CONDITION

Bone tumor

Learn about benign and cancerous bone tumors, including possible symptoms, diagnostic tests, treatment options, complications, and follow-up care.

WHAT IT IS
Abnormal cell growth in or around bone

BODY SYSTEM
Bones

MAIN SYMPTOMS
Persistent bone pain, swelling or lump, reduced movement, fractures

WHAT CAUSES IT
Usually unknown, abnormal cell changes

HOW IT IS DIAGNOSED
Biopsy with pathology examination

MAIN TREATMENT
Observation, surgery, chemotherapy or radiation therapy

CAN IT BE CURED?
Sometimes - depends on type and spread

IS IT AN EMERGENCY?
Sometimes - new weakness or bladder or bowel problems

LONG-TERM OUTLOOK
Ranges from stable benign lesions to spreading cancer

Overview

A bone tumor is an abnormal growth of cells in or around a bone. Some bone tumors are benign , meaning they are not cancer. Others are malignant , meaning they are cancerous and may invade nearby tissue or spread to other parts of the body.

Benign bone tumors do not spread to distant organs. However, some can grow, weaken a bone, press on nearby nerves, or return after treatment. Other benign tumors may remain small and never cause a problem.

A cancer that begins in bone is called primary bone cancer . Examples include osteosarcoma, chondrosarcoma, and Ewing sarcoma. Each develops from a different type of cell and may affect different age groups or parts of the skeleton.

Cancer found in bone more often began somewhere else, such as the breast, prostate, lung, kidney, or thyroid. This is called bone metastasis or secondary bone cancer. It is treated according to where the cancer started, not as primary bone cancer.

Bone tumors can occur at any age. The likely diagnosis depends partly on a person's age, the affected bone, the tumor's location within the bone, and its appearance on imaging. A spot on an X-ray is not automatically cancer. Cysts, infections, healing injuries, and other conditions can resemble tumors.

Careful diagnosis matters because treatment ranges from observation to surgery, chemotherapy, or radiation therapy. If a tumor could be cancerous, imaging and biopsy are usually coordinated by a team experienced in bone tumors.

Symptoms

Some bone tumors cause no symptoms. They may be found during an X-ray or scan performed for another reason.

When symptoms occur, they may include:

Tumor-related pain may occur during activity, at rest, or at night. These patterns are not specific to a tumor. Injuries, arthritis, infections, and other common conditions can cause similar pain.

Fever, fatigue, or unintended weight loss can occur with some malignant tumors, but these symptoms have many possible causes. Their presence or absence cannot determine whether a bone lesion is cancerous.

Arrange a routine medical appointment for a new lump, ongoing localized bone pain, unexplained swelling, or pain that is not improving as expected. Prompt evaluation is also appropriate if a previously identified mass changes or symptoms begin to limit normal activity.

Seek urgent care for sudden severe bone pain, visible deformity, or inability to put weight on a limb, especially after a minor injury. These may indicate a fracture through weakened bone.

Seek emergency care for new leg or arm weakness, loss of sensation, numbness around the groin, or loss of bladder or bowel control. A tumor affecting the spine can rarely compress the spinal cord or nearby nerves and requires immediate assessment.

- Persistent pain in one area of a bone
- Pain that becomes more frequent or severe over time
- Swelling, a lump, or tenderness

- Reduced movement near a joint
- A limp or difficulty using an arm or leg
- A broken bone after a minor injury
- Numbness, tingling, or weakness if a tumor presses on nerves

Causes and risk factors

Most bone tumors do not have a single identifiable cause. They develop when cells acquire changes that affect how they grow and divide. Having a bone tumor does not mean that a person caused it through activity, diet, or an injury.

An injury may draw attention to an area that already contained a tumor, but routine injuries are not considered a usual cause of bone cancer.

Risk factors differ among tumor types. Factors associated with certain malignant bone tumors include:

Most people with these risk factors do not develop primary bone cancer. Many people who do develop it have no known risk factor.

Age can help narrow the possibilities. Osteosarcoma and Ewing sarcoma often occur in children, teenagers, or young adults, although they can occur later. Chondrosarcoma is more often diagnosed in adults. Age alone cannot identify the type of tumor.

For bone metastases, the main risk factor is having cancer elsewhere in the body. A past cancer diagnosis remains relevant even if treatment occurred years earlier.

- Previous high-dose radiation treatment involving bone
- Certain inherited conditions, including Li-Fraumeni syndrome and hereditary retinoblastoma
- Some rare genetic disorders that affect DNA repair or bone growth
- Paget disease of bone, particularly in older adults
- A history of certain benign bone or cartilage conditions that can rarely become malignant

Diagnosis

Evaluation usually starts with a medical history and physical examination. A clinician may ask when the symptoms began, how they have changed, and whether there has been an injury, infection, or previous cancer. The examination may assess the mass, skin, nearby joint,

circulation, strength, and sensation.

A plain X-ray is often the first imaging test. It can show whether a lesion is destroying bone, producing new bone, or causing a fracture. Some patterns appear less concerning, while others require additional testing. Imaging alone does not always provide a final diagnosis.

Magnetic resonance imaging, or MRI , gives detailed pictures of the bone, bone marrow, muscles, nerves, and other nearby tissues. It helps show the tumor's size and local extent. Computed tomography, or CT , may provide more detail about the bone or check areas such as the lungs. A bone scan or positron emission tomography, known as PET , may be used in selected cases to look for disease elsewhere.

Blood tests cannot confirm most bone tumors. They may help look for infection, assess general health, or measure substances that can be abnormal in some cancers. Results are interpreted with imaging and other findings.

A biopsy removes a sample of tissue for examination by a pathologist. Needle biopsy is commonly performed with imaging guidance. An open biopsy requires a surgical incision.

When cancer is a possibility, the biopsy should be planned with the orthopedic oncology or sarcoma team that would perform definitive surgery. The biopsy path can affect later surgery, so an unplanned biopsy may make treatment more difficult.

The pathologist determines the tumor type and may assign a grade , which describes how abnormal and aggressive the cells appear. Molecular or genetic tests on the tumor may help classify certain sarcomas. If cancer is confirmed, staging tests assess its size, nearby involvement, and whether it has spread.

Treatment and management

Treatment depends on whether the tumor is benign or malignant, its exact type and location, its behavior on imaging, symptoms, fracture risk, and the person's overall health. A multidisciplinary team may include an orthopedic oncologist, medical oncologist, radiation oncologist, radiologist, pathologist, rehabilitation specialist, and pediatric specialist when appropriate.

Some benign tumors need only observation. Follow-up imaging can show whether the lesion remains stable. Observation may be reasonable when the imaging appearance is reassuring, symptoms are minor, and the bone is not at significant risk of fracture.

A benign tumor may need treatment if it causes pain, continues to grow, weakens the bone, affects a joint or nerve, or has uncertain features. Surgery may involve scraping out the tumor, a procedure called curettage . The resulting space may be filled with bone graft or bone

cement. Some tumors require removal of a larger section of tissue.

Surgery is an important part of treatment for many primary bone cancers. The goal is to remove the tumor with a margin of healthy tissue while preserving as much function as possible. Limb-sparing surgery is possible in many situations. Reconstruction may use a metal implant, donor bone, or bone moved from another part of the body. Amputation is sometimes necessary when a tumor cannot be removed safely while preserving a useful limb, but it is not required for every malignant bone tumor.

Chemotherapy uses medicines that travel through the bloodstream. It is commonly part of treatment for osteosarcoma and Ewing sarcoma. Its role in chondrosarcoma and other bone cancers varies by subtype. The treatment plan may include chemotherapy before surgery, after surgery, or both.

Radiation therapy uses focused high-energy beams to damage cancer cells. It is especially important for some tumors that are sensitive to radiation, when surgery cannot remove the entire tumor, or when surgery would cause unacceptable harm. Radiation can also reduce pain or other symptoms from metastatic disease.

Treatment for bone metastases focuses on the cancer's original site and on protecting the affected bone. Options may include systemic cancer therapy, radiation, surgery to stabilize a weak bone, or medicines that reduce cancer-related bone breakdown.

Pain relief, physical therapy, nutrition support, and emotional care are important parts of management. Rehabilitation can help maintain strength and movement before and after treatment. A patient should not begin supplements or intensive exercise intended to "strengthen" an affected bone without discussing safety with the treating team.

Complications

A bone tumor can weaken the normal structure of a bone. This may lead to a pathologic fracture , which is a break occurring in bone weakened by disease. Tumors near a joint can cause stiffness or reduced movement. Tumors near nerves or the spinal cord may cause pain, numbness, or weakness.

Malignant tumors can grow into nearby tissues or spread to distant organs. The lungs are an important site of spread for several primary bone sarcomas. Bone metastases can affect several bones and may cause pain, fractures, spinal cord compression, or high blood calcium.

Treatment can also have complications. Surgery may lead to infection, bleeding, blood clots, delayed healing, implant problems, or changes in limb function. Chemotherapy and radiation effects depend on the treatment used and the area treated. The care team should explain

expected short-term effects and possible long-term concerns before treatment.

Follow up

Follow-up is tailored to the tumor type and treatment. A benign lesion under observation may need periodic examinations and imaging to confirm that it is stable. Keep scheduled appointments even if symptoms improve, because growth may not cause immediate symptoms.

After treatment for a malignant bone tumor, follow-up may include examination of the treated area and imaging of the original site and chest. Visits also address mobility, pain, treatment effects, emotional health, school or work needs, and rehabilitation. The schedule varies by diagnosis and changes over time.

Contact the treating team between routine visits for a growing lump, new or worsening pain, increasing swelling, reduced limb function, unexplained fever, or new breathing symptoms. These changes do not necessarily mean the tumor has returned, but they should be assessed.

Sudden severe pain or inability to use a limb requires urgent evaluation for a possible fracture. New weakness, loss of sensation, or bladder or bowel problems requires emergency care.

Sources

- National Cancer Institute. Primary Bone Cancer . NCI Cancer Types.
- National Cancer Institute. Bone Cancer Treatment (PDQ®)-Patient Version . NCI Physician Data Query.
- American Academy of Orthopaedic Surgeons. Bone Tumor . OrthoInfo.
- World Health Organization Classification of Tumours Editorial Board. Soft Tissue and Bone Tumours . 5th edition. International Agency for Research on Cancer; 2020.
- Strauss SJ, Frezza AM, Abecassis N, et al. "Bone sarcomas: ESMO-EURACAN-GENTURIS-ERN PaedCan Clinical Practice Guideline for diagnosis, treatment and follow-up." Annals of Oncology . 2021;32(12):1520-1536.
- Roberts CC, Kransdorf MJ, Beaman FD, et al. "ACR Appropriateness Criteria® Primary Bone Tumors." Journal of the American College of Radiology . 2020;17(5S).