Bone Cancer: Questions and Answers

Key Points

- Cancer that starts in the bone is uncommon (see Question 4).
- Pain is the most common symptom of bone cancer (see Question 5).
- Surgery is the usual treatment for bone cancer (see Question 7).
- With modern surgical techniques, 9 out of 10 people who have bone cancer in an arm or leg may not need amputation (see Question 7).
- Because bone cancer can come back after treatment, regular follow-up visits are important (see Question 8).
- People with bone cancer are encouraged to enroll in clinical trials (research studies) that explore new treatments (see Question 9).

1. What is bone cancer?

Bone cancer is a malignant (cancerous) tumor of the bone that destroys normal bone tissue (1). Not all bone tumors are malignant. In fact, benign (noncancerous) bone tumors are more common than malignant ones. Both malignant and benign bone tumors may grow and compress healthy bone tissue, but benign tumors do not spread, do not destroy bone tissue, and are rarely a threat to life.

Malignant tumors that begin in bone tissue are called primary bone cancer. Cancer that metastasizes (spreads) to the bones from other parts of the body, such as the breast, lung, or prostate, is called metastatic cancer, and is named for the organ or tissue in which it began. Primary bone cancer is far less common than cancer that spreads to the bones.

2. Are there different types of primary bone cancer?

Yes. Cancer can begin in any type of bone tissue. Bones are made up of osteoid (hard or compact), cartilaginous (tough, flexible), and fibrous (threadlike) tissue, as well as elements of bone marrow (soft, spongy tissue in the center of most bones).

Common types of primary bone cancer include:

- Osteosarcoma, which arises from osteoid tissue in the bone. This tumor occurs most often in the knee and upper arm (1).

- Chondrosarcoma, which begins in cartilaginous tissue. Cartilage pads the ends of bones and lines the joints. Chondrosarcoma occurs most often in the pelvis (located between the hip bones), upper leg, and shoulder. Sometimes a chondrosarcoma contains cancerous bone cells. In that case, doctors classify the tumor as an osteosarcoma.

- The Ewing Sarcoma Family of Tumors (ESFTs), which usually occur in bone but may also arise in soft tissue (muscle, fat, fibrous tissue, blood vessels, or other supporting tissue). Scientists think that ESFTs arise from elements of primitive nerve tissue in the bone or soft tissue (2). ESFTs occur most commonly along the backbone and pelvis and in the legs and arms (3).

Other types of cancer that arise in soft tissue are called soft tissue sarcomas. They are not bone cancer and are not described in this resource. (More information about these types of cancer is available in the NCI fact sheet *Soft Tissue Sarcomas: Questions and Answers* at http://www.cancer.gov/cancertopics/factsheet/Sites-Types/soft-tissue-sarcoma on the Internet.)

3. What are the possible causes of bone cancer?

Although bone cancer does not have a clearly defined cause, researchers have identified several factors that increase the likelihood of developing these tumors. Osteosarcoma occurs more frequently in people who have had high-dose external radiation therapy or treatment with certain anticancer drugs; children seem to be particularly susceptible. A small number of bone cancers are due to heredity. For example, children who have had hereditary retinoblastoma (an uncommon cancer of the eye) are at a higher risk of developing osteosarcoma, particularly if they are treated with radiation. Additionally, people who have hereditary defects of bones and people with metal implants, which doctors sometimes use to repair fractures, are more likely to develop osteosarcoma (4). Ewing sarcoma is not strongly associated with any heredity cancer syndromes, congenital childhood diseases, or previous radiation exposure (2).

4. How often does bone cancer occur?

Primary bone cancer is rare. It accounts for much less than 1 percent of all cancers. About 2,300 new cases of primary bone cancer are diagnosed in the United States each year (5). Different types of bone cancer are more likely to occur in certain populations:

- Osteosarcoma occurs most commonly between ages 10 and 19. However, people over age 40 who have other conditions, such as Paget disease (a benign condition

characterized by abnormal development of new bone cells), are at increased risk of developing this cancer.

- Chondrosarcoma occurs mainly in older adults (over age 40). The risk increases with advancing age. This disease rarely occurs in children and adolescents.

- ESFTs occur most often in children and adolescents under 19 years of age. Boys are affected more often than girls. These tumors are extremely rare in African American children.

5. What are the symptoms of bone cancer?

Pain is the most common symptom of bone cancer, but not all bone cancers cause pain (1). Persistent or unusual pain or swelling in or near a bone can be caused by cancer or by other conditions. It is important to see a doctor to determine the cause.

6. How is bone cancer diagnosed?

To help diagnose bone cancer, the doctor asks about the patient's personal and family medical history. The doctor also performs a physical examination and may order laboratory and other diagnostic tests. These tests may include (1):

- **X-rays**, which can show the location, size, and shape of a bone tumor. If x-rays suggest that an abnormal area may be cancer, the doctor is likely to recommend special imaging tests. Even if x-rays suggest that an abnormal area is benign, the doctor may want to do further tests, especially if the patient is experiencing unusual or persistent pain.

    - A **bone scan**, which is a test in which a small amount of radioactive material is injected into a blood vessel and travels through the bloodstream; it then collects in the bones and is detected by a scanner.

    - A **computed tomography (CT or CAT) scan**, which is a series of detailed pictures of areas inside the body, taken from different angles, that are created by a computer linked to an x-ray machine.

    - A **magnetic resonance imaging (MRI) procedure**, which uses a powerful magnet linked to a computer to create detailed pictures of areas inside the body without using x-rays.

    - A **positron emission tomography (PET) scan**, in which a small amount of radioactive glucose (sugar) is injected into a vein, and a scanner is used to make detailed, computerized pictures of areas inside the body where the glucose is used. Because cancer cells often use more glucose than normal cells, the pictures can be used to find cancer cells in the body.

- An **angiogram**, which is an x-ray of blood vessels.

- **Biopsy** (removal of a tissue sample from the bone tumor) to determine whether cancer is present. The surgeon may perform a needle biopsy or an incisional biopsy. During a needle biopsy, the surgeon makes a small hole in the bone and removes a sample of tissue from the tumor with a needle-like instrument. In an incisional biopsy, the surgeon cuts into the tumor and removes a sample of tissue. Biopsies are best done by an orthopedic oncologist (a doctor experienced in the treatment of bone cancer) (1). A pathologist (a doctor who identifies disease by studying cells and tissues under a microscope) examines the tissue to determine whether it is cancerous.

- **Blood tests** to determine the level of an enzyme called alkaline phosphatase. A large amount of this enzyme is present in the blood when the cells that form bone tissue are very active—when children are growing, when a broken bone is mending, or when a disease or tumor causes production of abnormal bone tissue. Because high levels of alkaline phosphatase are normal in growing children and adolescents, this test is not a completely reliable indicator of bone cancer (1, 6).

7. What are the treatment options for bone cancer?

Treatment options depend on the type, size, location, and stage of the cancer, as well as the person's age and general health. Treatment options for bone cancer include surgery, chemotherapy, radiation therapy, and cryosurgery.

- **Surgery** is the usual treatment for bone cancer. The surgeon removes the entire tumor with negative margins (no cancer cells are found at the edge or border of the tissue removed during surgery). The surgeon may also use special surgical techniques to minimize the amount of healthy tissue removed with the tumor.

  Dramatic improvements in surgical techniques and preoperative tumor treatment have made it possible for most patients with bone cancer in an arm or leg to avoid radical surgical procedures (removal of the entire limb). However, most patients who undergo limb-sparing surgery need reconstructive surgery to maximize limb function (1).

- **Chemotherapy** is the use of anticancer drugs to kill cancer cells. Patients who have bone cancer usually receive a combination of anticancer drugs. However, chemotherapy is not currently used to treat chondrosarcoma (1).

- **Radiation therapy**, also called radiotherapy, involves the use of high-energy x-rays to kill cancer cells. This treatment may be used in combination with surgery. It is often used to treat chondrosarcoma, which cannot be treated with chemotherapy, as well as ESFTs (1). It may also be used for patients who refuse surgery.

- **Cryosurgery** is the use of liquid nitrogen to freeze and kill cancer cells. This technique can sometimes be used instead of conventional surgery to destroy the tumor (1).

8. Is follow-up treatment necessary? What does it involve?

Yes. Bone cancer sometimes metastasizes, particularly to the lungs, or can recur (come back), either at the same location or in other bones in the body (1). People who have had bone cancer should see their doctor regularly and should report any unusual symptoms right away. Follow-up varies for different types and stages of bone cancer. Generally, patients are checked frequently by their doctor and have regular blood tests and x-rays. People who have had bone cancer, particularly children and adolescents, have an increased likelihood of developing another type of cancer, such as leukemia, later in life. Regular follow-up care ensures that changes in health are discussed and that problems are treated as soon as possible.

9. Are clinical trials (research studies) available for people with bone cancer?

Yes. Participation in clinical trials is an important treatment option for many people with bone cancer. To develop new treatments and better ways to use current treatments, the National Cancer Institute (NCI), a part of the National Institutes of Health, is sponsoring clinical trials in many hospitals and cancer centers around the country. Clinical trials are a critical step in the development of new methods of treatment. Before any new treatment can be recommended for general use, doctors conduct clinical trials to find out whether the treatment is safe for patients and effective against the disease.

People interested in taking part in a clinical trial should talk with their doctor. Information about clinical trials is available from the NCI's Cancer Information Service (CIS) (see below) at 1–800–4–CANCER and in the NCI booklet *Taking Part in Cancer Treatment Research Studies*, which can be found at http://www.cancer.gov/clinicaltrials/Taking-Part-in-Cancer-Treatment-Research-Studies on the Internet. This booklet describes how research studies are carried out and explains their possible benefits and risks. Further information about clinical trials is available at http://www.cancer.gov/clinicaltrials on the NCI's Web site. The Web site offers detailed information about specific ongoing studies by linking to PDQ®, the NCI's comprehensive cancer information database. The CIS also provides information from PDQ.

Selected References

1. Malawer MM, Helman LJ, O'Sullivan B. *Sarcomas of bone*. In: DeVita VT, Hellman S, Rosenberg SA, editors. Cancer: Principles and Practice of Oncology. Vol. 2. 7th ed. Philadelphia: Lippincott Williams and Wilkins, 2004.

2. Pizzo P, Poplack DG, editors. *Principles and Practice of Pediatric Oncology*. 4th ed. Philadelphia: Lippincott Williams and Wilkins, 2002.

3. Ries LAG, Smith MA, Gurney JG, et al., editors. *Cancer Incidence and Survival among Children and Adolescents: United States SEER Program 1975-1999*. Bethesda, MD: National Cancer Institute, 1999.

4. Miller RW, Boice JD, Curtis RE. Bone cancer. In: Schottenfeld D, Fraumeni JF, editors. *Cancer Epidemiology and Prevention*. 2nd ed. New York: Oxford University Press, 1996.

5. American Cancer Society (2008). *Cancer Facts and Figures 2008*. Atlanta, GA: American Cancer Society. Retrieved March 13, 2008, from http://www.cancer.org/downloads/STT/2008CAFFfinalsecured.pdf

6. Fischbach FT, Dunning MB. *A Manual of Laboratory and Diagnostic Tests*. 7th ed. Philadelphia: Lippincott Williams and Wilkins, 2004.

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Related NCI materials and Web pages:

- National Cancer Institute Fact Sheet 6.12, *Soft Tissue Sarcomas: Questions and Answers* (http://www.cancer.gov/cancertopics/factsheet/Sites-Types/soft-tissue-sarcoma)
- National Cancer Institute Fact Sheet 6.20, *Metastatic Cancer: Questions and Answers* (http://www.cancer.gov/cancertopics/factsheet/Sites-Types/metastatic)
- National Cancer Institute Fact Sheet 7.34, *Cryosurgery in Cancer Treatment: Questions and Answers* (http://www.cancer.gov/cancertopics/factsheet/Therapy/cryosurgery)
- National Cancer Institute Fact Sheet 7.48, *Follow-up Care After Cancer Treatment: Questions and Answers* (http://www.cancer.gov/cancertopics/factsheet/Therapy/followup)
- Bone Cancer Home Page (http://www.cancer.gov/cancertopics/types/bone/)
- *Chemotherapy and You: Support for People With Cancer* (http://www.cancer.gov/cancertopics/chemotherapy-and-you)
- Clinical Trials Home Page (http://www.cancer.gov/clinicaltrials)
- *Radiation Therapy and You: Support for People With Cancer* (http://www.cancer.gov/cancertopics/radiation-therapy-and-you)
- *Taking Part in Cancer Treatment Research Studies* (http://www.cancer.gov/clinicaltrials/Taking-Part-in-Cancer-Treatment-Research-Studies)

For more help, contact:

NCI's Cancer Information Service
Telephone (toll-free): 1–800–4–CANCER (1–800–422–6237)
TTY (toll-free): 1–800–332–8615
LiveHelp® online chat: https://cissecure.nci.nih.gov/livehelp/welcome.asp

This fact sheet was reviewed on 03/13/08