

## Fractures: Causes, symptoms, and diagnosis

By Christian Nordqvist

Reviewed by William Morrison, MD

A bone fracture, also referred to as x, or #, is a medical condition where the continuity of the bone is broken.

A significant percentage of bone fractures occur because of high force impact or [stress](#).

However, a fracture may also be the result of some medical conditions which weaken the bones, for example [osteoporosis](#), some [cancers](#), or osteogenesis imperfecta (also known as brittle bone diseases).

A fracture caused by a medical condition is known as a pathological fracture.

Fast facts on fractures

Here are some key points about fractures. More detail and supporting information is in the main article.

- Most bone fractures are caused by falls and accidents.
- Bone fractures caused by disease are referred to as pathological fractures.
- A compound fracture is one that also causes injury to the overlying skin.
- There are a number of different types of fractures, including avulsion, comminuted, and hairline fractures.
- Bone healing is a natural process, treatment revolves around giving the bone optimum conditions to heal itself.

### What is a bone fracture?



Fractures can occur in any bone of the body.

The word "break" is commonly used by lay (non-professional) people.

Among doctors, especially bone specialists, such as orthopedic surgeons, "break" is a much less common term when talking about bones.

A crack (not only a break) in the bone is also known as a fracture. Fractures can occur in any bone in the body.

There are several different ways in which a bone can fracture; for example, a break to the bone that does not damage surrounding tissue or tear through the skin is known as a closed fracture.

On the other hand, one that damages surrounding skin and penetrates the skin is known as a compound fracture or an open fracture. Compound fractures are generally more serious than simple fractures, because, by definition, they are infected.

Most human bones are surprisingly strong and can generally stand up to fairly strong impacts or forces. However, if that force is too powerful, or there is something wrong with the bone, it can fracture.

The older we get, the less force our bones can withstand. Because children's bones are more elastic, when they do have fractures they tend to be different. Children also have growth plates at the end of their bones - areas of growing bone - which may sometimes be damaged.

### Types of bone fracture

There is a range of [fracture types](#), including:

- **Avulsion fracture** - a muscle or ligament pulls on the bone, fracturing it.
- **Comminuted fracture** - the bone is shattered into many pieces.
- **Compression (crush) fracture** - generally occurs in the spongy bone in the spine. For example, the front portion of a vertebra in the spine may collapse due to osteoporosis.
- **Fracture dislocation** - a joint becomes dislocated, and one of the bones of the joint has a fracture.
- **Greenstick fracture** - the bone partly fractures on one side, but does not break completely because the rest of the bone can bend. This is more common among children, whose bones are softer and more elastic.
- **Hairline fracture** - a partial fracture of the bone. Sometimes this type of fracture is harder to detect with routine xrays.
- **Impacted fracture** - when the bone is fractured, one fragment of bone goes into another.
- **Longitudinal fracture** - the break is along the length of the bone.
- **Oblique fracture** - a fracture that is diagonal to a bone's long axis.
- **Pathological fracture** - when an underlying disease or condition has already weakened the bone, resulting in a fracture (bone fracture caused by an underlying disease/condition that weakened the bone).
- **Spiral fracture** - a fracture where at least one part of the bone has been twisted.
- **Stress fracture** - more common among athletes. A bone breaks because of repeated stresses and strains.
- **Torus (buckle) fracture** - bone deforms but does not crack. More common in children. It is painful but stable.
- **Transverse fracture** - a straight break right across a bone.

### Symptoms of bone fractures



Symptoms of a bone fracture can vary wildly depending on the affected region and severity.

The signs and symptoms of a fracture vary according to which bone is affected, the patient's age and general health, as well as the severity of the injury. However, they often include some of the following:

- pain
- swelling
- bruising
- discolored skin around the affected area
- angulation - the affected area may be bent at an unusual angle
- the patient is unable to put weight on the injured area
- the patient cannot move the affected area
- the affected bone or joint may have a grating sensation
- if it is an open fracture, there may be bleeding

- When a large bone is affected, such as the pelvis or femur:
- the sufferer may look pale and clammy
- there may be dizziness (feeling faint)
- feelings of sickness and nausea.

If possible, do not move a person with a broken bone until a healthcare professional is present and can assess the situation and, if required, apply a splint. If the patient is in a dangerous place, such as in the middle of a busy road, one sometimes has to act before the emergency services arrive.

### **Causes of bone fractures**

The majority of fractures are caused by a bad fall or automobile accident. Healthy bones are extremely tough and resilient and can withstand surprisingly powerful impacts. As people age, two factors make their risk of fractures greater: Weaker bones and a greater risk of falling.

Children, who tend to have more physically active lifestyles than adults, are also prone to fractures.

People with underlying illnesses and conditions that may weaken their bones have a higher risk of fractures. Examples include osteoporosis, infection, or a [tumor](#). As mentioned earlier, this type of fracture is known as a pathological fracture.

Stress fractures, which result from repeated stresses and strains, commonly found among professional sports people, are also common causes of fractures.

### **Diagnosis and treatment of bone fractures**

Medical intervention focuses on supporting the bone as it heals naturally.

A doctor will carry out a physical examination, identify signs and symptoms, and make a diagnosis.

The patient will be interviewed - or friends, relatives, and witnesses if the patient cannot communicate properly - and asked about circumstances that caused the injury or may have caused it.

Doctors will often order an X-ray. In some cases, an [MRI](#) or [CT scan](#) may also be ordered.

Bone healing is a [natural process](#) which, in most cases, will occur automatically. Fracture treatment is usually aimed at making sure there is the best possible function of the injured part after healing.

Treatment also focuses on providing the injured bone with the best circumstances for optimum healing (immobilization).

For the natural healing process to begin, the ends of the broken bone need to be lined up - this is known as reducing the fracture.

The patient is usually asleep under a general anesthetic when fracture reduction is done. Fracture reduction may be done by manipulation, closed reduction (pulling the bone fragments), or surgery.

**Immobilization** - as soon as the bones are aligned they must stay aligned while they heal. This may include:

- **Plaster casts or plastic functional braces** - these hold the bone in position until it has healed.
- **Metal plates and screws** - current procedures may use minimally invasive techniques.
- **Intra-medullary nails** - internal metal rods are placed down the center of long bones. Flexible wires may be used in children.
- **External fixators** - these may be made of metal or carbon fiber; they have steel pins that go into the bone directly through the skin. They are a type of scaffolding outside the body.

Usually, the fractured bone area is immobilized for 2-8 weeks. The duration depends on which bone is affected and whether there are any complications, such as a blood supply problem or an infection.

**Healing** - if a broken bone has been aligned properly and kept immobile, the healing process is usually straightforward.

Osteoclasts (bone cells) absorb old and damaged bone while osteoblasts (other bone cells) are used to create new bone.

**Callus** is new bone that forms around a fracture. It forms on either side of the fracture and grows toward each end until the fracture gap is filled. Eventually, the excess bone smooths off and the bone is as it was before.

The patient's age, which bone is affected, the type of fracture, as well as the patient's general health are all factors which influence how rapidly the bone heals. If the patient smokes regularly, the healing process will [take longer](#).

**Physical therapy** - after the bone has healed, it may be necessary to restore muscle strength as well as mobility to the affected area. If the fracture occurred near or through a joint, there is a risk of permanent stiffness or [arthritis](#) - the individual may not be able to bend that joint as well as before.

**Surgery** - if there was damage to the skin and soft tissue around the affected bone or joint, plastic surgery may be required.

#### **Delayed unions and non-unions**

Non-unions are fractures that fail to heal, while delayed unions are those that take longer to heal.

- **Ultrasound therapy** - low-intensity [ultrasound](#) is applied to the affected area daily. This has been found to help the fracture heal. Studies in this area are still ongoing.
- **Bone graft** - if the fracture does not heal, a natural or synthetic bone is transplanted to stimulate the broken bone.
- **Stem cell therapy** - studies are currently underway to see whether [stem cells](#) can be used to treat fractures that do not heal.

#### **Complications of a bone fracture**

**Heals in the wrong position** - this is known as a malunion; either the fracture heals in the wrong position or it shifts (the fracture itself shifts).

**Disruption of bone growth** - if a childhood bone fracture affects the growth plate, there is a risk that the normal development of that bone may be affected, raising the risk of a subsequent deformity.

**Persistent bone or bone marrow infection** - if there is a break in the skin, as may happen with a compound fracture, bacteria can get in and infect the bone or [bone marrow](#), which can become a persistent infection ([chronic osteomyelitis](#)).

Patients may need to be hospitalized and treated with [antibiotics](#). Sometimes, surgical drainage and curettage is required.

**Bone death (avascular necrosis)** - if the bone loses its essential supply of blood it may die.

#### **Prevention of bone fractures**

**Nutrition and sunlight** - the human body needs adequate supplies of [calcium](#) for healthy bones. Milk, cheese, yoghurt, and dark green leafy vegetables are good sources of calcium.

Our body needs [vitamin D](#) to absorb calcium - exposure to sunlight, as well as eating eggs and oily fish are good ways of getting [vitamin D](#). Vitamin D plays a role in maintaining healthy bones.

**Physical activity** - the more weight-bearing exercises you do, the stronger and denser your bones will be.

Examples include skipping, walking, running, and dancing - any exercise where the body pulls on the skeleton.

Older age not only results in weaker bones, but often in less physical activity, which further increases the risk of even weaker bones. It is important for people of all ages to stay physically active.

**Menopause** - [estrogen](#), which regulates a woman's calcium, drops during [menopause](#), making calcium regulation much more difficult. Consequently, women need to be especially careful about the density and strength of their bones during and after the menopause.

The following steps may help reduce post-menopausal osteoporosis risk:

- Do several short weight-bearing exercise sessions each week.
- Do not smoke.
- Consume only moderate quantities of alcohol, or don't drink it.
- Get adequate exposure to daylight.
- Make sure your diet has plenty of calcium-rich foods. For those who find this difficult, a doctor may recommend calcium supplements.

1. Define what a "fracture" is.
2. What is the difference between a compound fracture and a simple (closed) fracture? Which is generally worse? Why?
3. Why do athletes generally get stress fractures?
4. Why do adults break more bones than children?
5. Why do doctors immobilize broken bones? Do doctors ever do surgery to fix a standard broken bone?
6. What can be done to prevent broken bones?