CONDITION

Osteosarcoma

Osteosarcoma is a bone cancer that begins in cells that normally make new bone.

WHAT IT IS
Bone cancer arising from bone-forming cells

BODY SYSTEM
Bones and nearby soft tissues

MAIN SYMPTOMS
Persistent bone pain, swelling, reduced movement, unexplained fracture

WHAT CAUSES IT
Usually unknown; rarely inherited or linked to prior radiation

HOW IT IS DIAGNOSED
Imaging and biopsy examined by a specialist pathologist

MAIN TREATMENT
Chemotherapy and surgery; sometimes radiotherapy

CAN IT BE CURED?
Sometimes - especially when localized and fully removable

IS IT AN EMERGENCY?
Sometimes - sudden severe pain or breathing difficulty

LONG-TERM OUTLOOK
Best when localized; harder to treat after spread

Overview

Osteosarcoma is a type of cancer that starts in bone-forming cells. These abnormal cells make immature bone tissue, but the tissue does not develop into healthy, strong bone.

It can begin in any bone. It most often affects the long bones of the arms or legs, particularly near the knee or at the upper end of the arm. It can also develop in areas such as the pelvis or jaw.

Osteosarcoma is most often diagnosed in children, teenagers, and young adults, when bones are growing quickly. It can also affect older adults. Most bone pain is not caused by cancer, but persistent or worsening symptoms need assessment.

The condition matters because it can damage the affected bone and spread to other parts of the body. The lungs are the most common place for it to spread. Treatment is usually planned

by a specialist bone sarcoma team and often combines chemotherapy with an operation.

Some osteosarcomas grow quickly and require intensive treatment. Less common, lower-grade forms may grow more slowly and can sometimes be managed mainly with surgery.

Symptoms

Pain in or around a bone is the most common symptom. It may initially come and go, seem related to exercise, or feel like a sports injury. Over time, it may become more frequent, occur at rest, or disturb sleep.

Other possible symptoms include:

Swelling may not appear until some time after the pain begins. A tumour in a deep bone, such as the pelvis, may not cause an obvious lump.

Less commonly, osteosarcoma that has spread to the lungs can cause a lasting cough, chest discomfort, or shortness of breath. Many other conditions cause these symptoms, so they do not by themselves mean that cancer is present.

- Swelling, a lump, or tenderness over a bone
- Stiffness or reduced movement in a nearby joint
- A limp or difficulty using the affected arm or leg
- A fracture after a minor injury because the bone has weakened

Causes and risk factors

In most people, the cause of osteosarcoma is unknown. It begins when genetic changes make a bone-forming cell grow and divide without the usual controls. These changes are usually acquired during life rather than inherited from a parent.

Risk is higher during periods of rapid bone growth, which helps explain why osteosarcoma often occurs during adolescence. Being tall or growing quickly does not mean someone will develop it.

A small number of cases are associated with inherited conditions that increase cancer risk. These include hereditary retinoblastoma, which involves the `RB1` gene, and Li-Fraumeni syndrome, which usually involves the `TP53` gene. Most people with osteosarcoma do not have one of these syndromes and do not pass the condition to their children.

Other established risk factors include previous high-dose radiotherapy to the affected area and certain long-standing bone conditions, particularly Paget's disease of bone in older adults.

An injury does not cause osteosarcoma. An injury may draw attention to pain or swelling that was already present.

Diagnosis

Assessment usually begins with questions about the symptoms and an examination of the painful or swollen area. An X-ray can show changes in the bone that need further investigation.

If osteosarcoma is suspected, further imaging may include:

Blood tests can help assess general health and organ function, but no blood test can confirm osteosarcoma.

A biopsy is required for confirmation. During a biopsy, a specialist removes a small sample of the tumour. A pathologist then examines the tissue under a microscope and may perform additional laboratory tests.

The biopsy should be planned by the sarcoma team that would carry out any later operation. The path through which the sample is taken may need to be removed with the tumour, so careful planning can protect future surgical options.

Tests also establish whether the cancer is localized to its original area or has spread. The tumour's grade describes how abnormal its cells look and how likely it is to behave aggressively. These findings guide treatment and help the team discuss outlook.

- MRI to show the tumour's size and its relationship to muscles, joints, nerves, and blood vessels
- CT of the chest to look for spread to the lungs
- A bone scan or PET scan to look for tumours elsewhere in the skeleton or body

Treatment and management

Treatment is coordinated by a team experienced in bone sarcoma. The team may include cancer specialists, orthopaedic surgeons, radiologists, pathologists, physiotherapists, specialist nurses, and rehabilitation professionals.

Most people with a high-grade osteosarcoma receive chemotherapy before surgery. This treats cancer cells throughout the body and may make the tumour easier to remove. The tumour is then removed surgically, followed by more chemotherapy. Examination of the

removed tissue shows how much of the tumour responded to the first phase of chemotherapy.

The aim of surgery is to remove the entire tumour with a rim of healthy tissue around it. Limb-sparing surgery is possible for many tumours in an arm or leg. The removed section of bone may be replaced with a metal implant, a bone graft, or a combination of materials.

Amputation is sometimes the safest or most effective option. It may be considered when the tumour involves important nerves or blood vessels, when a severe fracture or infection limits reconstruction, or when removing the tumour while keeping a useful limb is not possible. Rehabilitation and modern prosthetic limbs can support mobility and independence.

Some low-grade osteosarcomas can be treated with surgery without chemotherapy. The exact approach is based on the tumour's type, grade, site, and extent.

Osteosarcoma is generally less sensitive to radiotherapy than some other cancers. Radiotherapy may still be considered when surgery cannot remove all of the tumour, when an operation is not possible, or to relieve symptoms.

If the cancer has spread, treatment may combine chemotherapy with surgery to remove the original tumour and any removable areas of spread, including lung tumours. Clinical trials may offer access to treatments being studied, particularly if osteosarcoma returns or does not respond to standard treatment.

Supportive care is part of treatment. It can include pain control, help with nausea, fertility discussions, nutritional support, emotional care, physiotherapy, and practical support for school or work.

Complications

Osteosarcoma can weaken a bone enough to cause a fracture. It may also grow into nearby muscles, joints, nerves, or blood vessels, affecting movement or limb function.

Cancer cells can spread through the bloodstream. The lungs are the most common site, although other bones and areas of the body can also be affected. Osteosarcoma may return near the original site or elsewhere after treatment.

Treatment can cause short-term problems such as tiredness, infection risk, nausea, mouth soreness, and changes in blood counts. Some chemotherapy medicines can affect hearing, kidneys, the heart, or fertility. Surgery may cause stiffness, weakness, altered sensation, infection, or problems with an implant.

Some effects appear years later. These can include reduced joint movement, differences in limb growth, implant wear, heart or hearing problems, and, rarely, a second cancer related to

treatment. Follow-up is intended to identify these issues early and arrange appropriate support.

Prevention

There is no known way to prevent most osteosarcomas. They usually develop without a clear avoidable cause, and ordinary exercise, diet, or an injury does not cause them.

People with an inherited cancer syndrome cannot prevent the genetic change they were born with. Specialist genetic counselling can explain family risk and whether monitoring is appropriate.

Radiotherapy is used only when its expected benefit outweighs its long-term risks. People who previously received radiotherapy should report a new, persistent lump, swelling, or bone pain in the treated area.

Living with it and what to expect

Treatment for high-grade osteosarcoma commonly takes many months. Chemotherapy, surgery, and rehabilitation can interrupt school, work, sport, and family routines. Energy and mobility may change from week to week.

Recovery after surgery is gradual. Physiotherapy helps rebuild strength, movement, balance, and confidence. A person with a limb reconstruction may need to protect the implant from certain high-impact activities. Someone with an amputation may need adjustments to a prosthesis as their body, needs, or activity levels change.

After treatment, regular follow-up usually includes examinations and imaging of the original area and lungs. Appointments are more frequent at first and become less frequent over time. Follow-up also monitors growth, movement, organ health, hearing, fertility concerns, and emotional well-being.

Some people are cured and return to full lives after treatment. Others live with reduced movement, chronic discomfort, treatment effects, or uncertainty about recurrence. Outlook is generally better when the tumour is localized and can be completely removed. Cancer that has already spread, cannot be fully removed, or returns is more difficult to cure, although further treatment may control it or occasionally lead to long-term remission.

Fear before scans or follow-up visits is common. A cancer support service, counsellor, peer group, school support plan, or workplace adjustment may help. Survivorship care may continue for many years because some treatment effects develop later.

When to get medical help

Arrange a medical assessment for bone pain that persists, worsens, repeatedly returns, occurs at night, or is accompanied by swelling, a lump, a limp, or reduced movement. These symptoms commonly have non-cancerous causes, but they should not be ignored.

If you are being treated for osteosarcoma, contact your cancer team promptly about new symptoms, treatment side effects, or difficulty controlling pain. Fever during chemotherapy can indicate a serious infection and needs immediate advice from the treating cancer service, even if you otherwise feel well.

Seek urgent or emergency help for:

These symptoms do not always mean that osteosarcoma has worsened, but they require rapid assessment.

- Sudden severe bone pain, deformity, or inability to use a limb
- New or rapidly worsening breathing difficulty
- Chest pain, coughing up blood, fainting, or blue-grey lips
- New leg weakness, numbness, or loss of bladder or bowel control

Common questions

Is osteosarcoma curable?

Sometimes. Cure is more likely when the cancer is localized, responds to chemotherapy, and can be completely removed. Osteosarcoma that has spread or returned is harder to cure, but further surgery, chemotherapy, radiotherapy, or a clinical trial may still be considered.

How fast does osteosarcoma grow?

High-grade osteosarcoma can grow and spread over weeks or months. Lower-grade forms may grow more slowly. Scans and biopsy findings are needed to understand how a particular tumour is behaving.

Does bone pain mean I have osteosarcoma?

Usually not. Injuries, joint problems, infections, and many other conditions cause bone or limb pain. Pain that persists, worsens, occurs at night, or comes with swelling or reduced movement should be assessed.

Will I need an amputation?

Not necessarily. Many tumours in an arm or leg can be treated with limb-sparing surgery.

Amputation may be recommended if it offers the best chance of removing the tumour safely or of achieving a more reliable, useful limb.

Does osteosarcoma run in families?

Most cases do not. A small proportion are linked to inherited cancer syndromes. Genetic counselling may be offered when personal or family history suggests an inherited risk.

Can osteosarcoma come back after treatment?

Yes. It can return near the original bone or in another area, most often the lungs. Regular follow-up imaging is used to look for recurrence and monitor long-term treatment effects.

Sources

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