

Osteonecrosis after Cancer Treatment

What is osteonecrosis?

Osteonecrosis is a disorder resulting from a temporary or permanent loss of blood supply to the bone. Blood carries essential nutrients and oxygen to the bones. When the blood supply is disrupted, the bone tissues (osteo) begin to break down (necrosis). This can weaken the bone and eventually result in its collapse. If this occurs near a joint, it can lead to the collapse of the joint surface, resulting in pain and inflammation (arthritis). Osteonecrosis is also referred to as avascular necrosis or “AVN,” “aseptic necrosis,” and “ischemic bone necrosis.”

Osteonecrosis can occur in any bone, but most commonly affects the ends (epiphysis) of long bones such as the thigh bone (femur), causing hip and knee problems. Other common sites include the bones of the upper arms, shoulders, and ankles. Osteonecrosis can occur in a single bone, but more commonly occurs in several bones at one time (multifocal osteonecrosis).

Osteonecrosis can sometimes be disabling, depending on what part of the bone is affected, how large an area is involved, and how well the bone rebuilds itself. Normal bone continuously breaks down and rebuilds itself. This process keeps the bones strong. Osteonecrosis is the result of bone tissues breaking down faster than the body can repair them. If the disorder progresses, it can lead to pain and arthritis.

What causes osteonecrosis?

Osteonecrosis is caused by interruption of the blood supply to the bone. If blood vessels are blocked with fat, become too thick or too small, or get too weak, they may not be able to provide the amount of blood necessary for the bone tissue to survive.

What are the risk factors for osteonecrosis?

Corticosteroids (such as prednisone and dexamethasone) given during cancer treatment can affect the bone and blood vessels, resulting in osteonecrosis. People who have undergone hematopoietic cell transplant (bone marrow, cord blood, or stem cell transplant) are also at risk for developing osteonecrosis. Other factors that increase the risk of osteonecrosis in people who received corticosteroid therapy or hematopoietic cell transplant (HCT) include treatment with high doses of radiation to weight bearing bones, treatment with older radiation approaches (before 1970), being pubertal or post-pubertal at the time of treatment, having sickle cell disease, receiving total body irradiation (TBI), undergoing an allogeneic transplant (from someone other than yourself), and having prolonged treatment with corticosteroids for chronic graft-versus-host disease following HCT. Osteonecrosis is most likely to occur during the time that cancer is being treated, but it can also sometimes happen after completion of cancer therapy.

Steroids and osteonecrosis

Corticosteroids (such as prednisone and dexamethasone) are commonly used for treatment of many cancers, such as leukemia and lymphoma. Dexamethasone is also sometimes used for treatment of nausea and vomiting associated with chemotherapy and to control brain swelling. There is no clear explanation as to how corticosteroids cause osteonecrosis, but it is believed that they may interfere with

the body's ability to break down fatty substances. These substances can clog the blood vessels, causing them to narrow. This reduces the amount of blood that gets into the bone.

What are the symptoms of osteonecrosis?

People in the early stages of osteonecrosis may not have any symptoms. However, as the disorder progresses, most people will experience some joint pain. At first, the person may only experience pain when bearing weight on the affected bone or joint. As the disorder progresses, symptoms may be present even at rest. Pain may develop gradually and its intensity can range from mild to severe.

If osteonecrosis progresses and the bone and surrounding joint surfaces collapse, the pain can increase considerably and may become severe enough to limit movement in the affected joint. The period of time between the first symptoms of osteonecrosis and the loss of joint function is different for each person and ranges from several months to years.

How is osteonecrosis diagnosed?

An **x-ray** is usually the first test to be done when osteonecrosis is suspected. It can help distinguish osteonecrosis from other causes of bone pain, such as fracture. In the early stages of osteonecrosis, an x-ray may appear normal, so other tests may need to be done to establish the diagnosis. Once the diagnosis has been made, and in the later stages of osteonecrosis, x-rays are useful in monitoring the course of the condition. **MRI** is one of the most useful tools in diagnosing osteonecrosis because it can detect osteonecrosis in the earliest stages, when symptoms are not yet present. **Bone scans** are sometimes used to diagnose osteonecrosis. They are useful because one scan can show all the areas in the body affected by osteonecrosis. However, bone scans do not detect osteonecrosis at the earliest stages. A **CT scan** provides a three-dimensional image of the bone and can be useful in determining the extent of bone damage. **Surgical procedures** such as a bone biopsy can conclusively diagnose osteonecrosis, but are not commonly done.

How is osteonecrosis treated?

The goals of treatment for osteonecrosis are to improve the person's use of the affected joint, reduce pain, stop bone damage, and ensure joint survival. Treatment can be conservative or surgical. In order to decide the best treatment for a patient, the following factors are considered:

- The person's age
- The stage of the disorder (early or late)
- The location and the amount of bone affected (small or large)
- The status of cancer and cancer treatment

Conservative treatment

- **Medication**—to reduce pain
- **Reduced weight bearing**—to slow the damage and promote natural healing. Crutches may be recommended to limit weight or pressure on the affected joint.
- **Range of motion exercises**—to keep the joints flexible. This is also important to maintain

movement and increase circulation in the joints. This can promote healing and may relieve pain. Physical therapists can teach the correct exercises.

- **Electrical stimulation**—to induce bone growth

Conservative treatments may be used alone or in combination, but they may not provide lasting improvement. Some people may require surgery to permanently repair or replace the joint.

Surgical Treatment

- **Core decompression**—is a surgery that removes the inner layer of bone. This may reduce pressure within the bone and create an open area for new blood vessels to grow. Sometimes a piece of healthy bone with good blood vessels (bone graft) is put in this area to speed up the process. This procedure works best in the early stages of osteonecrosis and should help relieve pain and promote healing.
- **Osteotomy**—is a surgery that involves taking out a piece of bone, usually a wedge, to reposition the bone so that the tissue lacking blood supply (avascular area) bears less weight than an adjacent healthy area.
- **Arthroplasty**—is also referred to as joint replacement. The affected bone is removed and replaced with an artificial joint. This treatment may be needed in the late stages of osteonecrosis and when a joint is destroyed.

Health Promoting Behaviors/Interventions

- Avoid activities that put a lot of stress on your joints. Activities that stress the joints include running, jumping, football, soccer, volleyball, basketball and similar sports. Activities that are good for joints with osteonecrosis are swimming and bicycling.
- Be consistent with recommended exercises.
- Rest joints when they hurt.
- Let your healthcare provider or physical therapist know if there are any changes in your symptoms.
- Take pain or anti-inflammatory medications as prescribed.

Resources

- National Institute of Arthritis and Musculoskeletal and Skin Diseases
National Institutes of Health, 1 AMS Circle, Bethesda, MD 20892-3675
Phone: 301-495-4484 or 877-226-4267 (toll free), TTY: 301-565-2966
Fax: 301-718-6366. Web: <https://www.niams.nih.gov/health-topics/osteonecrosis>
- American Academy of Orthopaedic Surgeons
9400 West Higgins Road, Rosemont, IL 60018
Phone: 847-823-7186 (toll free). Web: www.aaos.org

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Musculoskeletal and Skin Diseases, January 2001, and “Avascular Necrosis – Do You Know” by St. Jude Children’s Research Hospital, used with permission.

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Additional health information for childhood cancer survivors is available at www-survivorshipguidelines.org

Note: Throughout this *Health Links* series, the term “childhood cancer” is used to designate pediatric cancers that may occur during childhood, adolescence, or young adulthood. Health Links are designed to provide health information for survivors of pediatric cancer, regardless of whether the cancer occurred during childhood, adolescence, or young adulthood.

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