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.

- What Are the Risk Factors for Bone Cancer?
- Do We Know What Causes Bone Cancer?

Prevention

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

What Are the 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) appear to be

hereditary and are caused by defects (mutations) in certain genes.

Osteosarcomas

Children with certain rare inherited syndromes have an increased risk of developing osteosarcoma.

- The **Li-Fraumeni (**lee-FRAH-meh-nee) **syndrome** makes people much more likely to develop several types of cancer, including breast cancer, brain cancer, osteosarcoma, and other types of sarcoma. Most of those cases are caused by a mutation of the *p53* tumor suppressor gene, but some are caused by mutations in the gene *CHEK2*.
- Another syndrome that includes bone cancer is the **Rothmund-Thomson syndrome**. Children with this syndrome are short, have skeletal problems, and rashes. They also are more likely to develop osteosarcoma. This syndrome is caused by abnormal changes in the gene *REQL4*.
- **Retinoblastoma** is a rare eye cancer of children that can be hereditary. The inherited form of retinoblastoma 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. 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 (PA-jet) 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 is mostly a disease of 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 the 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.

Injuries

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

- References

See all references for Bone Cancer

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Do We Know What Causes Bone Cancer?

The exact cause of most bone cancers is not known. However, scientists have found that bone cancers are associated with 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 cancerous. DNA carries the instructions for nearly everything our cells do. We usually look like our parents because they are the source of our DNA. However, DNA affects more than our outward appearance. It may influence our risks for developing certain diseases, including some kinds of cancer.

DNA is divided into units called *genes*. 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*. Others 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 the section, “ What are the risk factors for bone cancer?”). In many cases, genetic testing can be used to see if someone has one of these mutations.

Most bone cancers are not caused by inherited DNA mutations. They are the result of mutations acquired 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 and so cannot be passed on to the patient’s children.

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

- References

See all references for Bone Cancer

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Can Bone Cancer Be Prevented?

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

- References

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For additional assistance please contact your American Cancer Society
1-800-227-2345 or www.cancer.org