**OSTEOPOROSIS**

**DEFINITION AND DESCRIPTION**

Osteoporosis causes bones to become weak and brittle — so brittle that a fall or even mild stresses such as bending over or coughing can cause a break. Osteoporosis-related breaks most commonly occur in the hip, wrist or spine.

Bone is living tissue that is constantly being broken down and replaced. Osteoporosis occurs when the creation of new bone doesn't keep up with the loss of old bone.

Osteoporosis affects men and women of all races. But white and Asian women, especially older women who are past menopause, are at highest risk. Medicines, healthy diet and weight-bearing exercise can help prevent bone loss or strengthen already weak bones.

**Causes**

Your bones are in a constant state of renewal — new bone is made and old bone is broken down. When you're young, your body makes new bones faster than it breaks down old bones and your bone mass increases. After the early 20s this process slows, and most people reach their peak bone mass by age 30. As people age, bone mass is lost faster than it's created.

How likely you are to develop osteoporosis depends partly on how much bone mass you attained in your youth. Peak bone mass is partly inherited and varies also by ethnic group. The higher your peak bone mass, the more bone you have "in the bank" and the less likely you are to develop osteoporosis as you age.

**Risk factors**

Several factors can increase the likelihood that you'll develop osteoporosis — including your age, race, lifestyle choices, and medical conditions and treatments.

### **Unchangeable risks**

Some risk factors for osteoporosis are out of your control, including:

* **Your sex.** Women are much more likely to develop osteoporosis than are men.
* **Age.** The older you get, the greater your risk of osteoporosis.
* **Race.** You're at greatest risk of osteoporosis if you're white or of Asian descent.
* **Family history.** Having a parent or sibling with osteoporosis puts you at greater risk, especially if your mother or father fractured a hip.
* **Body frame size.** Men and women who have small body frames tend to have a higher risk because they might have less bone mass to draw from as they age.

### **Hormone levels**

Osteoporosis is more common in people who have too much or too little of certain hormones in their bodies. Examples include:

* **Sex hormones.** Lowered sex hormone levels tend to weaken bone. The fall in estrogen levels in women at menopause is one of the strongest risk factors for developing osteoporosis. Treatments for prostate cancer that reduce testosterone levels in men and treatments for breast cancer that reduce estrogen levels in women are likely to accelerate bone loss.
* **Thyroid problems.** Too much thyroid hormone can cause bone loss. This can occur if your thyroid is overactive or if you take too much thyroid hormone medicine to treat an underactive thyroid.
* **Other glands.** Osteoporosis has also been associated with overactive parathyroid and adrenal glands.

### **Dietary factors**

Osteoporosis is more likely to occur in people who have:

* **Low calcium intake.** A lifelong lack of calcium plays a role in the development of osteoporosis. Low calcium intake contributes to diminished bone density, early bone loss and an increased risk of fractures.
* **Eating disorders.** Severely restricting food intake and being underweight weakens bone in both men and women.
* **Gastrointestinal surgery.** Surgery to reduce the size of your stomach or to remove part of the intestine limits the amount of surface area available to absorb nutrients, including calcium. These surgeries include those to help you lose weight and for other gastrointestinal disorders.

### **Steroids and other medicines**

Long-term use of oral or injected corticosteroid medicines, such as prednisone and cortisone, interferes with the bone-rebuilding process. Osteoporosis has also been associated with medications used to combat or prevent:

* Seizures.
* Gastric reflux.
* Cancer.
* Transplant rejection.

### **Medical problems**

The risk of osteoporosis is higher in people who have certain medical problems, including:

* Celiac disease.
* Inflammatory bowel disease.
* Kidney or liver disease.
* Cancer.
* Multiple myeloma.
* Rheumatoid arthritis.

### **Lifestyle choices**

Some bad habits can increase your risk of osteoporosis. Examples include:

* **Sedentary lifestyle.** People who spend a lot of time sitting have a higher risk of osteoporosis than do those who are more active. Any weight-bearing exercise and activities that promote balance and good posture are good for your bones, but walking, running, jumping, dancing and weightlifting seem particularly helpful.
* **Excessive alcohol consumption.** Regular consumption of more than two alcoholic drinks a day increases the risk of osteoporosis.
* **Tobacco use.** The exact role tobacco plays in osteoporosis isn't clear, but it has been shown that tobacco use contributes to weak bones.

**Symptoms**

There typically are no symptoms in the early stages of bone loss. But once your bones have been weakened by osteoporosis, you might have signs and symptoms that include:

* Back pain, caused by a broken or collapsed bone in the spine.
* Loss of height over time.
* A stooped posture.
* A bone that breaks much more easily than expected.

### **When to see a doctor**

You might want to talk to your health care provider about osteoporosis if you went through early menopause or took corticosteroids for several months at a time, or if either of your parents had hip fractures.

**Complication**

Bone breaks, particularly in the spine or hip, are the most serious complications of osteoporosis. Hip fractures often are caused by a fall and can result in disability and even an increased risk of death within the first year after the injury.

In some cases, broken bones in the spine can occur even if you haven't fallen. The bones that make up your spine, called vertebrae, can weaken to the point of collapsing, which can result in back pain, lost height and a hunched-forward posture.

**Prevention**

Good nutrition and regular exercise are essential for keeping your bones healthy throughout your life.

### **Calcium**

Men and women between the ages of 18 and 50 need 1,000 milligrams of calcium a day. This daily amount increases to 1,200 milligrams when women turn 50 and men turn 70.

Good sources of calcium include:

* Low-fat dairy products.
* Dark green leafy vegetables.
* Canned salmon or sardines with bones.
* Soy products, such as tofu.
* Calcium-fortified cereals and orange juice.

If you find it difficult to get enough calcium from your diet, consider taking calcium supplements. However, too much calcium has been linked to kidney stones. Although yet unclear, some experts suggest that too much calcium, especially in supplements, can increase the risk of heart disease.

The Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine recommends that total calcium intake, from supplements and diet combined, should be no more than 2,000 milligrams daily for people older than 50.

### **Vitamin D**

Vitamin D improves the body's ability to absorb calcium and improves bone health in other ways. People can get some of their vitamin D from sunlight, but this might not be a good source if you live in a high latitude, if you're housebound, or if you regularly use sunscreen or avoid the sun because of the risk of skin cancer.

Dietary sources of vitamin D include cod liver oil, trout and salmon. Many types of milk and cereal have been fortified with vitamin D.

Most people need at least 600 international units (IU) of vitamin D a day. That recommendation increases to 800 IU a day after age 70.

People without other sources of vitamin D and especially with limited sun exposure might need a supplement. Most multivitamin products contain between 600 and 800 IU of vitamin D. Up to 4,000 IU of vitamin D a day is safe for most people.

### **Exercise**

Exercise can help you build strong bones and slow bone loss. Exercise will benefit your bones no matter when you start, but you'll gain the most benefits if you start exercising regularly when you're young and continue to exercise throughout your life.

Combine strength training exercises with weight-bearing and balance exercises. Strength training helps strengthen muscles and bones in your arms and upper spine. Weight-bearing exercises — such as walking, jogging, running, stair climbing, skipping rope, skiing and impact-producing sports — affect mainly the bones in your legs, hips and lower spine. Balance exercises such as tai chi can reduce your risk of falling especially as you get older.

## **Diagnosis**

Your bone density can be measured by a machine that uses low levels of X-rays to determine the proportion of minerals in your bones. During this painless test, you lie on a padded table as a scanner passes over your body. In most cases, only certain bones are checked — usually in the hip and spine.

**Treatment**

Treatment recommendations are often based on an estimate of your risk of breaking a bone in the next 10 years using information such as the bone density test. If your risk isn't high, treatment might not include medication and might focus instead on modifying risk factors for bone loss and falls.

### **Bisphosphonates**

For both men and women at increased risk of broken bones, the most widely prescribed osteoporosis medications are bisphosphonates. Examples include:

* Alendronate (Binosto, Fosamax).
* Risedronate (Actonel, Atelvia).
* Ibandronate.
* Zoledronic acid (Reclast, Zometa).

Side effects include nausea, abdominal pain and heartburn-like symptoms. These are less likely to occur if the medicine is taken properly. Intravenous forms of bisphosphonates don't cause stomach upset but can cause fever, headache and muscle aches.

A very rare complication of bisphosphonates is a break or crack in the middle of the thigh bone. A second rare complication is delayed healing of the jawbone, called osteonecrosis of the jaw. This can occur after an invasive dental procedure, such as removing a tooth.

### **Denosumab**

Compared with bisphosphonates, denosumab (Prolia, Xgeva) produces similar or better bone density results and reduces the chance of all types of breaks. Denosumab is delivered via a shot under the skin every six months.

Similar to bisphosphonates, denosumab has the same rare complication of causing breaks or cracks in the middle of the thigh bone and osteonecrosis of the jaw. If you take denosumab, you might need to continue to do so indefinitely. Recent research indicates there could be a high risk of spinal column fractures after stopping the drug.

### **Hormone-related therapy**

Estrogen, especially when started soon after menopause, can help maintain bone density. However, estrogen therapy can increase the risk of breast cancer and blood clots, which can cause strokes. Therefore, estrogen is typically used for bone health in younger women or in women whose menopausal symptoms also require treatment.

Raloxifene (Evista) mimics estrogen's beneficial effects on bone density in postmenopausal women, without some of the risks associated with estrogen. Taking this drug can reduce the risk of some types of breast cancer. Hot flashes are a possible side effect. Raloxifene also may increase your risk of blood clots.

In men, osteoporosis might be linked with a gradual age-related decline in testosterone levels. Testosterone replacement therapy can help improve symptoms of low testosterone, but osteoporosis medications have been better studied in men to treat osteoporosis and thus are recommended alone or in addition to testosterone.

### **Bone-building medicines**

If you have severe osteoporosis or if the more common treatments for osteoporosis don't work well enough, your doctor might suggest trying:

* **Teriparatide (Bonsity, Forteo).** This powerful drug is similar to parathyroid hormone and stimulates new bone growth. It's given by daily injection under the skin for up to two years.
* **Abaloparatide (Tymlos)** is another drug similar to parathyroid hormone. This drug can be taken for only two years.
* **Romosozumab (Evenity).** This is the newest bone-building medicine to treat osteoporosis. It is given as an injection every month at your doctor's office and is limited to one year of treatment.

After you stop taking any of these bone-building medications, you generally will need to take another osteoporosis drug to maintain the new bone growth.

**Lifestyle and home remedy**

These suggestions might help reduce your risk of developing osteoporosis or breaking bones:

* **Don't smoke.** Smoking increases rates of bone loss and the chance of fracture.
* **Limit alcohol.** Consuming more than two alcoholic drinks a day may decrease bone formation. Being under the influence of alcohol also can increase your risk of falling.
* **Prevent falls.** Wear low-heeled shoes with nonslip soles and check your house for electrical cords, area rugs and slippery surfaces that might cause you to fall. Keep rooms brightly lit, install grab bars just inside and outside your shower door, and make sure you can get into and out of your bed easily.

## **Outlook / Prognosis**

You should expect to manage osteoporosis for a long time, usually the rest of your life. You’ll need regular appointments with a healthcare provider and bone density tests. Your provider will monitor any changes in your bone density and will adjust your treatments as needed.

## **Living With**

Following a diet and exercise plan that’s healthy for you will help you maintain your bone (and overall) health. See a healthcare provider for regular checkups. They’ll also help catch any issues or symptoms that affect your bones as soon as possible.

Talk to your provider about a bone density test if you’re over 65 or have a family history of osteoporosis.

**Common Questions**

### **What is the life expectancy of someone with osteoporosis?**

Osteoporosis itself isn’t fatal and won’t change your life expectancy (how long you’ll live). But it can make you more likely to experience a bone fracture (and can increase your risk of more severe breaks or complications from a fracture). Some studies have found that hip fractures in adults older than 65 lead to reduced mobility and an earlier death.

Talk to your healthcare provider if you’re worried about your risk of falls or bone fractures. They’ll help you stay safe and healthy.

## Diagnostic Considerations

The differential diagnosis of osteoporosis is very extensive. When dealing with reduced bone density, always rule out the other possible causes before treating the patient for osteoporosis. Many patients have a coexisting cause of bone loss.

The differential diagnosis of an atraumatic compression fracture may include osteomalacia, tumor, osteonecrosis, infection, and other bone-softening metabolic disorders. Metastatic bone disease should always be ruled out when a patient incurs multiple fractures.

Osteoporosis may be confused with osteomalacia, but in osteoporosis the bones are porous and brittle, whereas in osteomalacia the bones are soft. This difference in bone consistency is related to the ratio of mineral to organic material (principally, collagen). In osteoporosis, the mineral-to-collagen ratio is within the reference range, whereas in osteomalacia, the proportion of mineral composition is reduced relative to organic matrix content.

Sometimes a patient's first fracture is the sentinel event that alerts the clinician to an underlying disorder leading to osteoporosis.

Other conditions to be considered include the following:

* Leukemia
* Lymphoma
* Fractures secondary to bone metastases from cancer
* Pediatric osteogenesis imperfecta
* Renal osteodystrophy

## **Differential Diagnoses**

* Homocystinuria/Homocysteinemia
* Hyperparathyroidism
* Osteomalacia and Renal Osteodystrophy Imaging
* Mastocytosis
* Multiple Myeloma
* Paget Disease
* Scurvy (Vitamin C Deficiency)
* Sickle Cell Disease (SCD)

## **Epidemiology**

According to the National Osteoporosis Foundation (NOF), in the United States in 2010 more than 10 million adults aged 50 years and older had osteoporosis and more than 43 million had low bone mineral density (BMD). In the United States in 2015, as many as 2 million Medicare beneficiaries sustained 2.3 million osteoporotic fractures. Within 12 months of experiencing a new osteoporotic fracture, approximately 15% of patients suffered one or more subsequent fractures and nearly 20% died. Mortality was highest in those with hip fracture, with 30% dying within 12 months.The NOF reported in 2018 that approximately 10.2 million adults in the United States have osteoporosis, with an additional 43.4 million having low bone mass.

Most studies assessing the prevalence and incidence of osteoporosis use the rate of fracture as a marker for the presence of this disorder, although BMD also relates to risk of disease and fracture. The risk of new vertebral fractures increases by a factor of 2-2.4 for each standard deviation (SD) decrease of BMD measurement. Women and men with metabolic disorders associated with secondary osteoporosis have a 2- to 3-fold higher risk of hip and vertebral fractures.

Globally, osteoporosis is by far the most common metabolic bone disease, estimated to affect over 200 million people worldwide.An estimated 75 million people in Europe, the United States, and Japan have osteoporosis.

### Age- and sex-related demographics

The risk for osteoporosis increases with age as BMD declines. Senile osteoporosis is most common in persons aged 70 years or older. Secondary osteoporosis, however, can occur in persons of any age. Although bone loss in women begins slowly, it speeds up around the time of menopause, typically at about age 50 years or later. The frequency of postmenopausal osteoporosis is highest in women aged 50-70 years.

The number of osteoporotic fractures increases with age. Wrist fractures typically occur first, when individuals are aged approximately 50-59 years.

Vertebral fractures occur more often in the seventh decade of life. Jensen et al studied Danish women aged 70 years and found a 21% prevalence of vertebral fractures.Melton et al reported that 27% of women in their study had evidence of vertebral fractures by age 65 years.

Ninety percent of hip fractures occur in persons aged 50 years or older, occurring most often in the eighth decade of life.

Women are at a significantly higher risk for osteoporosis. Half of all postmenopausal women will have an osteoporosis-related fracture during their lifetime; 25% of these women will develop a vertebral deformity, and 15% will experience a hip fracture.Risk factors for hip fracture are similar in different ethnic groups.

Men have a higher prevalence of secondary osteoporosis, with an estimated 45-60% of cases being a consequence of hypogonadism, alcoholism, or glucocorticoid excess.Only 35-40% of osteoporosis diagnosed in men is considered primary in nature. Overall, osteoporosis has a female-to-male ratio of 4:1.

Although loss of BMD is typically associated with postmenopausal women, a study to assess the likelihood of low BMD and related risk factors for osteoporosis in men and women aged 35 to 50 years found higher rates of osteopenia in men: 28% of men and 26% of women had osteopenia at the femoral neck region, and 6% and 2%, respectively, had osteoporosis of the lumbar spine. Of the 173 study subjects, 92 (53%) were women and 162 (94%) were white; none had previously known health issues or were taking medications that can affect BMD.

Fifty percent of all women and 21% of all men older than 50 years experience one or more osteoporosis-related fractures in their lifetime.Eighty percent of hip fractures occur in women.Women have a two-fold increase in the number of fractures resulting from non traumatic causes, as compared with men of the same age.

### Racial demographics

Osteoporosis can occur in persons of all races and ethnicities. In general, however, whites (especially of northern European descent) and Asians are at increased risk. In particular, non-Hispanic white women and Asian women are at higher risk for osteoporosis. In the most recent government census, 178 million Chinese were over 60 years old in 2009, a number that the United Nations estimates may reach 437 million—one-third of the population—by 2050.

These numbers suggest that approximately 50% of all hip fractures will occur in Asia in the next century. In fact, although age-standardized incidence rates of fragility fractures, particularly of the hip and forearm, have been noted to be decreasing in many countries over the last decade, that is not the case in Asia.

Table 4, below, summarizes some osteoporosis prevalence statistics among racial/ethnic groups. Note that this disease is under-recognized and undertreated in white and black women. Relative to other racial/ethnic groups, the risk of developing osteoporosis is increasing fastest among Hispanic women.

Table 4. Prevalence of Osteoporosis Among Racial and Ethnic Groups

| Race/Ethnicity | Sex (age ≥50 y) | % Estimated to have osteoporosis | % Estimated to have low bone mass |
| --- | --- | --- | --- |
| Non-Hispanic white; Asian | Women | 15.8 | 52.6 |
| Men | 3.9 | 36 |
| Non-Hispanic black | Women | 7.7 | 36.2 |
| Men | 1.3 | 21.3 |
| Hispanic | Women | 20.4 | 47.8 |
| Men | 5.9 | 38.3 |
|  | | | |

Melton et al reported that the prevalence of hip fractures is higher in white populations, regardless of geographic location.Another study indicated that, in the United States and South Africa, the incidence of hip fractures was lower in Black persons than in age-matched white persons. Cauley et al found that the absolute fracture incidence across BMD distribution was 30-40% lower in Black women than in white women. This lower fracture risk was independent of BMD and other risk factors

**osteoporosis treatment drugs and their common side effects**

## 1. Bisphosphonates (Antiresorptive agents)

These drugs prevent bone loss, increase bone density, and reduce fracture risk. They are often first-line treatments.

* Examples:
  + Alendronate (Fosamax™)
  + Risedronate (Actonel™, Atelvia™)
  + Ibandronate (Boniva™)
  + Zoledronic acid (Reclast™)
* How taken:  
  Oral tablets (daily, weekly, or monthly) or intravenous infusions (quarterly or yearly).
* Common side effects:
  + Gastrointestinal irritation (esophageal irritation, heartburn) with oral forms
  + Flu-like symptoms after IV infusion
  + Rarely, osteonecrosis of the jaw (ONJ)
  + Rare atypical femur fractures with long-term use

## 2. Denosumab (Prolia™) (Biologic, Antiresorptive)

A monoclonal antibody that inhibits osteoclast formation, reducing bone resorption.

* How taken:  
  Subcutaneous injection every 6 months.
* Common side effects:
  + Muscle or joint pain
  + Skin rashes
  + Increased risk of infections
  + Risk of rapid bone loss and fractures if stopped abruptly (requires careful management)

## 3. Selective Estrogen Receptor Modulators (SERMs)

Mimic estrogen effects on bone to reduce bone turnover and fracture risk, especially vertebral fractures.

* Example:
  + Raloxifene (Evista™)
* How taken:  
  Oral daily tablet.
* Common side effects:
  + Hot flashes
  + Leg cramps
  + Increased risk of blood clots (deep vein thrombosis)

## 4. Parathyroid Hormone Analogues (Anabolic agents)

Stimulate new bone formation, increasing bone density and strength.

* Examples:
  + Teriparatide (Forteo™)
  + Abaloparatide (Tymlos™)
* How taken:  
  Daily subcutaneous injections.
* Common side effects:
  + Nausea
  + Headache
  + Dizziness
  + Leg cramps
* Note: Treatment usually limited to 2 years, followed by antiresorptive therapy.

## 5. Romosozumab (Evenity™) (Anabolic and Antiresorptive)

Monoclonal antibody that blocks sclerostin, increasing bone formation and decreasing resorption.

* How taken:  
  Monthly subcutaneous injections (two injections per dose), usually for 12 months.
* Common side effects:
  + Joint or muscle pain
  + Injection site reactions
  + Possible increased risk of cardiovascular events (use caution in patients with heart disease)

## 6. Hormone Replacement Therapy (Estrogen or Estrogen-Progestin)

Used mainly in postmenopausal women to maintain bone density.

* Common side effects:
  + Increased risk of blood clots
  + Breast tenderness
  + Possible increased risk of certain cancers with long-term use

## **Genetic Influence on Osteoporosis**

* Heritability of Bone Mineral Density (BMD):  
  Twin and family studies estimate that 25% to 85% of BMD variation is inherited, making genetics one of the strongest determinants of bone strength and osteoporosis risk.
* Polygenic Nature:  
  Osteoporosis is a polygenic disorder, meaning multiple genes each contribute modestly to bone mass, bone turnover, and fracture risk. Rarely, single-gene mutations cause monogenic forms of osteoporosis.
* Key Genes and Genetic Regions Identified:
  + BMP2 (Bone Morphogenetic Protein 2): Located on Chromosome 20, involved in bone and cartilage formation.
  + VDR (Vitamin D Receptor): Influences calcium absorption and bone metabolism.
  + ESR1 and ESR2 (Estrogen Receptors 1 and 2): Affect bone remodeling through estrogen signaling.
  + COL1A1 (Collagen Type I Alpha 1): Important for bone matrix strength.
  + STAT1: A gene involved in bone cell regulation.
  + DAAM2: Recently associated with decreased bone strength in large population studies.
* Genome-Wide Association Studies (GWAS):  
  Large-scale GWAS involving hundreds of thousands of individuals have identified numerous single nucleotide polymorphisms (SNPs) linked to osteoporosis risk and BMD variation, although many causal genes remain to be fully defined.
* Gene-Environment Interaction:  
  Genetic predisposition interacts with environmental factors such as diet, physical activity, and lifestyle. Healthy behaviors can mitigate genetic risk.
* Monogenic Osteoporosis:  
  Rare familial forms caused by mutations in single genes provide insight into bone metabolism pathways and potential therapeutic targets

## **Doctor-Patient Conversation on Osteoporosis**

Doctor:  
“Hello, I want to talk with you about your recent diagnosis of osteoporosis. This means your bones have become weaker and more likely to break, even with minor falls or injuries.”

Patient:  
“That sounds worrying. What should I know about this condition?”

Doctor:  
“Osteoporosis is common, especially as we age, but there are many things we can do to manage it. It’s important you understand your condition, the risks, and the treatments available. I’ll explain everything clearly, and please feel free to ask questions at any time.”

Patient:  
“I’m afraid of fractures and pain. How can I protect myself?”

Doctor:  
“Your fear is understandable. We’ll work together to reduce your fracture risk through medications, lifestyle changes like diet and exercise, and fall prevention strategies. We’ll also monitor your bone density regularly with scans.”

Patient:  
“What treatments are there, and what are the side effects?”

Doctor:  
“There are several treatment options, including medications that strengthen your bones. Some common drugs are bisphosphonates, which can have side effects like stomach upset, but we monitor you closely. Other treatments include injections or hormone-related therapies. We’ll choose the best option based on your health and preferences.”

Patient:  
“I sometimes feel pain and stiffness. Is that normal?”

Doctor:  
“Some people with osteoporosis experience back pain or fractures that cause discomfort. It’s important to report any new pain, especially in your back or hips. We’ll investigate and manage symptoms carefully.”

Patient:  
“How often will I need to see you or have tests?”

Doctor:  
“We’ll schedule regular follow-ups and bone density scans to track your progress and adjust treatment as needed. You’re not alone in this—we have support groups and resources to help you.”

Patient:  
“I appreciate you taking the time to explain. It helps to know what to expect.”

Doctor:  
“I’m here to support you. Managing osteoporosis is a partnership, and your questions and concerns are important. Let’s work together to keep your bones strong and your quality of life high.”

REFERENCES

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### **OsteomaLacia**

Osteomalacia is a condition in which your bones soften and weaken, causing them to break more easily.

It most often affects adults due to a lack of vitamin D. Your body needs vitamin D to absorb calcium and phosphorus. These minerals help your bones maintain their strength and hardness. Without enough vitamin D, your bones don’t mineralize as they usually would. This leads to bone fragility.

In children, inadequate concentrations of vitamin D may cause a similar condition called rickets.

You may not notice osteomalacia at first. But over time, it can cause bone pain, usually in the lower half of your body. Eventually, you may feel pain all over your body. Simple movements may hurt. Know that you don’t have to live with this pain. Reach out to a healthcare provider. They can help find the cause and offer treatment options.

## **Symptoms and Causes**

The main symptom of osteomalacia is bone pain. It most commonly affects your hips, pelvis and legs.

Other osteomalacia symptoms may include:

* Bones that break more easily
* Muscle pain, stiffness and weakness, especially after being active
* Difficulty walking or a change in your gait
* Muscle spasms or cramps, especially in your hands and feet
* “Pins-and-needles” feeling (paresthesia) in your arms and legs
* More frequent falls

### **Cause of osteomalacia**

Osteomalacia develops most commonly due to a vitamin D deficiency. This is often from not getting enough sunlight. But it may also be from not getting enough vitamin D from the foods you eat. Vitamin D is essential for calcium absorption and for maintaining bone health.

Other osteomalacia causes may include:

* A digestive condition that leads to malabsorption
* Kidney failure
* Liver disease
* Anti Seizure medications
* Certain rare genetic conditions

#### **Risk factors for osteomalacia**

When you’re in sunlight, your skin naturally produces vitamin D. Your skin may not produce enough vitamin D if you:

* Live in a cold, dark climate
* Work inside all day
* Wear clothing that covers most of your skin
* Have darker skin pigmentation

You may not be getting enough vitamin D from the foods you eat if you:

* Don’t consume any milk products
* Follow a vegetarian or vegan diet
* Have a condition that causes malabsorption, like Crohn’s disease or celiac disease
* Have recently had bariatric surgery, like gastric bypass surgery

Other people who have a higher risk of osteomalacia include those who:

* Have obesity
* Are age 65 and older
* Are pregnant or breastfeeding

## **Diagnosis and Tests**

Your healthcare provider will do a physical examination and ask about your family and medical history. They’ll also ask questions about your nutrition and activity level.

Your provider will recommend blood tests to check your levels of vitamin D, calcium and phosphorus. The most significant sign of osteomalacia is low levels of vitamin D. But low calcium or phosphorus levels may also point to osteomalacia.

To confirm a diagnosis, your provider may also check your levels of:

* Creatinine
* Electrolytes
* Alkaline phosphatase
* Parathyroid hormone

Other tests may include:

* 24-hour urine test to check the amount of calcium in your urine
* X-rays to look for any signs of bone weakening or fractures
* Bone mineral density scan to assess your bone density and monitor for bone loss
* Bone biopsy to see if you have bone softening

## **Management and Treatment**

Osteomalacia treatment includes the use of vitamin D, calcium and/or phosphorus supplements. Your healthcare provider will tell you how much of each of these you need to take. If you have malabsorption issues or recently had bariatric surgery, you may need to take larger doses of vitamin D and calcium.

While supplements should help treat osteomalacia, your symptoms may take several months to improve. Depending on the severity of osteomalacia, you may need to continue taking vitamin D for a long time. If you stop taking it, osteomalacia may return.

People with conditions like liver or kidney failure will need additional treatment and support. Your provider will want to monitor your blood levels regularly. You may need a special form of vitamin D.

Other treatments to relieve or correct osteomalacia symptoms may include:

* Getting enough sunlight exposure
* Eating more foods with vitamin D and calcium
* Wearing braces to reduce or prevent bone irregularities
* Surgery to correct bone deformities (in severe cases)

## **Outlook / Prognosis**

With early diagnosis and treatment (dietary supplements), most people will start to recover from osteomalacia within a few weeks. But it can still take up to six months for your bones to heal and strengthen again.

## **Prevention**

Yes, you can usually prevent osteomalacia by:

* Getting enough sunlight
* Getting enough vitamin D and calcium from the foods you eat

Depending on where you live and the time of year, you may be able to get enough vitamin D from sunlight alone. People with lighter skin typically need to expose themselves to 10 to 15 minutes of sunshine two to three times per week. People with darker skin usually need more time in the sun. This must be direct sunlight — not through windows or clothing.

Be careful not to spend too much time in the sun without sunscreen. Too much sun exposure can increase your risk for skin cancer. Ask your healthcare provider about how much time you should spend in the sun.

You won’t be able to get all the vitamin D you need through food alone, but it can help. Some foods naturally contain vitamin D. These include:

* Fatty fish like tuna, salmon, sardines and mackerel
* Rainbow trout
* Red meat
* Beef liver
* Mushrooms
* Egg yolks
* Cod liver oil

Other foods are fortified with vitamin D. Talk to your healthcare provider about which sources are best for you. As with anything, you have to weigh the pros and cons of various foods.

If you’re still not getting enough vitamin D through sunlight and food, your provider may recommend a supplement.

## **Living With**

As we age, taking care of our bones becomes even more important. To help maintain your bone health:

* Eat an adequate amount of food containing vitamin D and calcium.
* Expose yourself to an adequate amount of sunlight.
* Maintain a healthy weight for you.
* Get regular physical activity.
* Don’t smoke.
* If you drink beverages containing alcohol, do so in moderation.

### **When should I see my healthcare provider?**

If you have bone pain or any of the other osteomalacia symptoms, reach out to a healthcare provider. They can test your blood levels and determine if this condition is affecting you.

### **What questions should I ask my healthcare provider?**

It may be helpful to ask the following questions:

## Are dietary supplements alone enough to treat osteomalacia?

* Dietary supplements of vitamin D and calcium are the cornerstone of osteomalacia treatment and usually lead to recovery. However, treatment often takes several months (up to 6 months) for bones to heal and symptoms like pain and muscle weakness to improve.
* Depending on severity and underlying causes (e.g., kidney or liver disease), you may need long-term or special forms of vitamin D, and your doctor will monitor blood levels regularly.
* Simply stopping supplements too early can lead to recurrence, so adherence is important.

## 2. What other treatments do you recommend?

* Correcting any underlying conditions that cause vitamin D deficiency or impair bone metabolism (like kidney or liver disease) is essential.
* In rare cases, your doctor may prescribe high-dose vitamin D therapy (loading doses) followed by maintenance dosing.
* Pain management with analgesics may be needed while bones heal.
* Regular blood tests to monitor calcium, phosphate, vitamin D, and parathyroid hormone levels help guide treatment.

## 3. What activities should I avoid while I’m healing?

* Avoid intensive or high-impact exercise while your bones are healing, especially if you have fractures or bone pain.
* Activities that risk falls or trauma should be minimized to prevent fractures during recovery.
* Follow your healthcare provider’s advice about weight-bearing and mobility based on your individual condition.

## 4. What types of exercise can help treat or prevent this condition?

* Once healing begins and pain decreases, weight-bearing exercises like walking and gentle resistance training help strengthen bones and muscles.
* Exercises that improve balance and coordination can reduce fall risk.
* Avoid overexertion initially; a physiotherapist can tailor an exercise program appropriate for your stage of recovery.

## 5. What else can I do to prevent osteomalacia from affecting me in the future?

* Maintain adequate vitamin D levels through safe sun exposure: about 10-15 minutes of direct sunlight 2-3 times per week for lighter skin; longer for darker skin.
* Eat a balanced diet rich in calcium and vitamin D, including dairy products, leafy greens, fortified foods, and fish with edible bones.
* Avoid smoking and limit alcohol intake, as both can affect bone health.
* Continue vitamin D and calcium supplementation as advised, especially if you have risk factors like limited sun exposure or malabsorption.
* Regular check-ups and blood tests to monitor your bone health and vitamin D status.

**EPIDEMIOLOGY**

The prevalence of postmortem histological osteomalacia is as high as 25% in adult Europeans have been reported. However, the true global incidence of osteomalacia remains vastly underestimated. At-risk individuals include those with dark skin, limited sun exposure, low socioeconomic status, poor diet, and frequent wearers of full-body clothing. These risks vary worldwide and are contingent on geographic location, cultural preferences, and ethnicity. Healthcare professionals should take these factors, as well as other relevant clinical findings, into account when choosing to obtain further studies or recommending vitamin D supplementation

## **Differential Diagnosis for Osteomalacia**

* Osteoporosis:  
  Characterized by decreased bone density and increased fracture risk, but unlike osteomalacia, bone mineralization is normal. Radiographically, osteomalacia may show coarser trabeculae and Looser zones (pseudofractures), which are absent in osteoporosis.
* Rickets:  
  The pediatric equivalent of osteomalacia, caused by defective mineralization in growing bones.
* Scurvy:  
  Vitamin C deficiency causes defective collagen synthesis, leading to bone pain, swelling, and fractures.
* Osteogenesis imperfecta:  
  A genetic disorder causing brittle bones, frequent fractures, and bone deformities.
* Multiple myeloma:  
  A malignancy of plasma cells causing lytic bone lesions, bone pain, and fractures.
* Homocystinuria:  
  A metabolic disorder affecting connective tissue and bone, leading to osteoporosis-like features.
* Hyperparathyroidism:  
  Causes increased bone resorption and osteopenia, sometimes mimicking osteomalacia.
* Renal osteodystrophy:  
  Bone disease secondary to chronic kidney disease, with features overlapping osteomalacia and hyperparathyroidism.
* Hypophosphatasia:  
  A rare inherited disorder characterized by defective bone mineralization and low alkaline phosphatase.
* Other metabolic bone diseases:  
  Such as Paget’s disease, which can cause localized bone deformities and pain.
* Bone infections (osteomyelitis) and malignancies:  
  May present with localized bone pain and fractures.

## **TREATMENT DRUG AND THEIR SIDE EFFECTS**

## Vitamin D Supplements

* Ergocalciferol (Vitamin D2)
  + Brand names: Drisdol, Calciferol
  + Used to correct vitamin D deficiency causing osteomalacia.
  + Side effects: Hypercalcemia (high calcium levels), nausea, vomiting, weakness, headache, and rarely allergic reactions.
* Cholecalciferol (Vitamin D3)
  + Used similarly to ergocalciferol for vitamin D deficiency.
  + Side effects: Similar to ergocalciferol; excessive doses can cause hypercalcemia.
* Calcitriol (1,25-dihydroxyvitamin D3)
  + Active form of vitamin D, especially used in patients with kidney disease or impaired vitamin D metabolism.
  + Brand names: Calcitriol, Rocaltrol
  + Side effects: Hypercalcemia, hypercalciuria (high urine calcium), weakness, headache.
* Alfacalcidol
  + A vitamin D analogue used in osteomalacia related to renal failure or genetic disorders.
  + Side effects: Hypercalcemia, hyperphosphatemia, gastrointestinal discomfort.

## 2. Calcium Supplements

* Calcium carbonate, calcium phosphate, calcium gluconate, calcium lactate gluconate
  + Used to ensure adequate calcium levels to support bone mineralization.
  + Side effects: Constipation, bloating, hypercalcemia if overdosed.

## 3. Phosphate Supplements

* Used in cases of hypophosphatemic osteomalacia (e.g., genetic causes).
* Side effects: Diarrhea, abdominal discomfort, electrolyte imbalances.

## 4. Burosumab

* A monoclonal antibody used to treat X-linked hypophosphatemia, a rare inherited cause of osteomalacia.
* Side effects: Injection site reactions, headache, hypersensitivity reactions.

## Additional Treatment Notes

* Treatment duration can be several months to years, depending on severity and cause.
* Monitoring of serum calcium, phosphate, vitamin D, and kidney function is essential to avoid complications like hypercalcemia.
* Pain management may be needed during bone healing.

## **Genetic Causes and Key Genes in Osteomalacia**

* X-linked Hypophosphatemic Osteomalacia (XLH):  
  The most common genetic form, caused by mutations in the PHEX gene located on the X chromosome (Xp22.2 and Xp22.1). These mutations lead to increased levels of fibroblast growth factor 23 (FGF23), which reduces phosphate reabsorption in kidneys and impairs vitamin D metabolism, resulting in defective bone mineralization.
* FGF23 Gene:  
  Mutations or dysregulation of FGF23 itself contribute to phosphate wasting and osteomalacia. Elevated FGF23 is a hallmark of XLH and tumor-induced osteomalacia.
* Other Genetic Mutations:
  + ENPP1 gene: Mutations cause autosomal recessive hypophosphatemic rickets/osteomalacia, affecting phosphate metabolism and sometimes associated with other systemic features.
  + ACVR1/ALK2 gene: Mutations linked to aberrant bone formation pathways.
  + GNAS1 gene: Postzygotic mutations affecting cAMP signaling pathways have been implicated in some cases.
* Tumor-Induced Osteomalacia (TIO):  
  A rare paraneoplastic syndrome caused by phosphaturic mesenchymal tumors producing excess FGF23. Genetic studies reveal mutations in genes such as FGFR1 and MED12 in tumor DNA, which contribute to disease development

**Doctor-patient conversation about osteomalacia,**

Doctor:  
“Hello, I want to discuss your diagnosis of osteomalacia. This means your bones are softer than normal because they aren’t mineralizing properly, usually due to a deficiency of vitamin D or problems with calcium or phosphate metabolism.”

Patient:  
“What causes this condition? Is it serious?”

Doctor:  
“Osteomalacia is most commonly caused by low vitamin D levels, which can happen if you don’t get enough sunlight, have dietary deficiencies, or have conditions affecting absorption. It can cause bone pain, muscle weakness, and increase your risk of fractures, so it’s important to treat it properly.”

Patient:  
“What symptoms should I expect, and how will it affect me?”

Doctor:  
“You might experience widespread bone pain, especially in your hips and lower back, muscle weakness, and sometimes difficulty walking or a waddling gait. Some patients also have tenderness over certain bones or fractures in areas like the ribs or pelvis.”

Patient:  
“How is osteomalacia treated?”

Doctor:  
“The main treatment is vitamin D supplementation, often combined with calcium and sometimes phosphate supplements if needed. We may start with higher doses of vitamin D to correct the deficiency, then move to maintenance doses. It’s also important to address any underlying causes, like kidney disease or malabsorption.”

Patient:  
“How long will it take to get better? Are there any side effects from treatment?”

Doctor:  
“Improvement usually takes several months. You may notice less pain and better muscle strength as your bones heal. Vitamin D and calcium supplements are generally safe, but we monitor your blood levels to avoid side effects like high calcium, which can cause nausea or weakness.”

Patient:  
“Are there things I should avoid while I’m healing?”

Doctor:  
“Yes, it’s best to avoid high-impact activities or anything that risks falls or injury while your bones are soft. Rest and gentle movement are important initially. Once your symptoms improve, we’ll guide you on safe exercises.”

Patient:  
“What exercises can help me recover and prevent this in the future?”

Doctor:  
“Weight-bearing exercises like walking and gentle resistance training help strengthen bones and muscles. Balance exercises can reduce fall risk. We’ll tailor a program to your needs, often with the help of a physiotherapist.”

Patient:  
“How can I prevent osteomalacia from coming back?”

Doctor:  
“Maintain adequate vitamin D through safe sun exposure and a balanced diet rich in calcium and vitamin D, including dairy, fish, and fortified foods. If you have risk factors like limited sun exposure or certain medical conditions, continuing supplements as advised is important. Regular check-ups and blood tests help us monitor your bone health.”

Patient:  
“Thank you, doctor. This helps me understand what to expect and what I can do.”

Doctor:  
“You’re welcome. We’ll work together to manage your condition and support your recovery.”

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**PAGET DISEASE OF BONE(osteitis deformans)**

**DEFINITION AND DESCRIPTION**

Paget's (PAJ-its) disease of bone interferes with your body's normal recycling process, in which new bone tissue gradually replaces old bone tissue. Over time, bones can become fragile and misshapen. The pelvis, skull, spine and legs are most commonly affected.

The risk of Paget's disease of bone increases with age and if family members have the disorder. However, for reasons unknown to doctors, the disease has become less common over the past several years and is less severe when it does develop. Complications can include broken bones, hearing loss and pinched nerves in your spine.

Bisphosphonates — the medications used to strengthen bones weakened by osteoporosis — are the mainstay of treatment. Surgery may be necessary if complications occur.

### **Which bones are affected by Paget’s disease of the bone (osteitis deformans)?**

Any of your bones can be affected by Paget’s disease. However, your pelvis, skull, spine and leg bones (femur and tibia) are most commonly affected by Paget’s disease. Paget’s disease can affect one bone (monostotic) or many bones (polyostotic).

### **Who does Paget’s disease of the bone (osteitis deformans) affect?**

Anyone can develop Paget’s disease of the bone, but it’s more common in people who are over the age of 50. People who are from northern Europe or people who are from countries settled by European immigrants are more likely to develop Paget’s disease.

The number of cases of Paget’s disease of the bone varies from country to country. Paget's disease of the bone is more common in some European countries. Approximately 1% of the population in the United States has Paget’s disease of the bone.

### **Is Paget’s disease of the bone (osteitis deformans) cancer?**

Paget’s disease of the bone isn’t a form of cancer. However, in very rare cases, Paget’s disease of the bone can cause bone cancer (osteosarcoma).

Other conditions have the name of Paget’s that aren’t bone diseases, including:

* **Paget’s disease of the breast (also known as Paget’s disease of the nipple):** This is a rare form of breast cancer in which cancer cells form in or around your nipple.
* **Paget’s disease of the vulva:** This is a rare form of skin cancer that forms on the vulva.

These Paget’s diseases are distinct from Paget’s disease of the bone, and they aren’t related.

## **Causes**

The cause of Paget's bone disease is unknown. Scientists suspect a combination of environmental and genetic factors contribute to the disease. Several genes appear to be linked to getting the disease.

Some scientists believe Paget's disease of bone is related to a viral infection in your bone cells, but this theory is controversial.

## **Risk factors**

Factors that can increase your risk of Paget's disease of bone include:

* **Age.** People older than 50 are most likely to develop the disease.
* **Sex.** Men are more commonly affected than are women.
* **National origin.** Paget's disease of bone is more common in England, Scotland, central Europe and Greece — as well as countries settled by European immigrants. It's uncommon in Scandinavia and Asia.
* **Family history.** If you have a relative who has Paget's disease of bone, you're more likely to develop the condition.

## **Symptoms**

Most people who have Paget's disease of bone have no symptoms. When symptoms occur, the most common complaint is bone pain.

Because this disease causes your body to generate new bone faster than normal, the rapid remodeling produces bone that's less organized and weaker than normal bone, which can lead to bone pain, deformities and fractures.

The disease might affect only one or two areas of your body or might be widespread. Your signs and symptoms, if any, will depend on the affected part of your body.

* **Pelvis.** Paget's disease of bone in the pelvis can cause hip pain.
* **Skull.** An overgrowth of bone in the skull can cause hearing loss or headaches.
* **Spine.** If your spine is affected, nerve roots can become compressed. This can cause pain, tingling and numbness in an arm or leg.
* **Leg.** As the bones weaken, they may bend — causing you to become bowlegged. Enlarged and misshapen bones in your legs can put extra stress on nearby joints, which may cause osteoarthritis in your knee or hip.

## **When to see a doctor**

Talk to your doctor if you have:

* Pain in your bones and joints
* Tingling and weakness in an extremity
* Bone deformities
* Unexplained hearing loss, especially if it's only on one side

## **Diagnosis**

During the physical exam, your doctor will examine areas of your body that are causing you pain. He or she may also order X-rays and blood tests that can help confirm the diagnosis of Paget's disease of bone.

### **Imaging tests**

Bone changes can be revealed by:

* **X-rays.** The first indication of Paget's disease of bone is often abnormalities found on X-rays done for other reasons. X-ray images of your bones can show areas of bone breakdown, enlargement of the bone and deformities that are characteristic of the disease, such as bowing of your long bones.
* **Bone scan.** In a bone scan, radioactive material is injected into your body. This material travels to the spots on your bones most affected, and they light up on the scan images.

### **Lab tests**

People who have Paget's disease of bone usually have elevated levels of alkaline phosphatase in their blood, which can be revealed by a blood test.

## **Treatment**

If you don't have symptoms, you might not need treatment. However, if the disease is active — indicated by an elevated alkaline phosphatase level — and is affecting high-risk sites in your body, such as your skull or spine, your doctor might recommend treatment to prevent complications, even if you don't have symptoms.

### **Medications**

Osteoporosis drugs (bisphosphonates) are the most common treatment for Paget's disease of bone. Bisphosphonates are typically given by injection into a vein, but they can also be taken by mouth. When taken orally, bisphosphonates are generally well tolerated but can irritate the stomach.

Bisphosphonates that are given intravenously include:

* Zoledronic acid (Zometa, Reclast)
* Pamidronate (Aredia)
* Ibandronate (Boniva)

Oral bisphosphonates include:

* Alendronate (Fosamax, Binosto)
* Risedronate (Actonel, Atelvia)

Rarely, bisphosphonate therapy has been linked to severe muscle, joint or bone pain, which might not resolve when the medication is discontinued. Bisphosphonates can also increase the risk of a rare condition in which a section of jawbone dies and deteriorates, usually associated with active dental disease or oral surgery.

If you can't tolerate bisphosphonates, your doctor might prescribe calcitonin (Miacalcin), a naturally occurring hormone involved in calcium regulation and bone metabolism. Calcitonin is a drug that you administer to yourself by injection or nasal spray. Side effects may include nausea, facial flushing and irritation at the injection site.

### **Surgery**

In rare cases, surgery might be required to:

* Help fractures heal
* Replace joints damaged by severe arthritis
* Realign deformed bones
* Reduce pressure on nerves

Paget's disease of bone often causes the body to produce too many blood vessels in the affected bones, increasing the risk of serious blood loss during an operation.

If you're scheduled for surgery that involves bones affected by Paget's disease of bone, your doctor might prescribe medications to reduce the activity of the disease, which may help reduce blood loss during surgery.

## **Self care**

To reduce your risk of complications associated with Paget's disease of bone, try these tips:

* **Prevent falls.** Paget's disease of bone puts you at high risk of bone fractures. Ask your doctor for advice on preventing falls. He or she may recommend that you use a cane or a walker.
* **Fall-proof your home.** Remove slippery floor coverings, use non skid mats in your bathtub or shower, tuck away chords, and install handrails on stairways and grab bars in your bathroom.
* **Eat well.** Be sure your diet includes adequate levels of calcium and vitamin D, which helps bones absorb calcium. This is especially important if you're taking a bisphosphonate. Review your diet with your doctor and ask if you should take vitamin and calcium supplements.
* **Exercise regularly.** Regular exercise is essential for maintaining joint mobility and bone strength. Talk to your doctor before beginning an exercise program to determine the right type, duration and intensity of exercise for you. Some activities may place too much stress on your affected bones.

## **Complications**

In most cases, Paget's disease of bone progresses slowly. The disease can be managed effectively in nearly all people. Possible complications include:

* **Fractures and deformities.** Affected bones break more easily, and extra blood vessels in these deformed bones cause them to bleed more during repair surgeries. Leg bones can bow, which can affect your ability to walk.
* **Osteoarthritis.** Misshapen bones can increase the amount of stress on nearby joints, which can cause osteoarthritis.
* **Neurological problems.** When Paget's disease of bone occurs in an area where nerves pass through the bone, such as the spine and skull, the overgrowth of bone can compress and damage the nerve, causing pain, weakness or tingling in an arm or leg or hearing loss.
* **Heart failure.** In severe cases, your heart may have to work harder to pump blood to the affected areas of your body. Sometimes, this increased workload can lead to heart failure.
* **Bone cancer.** Bone cancer occurs in up to 1% of people with Paget's disease of bone.

### **Is there a cure for Paget’s disease of the bone (osteitis deformans)?**

There's currently no cure for Paget’s disease of the bone, but it’s treatable. The sooner Paget’s disease can be diagnosed and treated, the less likely that you’ll experience complications from the disease.

### **How long will I have Paget’s disease of the bone (osteitis deformans)?**

Paget’s disease of the bone is a chronic (lifelong) condition but it’s treatable. It often gets worse slowly over time if it isn’t treated.

## **Outlook / Prognosis**

The prognosis (outlook) for Paget’s disease of the bone is excellent if it's diagnosed and treated early in the course of the disease before complications such as arthritis, fractures and hearing loss have occurred.

## **Prevention**

Unfortunately, there’s nothing you can do to prevent Paget’s disease of the bone. There are some things that are considered risk factors for developing Paget’s disease of the bone, including:

* **Your age**: People over the age of 50 are more likely to develop Paget’s disease of the bone.
* **Your national origin**: Paget’s disease of the bone is more common in European populations, including those living in England, Italy and Spain. It’s rare among Scandinavians and non-European immigrants living in Europe.
* **Your** [**sex**](https://my.clevelandclinic.org/health/articles/sex-recorded-at-birth): Males are slightly more at risk.
* **Your family history**: Paget’s disease of the bone can sometimes run in families. If you have a family member who has the disease, you may be more likely to develop it.

## **Living With**

If you have Paget’s disease of the bone and take medication, it’s important to follow your healthcare provider’s instructions for taking your medicine.

While medication and surgery are the only methods that can treat Paget’s disease of the bone, there are things you can do to help keep your skeletal system healthy in general, including:

* **Maintain a healthy weight:** Having obesity can cause extra pressure on your joints. Try to maintain a healthy weight to keep your joints and bones healthy.
* **Exercise:** Physical activity can help keep your skeletal system healthy and can help maintain your joint mobility. Be sure to talk with your healthcare provider before you begin an exercise routine. Certain exercises could put too much pressure on your bones that are affected by Paget’s disease.
* **Get enough calcium and vitamin D**: Calcium and vitamin D help keep bones strong and healthy. Be sure you're consuming enough calcium and vitamin D in your diet and/or through supplements.

## **Epidemiology**

### United States statistics

Paget disease is estimated to affect 1 to 3 million people in the United States. Epidemiologic studies are inherently imprecise, however, because many individuals with Paget disease are asymptomatic.

According to a 2000 study by Altman et al, the prevalence of pelvic Paget disease in the United States was 0.71% ± 0.18%, based on data from the National Health and Nutrition Examination Survey I (NHANES I, 1971-1975). The male-to-female ratio was 1.2:1, and the prevalence of pelvic Paget disease was the same in White persons and Black persons.

The prevalence of pelvic Paget disease increases with age, with the highest prevalence in persons older than 65 years. A survey study suggested that the prevalence in the United States is 2.3% of the population between ages 65 and 74 years.Paget disease is estimated to occur in 1-3% of individuals older than 45-55 years and in up to 10% of persons older than 80 years. Geographically, pelvic Paget disease was least common in the southern United States and most common in the northeastern United States.

### International statistics

The prevalence of Paget disease varies greatly in different areas of the world. The highest prevalence is in Europe (predominantly England, France, and Germany).The United States, Australia, and New Zealand have high prevalence rates because of significant populations with northern European ancestry and a large population of British immigrantsThe disease is rare in Asian countries, especially China, India, and Malaysia, and in the Middle East and Africa.

Prevalence may vary even within the same country.A prevalence of 2% in certain British cities can be contrasted with rates in Lancaster, England, which had a prevalence of 8.3%The incidence of Paget disease in the United Kingdom has been steadily dropping in the 21st century, decreasing from 0.75 case per 10,000 person-years in 1999 to 0.20 case per 10,000 person-years in 2015

In Europe, the prevalence rates of Paget disease appear to decrease from north to south, with the exception of Norway and Sweden, which both have very low rates (0.3%). The highest prevalence in Europe is found in England (4.6%) and France (2.4%) in hospitalized patients older than 55 years. Other European countries, such as Ireland, Spain, Germany, Italy, and Greece, report prevalence rates of Paget disease that range from 0.5% to approximately 2%. The prevalence rates of Paget disease in Australia and New Zealand range from 3-4%.

The prevalence of Paget disease in sub-Saharan Africa is 0.01-0.02%. In Israel, Paget disease is predominantly found in Jews; however, cases have been reported in Israeli Arabs.

In South America, the incidence of Paget disease is relatively high in Argentina (around Buenos Aires), which was settled by Spanish and Italian immigrants, and lower in Chile and Venezuela.

Research from Europe and New Zealand indicates that the prevalence of Paget disease has decreased since the 1980s but that increased incidence with age has been maintained.The estimated prevalence of Paget disease in patients aged 55 years or older has decreased to approximately 2%.

### Race-, sex-, and age-related differences in incidence

Paget disease is not known to demonstrate a predilection for any race. Nevertheless, unusual patterns of prevalence have been noted. Paget disease is more common in males than females. The male-to-female ratio is approximately 1.8:1.

Paget disease is distinctly rare in persons younger than 25 years and increases in frequency with increasing age. Paget disease is believed to develop in persons in the fifth decade of life and is most commonly diagnosed in the sixth decade. The incidence of Paget disease in persons older than 80 years is approximately 10%. There is a juvenile form of Paget disease, but it is very different from the adult form.

## **Diagnostic Considerations**

The differential diagnosis of Paget disease includes osteomalacia, which may be part of the spectrum of osseous abnormalities accompanying chronic renal insufficiency. Patients with mild osteomalacia may present with nonspecific bone pain and tenderness. Elevated levels of bone-specific alkaline phosphatase may occur in osteomalacia or in Paget disease. Both disorders may result in fractures. However, in Paget disease, distinctive horizontal radiolucencies are visible on the convex surface of the bone, whereas in osteomalacia they are visible on the concave aspects of the bone.

Both Paget disease and skeletal metastasis can produce bone pain and radiographically similar lytic lesions. If cortical thickening and bone enlargement are also present, that suggests Paget disease; however, diagnostic confirmation may require biopsy.

The following disorders have radiographic features that differ from those of Paget disease:

* Chronic nonbacterial osteomyelitis – Inhomogeneous osteosclerosis and/or sequestrum formation (necrotic bone)
* Fibrous dysplasia – Homogeneously sclerotic lesion with ground glass appearance; no bone expansion or cortical breach
* Hyperostosis frontalis interna – Usually affects the outer calvarial table more prominently
* Erdheim Chester disease – Osteosclerotic lesions are generally symmetrical and do not lead to bone deformity

## **Differential Diagnoses**

* Osteoarthritis
* Osteoporosis

**procedure and timeline for treating Paget disease of bone**

Treatment Procedure

* Bisphosphonates are the first-line treatment. The most commonly used is zoledronate (zoledronic acid), administered as a single intravenous infusion over about 15-30 minutes. This infusion can provide symptom relief and disease control for several years at a time.
* Other bisphosphonates include:
  + Oral agents like risedronate and alendronate, taken daily or weekly.
  + Intravenous options like pamidronate and ibandronate.
* If bisphosphonates are contraindicated or not tolerated, calcitonin injections may be used for up to 3 months, although they are less effective and have a shorter duration of action.
* Calcium and vitamin D supplements are typically recommended during and after bisphosphonate treatment to prevent hypocalcemia.

## Timeline and Follow-Up

* After the initial bisphosphonate infusion, remission can last on average about 2 years, with some patients experiencing longer-lasting remission. Treatment can be repeated when symptoms or biochemical markers (like alkaline phosphatase) indicate disease activity returns.
* Monitoring includes regular blood tests to check serum alkaline phosphatase levels, which reflect bone turnover. Follow-up intervals vary but often occur every 3 to 12 months, and patients may be followed indefinitely due to the chronic nature of the disease and risk of complications.
* Symptomatic patients or those with elevated biochemical markers are typically treated, while asymptomatic patients with stable disease may be monitored without immediate treatment.

## Additional Considerations

* Surgery is rarely required but may be necessary for complications such as fractures, severe bone deformities, or nerve compression.
* Treatment aims to control symptoms and reduce complications but does not cure the disease

**Doctor-patient conversation about Paget disease of bone,**

Doctor: "Hello, I have reviewed your scans and blood tests. You have a condition called Paget disease of bone. It means that some areas of your bones are remodeling abnormally — they break down and rebuild too quickly, which can cause the bones to become enlarged, misshapen, and sometimes painful."

Patient: "What causes this? Is it cancer?"

Doctor: "No, it’s not cancer. The exact cause isn’t fully understood, but it may involve genetic factors and possibly a slow viral infection. It’s most common in people over 50 and can affect any bone, but usually the pelvis, spine, skull, or long bones like your leg."

Patient: "I’ve noticed my leg is curved and it hurts a lot. Is that normal?"

Doctor: "Yes, bone deformities and pain are common symptoms. The abnormal bone growth can cause the bone to bow or thicken, which can affect your walking and cause discomfort. We’ll work on managing the pain and preventing further damage."

Patient: "How do you treat it? Is there a cure?"

Doctor: "There’s no cure, but we have effective treatments to control the disease. The main treatment is a medication called bisphosphonates, which slows down the abnormal bone breakdown and helps relieve pain. Sometimes, if the bone deformity is severe, surgery may be needed to realign the bone."

Patient: "What does the treatment involve? How long will it take?"

Doctor: "Typically, you’ll receive an intravenous bisphosphonate infusion that takes about 15 to 30 minutes. This can put the disease into remission for a couple of years. We’ll monitor your symptoms and blood tests regularly to see how you respond. If needed, the treatment can be repeated."

Patient: "Will I be able to walk normally again?"

Doctor: "Many patients improve significantly with treatment. In some cases, like one patient I know, surgery was needed to straighten the leg using a special external frame that gradually corrected the bone alignment over weeks. After healing, they regained much better function."

Patient: "Are there any risks or things I should watch out for?"

Doctor: "We’ll watch for complications like fractures or arthritis in affected joints. It’s important to maintain a healthy diet with enough calcium and vitamin D, and to stay active but avoid high-impact activities that might stress weakened bones. We’ll guide you on safe exercises."

Patient: "Thank you. It’s good to know there are options and support."

Doctor: "Absolutely. We’ll work together to manage your condition and keep you as comfortable and active as possible. If you have any questions or new symptoms, please let me know."

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## **Post-Traumatic Arthritis**

Post-traumatic arthritis affects a previously injured joint, causing arthritis symptoms like pain and swelling.

Post-traumatic arthritis is inflammation in a joint that develops after a traumatic injury to it. It’s a degenerative type of arthritis, which means it’s from wear and tear on the joint. Usually, degenerative arthritis (osteoarthritis) takes a long time to develop. But when you have an injury, wear and tear on your joint adds up faster. Post-traumatic arthritis develops in weeks or months rather than years.

Fortunately, this sort of damage usually isn’t permanent, and post-traumatic arthritis is usually a temporary issue. Most people recover in a few months with home care. But some injuries can do more damage than others, and sometimes, post-traumatic arthritis becomes a long-term (chronic) condition. Though it’s rare, you might need surgery if your symptoms are severe and limit your quality of life.

Other terms for post-traumatic arthritis include:

* Post-traumatic osteoarthritis
* Post-traumatic arthropathy

## **Symptoms and Causes**

Post-traumatic arthritis causes inflammation in your injured joint. Symptoms can include:

* Joint pain
* Joint swelling
* Limited range of motion in your joint
* Difficulty bearing weight on your joint

The joints most often affected by post-traumatic arthritis include your:

* Ankle joint
* Knee joint
* Hip joint
* Elbow joint

In severe cases, pieces of cartilage can break off and get stuck in your joint. This may cause:

* A crackling or crunching sound when you move your joint
* A feeling like something is catching in your joint when it moves

#### **Complications of post-traumatic arthritis**

Sometimes, severe post-traumatic arthritis doesn’t heal as expected. When it lasts more than six months, it’s considered a chronic condition. At this point, it becomes something else. Some scientists consider it to be the start of chronic osteoarthritis. This is a progressive condition, which means your joint continues to degenerate. Some also believe that it can trigger the start of inflammatory arthritis.

### **Post-traumatic arthritis causes**

Traumatic injuries that impact your joints can cause post-traumatic arthritis. Common causes include:

* Car accidents
* Sports injuries
* Falls

Injuries that move or damage the bones in your joint can also damage the cartilage that surrounds them, leading to arthritis. Common types of injuries that can affect your bones and cartilage include:

* Fractures
* Dislocations
* Sprains

#### **Risk factors for post-traumatic arthritis**

Unlike most types of arthritis, post-traumatic arthritis is more common in younger people, including kids. It’s also more common in athletes and other active adults, who tend to get injured more often.

## **Diagnosis and Tests**

Your healthcare provider will diagnose post-traumatic arthritis with a physical exam and imaging tests. Your provider will move your joint, ask you about your symptoms and compare your joint and its range of motion (how far you can move that part of your body) to what it was before your injury — if possible. After your physical exam, you might need at least one of the following imaging tests of your joint:

* X-ray
* MRI
* CT scan

## **Management and Treatment**

Most people can treat post-traumatic arthritis at home. Treatment may include:

* **Pain relievers**. Your healthcare provider can recommend appropriate medications for you.
* **Wearing a brace.** Wearing a brace around your joint can help hold it in place while it heals.
* **Physical therapy.** A physical therapist can show you exercises to help restore your joint.
* **Weight loss.** In some cases, taking excess weight off your joint can relieve pain and help it heal.

In rare circumstances, when your symptoms are severe and don’t seem to be improving, your healthcare provider might recommend surgery for post-traumatic arthritis. Surgical procedures might include:

* **Arthroscopy**. You might only need minimally invasive surgery to fix a small problem, like removing damaged tissues or loose pieces of cartilage from your joint.
* **Joint fusion (arthrodesis)**.This surgery fuses the bones in your joint together to prevent it from causing pain when it moves.
* **Joint replacement (arthroplasty)**.Your surgeon will replace your damaged joint with an artificial joint (a prosthesis) made of metal, ceramic or plastic.

### **When should I seek emergency care?**

Go to the emergency room if:

* You have intense or worsening pain
* You can’t move a part of your body that you normally can
* Your body part looks deformed or out of place
* New bruising appears with any of these other symptoms

## **Outlook / Prognosis**

Most people have post-traumatic arthritis for only a few months. Your arthritis will typically improve as your body recovers from your trauma. But in rare, severe cases, you may continue to experience symptoms for longer than six months. This is called chronic post-traumatic arthritis. When it’s chronic, it may be lifelong. Your healthcare provider will help you to manage your condition in the long term.

## **Prevention**

Follow these general safety tips to reduce your risk of an injury:

* Always wear your seatbelt.
* Wear protective equipment for all activities and sports.
* Make sure your home and workspace are free of clutter that could trip you or others.
* Use a stool when you need to reach things. Don’t stand on chairs, tables or countertops.

**Differential diagnoses (DDx) for post-traumatic arthritis**

* Osteoarthritis
* Rheumatoid arthritis
* Juvenile rheumatoid arthritis
* Psoriatic arthritis
* Calcium pyrophosphate deposition disease (Chondrocalcinosis)
* Gout
* Lyme disease arthritis
* Neuropathic (Charcot) arthropathy
* Metabolic bone disorders (e.g., hyperparathyroidism)
* Hypermobility syndromes
* Periarticular structure derangements (bursitis, tendonitis, periostitis)
* Infectious arthritis (septic arthritis)
* Other inflammatory/systemic conditions (e.g., lupus, polymyalgia rheumatica)

**Epidemiology of Post-Traumatic Arthritis (Post-Traumatic Osteoarthritis, PTOA)**:

* Prevalence:  
  Post-traumatic arthritis accounts for approximately 12% of all symptomatic osteoarthritis (OA) cases in the general population. This translates to millions of cases, for example, about 5.6 million cases of lower extremity OA in the U.S. are due to PTOA.
* Commonly Affected Joints:  
  The knee and ankle joints are the most frequently affected sites, with the knee being the most prevalent worldwide and the ankle accounting for a significant proportion of injuries leading to PTOA. The hip and shoulder can also be involved, but less commonly.
* Incidence and Risk Factors:  
  Individuals with a history of joint injury have a substantially increased risk of developing OA compared to uninjured persons. The risk increases with age at the time of injury and the time elapsed since injury. For example, a knee injury increases the risk of OA by about 4.2 times compared to those without such injury.
* Age and Demographics:  
  PTOA tends to affect younger adults compared to primary OA. Symptoms often begin in the 40s for those with combined knee injuries, earlier than primary OA which typically starts around age 54. Patients with PTOA are often younger at diagnosis and may require joint replacement surgery earlier than those with primary OA.
* Economic Impact:  
  Treating lower extremity PTOA is costly; as of 2005, direct costs exceeded $3 billion annually in the U.S., with total costs around $11.79 billion.
* Timeline:  
  PTOA can develop anywhere from 6 months to 10-20 years after the initial injury, depending on injury severity and type. It is often a chronic, lifelong condition once established.
* Other Notes:  
  PTOA patients may have different comorbidity profiles compared to those with primary

**Treatment of Post-Traumatic Arthritis (PTA): Drug Information and Side Effects**

## 1. Nonsteroidal Anti-Inflammatory Drugs (NSAIDs)

* Examples: Ibuprofen, naproxen, indomethacin
* Use: Reduce pain and inflammation
* Side Effects:
  + Gastrointestinal irritation, ulcers, bleeding
  + Kidney impairment
  + Increased cardiovascular risk with long-term use
* NSAIDs are commonly used as first-line agents for symptom relief in PTA.

## 2. Acetaminophen (Paracetamol)

* Use: Mild to moderate pain relief without anti-inflammatory effect
* Side Effects:
  + Generally well tolerated
  + Risk of liver toxicity in overdose or chronic high doses
* Often used when inflammation is minimal or NSAIDs contraindicated.

## 3. Corticosteroids

* Examples: Dexamethasone, triamcinolone acetonide (intra-articular injections)
* Use: Potent anti-inflammatory effect to reduce joint inflammation and pain; may have disease-modifying potential in early PTOA by reducing cytokines and matrix degradation.
* Side Effects:
  + Local: joint infection risk, cartilage damage with repeated injections
  + Systemic (oral or repeated injections): weight gain, osteoporosis, hyperglycemia, hypertension, adrenal suppression
* Intra-articular corticosteroids can provide temporary symptom relief but are not curative.

## 4. Hyaluronic Acid Injections

* Use: Viscosupplementation to improve joint lubrication and reduce pain
* Side Effects:
  + Injection site pain or swelling
  + Rare allergic reactions
* May provide symptom relief but evidence is mixed.

## 5. Other Emerging Therapies

* Platelet-Rich Plasma (PRP) Injections: Promote healing by delivering growth factors; still under investigation

## **Doctor-Patient Conversation: Post-Traumatic Arthritis**

Doctor:  
“Hello, I’ve reviewed your symptoms and your imaging results. It appears you have post-traumatic arthritis in your joint, which means arthritis that developed as a result of your previous injury.”

Patient:  
“So, the pain and stiffness I’m feeling now is because of that old injury I had?”

Doctor:  
“Yes, exactly. When a joint is injured—like from a fracture, ligament tear, or dislocation—it can damage the cartilage and change the joint’s mechanics. Over time, this can lead to arthritis, causing pain, swelling, and stiffness.”

Patient:  
“Is this different from regular arthritis? Can it get worse?”

Doctor:  
“It’s a form of osteoarthritis triggered by trauma. It can progress over time, but with proper treatment, we can manage your symptoms and slow down the progression.”

Patient:  
“What treatments are available? Is there a cure?”

Doctor:  
“There’s no cure to reverse the arthritis, but we have effective treatments to reduce pain and improve function. These include medications like anti-inflammatory drugs, physical therapy, and sometimes injections into the joint. In severe cases, surgery may be needed.”

Patient:  
“Will I need surgery?”

Doctor:  
“Surgery is usually considered only if other treatments don’t help and if the joint damage is severe. Many patients do well with conservative treatments.”

Patient:  
“Is there anything I can do myself to help?”

Doctor:  
“Yes, maintaining a healthy weight, staying active with low-impact exercises like swimming or cycling, and avoiding activities that strain the joint can help. Physical therapy will also teach you exercises to strengthen the muscles around your joint.”

Patient:  
“Will the pain go away completely?”

Doctor:  
“Pain relief varies, but many patients experience significant improvement. Our goal is to reduce your pain and improve your quality of life.”

Patient:  
“Thank you, doctor. That helps me understand what’s going on.”

Doctor:  
“You’re welcome. We’ll work together to manage your condition. Please let me know if you have any questions or new symptoms.”

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[Post-Traumatic Arthritis: What It Is, Symptoms & Treatment](https://my.clevelandclinic.org/health/diseases/14616-post-traumatic-arthritis#what-is-post-traumatic-arthritis)

**SPINAL STENOSIS**

**DEFINITION AND DESCRIPTION**

Spinal stenosis happens when the space inside the backbone is too small. This can put pressure on the spinal cord and nerves that travel through the spine. Spinal stenosis happens most often in the lower back and the neck.

Some people with spinal stenosis have no symptoms. Others may experience pain, tingling, numbness and muscle weakness. Symptoms can get worse over time.

The most common cause of spinal stenosis is wear-and-tear damage in the spine related to arthritis. People who have serious spinal stenosis may need surgery.

Surgery can create more space inside the spine. This can ease the symptoms caused by pressure on the spinal cord or nerves. But surgery can't cure arthritis, so arthritis pain in the spine may continue.

Spinal stenosis can affect anyone, but it’s most common in people over the age of 50.

The condition most commonly affects two areas of your spine:

* **Lower back (lumbar spinal stenosis)**: Your lumbar spine consists of five bones (vertebrae) in your lower back. Your lumbar vertebrae, known as L1 to L5, are the largest of your entire spine.
* **Neck (cervical spinal stenosis)**: Your cervical spine consists of seven vertebrae in your neck. These vertebrae are labeled C1 to C7.

Your middle back (thoracic spine) can also have spinal stenosis, but this is rare.

Spinal stenosis is fairly common. Degenerative spinal changes affect up to 95% of people by the age of 50. Spinal stenosis is one of those changes. For people over 65 undergoing spine surgery, lumbar spinal stenosis is the most common diagnosis.

## **Symptoms and Causes**

Depending on where and how severe your spinal stenosis is, you might feel the following in your neck, back, arms, legs, hands or feet:

* Pain
* Numbness.
* Tingling.
* Weakness.

Spinal stenosis usually develops slowly over time. For this reason, you may not have any symptoms for a while, even if it shows up on X-rays or other imaging tests. Symptoms may come and go and affect each person differently.

#### **Symptoms of lumbar spinal stenosis**

Symptoms of lumbar (low back) spinal stenosis include:

* Pain in your low back.
* Pain that begins in your buttocks and extends down your leg. It may continue into your foot.
* A heavy feeling in your legs, which may lead to cramping in one or both legs.
* Numbness or tingling (“pins and needles”) in your buttocks, leg or foot.
* Pain that worsens when you stand for long periods of time, walk or walk downhill.
* Pain that lessens when you lean forward, walk uphill or sit.

#### **Symptoms of cervical spinal stenosis**

You can feel symptoms of cervical spinal stenosis anywhere below the point of the nerve compression in your neck. Symptoms include:

* Neck pain.
* Numbness or tingling in your arm, hand, leg or foot.
* Weakness or clumsiness in your arm, hand, leg or foot.
* Balance problems.
* Decreased function in your hands, like having issues writing or buttoning shirts.

#### **What does spinal stenosis pain feel like?**

Pain from spinal stenosis can feel different from person to person. Some describe it as a dull ache or tenderness. Others describe it as an electric-like or burning sensation. The pain can come and go.

### **What causes spinal stenosis?**

Spinal stenosis has several causes. Many different changes or injuries in your spine can cause a narrowing of your spinal canal. The causes are split into two main groups:

* Acquired (developing after birth).
* Congenital (from birth).

Acquired spinal stenosis is more common. It usually happens from “wear and tear” changes that naturally occur in your spine as you age. Only 9% of cases result from congenital causes.

#### **Acquired causes of spinal stenosis**

Acquired spinal stenosis means you develop it later in life (after birth) — most commonly after the age of 50. These cases usually happen from an injury or changes in your spine that occur as you age (degenerative changes).

Causes of acquired spinal stenosis include:

* **Bone overgrowth**: Osteoarthritis is the “wear and tear” condition that breaks down the cartilage in your joints, including your spine. Cartilage is the protective covering of joints. As your cartilage wears away, your bones begin to rub against each other. Your body responds by growing new bones. Bone spurs, or an overgrowth of bone, commonly form. Bone spurs on your vertebrae extend into your spinal canal, narrowing the space and pinching nerves in your spine. Paget’s disease of the bone can also cause an overgrowth of bone in your spine.
* **Bulging or herniated disks**: Between each vertebra is a flat, round cushioning pad (vertebral disk) that acts as a shock absorber. As you age, the disks can dry out and flatten. Cracking in the outer edge of the disks can cause the gel-like center to break through. The bulging disk then presses on the nerves near the disk.
* **Thickened** **ligaments**: Ligaments are the fiber bands that hold your spine together. Arthritis can cause ligaments to thicken over time and bulge into your spinal canal.
* **Spinal** **fractures** **and injuries**: Broken or dislocated bones in your vertebrae or near your spine can narrow your canal space. Inflammation from injuries near your spine can also cause issues.
* **Spinal cysts or** **tumors**: Growths within your spinal cord or between your spinal cord and vertebrae can narrow your spinal canal.

#### **Congenital causes of spinal stenosis**

Congenital spinal stenosis affects babies and children. It can happen due to:

* Issues with spine formation during fetal development.
* Genetic (inherited) conditions that affect bone growth. These are due to genetic mutations (changes).

Some congenital causes of spinal stenosis include:

* **Achondroplasia**: A bone growth disorder that results in dwarfism due to a genetic mutation.
* **Spinal dysraphism**: When the spine, spinal cord or nerve roots don’t form properly during fetal development. Spina bifida and other neural tube defects are examples.
* **Congenital** **kyphosis**: When your child’s spine curves outward more than it should. As a result, their upper back looks overly rounded. This happens due to an issue with fetal spine development.
* **Congenital short pedicles**: When your baby is born with vertebrae pedicles (the bony “sides” of the spinal canal) that are shorter in length. This decreases their spinal canal size.
* **Osteopetrosis**: A rare genetic condition that causes your child’s bones to grow abnormally and become overly dense.
* **Morquio syndrome:** A rare genetic condition that affects your child’s bones, spine and other body systems.
* **Hereditary multiple exostoses (diaphyseal aclasis)**: A rare genetic condition that causes several small bone growths (protrusions). They can grow on your child’s vertebrae and affect their spinal canal.

## **Diagnosis and Tests**

Your healthcare provider will review your medical history, ask about your symptoms and do a physical exam. Your provider may feel your spine, pressing on different areas to see if it causes pain. They’ll likely ask you to bend in different directions to see if certain spine positions bring on symptoms.

You’ll also have imaging tests so your provider can “see” your spine and determine the exact location, type and extent of the problem. These tests may include:

* **Spine X-ray**: X-rays use a small amount of radiation and can show changes in bone structure. For example, they can show a loss of disk height or bone spurs.
* **MRI**: Magnetic resonance imaging (MRI) uses radio waves and a powerful magnet to create cross-sectional images of your spine. MRI provides detailed images of your nerves, disks and spinal cord. It can reveal any tumors as well.
* **CT scan** **or CT** **myelogram**: A computed tomography (CT) scan is a combination of X-rays that creates cross-sectional images of your spine. A CT myelogram uses a contrast dye so your provider can more clearly see your spinal cord and nerves.

## **Management and Treatment**

There are many treatment options for spinal stenosis. What’s best for you depends on:

* The cause.
* The location of the issue.
* The severity of your symptoms.

If your symptoms are mild, your healthcare provider may recommend at-home care first. If these methods don’t work and as symptoms worsen, your provider may recommend physical therapy, medications, injections and, finally, surgery.

#### **At-home care for spinal stenosis**

At-home care may include:

* **Applying heat**: Heat usually is the better choice for osteoarthritis pain. Heat increases blood flow, which relaxes your muscles and relieves aching joints. Be careful when using heat — a high heat setting can burn you.
* **Applying cold**: If heat isn’t easing your symptoms, try ice, like an ice pack, frozen gel pack or a frozen bag of peas. Apply the ice for 20 minutes on and 20 minutes off. Ice reduces swelling, tenderness and inflammation.
* **Exercising**: Check with your healthcare provider first, but exercise can help relieve pain. It also strengthens your muscles to support your spine and improves your flexibility and balance.

#### **Nonsurgical treatment for spinal stenosis**

Nonsurgical treatments mainly help manage symptoms of spinal stenosis. They include:

* **Oral medications**: Over-the-counter nonsteroidal anti-inflammatory medications (NSAIDs) can help relieve inflammation and provide pain relief from spinal stenosis. Be sure to talk with your provider to learn about the possible long-term problems of taking these medicines. Your provider may also recommend prescription medications with pain-relieving properties. These may include the antiseizure medication called gabapentin or tricyclic antidepressants, like amitriptyline. If you have muscle cramps or spasms, muscle relaxants may help.
* **Physical therapy**: Physical therapists will work with you to develop a back-healthy exercise program to help you gain strength and improve your balance, flexibility and spine stability. Strengthening your back and abdominal muscles (your core) will make your spine more resilient. Physical therapists can teach you how to walk in a way that opens up your spinal canal, which can help ease pressure on your nerves.
* **Steroid injections**: Getting corticosteroid injections in the space around pinched spinal nerves may help reduce inflammation, pain and irritation.

#### **Surgery for spinal stenosis**

Spinal stenosis is complex, and your spine is a delicate area. Because of this, providers consider surgery only if all other treatment options haven’t worked. Fortunately, most people who have spinal stenosis don’t need surgery.

Types of spine surgery include:

* **Laminectomy** **(decompression surgery)**: This is the most common type of surgery for spinal stenosis. It involves removing the lamina, which is a portion of your vertebra. The surgeon may also remove some ligaments and bone spurs. The procedure makes more room for your spinal cord and nerves.
* **Laminotomy**: This is a partial laminectomy. The surgeon only removes a small part of the lamina — the area causing the most pressure on the nerve.
* **Laminoplasty**: This surgery is just for your neck (cervical spinal stenosis). The surgeon removes part of the lamina to provide more canal space. They use metal plates and screws to create a hinged bridge across the area where they removed bone.
* **Foraminotomy**: The foramen is the area in your vertebrae where the nerve roots exit. This procedure involves removing bone or tissue in this area to provide more space for the nerve roots.
* **Interspinous process spacers**: This is a minimally invasive surgery for some people with lumbar spinal stenosis. The surgeon inserts spacers between the bones that extend off the back of each vertebrae called the spinous processes. The spacers help keep your vertebrae apart, creating more space for nerves.
* **Spinal fusion**: Healthcare providers use spinal fusion as a last option. They only consider it if you have radiating nerve pain from spinal stenosis, your spine is not stable and other treatments haven’t helped. Spinal fusion surgery permanently joins (fuses) two vertebrae together.

## **Outlook / Prognosis**

The prognosis (outlook) for spinal stenosis varies based on several factors, like:

* Its location.
* Its severity.
* Your overall health.

In most cases, the prognosis for spinal stenosis is good. Many people with spinal stenosis can live full and active lives with nonsurgical treatment. But it’s important to remember that spinal stenosis affects each person differently, so not every treatment works for everyone.

#### **Complications of spinal stenosis**

In severe cases, spinal stenosis can cause a loss of bladder or bowel control (incontinence). It can also cause sexual dysfunction due to nerve issues, like erectile dysfunction or anorgasmia.

It’s very rare, but extreme cases of spinal stenosis can cause partial or complete leg paralysis.

## **Prevention**

As most causes of spinal stenosis are normal age-related “wear and tear” conditions, you can’t totally prevent spinal stenosis. But you can take certain steps to keep your spine healthy. They may help lower your risk or slow the progression of spinal stenosis. These steps include:

* Eating healthy foods. Be sure you’re getting enough calcium in your diet to keep your bones strong.
* Maintaining a weight that’s healthy for you.
* Avoiding smoking or quitting smoking. Smoking damages your arteries, which can contribute to back pain and make it difficult for any injuries to heal.
* Practicing good posture.
* Exercising regularly. Keeping your muscles strong, especially your back and core muscles, helps to keep your spine healthy.

### **When should I see my healthcare provider about spinal stenosis?**

If you notice new back pain or other symptoms, like tingling or weakness in your extremities, talk to a healthcare provider.

If you’re receiving treatment for spinal stenosis and it’s not working to help your symptoms, talk to your provider about other options.

**Lifestyle and home remedies**

Your healthcare professional may suggest:

* **Pain relievers.** Medicines you can buy without a prescription — such as aspirin, ibuprofen (Advil, Motrin IB, others), naproxen sodium (Aleve) and acetaminophen (Tylenol, others) — can help reduce pain and swelling.
* **Weight loss.** Losing excess weight can reduce pain by taking some stress off the lower back.
* **Exercise.** Stretching and strengthening exercises may help relieve symptoms. Talk with your healthcare team about what exercises are safe to do at home.
* **Walking aids.** In addition to providing stability, canes and walkers can help relieve pain by allowing you to bend forward while walking.

**Alternative medicine**

Integrative medicine and alternative therapies may be used with conventional treatments to help you cope with spinal stenosis pain. Examples include:

* Massage therapy.
* Chiropractic treatment.
* Acupuncture.

## 

## **Diagnostic Considerations**

Problems to be considered in these patients include the following:

* Rheumatologic - Ankylosing spondylitis/spondyloarthropathy, diffuse idiopathic skeletal hyperostosis (DISH)
* Infectious - Epidural, subdural, intradural abscess; diskitis; Pott disease
* Metabolic – Osteomalacia, parathyroid disease, vitamin B-12 or folic acid deficiency
* Traumatic - Lumbar strain
* Developmental/congenital - Scoliosis
* Vascular - Peripheral vascular disease (with vascular claudication), abdominal aortic dissection
* Psychogenic - Conversion disorder, malingering
* Other - Metastatic breast cancer, prostate cancer, Paget disease

## 

## **Differential Diagnoses**

* Lumbar Compression Fracture
* Lumbar Degenerative Disk Disease
* Lumbar Facet Arthropathy
* Lumbar Spondylolysis and Spondylolisthesis
* Mechanical Low Back Pain
* Physical Medicine and Rehabilitation for Myofascial Pain
* Rehabilitation for Osteoarthritis
* Rheumatoid Arthritis (RA)
* Spondylodiskitis
* Spondylolisthesis Imaging

## 

## **Epidemiology**

Approximately 250,000-500,000 US residents have symptoms of spinal stenosis. This represents about 1 per 1000 persons older than 65 years and about 5 of every 1000 persons older than 50 years. About 70 million Americans are older than 50 years, and this number is estimated to grow by 18 million in the next decade alone, suggesting that the prevalence of spinal stenosis will increase. Lumbar spinal stenosis (LSS) remains the leading preoperative diagnosis for adults older than 65 years who undergo spine surgery. The incidence of lateral nerve entrapment is reportedly 8-11%. Some studies implicate lateral recess stenosis as the pain generator for 60% of patients with symptomatology of failed back surgery syndrome.

As many as 35% of persons who are asymptomatic and aged 20-39 years demonstrate disc bulging. CT scanning and MRI studies in patients who are asymptomatic and younger than 40 years demonstrate a 4-28% occurrence of spinal stenosis. Most persons older than 60 years have spinal stenosis to some degree. Because most patients with mild spinal stenosis are asymptomatic, the absolute frequency can only be estimated.

Incidence of foraminal stenosis increases in lower lumbar levels because of increased dorsal root ganglion (DRG) diameter with resulting decreased foramen (ie, nerve root area ratio). Jenis and An cite commonly involved roots as L5 (75%), L4 (15%), L3 (5.3%), and L2 (4%).The lower lumbar levels maintain greater obliquity of nerve root passage, as well as higher incidence of spondylosis and DDD, further predisposing patients to L4 and L5 nerve root impingement.

Cervical stenosis resulting from ossification of the posterior longitudinal ligament is more common among Asians, and LSS occurs most frequently in males. Patients with LSS due to degenerative causes generally are aged at least 50 years; however, LSS may be present at earlier ages in cases of congenital malformations.

**Doctor-patient conversation about spinal stenosis**,

Doctor:  
“Hello, I understand you’ve been having back pain and some leg symptoms. After reviewing your scans and exam, it looks like you have spinal stenosis. This means the spaces in your spine where the nerves pass through have narrowed, which can pinch the nerves and cause your symptoms.”

Patient:  
“What causes this narrowing? Is it serious?”

Doctor:  
“It’s most often caused by age-related changes like arthritis, disc degeneration, and thickening of ligaments. It’s quite common in people over 60. While it can cause pain, numbness, and weakness, many people manage it well with treatment.”

Patient:  
“I’ve noticed my legs feel weak and tingly, especially when I walk. Is that normal?”

Doctor:  
“Yes, those are typical symptoms called neurogenic claudication. The nerve compression worsens when you stand or walk, and often improves when you sit or bend forward.”

Patient:  
“What treatments are available? Do I need surgery?”

Doctor:  
“We usually start with conservative treatments like physical therapy, pain medications, and sometimes steroid injections to reduce inflammation. Surgery is considered if symptoms worsen or don’t improve, especially if there’s significant weakness or loss of bladder control.”

Patient:  
“Is surgery risky? How long is recovery?”

Doctor:  
“Like any surgery, there are risks, but many patients improve significantly. Recovery varies but often includes physical therapy to regain strength and mobility. We’ll discuss all options carefully so you can make an informed decision.”

Patient:  
“Are there things I can do on my own to help?”

Doctor:  
“Yes, maintaining good posture, staying active with low-impact exercises, and avoiding prolonged standing or walking can help manage symptoms.”

Patient:  
“Thank you, doctor. It helps to understand what’s going on and what to expect.”

Doctor:  
“You’re welcome. We’ll work together to manage your symptoms and maintain your quality of life. Please reach

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### **Rotator cuff tear**

A rotator cuff tear is an injury to your rotator cuff that can cause shoulder pain and the inability to use your arm. Your rotator cuff is a group of muscles and tendons in your shoulder. They help you lift and move your arms away from your body. Your rotator cuff keeps the ball of your upper arm bone (humerus) in the shoulder blade socket.

Your shoulder is a ball-and-socket joint that’s part of your skeletal system. It’s like a golf ball sitting on a golf tee. Rotator cuff tears occur when tendons pull away from your arm bone. A tear may result from overuse or another injury.

#### **Types of rotator cuff tears**

Types of torn rotator cuffs include:

* **Partial:** With an incomplete or partial tear, your tendon still somewhat attaches to your arm bone.
* **Complete:** With a full-thickness or complete tear, your tendon separates completely from your bone. There’s a hole or rip in your tendon.

More than 2 million Americans experience some type of rotator cuff problem every year. Rotator cuff tears affect people of all ages, but the problem is more common in adults. In fact, it’s so common that there are people who have rotator cuff tears and don’t even know they have one because they have no symptoms.

## **Symptoms and Causes**

Rotator cuff tear symptoms include:

* Difficulty, pain and weakness caused by raising, lowering or rotating your arm.
* Popping, clicking or crackling sounds or sensations when moving your arm in certain positions.
* Shoulder pain that worsens at night or when resting your arm.
* Shoulder weakness and struggling to lift items.

#### **What does a rotator cuff tear feel like?**

It depends. You may feel a dull ache deep within your shoulder, or it may feel like you’re being stabbed with a knife. Sudden tears from accidents or trauma cause immediate, intense shoulder pain and arm weakness. With degenerative tears, you may have mild pain that improves with over-the-counter (OTC) pain relievers. Over time, the pain gets worse, and pain relievers don’t help. Not everyone has pain, but most people have some degree of arm and shoulder weakness.

### **What causes rotator cuff tears?**

An accident, such as a fall, can cause a broken collarbone or dislocated shoulder that tears your rotator cuff.

More commonly, rotator cuff tears occur over time as your tendon wears down with age and use (degenerative tear). People over age 40 are most at risk.

Causes of degenerative tears include:

* **Bone spurs:** Bony growths can form on the top of your shoulder bone. These bone spurs rub against your tendon when you lift your arm. This shoulder impingement creates friction between your bone and tendon. Eventually, a partial or complete tear may occur.
* **Decreased blood flow:** Blood flow to your rotator cuff decreases as you get older. Your muscles and tendons need a healthy blood supply to repair themselves. If blood doesn’t nourish your tendons, they can tear.
* **Overuse:** Repetitive shoulder movements during sports or on the job can stress your muscles and tendons, causing a tear.

#### **Risk factors for rotator cuff tears**

Anyone can experience a rotator cuff tear. These factors may increase your risk:

* Biological family history of shoulder problems or rotator cuff injuries.
* Poor posture.
* Smoking.
* Being age 40 or older.

Degenerative tears are more common among people who do the same repetitive shoulder movements, such as:

* Carpenters.
* Mechanics.
* Painters.
* Recreational and professional athletes who play baseball, softball and tennis or are part of a rowing crew.

### **Complications of a rotator cuff tear**

A rotator cuff tear can get worse without treatment. A complete tear can make it almost impossible to move your arm. Without treatment, you may have chronic shoulder pain and find it very difficult to use your injured arm.

## **Diagnosis and Tests**

Your healthcare provider will perform a physical exam to check for shoulder tenderness, range of motion and arm strength.

To confirm a diagnosis, you may get:

* An X-ray to check for arthritis or bone spurs.
* An MRI (magnetic resonance imaging) or ultrasound to look for tendon tears.

## **Management and Treatment**

Rotator cuff tear treatment may include nonsurgical and surgical options.

**Nonsurgical options**

Rotator cuff tears don’t heal on their own without surgery, but many people can improve functionally and decrease pain with nonsurgical treatment by strengthening their shoulder muscles. Just because you have a tear doesn’t necessarily mean you need surgery, as many people have rotator cuff tears and don’t even know it. About 8 out of 10 people with partial tears get better with nonsurgical treatments. It can take up to a year for the condition to improve.

Nonsurgical treatments include:

* **An arm sling and rest** to give your shoulder time to heal. You may need to modify activities and stop certain work or sports for a period of time.
* **Nonsteroidal anti-inflammatory drugs (NSAIDs)** to minimize pain and swelling.
* **Physical therapy** to learn strengthening and stretching exercises.
* **Steroid injections** to ease pain and swelling.

**Surgical options**

Your healthcare provider may recommend surgery if you have a complete tear or nonsurgical treatments don’t help a complete or partial tear. You may also have surgery if your job or athletic interests affect your shoulder.

Most rotator cuff surgeries take place arthroscopically through small cuts (incisions). Occasionally, the surgeon will use an open approach when needed. The surgery is an outpatient procedure. You go home the same day, but the overall recovery after this surgery is very substantial and can take up to a year or more.

During surgery, your healthcare provider:

1. Inserts an arthroscope (small camera) through a small incision in your shoulder.
2. Refers to images from the arthroscope to perform the procedure.
3. Inserts tiny instruments into small incisions in your shoulder to remove bone spurs and reattach your tendon to your upper arm bone.

For a partial tear, your healthcare provider may only need to trim fraying pieces of a partially torn tendon. This debridement procedure keeps your shoulder ball and socket from catching on your tendon and tearing it more.

Some tears aren’t repairable due to their size and/or the age of the tear. For these types of tears, you may need reverse shoulder replacement, tendon transfer or a debridement of scar tissue without repair.

#### **Rotator cuff tear recovery time**

After surgery, you need to wear a sling to immobilize your arm for four to six weeks. You can then start physical therapy. Most people regain shoulder function and strength within four to six months after surgery, but full recovery may take up to 12 to 18 months.

## **Outlook / Prognosis**

Most people see improvements with nonsurgical treatments. Recovery takes time because your body needs time to heal. Most people who have surgery to repair a torn rotator cuff regain function.

It’s possible to tear the same tendon again, especially if the first tear was bigger than 1 inch. A re-tear that causes severe pain or loss of movement may require surgery.

## **Prevention**

To prevent a symptomatic rotator cuff tear, it’s important to keep your muscles and tendons flexible. Your healthcare provider can teach you stretching and strengthening exercises to do at home.

### **When should I call my healthcare provider?**

You should call your healthcare provider if you experience:

* Chronic shoulder and arm pain.
* Pain that worsens at night or interferes with sleep.
* Redness, swelling or tenderness in your shoulder joint area.
* Shoulder or arm weakness.

### **What questions should I ask my healthcare provider?**

You may want to ask your healthcare provider:

## What caused the rotator cuff tear?

Rotator cuff tears arise mainly from two causes:

* Injury (Acute Tear): A sudden trauma such as falling on an outstretched arm, lifting something heavy with a jerking motion, or a direct blow to the shoulder can cause a tear. These are more common in younger people or athletes.
* Wear and Degeneration (Chronic Tear): Most tears happen gradually due to wear and tear of the tendon over time, especially after age 40. Repetitive overhead activities (like painting, carpentry, baseball, tennis), poor blood supply to the tendon with aging, and chronic overuse contribute to tendon weakening and tearing.

## What’s the best treatment for me?

Treatment depends on the tear size, symptoms, your age, and activity level:

* Non-surgical options:
  + Rest and activity modification
  + Physical therapy to strengthen shoulder muscles and improve motion
  + NSAIDs or pain relievers for inflammation and pain
  + Corticosteroid injections to reduce inflammation if needed
* Surgery:  
  Recommended for large or full-thickness tears, persistent pain, significant weakness, or if non-surgical treatments fail. Surgery repairs the torn tendon and recovery includes physical therapy.

Your doctor will tailor treatment based on your specific condition.

## What can I do to lower the risk of getting another rotator cuff tear?

* Avoid repetitive overhead activities or heavy lifting that strain the shoulder tendons.
* Maintain good posture and ergonomics, especially if your work involves overhead motions.
* Engage in regular shoulder strengthening and flexibility exercises to support the rotator cuff muscles.
* Avoid smoking, as it impairs tendon health and healing.
* Manage chronic conditions like diabetes or hypertension that may affect tendon quality.

## Should I look out for signs of complications?

Yes, it’s important to monitor your shoulder during treatment and recovery.

## What are signs of complications?

* Increasing or severe shoulder pain that doesn’t improve with treatment
* Progressive weakness or inability to lift your arm
* Loss of shoulder motion or stiffness beyond expected recovery
* Signs of infection if you had surgery (redness, swelling, warmth, fever)
* New numbness, tingling, or changes in sensation in your arm
* Shoulder instability or recurrent dislocations

If you notice any of these, contact your healthcare provider promptly

## 

## **Differential Diagnoses**

* Adhesive Capsulitis (Frozen Shoulder)
* Biceps Rupture
* Bicipital Tendonitis
* Cervical Disc Disease
* Cervical Myofascial Pain
* Cervical Spondylosis
* Cervical Sprain and Strain
* Complex Regional Pain Syndromes
* Fibromyalgia
* Osteoarthritis
* Rheumatoid Arthritis (RA)
* Rotator Cuff Disease
* Shoulder Pain in Hemiplegia
* Thoracic Outlet Syndrome

## 

## **Epidemiology**

Shoulder pain is the third most common cause of MSDs, after low back pain and cervical pain. Estimates of the cumulative annual incidence of shoulder disorders have ranged from 7% to 25% in the Western general population. The annual incidence has been estimated at 10 cases per 1000 population, peaking at 25 cases per 1000 population in persons aged 42-46 years.

Of persons aged 70 years or older, 21% have shoulder symptoms, most of which can be attributed to the rotator cuff. In cadaver studies, the rate of full-thickness tears has ranged from 18% to 26%. The rate of partial-thickness tears has ranged from 32% to 37% after age 40 years; before age 40 years, tears are rare. In magnetic resonance imaging (MRI) studies, tears have been observed in 34% of asymptomatic individuals of any age. After age 60 years, 26% of patients have partial-thickness tears, and 28% demonstrate full-thickness tears.

No known racial variation associated with rotator cuff disease is cited in the literature. In one study, a predominance of male patients (66%) seeking consultation for rotator disease was reported, but in other studies, the male-to-female ratio was 1:1. Rotator cuff disease is more common after age 40 years. The average age of onset has been estimated at 55 years.

**Doctor-patient conversation about a rotator cuff tear**,

Doctor:  
“After reviewing your symptoms and imaging, it looks like you have a rotator cuff tear. This is a common injury where one or more of the tendons that help lift and rotate your shoulder are partially or fully torn.”

Patient:  
“What causes this? I don’t remember a big injury.”

Doctor:  
“Rotator cuff tears can happen gradually over time due to wear and tear, especially in people over 50. Sometimes, they result from a fall or sudden injury, like landing on an outstretched arm. Many tears develop slowly and may not cause symptoms until the tendon weakens enough.”

Patient:  
“I’ve been having pain on the outside of my shoulder, especially at night, and it’s hard to lift my arm. Is that typical?”

Doctor:  
“Yes, pain along the outer shoulder and night pain are classic signs. You might also notice weakness when lifting your arm or doing overhead activities like putting your hair in a ponytail or reaching for something on a shelf.”

Patient:  
“Will this heal on its own, or do I need surgery?”

Doctor:  
“Most rotator cuff tears, especially small or partial ones, can improve with non-surgical treatments like physical therapy, anti-inflammatory medications, and sometimes corticosteroid injections. Surgery is usually reserved for larger tears, persistent pain, or significant weakness that doesn’t improve with therapy.”

Patient:  
“What does physical therapy involve?”

Doctor:  
“Physical therapy focuses on strengthening the shoulder muscles around the tear to improve function and reduce pain. It also helps improve your range of motion and shoulder mechanics.”

Patient:  
“If I do need surgery, what should I expect?”

Doctor:  
“Surgery usually involves repairing the torn tendon, often arthroscopically. Recovery can take several months, including physical therapy afterward. But many patients regain good strength and function after surgery.”

Patient:  
“Is there anything I can do now to help?”

Doctor:  
“Absolutely. Avoid activities that worsen your pain, apply ice for inflammation, take over-the-counter pain relievers as needed, and start gentle range-of-motion exercises. I’ll refer you to a physical therapist to guide you through a tailored program.”

Patient:  
“Thank you, doctor. It’s good to know there are options.”

Doctor:  
“You’re welcome. We’ll work together to manage your symptoms and help you get back to your normal activities.”

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### **Sarcopenia**

The medical definition of sarcopenia is the gradual loss of muscle mass, strength and function. The condition commonly affects the elderly population and is thought to occur due to aging. Sarcopenia can greatly impact your quality of life by reducing your ability to perform daily tasks. It can lead to the loss of your independence and the need for long-term care.

Sarcopenia affects your musculoskeletal system and is a major factor in increased frailty, falls and fractures. These conditions can lead to hospitalizations and surgeries, which increase the risk of complications including death.

Sarcopenia can also affect people with a high body mass index (BMI), in a condition called sarcopenic obesity. People with obesity and sarcopenia have a greater risk for complications than with obesity or sarcopenia alone.

### **Who does sarcopenia affect?**

Sarcopenia most commonly affects people ages 60 and older. The rates increase with age. The disease affects both sexes equally. Studies on affected ethnicities are inconsistent. The rates of the condition increase in people with chronic disease.

Studies are inconsistent, and many people don’t receive a diagnosis or treatment for sarcopenia. But rates of the condition range from 5% to 13% in people ages 60 and older. The estimates increase to 11% to 50% in people ages 80 and older.

A decrease in both the number and size of your muscle fibers causes your muscles to thin (muscle atrophy).

As you age, your body goes through certain changes that play a major factor in developing sarcopenia. For instance, your body doesn’t produce the same amount of proteins your muscles need to grow. When this happens, your muscle cells get smaller.

In addition, as you grow older, changes in certain hormones — like testosterone and insulin-like growth factor (IGF-1) — affect your muscle fibers. This can lead to sarcopenia.

## **Symptoms and Causes**

Many factors, including aging, can lead to sarcopenia, but there are steps you can take to slow down the disease.

### **Symptoms of sarcopenia**

The most common symptom of sarcopenia is muscle weakness. Other symptoms may include:

* Loss of stamina.
* Difficulty performing daily activities.
* Walking slowly.
* Trouble climbing stairs.
* Poor balance and falls.
* Decrease in muscle size.

### **What causes sarcopenia?**

The most common cause of sarcopenia is the natural aging process. You gradually begin losing muscle mass and strength sometime in your 30s or 40s. This process picks up between the ages of 65 and 80. Rates vary, but you may lose as much as 8% of your muscle mass each decade. Everyone loses muscle mass over time, but people with sarcopenia lose it more quickly.

Although aging tends to be the dominant factor, researchers have discovered other possible risk factors for sarcopenia. These may include:

* Physical inactivity.
* Obesity.
* Chronic diseases such as chronic obstructive pulmonary disease (COPD), kidney disease, diabetes, cancer and HIV.
* Rheumatoid arthritis.
* Insulin resistance.
* Reduction in hormone levels.
* Malnutrition or inadequate protein intake.
* Decrease in your ability to convert protein to energy.
* Decline in the number of nerve cells that send messages from your brain to your muscles telling them to move.

## **Diagnosis and Tests**

Your healthcare provider may diagnose sarcopenia after performing a physical exam and asking you about your symptoms. You may complete a questionnaire based on your self-reported symptoms called the SARC-F. SARC-F stands for:

* **S** — Strength.
* **A** — Assistance with walking.
* **R** — Rising from a chair.
* **C** — Climbing stairs.
* **F** — Falls.

You score each factor with a number between 0 and 2. The highest maximum SARC-F score is 10. A SARC-F score of 4 or more warrants more testing.

### **What tests will be done to diagnose sarcopenia?**

There is no single test that can diagnose sarcopenia. Your healthcare provider may recommend several tests to diagnose and then determine the severity of sarcopenia.

#### **Muscle strength tests**

* **Handgrip test:** Handgrip strength draws a parallel to the strength in your other muscles. Providers use it to identify shortages in overall muscle strength.
* **Chair stand test:** Providers use the chair stand test to measure your leg muscle strength, especially your quadriceps. The chair stand test measures the number of times you can stand and sit from a chair without the use of your arms in 30 seconds.
* **Walking speed test:** The walking (gait) speed test measures the time it takes for you to travel 4 meters (about 13 feet) at your usual walking pace.
* **Short physical performance battery (SPPB):** With the SPPB test, you take three timed tasks: chair stand test, standing balance test and walking speed test.
* **Timed-up and go test (TUG):** The TUG test measures the time it takes for you to rise from a chair, walk 3 meters (about 10 feet) away from the chair, walk 3 meters back to the chair, and sit back down in the chair.

#### **Imaging tests for measurement of muscle mass**

* **Dual-energy X-ray absorptiometry (DEXA or DXA):** This type of imaging test uses low-energy X-rays to measure your muscle mass, fat mass and bone density.
* **Bioelectrical impedance analysis (BIA):** The BIA test is less expensive and more widely available than DEXA. It measures your body fat in relation to your lean body mass.

## **Management and Treatment**

Treatment for sarcopenia typically includes lifestyle changes. These modifications to your lifestyle behaviors can treat and help reverse sarcopenia.

* **Physical activity:** Your healthcare provider may recommend progressive resistance-based strength training. This type of exercise can help improve your strength and reverse your muscle loss.
* **Healthy diet:** When paired with regular exercise, eating a healthy diet can also help reverse the effects of sarcopenia. It’s especially important to increase your protein intake through food or supplements.

### **What medications are used to treat sarcopenia?**

Researchers are studying the possibility of using hormone supplements to increase muscle mass. But there aren’t currently any FDA-approved medications to treat sarcopenia.

## **Outlook / Prognosis**

The outlook for sarcopenia primarily depends on your age. Rates of the condition increase as you grow older. In addition, the outlook for the condition varies based on your health and lifestyle.

The disease can greatly affect your quality of life. You may be able to reverse the effects of the condition with lifestyle changes. If you don’t make recommended changes, the disease will continue to weaken your muscles. Over time, you may need full-time care to live your life.

**Prevention**

You may not be able to completely prevent sarcopenia since the condition happens as part of the natural aging process. But you can take steps to slow the progression of the disease. These include:

* **Make healthy food choices:** Maintain a healthy diet that includes high-quality proteins. Aim for 20 to 35 grams of protein in each meal.
* **Exercise:** Maintain a physically active lifestyle that includes exercises such as resistance training.
* **Routine physicals:** See your healthcare provider regularly, and let them know about any changes in your health.

## **Common Questions**

### **Is sarcopenia a disease?**

In 2016, the Centers for Disease Control and Prevention (CDC) declared sarcopenia a specific disease by creating an International Classification of Disease (ICD) 10 code for the condition. This designation made sarcopenia a reportable disease by healthcare providers. Therefore, it increased the diagnosis and treatment of the disease. This label helps distinguish sarcopenia from similar diseases and allows researchers to begin collecting valuable data about the condition.

### **What’s the difference between sarcopenia and muscle atrophy?**

Sarcopenia is a type of muscle atrophy that specifically affects people as they grow older. Muscle atrophy is the loss of muscle tissue. The two conditions share common features of muscle loss, but the processes behind them are different. A decrease in the size and number of your muscle fibers causes sarcopenia. With muscle atrophy, there’s a reduction in the size of the fibers, but the amount of fibers stays the same.

**DIFFERENTIAL DIAGNOSIS**

Considering the high probability that sarcopenia may co-exist with the below conditions and considering the overlap between conditions, an accurate differential diagnosis may be difficult.

* Frailty: While sarcopenia and frailty present with significant overlap of symptoms, they remain distinguishable. Frailty is defined as multi-system impairment and encompasses a broader range of dysfunction than sarcopenia, whereas sarcopenia mainly includes the musculoskeletal system. One condition may contribute directly to the other, as they often co-exist in elderly patients.
* Malnutrition: Both malnutrition and sarcopenia present with low muscle mass, though sarcopenia more often presents with the additional loss of function. Additionally, as a function of caloric restriction, reduced fat mass is observed in patients with malnutrition – this is often not the case with sarcopenia. Functional tests for strength and performance may be administered to rule out malnutrition.
* Cachexia: Cachexia is thought to have a more complex etiology than sarcopenia. Cachexia is described as severe weight loss and muscle-wasting associated with conditions such as HIV, cancer, and end-stage organ failure. While cachexia and sarcopenia may co-exist, a patient with severe muscle wasting diseases such as HIV or cancer is more likely to have cachexia. Additionally, the Glasgow prognostic score can be utilized to distinguish the two conditions.
* Osteoarthritis of the hand: Patients with osteoarthritis of the hand may elicit a false positive test when performing the handgrip strength test. In cases where severe osteoarthritis is suspected, patients may perform methods to measure isometric torque of the lower limb to more accurately assess or rule out sarcopenia

**EPIDEMIOLOGY**

The prevalence of sarcopenia is estimated within the ranges of 5 – 13% and 11 – 50% in patients aged 60 and above, and 80 and above, respectively. The worldwide prevalence of sarcopenia in patients over the age of 60 is estimated to be 10%. Variations observed among studies are likely due to inconsistent diagnostic criteria, and heterogeneous populations studied. Sarcopenia almost exclusively affects elderly populations and affects both sexes equally. Data regarding sarcopenia and ethnicity is inconsistent among studies. Furthermore, the prevalence of sarcopenia is greater in patients with chronic diseases such as COPD, CHF, CKD, DM, HIV, and cancer

## **Doctor-Patient Conversation: Sarcopenia**

Doctor:  
“Hello! I wanted to talk to you about some of the muscle loss and weakness you’ve been experiencing. Based on your symptoms and tests, it looks like you have a condition called sarcopenia.”

Patient:  
“Sarcopenia? What does that mean?”

Doctor:  
“Sarcopenia is the gradual loss of muscle mass and strength that happens as people get older. It can make everyday activities like climbing stairs, carrying groceries, or even getting up from a chair more difficult.”

Patient:  
“Is this normal with age? Can it be treated?”

Doctor:  
“It’s quite common, but it’s not something you just have to accept. The good news is that sarcopenia can be managed and even improved with the right approach.”

Patient:  
“What causes it? Why am I losing muscle?”

Doctor:  
“As we age, our muscles naturally shrink and weaken, but other factors can speed this up, like reduced physical activity, poor nutrition, chronic illnesses, or hormonal changes. Sometimes, not getting enough protein or calories can contribute too.”

Patient:  
“So, what can I do to get better?”

Doctor:  
“The best treatment includes a combination of resistance exercises—like weight training or using resistance bands—and making sure you have a balanced diet with enough protein. Sometimes, we may also check for underlying conditions that could be contributing.”

Patient:  
“Is exercise safe for me? I’m a bit worried about falling or hurting myself.”

Doctor:  
“That’s a very valid concern. We’ll start with gentle, supervised exercises tailored to your ability, and a physical therapist can guide you safely. Improving your strength will actually help reduce your risk of falls.”

Patient:  
“How long does it take to see improvement?”

Doctor:  
“Many people notice benefits within a few months of consistent exercise and good nutrition. It’s important to keep it up long-term to maintain muscle strength.”

Patient:  
“Are there any medications I can take?”

Doctor:  
“Currently, there’s no specific medication approved just for sarcopenia. Our focus is on lifestyle changes, but if we find other health issues contributing, we’ll treat those as well.”

Patient:  
“Thank you, doctor. It’s good to know there’s something I can do.”

Doctor:  
“You’re welcome! We’ll work together to help you regain strength and improve your quality of life. If you have any questions or concerns along the way, don’t hesitate to reach out.”

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### **Herniated disk**

A herniated disk occurs when one of the disks in your spine (backbone) tears or leaks due to natural wear and tear or injury. This puts pressure on your spinal cord and irritates your spinal nerves, leading to pain, numbness and weakness.

You have a series of bones (vertebrae) in your spine, stretching from the base of your skull to your tailbone. Between your vertebrae are round cushions called disks. The disks act as buffers between your bones, allowing you to bend and move with ease. Over time, the disks become less effective and may become displaced. When this occurs, it’s called a herniated disk.

**Other names for a herniated disk include:**

* Bulging disk.
* Slipped disk.
* Ruptured disk.
* Protruding disk.

Every year, more than 3 million people in the U.S. get a herniated disk. Bulging disks are a leading cause of neck, back and leg pain. They can happen anywhere along your spine, but they most often occur in your lower back (lumbar spine) or your neck (cervical spine). It’s rare for a herniated disk to be in your upper-to-mid back (thoracic spine).

If you’ve experienced a slipped disk, you know the pain can be severe. The good news is that most cases resolve on their own without the need for surgical treatment. If you’ve had symptoms for more than a few weeks, reach out to a healthcare provider. They can explain your treatment options and get you back to enjoying the activities that you love.

## **Symptoms and Causes**

Herniated disk symptoms vary depending on where the problem is in your spine. Although pain is a common symptom throughout your back, the location of the slipped disk may lead to other symptoms.

#### **Symptoms of a herniated disk in your lower back (herniated lumbar disk)**

It’s common for a herniated disk in your lower back to cause “sciatic nerve” pain (sciatica). This sharp pain usually shoots down one side of your buttocks into your leg and sometimes your foot. Other symptoms of a slipped disk in your lower back may include:

* Lower back pain.
* Tingling or numbness in your legs and/or feet.
* Muscle weakness.

#### **Symptoms of a herniated disk in your neck (herniated cervical disk)**

Symptoms of a bulging disk in your neck may include:

* Neck pain, especially in the back and on the sides of your neck.
* Numbness or tingling in your arms.
* Pain near or between your shoulder blades.
* Pain that travels to your shoulder, arm and sometimes your hand and fingers.
* Pain that increases when bending or turning your neck.

### **What causes a bulging disk?**

Each disk in your spine has a soft, gel-like center and a firmer outer layer, kind of like a jelly doughnut. With time, the outer layer weakens and can crack. A herniated disk happens when the inner “jelly” substance pushes through the crack and presses on your spinal cord. The leaked material may press on nearby spinal nerves, causing the symptoms of a herniated disk.

Several factors can contribute to a disk rupture. Herniated disk causes include:

* Aging.
* Traumatic injuries, like falls.
* Performing repetitive bending or twisting motions.
* Improper lifting of heavy objects.

#### **Risk factors for a slipped disk**

People ages 30 to 50 are most likely to get a herniated disk. The problem affects men twice as often as women. In addition, the condition tends to run in families. Other risk factors include:

* Smoking.
* Sitting for long periods in the same position.
* Being overweight or obesity.
* Having diabetes.
* Having a connective tissue disorder.

## **Diagnosis and Tests**

Your healthcare provider will do a thorough physical exam. During the exam, your provider will assess your pain, muscle reflexes, sensation and muscle strength. They may perform a straight leg raise test. With this test, your provider will have you lie on your back. Then, they’ll raise your leg straight in the air. If you experience any pain down your leg, you likely have a ruptured disk.

Your provider may also perform a neurological exam. They may also order imaging tests, including:

* Magnetic resonance imaging (MRI) scan.
* X-rays.
* Computed tomography (CT) scan.
* Myelogram.
* Electromyogram (EMG).
* Nerve conduction study.

## **Management and Treatment**

In most cases, pain from a slipped disk goes away in time. To ease pain while your disk heals, you can:

* Rest for one to three days if the pain is severe. But it’s important to avoid long periods of bed rest to prevent stiffness.
* Take an over-the-counter pain reliever, like ibuprofen or acetaminophen.
* Apply heat or ice to the affected area.

### **Treatment for a herniated disk**

You may need more advanced herniated disk treatment if your symptoms aren't getting better. Your healthcare provider might recommend:

* **Medication:** Your provider may prescribe an anti-inflammatory pain reliever or muscle relaxant.
* **Physical therapy:** A physical therapist teaches you a fitness program to help relieve pressure on your nerves. Physical activity loosens tight muscles and improves circulation.
* **Spinal injections:** Called an epidural or nerve block, a spinal injection is a shot of steroid medication directly into your spine.

#### **When might I need herniated disk surgery?**

Herniated disks get better on their own or with nonsurgical treatment for 9 out of 10 people. If other treatments don’t relieve your symptoms, your healthcare provider may recommend surgery. There are multiple surgical techniques for relieving pressure on your spinal cord and nerves.

In rare cases, a large ruptured disk might injure nerves to your bladder or bowel. That may require emergency surgery. For non-emergency cases, herniated disk surgery is an option when other treatments don’t work. There are various ways to perform spinal decompression surgery, but the goal is to relieve pressure on your nerves.

The most common procedure is called a microdiscectomy. With this minimally invasive spine surgery, your provider will make a small cut (incision) through the skin near the slipped disk. They’ll insert a microscope and small tools through the incision to remove the herniated part of the disk.

Other surgical treatment options include:

* Diskectomy.
* Laminotomy.
* Laminectomy.
* Artificial disk surgery.
* Spinal fusion.

## **Outlook / Prognosis**

For the majority of people, herniated disk pain gets better on its own or with simple medical care. You’ll probably feel better within a month. If you don’t, you should see a healthcare provider. Some people need more aggressive medical measures, like spinal injections or herniated disk surgery.

#### **Will a slipped disk get worse?**

An untreated herniated disk can get worse. That’s especially true if you continue the activities that caused it — for instance, if it developed because of your work. A worsening ruptured disk may cause chronic (ongoing) pain and loss of control or sensation in the affected area. See a healthcare provider if you still have symptoms after four to six weeks of conservative care.

## **Prevention**

It’s not always possible to prevent a bulging disk. But you can reduce your risk by:

* **Using proper lifting techniques.** Don’t bend at the waist. Bend your knees while keeping your back straight. Use your strong leg muscles to help support the load.
* **Maintaining a healthy weight for you.** Excess weight puts pressure on your lower back.
* **Practicing good posture.** Learn how to improve your posture when you walk, sit, stand and sleep. Good posture reduces strain on your spine.
* **Stretching.** It’s especially important to take stretching breaks if you often sit for long periods.
* **Avoiding wearing high-heeled shoes.** This type of shoe throws your spine out of alignment.
* **Getting regular physical activity.** Focus on workouts that strengthen your back and abdomen muscles to help support your spine.
* **Stopping smoking.** Smoking can weaken disks, making them vulnerable to rupture. Consider quitting smoking.

### **When should I see my healthcare provider?**

Initially, you can treat ruptured disk pain at home. But you should see a healthcare provider if:

* Pain interferes with daily life, like going to work.
* Symptoms aren’t better after four to six weeks.
* Symptoms get worse.
* You develop loss of bladder or bowel control.
* You notice tingling, numbness or loss of strength in your arms, hands, legs or feet.
* You have trouble standing or walking.

### **What questions should I ask my healthcare provider?**

Questions to ask your provider include:

## **How long should I stay off my feet?**

You don’t need to stay off your feet completely. In fact, returning to normal day-to-day activities like walking as soon as you feel comfortable is encouraged because gentle movement helps stimulate healing and strengthens the muscles supporting your spine. If pain is severe, a few days of rest may be helpful, but prolonged bed rest is not recommended.

## **How much walking or other activities should I be doing?**

* Walking and gentle movement should be resumed early, as tolerated.
* Light exercise such as brisk walking, swimming, or using an elliptical machine is usually safe to start within 2 to 4 weeks after injury once pain decreases.
* More intense exercise or heavy lifting should generally be avoided until about 8 to 12 weeks, when healing has progressed and pain has mostly resolved.
* Physical therapy can guide you on safe exercises to improve strength and flexibility.

## **What pain medication should I take?**

* Over-the-counter NSAIDs (like ibuprofen or naproxen) are commonly recommended to reduce pain and inflammation.
* Acetaminophen can be used for pain relief if NSAIDs are contraindicated.
* For more severe pain, your doctor might prescribe short courses of stronger pain medications or muscle relaxants.
* Corticosteroid injections may be considered if inflammation is significant and pain persists despite medications.

## **Will ice or heat help?**

* Ice therapy is most helpful in the acute phase (first few days) to reduce inflammation and numb pain. Apply ice packs for 15-20 minutes several times daily.
* Heat therapy can be useful after the initial inflammation subsides to relax muscles and improve blood flow.
* You can alternate between ice and heat depending on what feels better.

## **If considering surgery, what are my surgical options?**

Surgery is generally reserved for patients who:

* Have severe or worsening neurological symptoms (e.g., weakness, numbness, loss of bladder/bowel control)
* Do not improve with conservative treatment after 6-12 weeks
* Have significant functional impairment

Common surgical options include:

* Microdiscectomy: Removal of the herniated portion of the disc to relieve nerve pressure; most common procedure for lumbar herniation.
* Laminectomy or laminotomy: Removal of part of the vertebral bone to decompress nerves if stenosis coexists.
* Spinal fusion: Sometimes performed if instability is present.

**The differential diagnoses for a herniated disc include:**

* Discal cyst
* Mechanical back pain
* Degenerative spinal stenosis
* Epidural abscess
* Epidural hematoma
* Metastasis
* Diabetic amyotrophy
* Neurinoma
* Osteophytes
* Cauda equina syndrome
* Synovial cyst

**EPIDEMIOLOGY**

The incidence of a herniated disc is about 5 to 20 cases per 1000 adults annually and is most common in people in their third to fifth decade of life, with a man-woman ratio of 2:1. The estimated prevalence of symptomatic herniated discs of the lumbar spine is about 1% to 3% of patients. The prevalence is most significant among 30-50-year-olds. Patients between 25 and 55 years old have an approximately 95% chance of herniated discs occurring either at L4-L5 or L5-S1. Disc disease is the underlying etiology in less than five percent of patients with back pain

## **Doctor-Patient Conversation: Herniated Disk**

Doctor:  
“Hello, I’ve reviewed your symptoms and imaging results, and it looks like you have a herniated disk in your spine. This means that one of the discs between the bones of your spine has bulged out and is pressing on nearby nerves.”

Patient:  
“What causes this? Did I do something wrong?”

Doctor:  
“Not necessarily. Herniated disks can happen from a sudden injury like lifting something heavy incorrectly, or they can develop gradually as the discs wear down with age. Sometimes, even simple movements can cause a disk to herniate if the disc is already weakened.”

Patient:  
“I’ve been having pain shooting down my leg and numbness. Is that normal?”

Doctor:  
“Yes, those symptoms are common because the herniated disk is pressing on the nerve that travels down your leg. This can cause pain, numbness, tingling, or weakness along the path of that nerve.”

Patient:  
“What treatments are available? Do I need surgery?”

Doctor:  
“Most people improve with conservative treatments like physical therapy, pain medications, and sometimes steroid injections to reduce inflammation. Surgery is usually only considered if symptoms are severe, worsening, or if there’s significant weakness or loss of bladder or bowel control.”

Patient:  
“How long does it take to get better?”

Doctor:  
“Many patients start to feel better within a few weeks to a few months with proper treatment. Healing times vary, but most herniated disks improve without surgery.”

Patient:  
“Are there things I can do to help myself?”

Doctor:  
“Yes, staying active with gentle exercises, avoiding heavy lifting or twisting, and practicing good posture can help. Your physical therapist will guide you on safe movements.”

Patient:  
“What should I watch out for that means I need to come back quickly?”

Doctor:  
“If you develop severe weakness, loss of sensation in your groin or inner thighs, difficulty controlling your bladder or bowels, or worsening pain that doesn’t improve, you should seek medical help immediately.”

Patient:  
“Thank you, doctor. I feel better knowing what’s going on and what to do.”

Doctor:  
“You’re welcome. We’ll work together to manage your symptoms and help you recover. Please call if you have any concerns.”

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**SEPTIC ARTHRITIS**

**DEFINITION AND DESCRIPTION**

Septic arthritis is a painful infection in a joint that can come from germs that travel through your bloodstream from another part of your body. Septic arthritis can also occur when a penetrating injury, such as an animal bite or trauma, delivers germs directly into the joint.

Infants and older adults are most likely to develop septic arthritis. People who have artificial joints are also at risk of septic arthritis. Knees are most commonly affected, but septic arthritis also can affect hips, shoulders and other joints. The infection can quickly and severely damage the cartilage and bone within the joint, so prompt treatment is crucial.

Treatment involves draining the joint with a needle or during surgery. Antibiotics also are usually needed.

## **Symptoms**

Septic arthritis typically causes extreme discomfort and difficulty using the affected joint. The joint could be swollen, red and warm, and you might have a fever.

If septic arthritis occurs in an artificial joint (prosthetic joint infection), signs and symptoms such as minor pain and swelling may develop months or years after knee replacement or hip replacement surgery. Also, a loosening of the joint may occur, which causes pain while moving the joint or while putting weight on the joint. Typically, the pain goes away when at rest. In extreme cases, the joint may become dislocated.

## **When to see a doctor**

See your doctor if you have severe pain in a joint that comes on suddenly. Prompt treatment can help minimize joint damage.

If you have an artificial joint, see your doctor if you experience pain while using the joint.

## **Causes**

Septic arthritis can be caused by bacterial, viral or fungal infections. Bacterial infection with Staphylococcus aureus (staph) is the most common cause. Staph commonly lives on even healthy skin.

Septic arthritis can develop when an infection, such as a skin infection or urinary tract infection, spreads through your bloodstream to a joint. Less commonly, a puncture wound, drug injection, or surgery in or near a joint — including joint replacement surgery — can give the germs entry into the joint space.

The lining of your joints has little ability to protect itself from infection. Your body's reaction to the infection — including inflammation that can increase pressure and reduce blood flow within the joint — contributes to the damage.

## **Risk factors**

Risk factors for septic arthritis include:

* **Existing joint problems.** Chronic diseases and conditions that affect your joints — such as osteoarthritis, gout, rheumatoid arthritis or lupus — can increase your risk of septic arthritis, as can previous joint surgery and joint injury.
* **Having an artificial joint.** Bacteria can be introduced during joint replacement surgery, or an artificial joint may become infected if germs travel to the joint from a different area of the body through the bloodstream.
* **Taking medications for rheumatoid arthritis.** People with rheumatoid arthritis have a further increase in risk because of medications they take that can suppress the immune system, making infections more likely to occur. Diagnosing septic arthritis in people with rheumatoid arthritis is difficult because many of the signs and symptoms are similar.
* **Skin fragility.** Skin that breaks easily and heals poorly can give bacteria access to your body. Skin conditions such as psoriasis and eczema increase your risk of septic arthritis, as do infected skin wounds. People who regularly inject drugs also have a higher risk of infection at the site of injection.
* **Weak immune system.** People with a weak immune system are at greater risk of septic arthritis. This includes people with diabetes, kidney and liver problems, and those taking drugs that suppress their immune systems.
* **Joint trauma.** Animal bites, puncture wounds or cuts over a joint can put you at risk of septic arthritis.

Having a combination of risk factors puts you at greater risk than having just one risk factor does.

## **Complications**

If treatment is delayed, septic arthritis can lead to joint degeneration and permanent damage. If septic arthritis affects an artificial joint, complications may include joint loosening or dislocation.

## **Diagnosis and Tests**

After a physical exam of your joint, if your healthcare provider suspects you have septic arthritis, they will most likely withdraw synovial fluid (the fluid that lubricates your joint) from your affected joint with a needle. This is called aspiration. They will then do a laboratory test to look at the synovial fluid. Having bacteria in the synovial fluid of your joint confirms the diagnosis of septic arthritis.

### **What tests are used to diagnose septic arthritis?**

Tests that are used to diagnose septic arthritis include:

* **Synovial fluid aspiration**: Your healthcare provider may withdraw fluid from your affected joint with a fine needle to check it for bacteria. This is known as aspiration.
* **Blood tests**: Your provider may have you undergo blood tests to see if your body’s immune system is responding to an infection and/or to rule out other possible issues.
* **X-rays**: X-rays use radiation to take images of your bones. X-rays can show widened joint spaces and bulging of the soft tissues, which can be signs of septic arthritis.
* **Ultrasound**: Ultrasound uses sound waves to take pictures inside your body. An ultrasound can help your provider see how swollen your joint is and help them see your joint fluid when aspirating it.
* **MRI**: An MRI (magnetic resonance imaging) uses a large magnet, radio waves and a computer to make detailed images of your organs and bones. An MRI can help detect early cases of septic arthritis.

## **Management and Treatment**

The following treatments are used for septic arthritis:

* **Surgery:** Removal of the inflamed tissue (surgical debridement) and IV (intravenous) antibiotics are necessary in most cases.
* **Antibiotics**: All cases of septic arthritis need to be treated with antibiotics. Your healthcare provider may give you antibiotics through an IV and/or in pill form.
* **Joint fluid drainage**: Your provider may drain (aspirate) fluid from your joint using a fine needle. They may have to do this more than once as you recover.
* **Physical therapy**: You will likely need physical therapy to restore function in your joint and prevent the muscles around your joint from weakening.
* **Removal of an artificial joint**: If you get septic arthritis in an artificial (prosthetic) joint, you will likely have to have your artificial joint removed and replaced with a joint spacer, a device made of antibiotic cement. After several months, your healthcare provider will replace your artificial joint.

### **How long does it take septic arthritis to heal?**

The length of time it takes for septic arthritis to fully heal depends on what caused your infection and your overall health. You may have to take antibiotics for a few weeks. It could take longer for your joint to fully heal if the infection caused damage to your joint and the surrounding soft tissues.

### **Does septic arthritis go away on its own?**

Septic arthritis cannot go away on its own since it’s an infection. Bacterial infections need to be treated with antibiotics. If you’re experiencing signs and symptoms of septic arthritis, contact your healthcare provider right away or go to the nearest hospital. Septic arthritis can lead to serious complications and can be life-threatening if it’s not treated.

## **Outlook / Prognosis**

The prognosis (outlook) for septic arthritis depends on a few factors, including:

* The type of bacteria or organism that caused your infection.
* How long your infection lasts.
* Your age and overall health.

Some types of bacteria, such as MRSA, are more challenging to treat than others. The longer septic arthritis lasts, the more likely the affected joint will become damaged. People who have weakened immune systems are also more likely to have damage to their affected joints.

### **Can septic arthritis be fatal?**

Despite the use of antibiotics for treatment, there’s a 7% to 15% mortality (death) rate for septic arthritis. If you’re experiencing signs or symptoms of septic arthritis, be sure to contact your healthcare provider or go to the nearest hospital as soon as possible.

### **Complications associated with septic arthritis**

Septic arthritis is a serious condition. Complications of septic arthritis can include:

* Chronic pain.
* Osteomyelitis (inflammation or swelling in the bone).
* Osteonecrosis (bone tissue dies due to lack of blood flow).
* A difference in leg length.
* Sepsis (widespread inflammation in the body).
* Death.

## **Prevention**

The risk factors for developing septic arthritis are different for children and adults. Risk factors for children include:

* **Age**: Newborn children are at a higher risk of getting septic arthritis because their immune systems aren’t as strong.
* **Having hemophilia**: Children who have hemophilia, an inherited bleeding disorder in which their blood does not clot properly, are at a higher risk of developing septic arthritis.
* **Having a weakened immune system**: Children who are immunocompromised (have a weak immune system) from conditions like sickle cell anemia and HIV have a higher risk of getting septic arthritis.
* **Being on chemotherapy**: Chemotherapy weakens your immune system, which makes it more likely that people undergoing it will develop septic arthritis.

Risk factors for adults include:

* **Age**: Adults over the age of 80 are at a higher risk of getting septic arthritis.
* **Having rheumatoid arthritis (RA) or osteoarthritis**: People who have damaged joints from rheumatoid arthritis or osteoarthritis are more susceptible to septic arthritis. Cases of septic arthritis in people who have rheumatoid arthritis are up to 70 per 100,000 people per year.
* **Having HIV (human immunodeficiency virus)**: HIV weakens your immune system, which makes it more likely that you’ll get an infection, which could lead to septic arthritis.
* **Having diabetes**: Having high blood sugar can weaken your immune system. People who have diabetes and have persistent high blood sugar are at a greater risk of getting an infection and septic arthritis.
* **Having skin infections**: Since septic arthritis is usually caused by an infection elsewhere on or in your body, having a skin infection could lead to septic arthritis.
* **Having a recent joint surgery**: Having a recent joint surgery puts you at a higher risk of getting septic arthritis because the wound from the surgery could become infected.
* **Having an artificial (prosthetic) joint**: Infections are more common in prosthetic (artificial) joints than in natural joints. Having a prosthetic joint increases your risk of getting septic arthritis.
* **Injection drug use**: Injection drug use puts you at a higher risk of getting septic arthritis because the needle can introduce harmful bacteria and other organisms into your body when it breaks the skin.
* **Sexual activity**: Sexual activity, especially unprotected sex, can put you at a higher risk of developing septic arthritis from the bacteria that causes gonorrhea, a sexually transmitted infection (STI). The bacterium is called *Neisseria gonorrhoeae*.

### **How can I prevent septic arthritis?**

While not all cases of septic arthritis are preventable, there are a few things you can do to try to prevent getting it, including:

* **Make sure cuts and wounds don’t get infected**: If you have a cut or wound on your skin, keep it clean to prevent infection. If you are experiencing signs of an infection — such as redness, warmth and/or pus in or around your wound — contact your healthcare provider immediately.
* **Try to manage your chronic health condition(s) well**: If you have a chronic health condition such as diabetes or AIDS (acquired immunodeficiency syndrome), try to manage your condition as well as you can in order to stay healthy.
* **Practice safe sex**: Always follow safe sex practices, such as always using a condom or dental dam and talking with your sexual partner about past partners and STI (sexually transmitted infection) history.
* **Don’t abuse drugs**: Injection drug use can cause infections. Only take medications as prescribed by your healthcare provider.

### **When should I see my healthcare provider?**

If you’re experiencing symptoms of septic arthritis, such as pain, fever, extreme warmth, redness or tenderness in your joint and having limited mobility in your joint, contact your healthcare provider or go to the nearest hospital immediately. Septic arthritis is a serious condition that needs to be treated with antibiotics. If left untreated, it can be life-threatening.

## **Common Questions**

### **What is the difference between septic arthritis and osteomyelitis?**

Osteomyelitis and septic arthritis are both rare and serious conditions. Osteomyelitis is an infection of the bone. Septic arthritis is inflammation in the surface of the cartilage that lines the joint and the synovial fluid that lubricates the joint that is caused by an infection. Both conditions are usually caused by the bacterium *Staphylococcus aureus.*

Osteomyelitis and septic arthritis can be tricky to tell apart because they have similar symptoms, including pain, tenderness and swelling in the affected area. Septic arthritis can lead to osteomyelitis, and you can have both at the same time. If you have symptoms of osteomyelitis and/or septic arthritis, go to the nearest hospital immediately. Both conditions need medical treatment. Your healthcare provider will perform certain tests to determine which condition is causing your symptoms.

### **What is the difference between septic arthritis and gout?**

Gout is a common form of inflammatory arthritis that’s caused by a crystal called uric acid. Septic arthritis is inflammation in a joint that’s caused by an infection.

Septic arthritis is a rare, but serious, complication of gout. Since both conditions may have similar symptoms, such as inflammation of the affected joint with redness and swelling, it can be difficult to tell them apart. If you are experiencing symptoms of gout and/or septic arthritis, contact your healthcare provider as soon as possible. Your healthcare provider will ask you questions about your symptoms and may have you come to the hospital to perform certain tests to determine which condition is causing your symptoms.

**Doctor-patient conversation about septic arthritis,**

Doctor:  
“Hello, I understand you’ve been having severe pain, swelling, and redness in your knee for the past few days. Based on your symptoms and examination, it looks like you have septic arthritis, which is an infection in the joint.”

Patient:  
“Yes, doctor, it’s been getting worse. The pain is unbearable, and my knee is very swollen and hot. I even had a fever and chills.”

Doctor:  
“That’s typical for septic arthritis. The infection causes inflammation, which leads to pain, swelling, and reduced movement. It’s important we treat this quickly to prevent damage to your joint.”

Patient:  
“How did I get this infection? Is it serious?”

Doctor:  
“Septic arthritis can happen when bacteria enter the joint, sometimes through a cut or injury like you mentioned falling and cutting your knee. It is serious because the infection can rapidly damage the joint if not treated promptly.”

Patient:  
“What will the treatment involve?”

Doctor:  
“We’ll start you on intravenous antibiotics right away to fight the infection. We’ll also need to drain the infected fluid from your knee, usually by inserting a needle to remove the pus. Sometimes, if the infection is severe or doesn’t improve, surgery may be necessary to clean the joint.”

Patient:  
“Will I need to stay in the hospital?”

Doctor:  
“Yes, you’ll likely stay in the hospital initially for IV antibiotics and monitoring. Once you improve, you may switch to oral antibiotics and continue treatment at home for several weeks.”

Patient:  
“Is there anything I can do to help my recovery?”

Doctor:  
“Resting the joint initially is important to reduce pain, but once the infection is controlled, we’ll start gentle physical therapy to regain movement and strength. It’s also important to report any worsening symptoms immediately.”

Patient:  
“What signs should I watch out for that mean something is wrong?”

Doctor:  
“If you notice increasing pain, swelling, fever, redness spreading, or if you develop new symptoms like numbness or difficulty moving your leg, you should contact us immediately. These could mean the infection isn’t improving or complications are developing.”

Patient:  
“Thank you, doctor. I’m glad to know what’s going on and how we’ll treat it.”

Doctor:  
“You’re welcome. We’ll work closely together to get you better and protect your knee. Please don’t hesitate to ask questions at any time.”

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[Septic arthritis - Symptoms & causes - Mayo Clinic](https://www.mayoclinic.org/diseases-conditions/bone-and-joint-infections/symptoms-causes/syc-20350755)

### **Achilles tendon rupture**

The Achilles tendon attaches the calf muscle to the heel bone. This thick band of tissue is very strong. In fact the Achilles tendon is the largest and strongest tendon in the body. The Achilles tendon gives your leg strength to walk, run and jump.

An Achilles tendon rupture is a full or partial tear of the Achilles tendon. This acute (sudden) injury occurs when the tendon stretches to its breaking point. It happens most frequently while playing sports. Tripping, falling or twisting your ankle can also cause an Achilles tear.

Achilles tendon ruptures are very common sports injuries. They occur most frequently in people ages 30 to 40 and are more common in men than in women.

People who are “weekend warriors” (usually adults who don't train regularly, then exercise at a high intensity) are more likely to tear an Achilles tendon than younger, well-trained athletes.

### **What causes an Achilles tendon rupture?**

Sudden movement that puts stress on the Achilles tendon can lead to a rupture. Typically, people tear the Achilles tendon while playing sports. The biggest culprits are sports with sudden stops, starts and pivots — such as soccer, football, basketball, tennis or squash. Achilles tendon tears aren’t always a sports injury. You can tear your Achilles tendon by tripping, missing a step when going downstairs or accidentally stepping into a hole and twisting your ankle. Some medications — including certain antibiotics and steroid injections in the area — can weaken the Achilles tendon. This can put you at a higher risk for a tear.

### **Symptoms of a torn Achilles tendon**

The classic sign of a ruptured Achilles tendon is feeling (and sometimes hearing) a pop or snap at the back of your ankle. People often mistakenly think something has hit them, but they’re actually feeling the tendon snap.

Other common symptoms include:

* Sharp, sudden pain in the back of the ankle near the heel.
* Swelling and bruising in the back of the ankle.
* Pain when walking, especially upstairs or uphill.
* Tenderness in the spot where the tendon is torn.

### **Complications of an Achilles tendon rupture**

A torn Achilles tendon is a traumatic injury that requires medical attention. Without treatment, an Achilles tendon rupture may not heal properly. This can increase your risk of rupturing it again.

## **Diagnosis and Tests**

Your healthcare provider will physically examine your foot and ankle. They’ll check your ability to move it in various directions and see how you react to pressure on the area. They will also feel for a gap in the tendon that suggests it’s torn.

Your provider may also use imaging tests — such as ultrasound or MRI — to determine the extent of the Achilles tear.

## **Management and Treatment**

Even before you seek medical help, you can reduce pain and swelling to the injured tendon by following the RICE (Rest, Ice, Compression, Elevation) method:

* Rest, by staying off the injured leg.
* Apply ice to the injured area.
* Wrap your ankle to compress the injured area and prevent more swelling.
* Elevate your leg at or above the level of your heart to reduce swelling.

Full healing of a torn Achilles tendon typically takes about four to six months. Medical treatment for a ruptured Achilles tendon may include:

* **Brace or walking cast:** Nonsurgical treatment for a torn Achilles tendon requires immobilizing the injured foot and ankle. Your provider will place your foot, ankle and calf in a brace or walking cast. Your foot and ankle flex downward so that the Achilles tendon can heal.
* **Surgery:** Most providers recommend surgical repair of a torn Achilles tendon in people who are active and middle-aged or younger. During surgery, a surgeon stitches the two ends of the torn tendon back together. After surgery, you’ll need a cast on your lower leg to immobilize the tendon while it heals.
* **Physical therapy:** You will need physical therapy to regain strength and mobility in your Achilles tendon, whether or not you had surgery.

## **Outlook / Prognosis**

With proper treatment, most Achilles tendon ruptures fully heal within four to six months.

Having surgery to repair a torn Achilles tendon is usually the best option for younger, active people. After surgical repair, you can regain your Achilles tendon’s full strength and function.

## **Prevention**

You can’t always prevent an accidental injury like tearing your Achilles tendon. But you can take steps to reduce the risk of an Achilles tendon rupture, including:

* Doing warmup exercises before a workout or game.
* Increasing the intensity of workouts gradually.
* Regularly stretching your calf muscles and Achilles tendons.

### **When should I call the doctor?**

You should call your healthcare provider if you experience:

* A snap or pop at the back of your ankle during activity.
* Sudden sharp pain at the back of your ankle.
* Difficulty walking after an injury.

### **What questions should I ask my doctor?**

You may want to ask your healthcare provider:

## Do I need surgery to repair my Achilles tendon?

* Surgery is not always required. Many Achilles tendon ruptures can be treated non-surgically with functional bracing and rehabilitation, especially in less active or older patients.
* Surgery is often recommended if:
  + The rupture is large or the tendon ends are widely separated
  + You are a young, active, or athletic person aiming to return to high-level sports
  + There is delayed presentation or atypical rupture
* Surgical repair involves stitching the torn tendon ends back together and generally leads to a lower risk of re-rupture but carries surgical risks.

## How long will I need to wear a brace or cast?

* After surgery or non-surgical treatment, you will typically wear a cast, splint, or walking boot for 6 to 12 weeks.
* Initially, the foot is positioned in plantarflexion (toes pointed down) to reduce tension on the tendon.
* Gradually, the foot is brought back to a neutral position as healing progresses.
* Weight-bearing is usually limited or assisted with crutches during this period, depending on your doctor’s protocol.

## When can I start exercising or playing sports again?

* Return to light activities and walking often begins within a few weeks as tolerated, guided by your healthcare team.
* More structured physical therapy starts around 4 to 6 weeks post-injury or surgery to restore ankle mobility and calf strength.
* Running and higher-impact activities are generally resumed around 6 months after surgery.
* Return to full sports and strenuous activities may take 9 to 12 months, depending on your healing, rehab progress, and sport demands.

## Am I at risk of tearing my Achilles again after it heals?

* Yes, there is a risk of re-rupture, though surgery tends to reduce this risk compared to non-surgical treatment.
* Risk factors include premature return to activity, inadequate rehabilitation, poor tendon healing, and certain patient factors like age and smoking.
* To lower risk:
  + Follow your rehabilitation program carefully
  + Maintain calf strength and flexibility
  + Avoid sudden increases in activity intensity
  + Use proper warm-up and stretching before exercise
  + Avoid high-heeled shoes and activities involving sudden stops and starts without adequate preparation

**Differential diagnoses for Achilles tendon rupture include the following:**

* Achilles bursitis
* Ankle fracture
* Ankle impingement syndrome
* Ankle osteoarthritis
* Ankle sprain
* Calf injuries
* Calcaneofibular ligament injury
* Calcaneus fractures
* Deep venous thrombosis (DVT)
* Exertional compartment syndrome
* Fascial tears
* Gastrocnemius or soleus muscle strain or rupture
* Haglund deformity
* Plantaris tendon tear
* Psoriatic arthritis
* Reiter syndrome
* Retrocalcaneal bursitis
* Ruptured Baker cyst
* Syndesmosis
* Talofibular ligament injury

**EPIDEMIOLOGY**

The incidence of Achilles tendon ruptures varies in the literature, with recent studies reporting a rate of up to 40 patients per 100,000 patient population annually. The significant increase in ruptures this past decade is thought to be linked to the increased number of individuals engaging in sporting activities, particularly adults older than 30. During recreational sports, 75% of ruptures occur in men between the third and fourth decades of life.

The true incidence of Achilles tendinosis is unknown, but more than 20% of ruptures are misdiagnosed.Reported incidence rates among athletes are 7% to 18% in runners, 9% in dancers, 5% in gymnasts, 2% in tennis players, and less than 1% in American football players. Achilles disorders affect approximately 1 million athletes per year

## **Types of Achilles Tendon Repair Procedures**

1. Percutaneous Achilles Repair
   * Minimally invasive technique with several small incisions along the back of the calf.
   * Damaged tendon tissue is removed, and the torn ends are sutured together using needles and sutures passed through the small incisions.
   * The tendon may be anchored to the heel bone with sutures and small plastic screws.
   * Benefits: smaller scars, fewer wound complications, faster recovery.
2. Open Achilles Repair
   * A larger incision is made on the back of the calf to expose the torn tendon.
   * Damaged tissue is removed, and the tendon ends are sewn together with strong sutures.
   * The tendon may be attached to the heel bone with sutures and screws if needed.
   * This approach allows direct visualization and repair, often used for complex or large tears.
3. Tendon Transfer (Flexor Hallucis Longus Transfer)
   * Used when the Achilles tendon is severely damaged, shortened, or cannot be repaired end-to-end.
   * The tendon that flexes the big toe (flexor hallucis longus) is detached and reattached to the heel to reinforce or replace the Achilles tendon.
   * This procedure helps restore function with minimal impact on toe movement.
4. Debridement and Repair
   * Removal of degenerated tendon tissue followed by repair with sutures.
   * May include excision of bony spurs (Haglund’s deformity) if they irritate the tendon.
5. Gastrocnemius Recession
   * Surgical lengthening of calf muscles to reduce stress on the Achilles tendon, sometimes done alongside tendon repair.

## Surgical Procedure Steps (Typical)

* Performed under general or regional anesthesia.
* Incision(s) made to access the tendon.
* Torn tendon ends identified, cleaned, and sutured together.
* Tendon may be anchored to heel bone with screws or sutures if avulsed.
* Damaged tissue and bone spurs removed if present.
* Incision closed with sutures; patient moved to recovery.

## Recovery Timeline

| **Phase** | **Timeline** | **Key Points** |
| --- | --- | --- |
| Immobilization | 0–6 weeks | Foot placed in plantarflexion (toes pointed down) in a cast or walking boot; limited weight-bearing or non-weight-bearing initially. |
| Early Mobilization | 4–8 weeks | Gradual dorsiflexion of foot; partial weight-bearing allowed as tolerated; start gentle range-of-motion exercises. |
| Strengthening & Rehab | 8–12 weeks | Physical therapy focuses on restoring ankle strength, flexibility, and proprioception. |
| Return to Low-Impact Activities | 3–4 months | Walking without assistive devices; light activities encouraged. |
| Return to Running & Sports | 6–9 months | Gradual return to running and sport-specific training under supervision. |
| Full Recovery | 9–12 months | Most patients regain near-normal strength and function; continued strengthening advised. |

**Doctor-patient conversation about Achilles tendon rupture**,:

Doctor:  
“Hello, I understand you’ve had a sudden pain in the back of your ankle and calf, and after examination, it appears you have ruptured your Achilles tendon. This means the tendon connecting your calf muscle to your heel bone has torn.”

Patient:  
“Oh no, what exactly does that mean? How serious is it?”

Doctor:  
“It’s a significant injury but one that we can treat effectively. The Achilles tendon is important for walking, running, and standing on your toes. A rupture means it’s torn, which causes pain, swelling, and difficulty pushing off your foot.”

Patient:  
“How did this happen? I didn’t think I was doing anything risky.”

Doctor:  
“Achilles tendon ruptures often occur during sudden movements like pushing off or jumping, especially if the tendon has been weakened over time. It’s common in people between 30 and 50 who suddenly increase their activity or play sports.”

Patient:  
“What are my treatment options?”

Doctor:  
“There are two main options:

* Non-surgical treatment, which involves wearing a walking boot with wedges to keep your foot pointed down, allowing the tendon to heal over several weeks. You’ll gradually adjust the boot position and start physiotherapy.
* Surgical repair, where we stitch the torn tendon ends back together. Surgery tends to reduce the risk of the tendon tearing again but carries some risks like infection.”

Patient:  
“How long will I need to wear the boot and when can I start moving again?”

Doctor:  
“You’ll wear the boot for about 8 weeks, starting with your foot pointed down and gradually moving it to a neutral position. You can bear weight on the leg as tolerated, often with crutches at first. Around week 7, physiotherapy usually begins to help restore movement and strength.”

Patient:  
“When can I expect to get back to normal activities or sports?”

Doctor:  
“Most people return to low-impact activities within 4 to 6 months. Returning to high-impact sports like football or tennis may take longer, often 9 to 12 months. Your physiotherapist will guide your rehab to make sure you regain strength safely.”

Patient:  
“Are there any signs I should watch for that mean something’s wrong?”

Doctor:  
“Yes, please seek medical advice if you experience sudden cramp-like pain in your calf or thigh, chest pain or shortness of breath, sudden swelling, numbness, pins and needles, or wound problems if you had surgery.”

Patient:  
“Thank you, doctor. It’s reassuring to know what to expect and how to recover.”

Doctor:  
“You’re welcome. We’ll work closely with you through your recovery to help you regain full function. Please don’t hesitate to contact us if you have any concerns.”

**Systemic Factors**

Systemic diseases that may be associated with Achilles tendon injuries include the following:

* Chronic renal failure
* Collagen deficiency
* Diabetes mellitus
* Gout
* Infections
* Lupus
* Parathyroid disorders
* Rheumatoid arthritis
* Thyroid disorders

Foot problems that increase the risk of Achilles tendon injuries include the following:

* Cavus foot
* Insufficient gastroc-soleus flexibility and strength
* limited ability to perform ankle dorsiflexion
* Tibia vara
* Varus alignment with functional hyperpronation

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**OSTEOMYELITIS**

**DEFINITION AND DESCRIPTION**

Osteomyelitis is an infection in a bone. It can affect one or more parts of a bone. Infections can reach a bone through the bloodstream or from nearby infected tissue. Infections also can begin in the bone if an injury opens the bone to germs.

People who smoke and people with chronic health conditions, such as diabetes or kidney failure, are at higher risk of getting osteomyelitis. People who have diabetes with foot ulcers may get osteomyelitis in the bones of their feet.

Most people with osteomyelitis need surgery to remove areas of the affected bone. After surgery, most often people need strong antibiotics given through a vein.

#### **Types of osteomyelitis**

There are a few types of osteomyelitis:

* **Acute osteomyelitis:** A bone infection that happens after an infection spreads to your bones. Acute osteomyelitis is the most common type.
* **Vertebral osteomyelitis:** Osteomyelitis that infects the vertebrae in your spine.
* **Chronic osteomyelitis:** Bone infections that aren’t completely cured after treatment can linger in your body and come back (recur) months or years later. Taking the full dose of any medication your healthcare provider prescribes to kill the initial infection is the best way to prevent chronic osteomyelitis.

Researchers think fewer than 25 per 100,000 people experience osteomyelitis each year. However, some studies have found it’s much more common among people who need to stay in the hospital — as high as 1 out of every 675 hospital admissions.

Experts think this difference may be because people who are admitted to the hospital often have health conditions or injuries that make them much more susceptible to bacteria and fungi getting into their blood and bones.

## **Symptoms and Causes**

Osteomyelitis symptoms can vary depending on which type you have and which of your bones are infected. The most common bone infection symptoms include:

* Fever.
* A general feeling of being sick or unwell.
* Bone pain.
* Chills.
* Sweating.
* Nausea and vomiting.
* Skin discoloration.
* Swelling (inflammation).
* A feeling of heat or warmth on your skin.
* Pus or discharge (if the infection is near a wound or surgery site).

Vertebral osteomyelitis also usually causes low back pain. Some people with chronic osteomyelitis don’t have symptoms.

### **Cause of osteomyelitis**

Infections that spread to your bones cause osteomyelitis. It usually happens when an infection on the surface of your skin (like at a wound or a surgery site) gets into your bloodstream and spreads to your bone marrow (the spongy center of some bones).

#### **What are the risk factors?**

Anyone can develop an infection that causes osteomyelitis, but some people have a higher risk, including people who:

* Are younger than 20 or older than 50.
* Have open wounds after an injury or trauma.
* Have recently had surgery, especially arthroplasty (joint replacement) or other procedures where surgeons implant pieces into your body — including pins and screws to repair bone fractures (broken bones).
* Experience puncture injuries (something stabbing into your body).
* Have pressure injuries (bedsores).

People with health conditions or who need treatments that weaken their immune system are more likely to develop osteomyelitis, including:

* Sickle cell anemia.
* Diabetes (especially if you have diabetes-related foot ulcers).
* People who take immunosuppressants.
* People who need hemodialysis.

### **What are osteomyelitis complications?**

Osteomyelitis complications can include:

* **Abscesses:** Bone infections can cause pockets of pus that break through your skin. Treatment to drain these abscesses may slightly increase your risk of skin cancer.
* **Osteonecrosis:** Osteonecrosis (bone death) can happen if swelling from the infection cuts off blood flow to your bone. It’s very rare, but some people with osteonecrosis need an amputation.
* **Slowed growth:** Osteomyelitis can cause children’s bones to grow and develop slower than usual.

## **Diagnosis and Tests**

A healthcare provider will diagnose osteomyelitis with a physical exam and some tests. They’ll ask about your symptoms and when you first noticed them. Tell your provider if you’ve recently had surgery, an injury or if you’ve started new treatments for other health conditions.

Your provider will use some of the following tests to diagnose the infection and take pictures of your bones:

* Blood tests.
* X-ray.
* Magnetic resonance imaging (MRI).
* Computed tomography (CT) scan.
* Ultrasound.
* Bone scan.
* Bone marrow biopsy.

## **Management and Treatment**

Your provider will suggest treatments to kill the infection and prevent permanent bone damage. The most common osteomyelitis treatments include:

* **Antibiotics:** You’ll need antibiotics to cure a bacterial infection. You may need intravenous (IV) antibiotics for a few weeks before taking oral (pills you take by mouth) antibiotics for several weeks afterward.
* **Antifungals:** Antifungals treat fungal infections. You’ll probably need oral antifungal medications for several months.
* **Over-the-counter pain relievers:** Over-the-counter (OTC) NSAIDs or acetaminophen relieve pain and reduce inflammation. Your provider will tell you which kind of anti-inflammatory medicine is best for you, and how often it’s safe to take it.
* **Needle aspiration:** Your healthcare provider may use a needle to drain pus or fluid from any abscesses that develop.
* **Surgery:** You may need surgery if the bone infection is severe or you have a high risk of complications. It’s more common to need surgery if you have vertebral osteomyelitis.

### **How soon after treatment will I feel better?**

It can take a long time for osteomyelitis to heal. You might need antibiotics or antifungals for a few months. You should start feeling better as medications start killing the infection and slowing its spread.

Ask your provider how long you’ll need to take antibiotics or antifungals. Make sure you take the full dose they prescribe for as long as they say, even if you start feeling better.

## **Outlook / Prognosis**

Most people with osteomyelitis recover without long-term complications. But it’s important to get the infection diagnosed and start treatment right away. Contact your provider as soon as you notice any signs of an infection.

#### **How long osteomyelitis lasts**

Osteomyelitis can last for a long time. You might need treatment for several months to make sure the infection is completely cured. Ask your provider or surgeon what to expect.

## **Prevention**

Cleaning new wounds or cuts and keeping surgery sites sterile are the best ways to prevent bone infections. Wash your hands frequently, and clean scrapes and cuts with warm, soapy water. Go to the emergency room if you have a deep cut or puncture (stab) wound or experience trauma.

Ask your provider how to clean your surgery site after any type of procedure.

## **Living With**

Make sure you take the full course of your antibiotic or antifungal medication exactly as your provider prescribes. You need to finish the full dose, even if you feel better. If you stop taking your medications before you should, there’s a chance they won’t completely kill the infection. This increases your risk of chronic osteomyelitis and other complications.

Ask your surgeon how to keep incisions clean after surgery. They’ll tell you when it’s safe to shower or bathe, how to clean your surgical site and which kind of soap is best to use on it.

Contact your healthcare provider or surgeon right away if you notice signs of an infection, especially at a surgery site.

### **When should I see my healthcare provider?**

Contact your provider or surgeon right away if you notice signs of an infection, especially if you notice pus or discharge at a wound or surgery site.

**DIFFERENTIAL DIAGNOSIS**

The differential diagnosis for osteomyelitis is broad, and it is essential to keep these in mind during the evaluation of a patient with a suspected bone infection. These differentials include:

* Charcot arthropathy especially in people with diabetes
* SAPHO syndrome (synovitis, acne, pustulosis, hyperostosis, and osteitis)
* Arthritis including rheumatoid arthritis
* Metastatic bone disease
* Fracture, including pathological and stress fractures.
* Gout
* Avascular necrosis of the bone
* Bursitis
* Sickle cell vaso-occlusive pain crisis

**Pathogen-Specific Antibiotic Therapy for Osteomyelitis in Adults**

***Staphylococcus aureus* penicillin-sensitive**

Treatment of choice is penicillin G 4 million units every 6 hours

Alternative regimens are a first-generation cephalosporin, e.g., cefazolin 2 g IV every 8 hours, clindamycin 900 mg IV every 8 hours, vancomycin 15 mg/kg IV every 12 hours, oxacillin or nafcillin 2 g IV every 4 hours

***Staphylococcus aureus* penicillin-resistant**

Treatment of choice is nafcillin 2 gm IV every 4 hours

Alternative therapies are cefazolin, clindamycin, or vancomycin (doses as above)

***Staphylococcus aureus* methicillin-resistant**

Treatment of choice is vancomycin IV

An alternative regimen is linezolid 600 mg IV every 12 hours.

***Streptococci* (group A, B, Beta hemolytic, *Streptococcus pneumoniae)***

Treatment of choice is penicillin G 4 million units every 6 hours

Alternative regimens include ceftriaxone 2 gm IV daily, clindamycin IV, vancomycin IV, cefazolin IV (doses as above)

***Enterobacteriaceae* quinolone sensitive**

Treatment of choice is ciprofloxacin 400 mg IV twice per day (bid) or 750 mg orally (PO) bid, levofloxacin 500 to 750 mg PO or IV daily

Alternative regimens include ceftriaxone 2g IV daily, cefepime 2 gm IV every 12 hours, ceftazidime 2 gm IV every 8 hours

***Enterobacteriaceae,* quinolone-resistant *(Escherichia coli)***

Treatment of choice is piperacillin/tazobactam 3.375 g IV every 8 hours, Ticarcillin/clavulanate 3.1 gm IV every 4 hours

An alternative regimen is ceftriaxone 2 g IV daily

***Pseudomonas aeruginosa***

Treatment of choice is cefepime 2 gm IV every 12 hours, ceftazidime 2 gm IV every 8 hours

Alternative regimens include meropenem 1 gm IV every 8 hours, Imipenem 500 mg IV every 6 hours, ciprofloxacin 400 mg IV every 12 hours, or 750 mg PO daily

***Enterococci***

Treatment of choice is penicillin G 4 million units every 6 hours

Alternatively, vancomycin 15 mg/kg every 12 hours, daptomycin 6 mg/kg IV daily, linezolid 600 mg IV or PO every 12 hours

***Anaerobes***

Treatment of choice is clindamycin 900 mg IV every 8 hours, ticarcillin/clavulanate 3.1 gm IV every 4 hours

Alternatively, metronidazole 500 mg IV every 8 hours (for gram-negative anaerobes)

The recommended duration of treatment for osteomyelitis in adults is 4 to 6 weeks of parenteral antibiotic therapy to achieve acceptable cure rates with a decreased risk of recurrence.In cases where the infected bone is wholly debrided or amputated with clean disease-free margins documented, a shorter duration of antibiotic therapy is acceptable. A 2-week course of antibiotics postoperatively is sufficient to allow for the treatment of any residual tissue infection and wound healing of the surgical site.

Vacuum-assisted wound closure devices are used in the right clinical setting, especially where large or deep wounds are left after extensive debridement. These devices have been shown to promote healing by both direct and indirect effects on the wound.Hyperbaric oxygen therapy is not routinely recommended in the treatment of osteomyelitis.

**STAGING**

The categories and corresponding anatomic types are:

* Stage 1: Disease confined to the medullary of the bone
* Stage 2: Superficial disease
* Stage 3: Localized spread
* Stage 4: Diffuse disease

The local and systemic factors which define host health status are:

* A: Normal host
* Bs: Host with systemic compromising factors
* Bl: Host with local compromising factors
* Bsl: Host with both local and systemic compromising factors
* C: Host for whom treatment of the osteomyelitis is worse than the disease itself.

The overall incidence of osteomyelitis in the United States is mostly unknown, but reports show it to be as high as 1 in 675 US hospital admissions each year or about 50,000 cases annually. Other studies show an overall incidence of osteomyelitis of 21.8 cases per 100,000 person-years.The incidence was higher in men for unknown reasons but increases with age, mainly due to an increase in the prevalence of comorbid factors such as diabetes mellitus and peripheral vascular disease.Also, an increase in the availability of sensitive imaging tests, such as magnetic resonance imaging (MRI) and bone scintigraphy has improved diagnostic accuracy and the ability to characterize the infection

## **Common Questions**

### **How serious is osteomyelitis?**

Osteomyelitis is a serious condition that needs treatment right away. It usually responds very well to treatment, but you need to start treating it as soon as possible to prevent serious complications.

Once a provider diagnoses the infection and you start treatment, try not to worry. It might take a while to cure the infection, but the most important part is catching osteomyelitis early.

### **Does osteomyelitis go away on its own?**

No, osteomyelitis won’t go away on its own. It’s extremely important to see a healthcare provider for a diagnosis and treatment. Your immune system does an amazing job of fighting off germs and other invaders, but you need antibiotics or antifungals to kill the infections that cause osteomyelitis.

Never ignore signs of infection around a wound, especially if you just had surgery. Contact your provider or surgeon right away if you notice any changes in your incisions. It’s always better to ask too many questions than not enough. Trust your instincts — if something doesn’t look or feel right, it’s worth checking out.

## **Osteomyelitis Procedure and Treatment Overview**

1. Diagnosis and Initial Assessment

* Diagnosis involves physical exam, blood tests (elevated inflammatory markers), imaging (X-ray, MRI, bone scan), and bone biopsy to identify the infecting organism and guide antibiotic choice.
* Biopsy can be done via needle (local anesthetic) or open surgical procedure (general anesthesia). Imaging may guide needle placement.

2. Surgical Procedures

* Surgery is often necessary, especially in acute or chronic osteomyelitis, to:
  + Drain abscesses or pus collections around the infected bone.
  + Debride (remove) necrotic and infected bone and soft tissue to eliminate infection sources.
  + Restore blood flow to the affected bone, sometimes using bone grafts or tissue transfers (skin, muscle).
  + Remove foreign bodies or infected implants if present.
  + In severe cases, amputation may be required to control infection.
* Surgery aims to reduce bacterial load and create an environment conducive to healing.

3. Antibiotic Therapy

* High-dose intravenous (IV) antibiotics are started promptly, tailored to the organism identified by culture.
* IV antibiotics are typically administered for 4 to 6 weeks, sometimes longer depending on severity and response.
* After IV therapy, a prolonged course of oral antibiotics (often 4 to 8 weeks or more) may be prescribed to ensure complete eradication.
* Close monitoring of clinical response and inflammatory markers guides therapy duration.

4. Supportive Care and Rehabilitation

* Immobilization or limited weight-bearing may be necessary initially to reduce stress on the infected bone.
* Pain management and treatment of underlying conditions (e.g., diabetes control) are important.
* Physical therapy may be initiated once infection is controlled to restore function.

## **Typical Timeline for Osteomyelitis Treatment**

| **Phase** | **Duration** | **Key Activities and Goals** |
| --- | --- | --- |
| Diagnosis and biopsy | Days 0–7 | Imaging, blood tests, bone biopsy to identify infection |
| Surgical intervention | Within first 1–2 weeks | Drainage, debridement, removal of infected tissue |
| Intravenous antibiotics | 4–6 weeks (sometimes longer) | High-dose targeted antibiotics to kill bacteria |
| Oral antibiotics | Additional 4–8 weeks or more | Continued therapy to ensure infection clearance |
| Monitoring and follow-up | Throughout treatment | Clinical assessment, lab markers, imaging as needed |
| Rehabilitation | Begins after infection control | Restore mobility, strength, and function |

**Doctor-patient conversation about osteomyelitis**,

Doctor:  
“Hello, I’ve reviewed your symptoms and test results, and it appears you have osteomyelitis, which is an infection in your bone.”

Patient:  
“Oh no, how serious is that? How did I get it?”

Doctor:  
“Osteomyelitis can be serious if not treated promptly. It usually happens when bacteria enter the bone, either through an injury, surgery, or from an infection elsewhere in your body spreading through the bloodstream. Sometimes, it can develop from a wound or ulcer near the bone, especially if healing is poor.”

Patient:  
“What symptoms should I expect, and how will you treat it?”

Doctor:  
“You may experience localized bone pain, swelling, redness, and sometimes fever. Treatment involves a combination of antibiotics and sometimes surgery. We’ll start with intravenous antibiotics to fight the infection, often for several weeks. If there’s dead or infected bone, surgery may be needed to remove it and help the area heal.”

Patient:  
“How long will the treatment last? Will I need to stay in the hospital?”

Doctor:  
“Treatment usually lasts several weeks. You may need to stay in the hospital at first to receive IV antibiotics and be closely monitored. Later, you might continue antibiotics at home. Surgery, if needed, is done early to remove infected tissue.”

Patient:  
“Will I be able to move around? How will this affect my daily life?”

Doctor:  
“Initially, you might need to limit movement or weight-bearing on the affected area to reduce pain and help healing. As treatment progresses, physical therapy can help you regain strength and function. We’ll support you throughout the recovery.”

Patient:  
“What signs should I watch for that mean I need to come back quickly?”

Doctor:  
“If you develop worsening pain, increased swelling or redness, fever, chills, or if a wound starts draining pus, please contact us immediately. These could mean the infection is worsening or complications are developing.”

Patient:  
“Thank you, doctor. It’s reassuring to know what to expect and how you’ll help me.”

Doctor:  
“You’re welcome. We’ll work together to treat this infection and help you recover fully. Please don’t hesitate to reach out with any questions or concerns.”

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