherapy (chemo) drugs and have different side effects. Targeted drugs are especially important in diseases like chordomas and other bone cancers, where chemo has not been very useful. They may prove to be a better treatment for these cancers. A lot of researchers are looking at how these drugs might be used to treat primary bone cancers.

## Imatinib

Some chordomas have [gene defects](#)<sup>2</sup> (mutations) that make proteins that signal the cells to grow. The drug imatinib (Gleevec<sup>®</sup>) is a targeted therapy drug that can block the signals from these genes. This can make some tumors stop growing or even shrink a little. Imatinib is used to treat chordomas that have spread or have come back after treatment. Imatinib has been used to treat chordomas for many years, but it isn't approved by the FDA (Food and Drug Administration) to treat this type of cancer. It is approved to treat other cancers.

This drug is a pill, taken with food once a day. Common [side effects](#)<sup>3</sup> are mild and can include diarrhea, nausea, muscle pain, and fatigue. These are generally mild. Some people taking the drug have itchy skin rashes. Fluid build-up around the eyes, feet, or belly can also be a problem.

## Denosumab

Denosumab (Xgeva<sup>®</sup> or Prolia<sup>®</sup>) is a [monoclonal antibody](#)<sup>4</sup> (a man-made version of an immune system protein) that binds to a protein called RANK ligand. RANK ligand normally tells cells called osteoclasts to break down bone, but when denosumab binds to it, that action is blocked. In patients with giant cell tumors of bone that have either come back after surgery or cannot be removed with surgery, denosumab can help shrink tumors for a while.

To treat giant cell tumors, this drug is injected under the skin (sub-q or SQ). Often, it can take months for the tumor to shrink.

Most [side effects](#)<sup>5</sup> are mild and can include body aches, fatigue, and nausea. A rare but very distressing side effect of denosumab is damage to the jawbone called **osteonecrosis of the jaw** (ONJ). ONJ often starts as an open sore in the jaw that won't heal. It can lead to loss of teeth and/or infections of the jaw bone. Doctors don't know why this happens, but it can be triggered by having a tooth removed while taking the

drug. The best treatment is also unclear, other than to stop denosumab. Maintaining good oral hygiene by flossing, brushing, making sure that dentures fit properly, and having regular dental check-ups may help prevent this. Most doctors recommend that patients have a dental check-up and have any tooth or jaw problems treated before they start taking this drug.

For more general information about these drugs, see the [targeted cancer therapy](#)<sup>6</sup> section of our website.

## Interferon

Interferons are not exactly targeted therapies. They're a family of substances naturally made by our immune system. Interferon-alpha is the type that may be used to treat giant cell tumors of the bone that have come back after treatment (recurred) or spread (metastasized).

This drug is most often given as a daily injection under the skin. It can also be injected into a muscle or vein.

Interferon can cause significant side effects. These include "flu-like" symptoms like muscle aches, bone pain, fever, headaches, fatigue, nausea, and vomiting. Patients taking this drug might have problems thinking and concentrating. Interferon can also lower blood cell counts. These effects continue as long as the drug is used, but can become easier to tolerate over time. They do improve after the drug is stopped. Still, some patients find it hard to deal with these side effects every day and may need to stop treatment because of them.

For more information about drugs that use the immune system, see [Immunotherapy](#)<sup>7</sup>.

## Hyperlinks

1. [www.cancer.org/treatment/treatments-and-side-effects/treatment-types/targeted-therapy.html](http://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/targeted-therapy.html)
2. [www.cancer.org/cancer/cancer-causes/genetics/genes-and-cancer.html](http://www.cancer.org/cancer/cancer-causes/genetics/genes-and-cancer.html)
3. [www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html](http://www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html)
4. [www.cancer.org/treatment/treatments-and-side-effects/treatment-types/immunotherapy/monoclonal-antibodies.html](http://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/immunotherapy/monoclonal-antibodies.html)
5. [www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html](http://www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html)
6. [www.cancer.org/treatment/treatments-and-side-effects/treatment-types/targeted-therapy.html](http://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/targeted-therapy.html)

7. [www.cancer.org/treatment/treatments-and-side-effects/treatment-types/immunotherapy.html](http://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/immunotherapy.html)

## References

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

Amgen Inc. Xgeva® (denosumab), Highlights of Prescribing Information, 6/2015. Accessed at [www.accessdata.fda.gov/drugsatfda\\_docs/label/2016/125320Orig1s1771bl.pdf](http://www.accessdata.fda.gov/drugsatfda_docs/label/2016/125320Orig1s1771bl.pdf) on December 5, 2017.

Benjamin RS, Wagner MJ, Livingston JA, Ravi V, Patel SR. Chemotherapy for Bone Sarcomas in Adults: The MD Anderson Experience. *Am Soc Clin Oncol Educ Book*. 2015:e656-660.

Colia V, Stacchiotti S. Medical treatment of advanced chordomas. *Eur J of Ca*. 2017;83:220-228.

Mavrogenis AF, Igoumenou VG, Megaloikonomos PD, et al. Giant cell tumor of bone revisited. *SICOT J*. 2017;3:54.

Merck & Co., Inc. Product Information INTRON® A, Interferon alfa-2b, Recombinant For Injection, 2/2016. Accessed at [www.merck.com/product/usa/pi\\_circulars/i/intron\\_a/intron\\_a\\_pi.pdf](http://www.merck.com/product/usa/pi_circulars/i/intron_a/intron_a_pi.pdf) on December 5, 2017.

Novartis Pharmaceuticals Corporation. Gleevec® (imatinib mesylate), Highlights of Prescribing Information, 9/2017. Accessed at [www.accessdata.fda.gov/drugsatfda\\_docs/label/2017/021588s0521bl.pdf](http://www.accessdata.fda.gov/drugsatfda_docs/label/2017/021588s0521bl.pdf) on December 5, 2017.

Polychronidou G, Karavasilis V, Pollack SM, et al. Novel therapeutic approaches in chondrosarcoma. *Future Oncol*. 2017;13(7):637-648.

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# Treating Specific Bone Cancers

Information on treating [Ewing sarcoma](#)<sup>1</sup> and [osteosarcoma](#)<sup>2</sup> is not covered here. Please see the American Cancer Society information on those cancers to learn more.

## Chondrosarcomas

After a [biopsy](#)<sup>3</sup> confirms the diagnosis, [surgery](#) is done to remove the tumor. Again, it's important that the biopsy be done by the same surgeon who will remove the tumor.

For a low-grade chondrosarcoma in an arm or leg, [curettage with cryotherapy](#) is an option.

If the tumor is high-grade, [limb-sparing surgery](#) will be done if possible. Sometimes [amputation](#) is needed to completely remove the cancer. If the chondrosarcoma has spread to the lungs and there are only a few tumors, they may be removed surgically.

Chondrosarcomas in the skull are hard to treat. Complete surgical removal is difficult, and might cause serious side effects. Some low-grade tumors are treated with curettage and cryosurgery.

Sometimes the patient is treated with [radiation therapy](#) before and/or after surgery. Radiation can also be used if surgery can't be done. Since chondrosarcomas are resistant to radiation, high doses are required. [Proton-beam radiation](#) works best for these tumors.

[Chemotherapy](#) (chemo) is not often used to treat chondrosarcoma, because it doesn't work. Most types of chondrosarcoma are resistant to chemo. Still, chemo can be used to treat some special types of chondrosarcoma. For example, dedifferentiated chondrosarcoma is often treated like [osteosarcoma](#)<sup>4</sup>, with chemo followed by surgery and then more chemo. Patients with mesenchymal chondrosarcomas also get chemo before surgery. These tumors are treated the same as [Ewing tumors](#)<sup>5</sup> or [soft tissue sarcomas](#)<sup>6</sup>.

## Malignant fibrous histiocyomas (MFH)

MFH is treated the same way [osteosarcoma is treated](#)<sup>7</sup>.

Often the patient is treated first with [chemotherapy](#) to shrink the tumor. Then the tumor and some surrounding normal tissue is removed (wide-excision). After surgery, the

bone may be reconstructed with a bone graft or a prosthesis (metallic rod). Amputation is rarely needed.

In some cases, chemotherapy is also given after [surgery](#).

## Fibrosarcomas

[Surgery](#) is the main treatment for this kind of cancer. The goal is take out the tumor and a margin of surrounding normal bone.

This tumor tends to come back in the same place it started, so [radiation](#) may be given after surgery to help keep this from happening. Radiation is also used if the doctor suspects that some cancer has been left behind.

Radiation is sometimes used instead of surgery if the tumor cannot be removed completely. It also can be used if a fibrosarcoma returns after surgery.

Chemotherapy may be tried, but this has not been studied well, and it's not clear that it helps.

## Giant cell tumors of bone

These are treated mainly with [surgery](#). Different operations are used, depending on the size and location of the tumor. Overall, treatment is much like the [treatment<sup>8</sup>for osteosarcoma<sup>9</sup>](#).

One option is wide-excision. This often means removing the part of the bone that has the tumor, and replacing it with a bone graft or prosthesis (such as a metal rod). If this operation can be done without seriously affecting the ability of the limb to move or without causing serious damage to nearby tissues, this approach has a good likelihood of success.

Another option is curettage followed by cryosurgery. The defect (hole) in the bone can then be filled in with bone cement or a bone graft.

Amputation is rarely needed to treat a giant cell tumor.

[Radiation](#) therapy may sometimes be used for giant cell tumors in bones where surgery may be hard to do without damaging nearby sensitive tissues such as tumors in the skull or spine. Radiation is not often used to treat giant cell tumors because if the non-cancerous tumor is not completely destroyed, it might increase the chance that it comes

back as cancer.

If a giant cell bone tumor spreads to other organs, the lungs are most commonly affected. If there are only a few tumors in the lungs, it might be possible to remove them surgically.

Because these tumors are benign, chemotherapy isn't used.

Both primary tumors and metastases that can't be removed can be treated with radiation with or without the [targeted therapy](#) drug denosumab (Xgeva).

## Chordomas

This rare primary tumor of bone most often occurs in the base of the skull or the lower bones of the spine. The best treatment is a [wide excision](#) to remove all of the tumor with some nearby normal tissue. This is not always possible because the spinal cord and nearby nerves may be involved. Still, as much of the tumor will be removed as possible

[Radiation](#) may be given after surgery to lower the chance that the tumor will grow back. Proton-beam radiation, either alone or with intensity-modulated radiation therapy, is best. Radiation may also be used if the tumor cannot be taken out with surgery.

Imatinib (Gleevec) is a [targeted therapy](#) drug that may be used for a chordoma that has spread widely. It rarely shrinks the tumors, but it can slow down tumor growth and help ease symptoms.

So far, [chemo](#) hasn't been found to work by itself. Still, it may be used to treat high-grade/dedifferentiated types of chordoma.

Chordomas can come back, even 10 or more years after treatment, so long-term follow-up is important.

## Hyperlinks

1. [www.cancer.org/cancer/ewing-tumor.html](http://www.cancer.org/cancer/ewing-tumor.html)
2. [www.cancer.org/cancer/osteosarcoma.html](http://www.cancer.org/cancer/osteosarcoma.html)
3. [www.cancer.org/cancer/bone-cancer/detection-diagnosis-staging/how-diagnosed.html](http://www.cancer.org/cancer/bone-cancer/detection-diagnosis-staging/how-diagnosed.html)
4. [www.cancer.org/cancer/osteosarcoma.html](http://www.cancer.org/cancer/osteosarcoma.html)

5. [www.cancer.org/cancer/ewing-tumor.html](http://www.cancer.org/cancer/ewing-tumor.html)
6. [www.cancer.org/cancer/soft-tissue-sarcoma.html](http://www.cancer.org/cancer/soft-tissue-sarcoma.html)
7. [www.cancer.org/cancer/osteosarcoma/treating.html](http://www.cancer.org/cancer/osteosarcoma/treating.html)
8. [www.cancer.org/cancer/osteosarcoma/treating.html](http://www.cancer.org/cancer/osteosarcoma/treating.html)
9. [www.cancer.org/cancer/osteosarcoma/treating.html](http://www.cancer.org/cancer/osteosarcoma/treating.html)

## References

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

Benjamin RS, Wagner MJ, Livingston JA, Ravi V, Patel SR. Chemotherapy for Bone Sarcomas in Adults: The MD Anderson Experience. *Am Soc Clin Oncol Educ Book*. 2015:e656-660.

Colia V, Stacchiotti S. Medical treatment of advanced chordomas. *Eur J Cancer*. 2017;83:220-228.

Giridhar P, Mallick S, Haresh KP, et al. Intracranial fibrosarcoma treated with adjuvant radiation and temozolomide: Report of a case and review of all published cases. *J Egypt Natl Canc Inst*. 2016;28(2):111-116.

Mavrogenis AF, Igoumenou VG, Megaloikonos PD, et al. Giant cell tumor of bone revisited. *SICOT J*. 2017;3:54.

National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology. Bone Cancer. Version 1.2018 -- August 29, 2017.

Özkurt B, Baarr K, Yldz YH, Kalem M, Salk Y. Primary malignant fibrous histiocytoma of long bones: long-term follow-up. *Ekleml Hastalik Cerrahisi*. 2016;27(2):94-99.

Polychronidou G, Karavasilis V, Pollack SM, et al. Novel therapeutic approaches in chondrosarcoma. *Future Oncol*. 2017;13(7):637-648.

Van Gompel JJ, Janus JR. Chordoma and chondrosarcoma. *Otolaryngol Clin North Am*. 2015;48(3):501-514.

Zheng K, Yu X, Hu Y, et al. Surgical treatment for pelvic giant cell tumor: a multi-center study. *World J Surg Onc*. 2016;14:104



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## After Bone Cancer Treatment

### Living as a Cancer Survivor

For many people, cancer treatment often raises questions about next steps as a survivor.

- [Living As a Bone Cancer Survivor](#)

### Cancer Concerns After Treatment

Treatment may remove or destroy the cancer, but it is very common to be concerned about the risk of another cancer, the cancer coming back, or treatment no longer working.

- [Second Cancers After Bone Cancer](#)
- 

## Living As a Bone Cancer Survivor

For some people with bone cancer, treatment may remove or destroy the cancer. Completing treatment can be both stressful and exciting. You may be relieved to finish treatment, but find it's hard not to worry about cancer coming back. This is very common if you've had cancer.

For other people, the cancer might never go away completely. Some people may get regular treatment with chemotherapy or targeted therapy or other treatments to try and

help keep the cancer in check. Learning to live with cancer that does not go away can be difficult and very stressful.

Life after bone cancer means returning to some familiar things and also making some new choices.

## Follow-up care

When treatment ends, your doctors will still want to watch you closely. It's very important to go to all of your follow-up appointments. During these visits, your doctors will ask about any problems you might be having. Exams, lab tests, x-rays, and scans will be needed to look for signs that the cancer has come back. These may be done every 3 to 6 months for a few years. You'll see your doctor and have imaging scans quite often at first, but as time goes on there will be more time between scans and visits. Because primary bone tumors tend to come back, you may need to have imaging scans every year for many, many years.

Your doctor will also look for treatment [side effects](#)<sup>1</sup>. Almost every cancer treatment has side effects. Some may last for a few weeks to months, but others can last the rest of your life. Now is the time for you to talk to your cancer care team about any changes or problems you notice and any questions or concerns you have.

After bone surgery, fitting for a prosthetic limb, rehabilitation, and/or physical therapy might be important to help you regain as much of your mobility and independence as possible.

## Ask your doctor for a survivorship care plan

Talk with your doctor about developing a [survivorship care plan](#)<sup>2</sup> for you. This plan might include:

- A suggested schedule for follow-up exams and tests
- A schedule for other tests you might need in the future, such as [early detection \(screening\) tests](#)<sup>3</sup> for other types of cancer, or tests to look for long-term health effects from your cancer or its treatment
- A list of possible late- or long-term side effects from your treatment, including what to watch for and when you should contact your doctor
- Diet and physical activity suggestions
- Reminders to keep your appointments with your primary care provider (PCP), who

will monitor your general health care

## Keeping health insurance and copies of your medical records

Even after treatment, it's very important to keep health insurance. Tests and doctor visits cost a lot, and even though no one wants to think of their cancer coming back, this could happen.

At some point after your cancer treatment, you might find yourself seeing a new doctor who doesn't know about your medical history. It's important to keep copies of your medical records to give your new doctor the details of your diagnosis and treatment. Learn more in [Keeping Copies of Important Medical Records](#)<sup>4</sup>.

## Can I lower my risk of the bonecancer progressing or coming back?

If you have (or have had) primary bone cancer, you probably want to know if there are things you can do that might lower your risk of the cancer growing or coming back, such as exercising, eating a certain type of diet, or taking nutritional supplements. Unfortunately, it's not yet clear if there are things you can do that will help.

Adopting healthy behaviors such as [not smoking](#)<sup>5</sup>, [eating well](#)<sup>6</sup>, [getting regular physical activity](#)<sup>7</sup>, and [staying at a healthy weight](#)<sup>8</sup> might help, but no one knows for sure. Still, we do know that these types of changes can have positive effects on your overall health beyond your risk of bonecancer or other cancers.

### About dietary supplements

So far, no [dietary supplements](#)<sup>9</sup> (including vitamins, minerals, and herbal products) have been shown to clearly help lower the risk of bonecancer progressing or coming back. This doesn't mean that no supplements will help, but it's important to know that none have been proven to do so.

Dietary supplements are not regulated like medicines in the United States – they do not have to be proven effective (or even safe) before being sold, although there are limits on what they're allowed to claim they can do. If you're thinking about taking any type of nutritional supplement, talk to your health care team. They can help you decide which ones you can use safely while avoiding those that might be harmful.

## If the cancer comes back

If the cancer does come back (recur) at some point, your treatment options will depend on where the cancer is located, what treatments you've had before, and your overall health.

For more general information, see [Understanding Recurrence](#)<sup>10</sup>.

## Could I get a second cancer after treatment?

People who've had bone cancer can still get other cancers. In fact, bone cancer survivors are at higher risk for getting some other types of cancer. Learn more in [Second Cancers After Bone Cancer](#).

## Getting emotional support

Some amount of feeling depressed, anxious, or worried is normal when cancer is a part of your life. Some people are affected more than others. But everyone can benefit from help and support from other people, whether friends and family, religious groups, support groups, professional counselors, or others. Learn more in [Life After Cancer](#)<sup>11</sup>.

## Hyperlinks

1. [www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html](http://www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html)
2. [www.cancer.org/treatment/survivorship-during-and-after-treatment/survivorship-care-plans.html](http://www.cancer.org/treatment/survivorship-during-and-after-treatment/survivorship-care-plans.html)
3. [www.cancer.org/healthy/find-cancer-early/cancer-screening-guidelines.html](http://www.cancer.org/healthy/find-cancer-early/cancer-screening-guidelines.html)
4. [www.cancer.org/treatment/survivorship-during-and-after-treatment/be-healthy-after-treatment/keeping-copies-of-important-medical-records.html](http://www.cancer.org/treatment/survivorship-during-and-after-treatment/be-healthy-after-treatment/keeping-copies-of-important-medical-records.html)
5. [www.cancer.org/healthy/stay-away-from-tobacco.html](http://www.cancer.org/healthy/stay-away-from-tobacco.html)
6. [www.cancer.org/healthy/eat-healthy-get-active/eat-healthy.html](http://www.cancer.org/healthy/eat-healthy-get-active/eat-healthy.html)
7. [www.cancer.org/healthy/eat-healthy-get-active/get-active.html](http://www.cancer.org/healthy/eat-healthy-get-active/get-active.html)
8. [www.cancer.org/healthy/eat-healthy-get-active/take-control-your-weight.html](http://www.cancer.org/healthy/eat-healthy-get-active/take-control-your-weight.html)
9. [www.cancer.org/treatment/treatments-and-side-effects/complementary-and-alternative-medicine/dietary-supplements.html](http://www.cancer.org/treatment/treatments-and-side-effects/complementary-and-alternative-medicine/dietary-supplements.html)
10. [www.cancer.org/treatment/survivorship-during-and-after-treatment/understanding-recurrence.html](http://www.cancer.org/treatment/survivorship-during-and-after-treatment/understanding-recurrence.html)
11. [www.cancer.org/treatment/survivorship-during-and-after-treatment/be-healthy-after-treatment/life-after-cancer.html](http://www.cancer.org/treatment/survivorship-during-and-after-treatment/be-healthy-after-treatment/life-after-cancer.html)

## References

National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology. Bone Cancer. Version 1.2018 -- August 29, 2017.

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

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# Second Cancers After Bone Cancer

Cancer survivors can be affected by a number of health problems, but often their greatest concern is facing cancer again. If a cancer comes back after treatment it's called a [recurrence](#)<sup>1</sup>. But some cancer survivors develop a new, unrelated cancer later. This is called a **second cancer**.

Being treated for cancer doesn't mean you can't get another cancer, even after surviving the first one. People who have had cancer can still get the same types of cancers that other people get. In fact, certain types of cancer and cancer treatments can be linked to a higher risk of certain second cancers.

Survivors of [bone and joint cancers](#)<sup>2</sup> can get any type of second cancer, but they have an increased risk of getting another bone or joint cancer (this is different from the first cancer coming back). Sometimes this is the same kind of cancer as the original tumor, but it can be a different type. For example, someone who had a [chondrosarcoma](#)<sup>3</sup> can get an [osteosarcoma](#)<sup>4</sup>. [Sarcoma of the soft tissues](#)<sup>5</sup> is also seen more often than expected after a cancer of the bone or joints.

Survivors of bone and joint cancers also have an increased risk of:

- [Lung cancer](#)<sup>6</sup>
- [Esophagus cancer](#)<sup>7</sup>
- [Stomach cancer](#)<sup>8</sup>
- [Colorectal cancer](#)<sup>9</sup>
- [Liver cancer](#)<sup>10</sup>

- [Pancreas cancer](#)<sup>11</sup>
- [Acute myeloid leukemia \(AML\)](#)<sup>12</sup>

The risk of leukemia is linked to treatment with [chemotherapy](#)<sup>13</sup>.

### Follow-up after treatment

After treatment for bone cancer, you should see your doctor regularly. You will need tests to look for signs that the cancer has come back or spread. Experts do not recommend any additional testing to look for second cancers in patients without symptoms. Let your doctor know about any new symptoms or problems, because they could be caused by the cancer coming back or by a new disease or second cancer.

Survivors of bone cancer should follow the [American Cancer Society guidelines for the early detection of cancer](#)<sup>14</sup>.

The Children's Oncology Group has guidelines for the follow-up of patients treated for cancer as a child, teen, or young adult, including screening for second cancers. These can be found at [www.survivorshipguidelines.org](http://www.survivorshipguidelines.org)<sup>15</sup>.

All cancer survivors should [stay away from tobacco products](#)<sup>16</sup>. Smoking increases the risk of many cancers and might further increase the risk of some of the second cancers seen after bone cancer.

To help [maintain good health](#)<sup>17</sup>, survivors should also:

- Get to and stay at a healthy weight
- Be physically active
- Eat healthy foods, with an emphasis on plant foods
- Limit alcohol use to no more than 1 drink per day for women or 2 per day for men

These steps may also help lower the risk of some cancers.

See [Second Cancers in Adults](#)<sup>18</sup> for more information about the causes of second cancers.

### Hyperlinks

1. [www.cancer.org/treatment/survivorship-during-and-after-treatment/understanding-recurrence.html](http://www.cancer.org/treatment/survivorship-during-and-after-treatment/understanding-recurrence.html)

2. [www.cancer.org/cancer/bone-cancer/about.html](http://www.cancer.org/cancer/bone-cancer/about.html)
3. [www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html](http://www.cancer.org/cancer/bone-cancer/about/what-is-bone-cancer.html)
4. [www.cancer.org/cancer/osteosarcoma.html](http://www.cancer.org/cancer/osteosarcoma.html)
5. [www.cancer.org/cancer/soft-tissue-sarcoma.html](http://www.cancer.org/cancer/soft-tissue-sarcoma.html)
6. [www.cancer.org/cancer/lung-cancer.html](http://www.cancer.org/cancer/lung-cancer.html)
7. [www.cancer.org/cancer/esophagus-cancer.html](http://www.cancer.org/cancer/esophagus-cancer.html)
8. [www.cancer.org/cancer/stomach-cancer.html](http://www.cancer.org/cancer/stomach-cancer.html)
9. [www.cancer.org/cancer/colon-rectal-cancer.html](http://www.cancer.org/cancer/colon-rectal-cancer.html)
10. [www.cancer.org/cancer/liver-cancer.html](http://www.cancer.org/cancer/liver-cancer.html)
11. [www.cancer.org/cancer/pancreatic-cancer.html](http://www.cancer.org/cancer/pancreatic-cancer.html)
12. [www.cancer.org/cancer/acute-myeloid-leukemia.html](http://www.cancer.org/cancer/acute-myeloid-leukemia.html)
13. [www.cancer.org/treatment/treatments-and-side-effects/treatment-types/chemotherapy.html](http://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/chemotherapy.html)
14. [www.cancer.org/healthy/find-cancer-early/cancer-screening-guidelines/american-cancer-society-guidelines-for-the-early-detection-of-cancer.html](http://www.cancer.org/healthy/find-cancer-early/cancer-screening-guidelines/american-cancer-society-guidelines-for-the-early-detection-of-cancer.html)
15. <http://www.survivorshipguidelines.org/>
16. [www.cancer.org/healthy/stay-away-from-tobacco.html](http://www.cancer.org/healthy/stay-away-from-tobacco.html)
17. [www.cancer.org/healthy/eat-healthy-get-active.html](http://www.cancer.org/healthy/eat-healthy-get-active.html)
18. [www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/second-cancers-in-adults.html](http://www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/second-cancers-in-adults.html)

## References

See all references for Bone Cancer ([www.cancer.org/cancer/bone-cancer/references.html](http://www.cancer.org/cancer/bone-cancer/references.html))

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