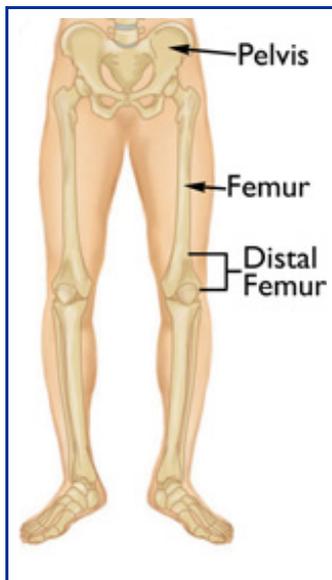




Distal Femur (Thighbone) Fractures of the Knee

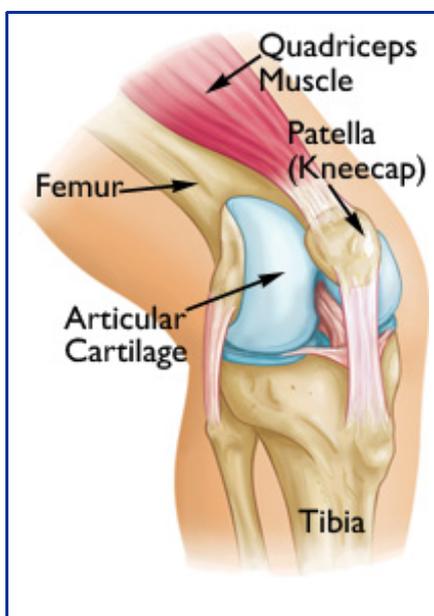
A fracture is a broken bone. Fractures of the thighbone that occur just above the knee joint are called distal femur fractures. The distal femur is where the bone flares out like an upside-down funnel.

Distal femur fractures most often occur either in older people whose bones are weak, or in younger people who have high energy injuries, such as from a car crash. In both the elderly and the young, the breaks may extend into the knee joint and may shatter the bone into many pieces.



Anatomy

The knee is the largest weightbearing joint in your body. The distal femur makes up the top part of your knee joint. The upper part of the shinbone (tibia) supports the bottom part of your knee joint. The ends of the femur are covered in a smooth, slippery substance called articular cartilage. This cartilage protects and cushions the bone when you bend and straighten your knee.



The normal anatomy of the knee

Strong muscles in the front of your thigh (quadriceps) and back of your thigh (hamstrings) support your knee joint and allow you to bend and straighten your knee.



The quadriceps muscles at the front of the thigh.

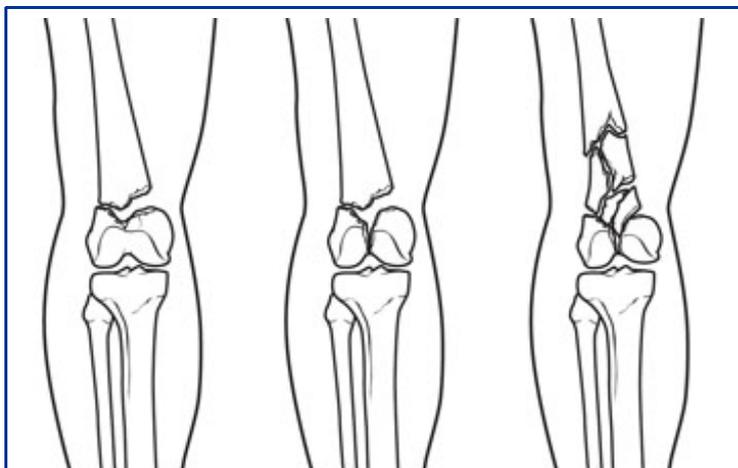


Back

The hamstring muscles at the back of the thigh.

Description

Distal femur fractures vary. The bone can break straight across (transverse fracture) or into many pieces (comminuted fracture). Sometimes these fractures extend into the knee joint and separate the surface of the bone into a few (or many) parts. These types of fractures are called intra-articular. Because they damage the cartilage surface of the bone, intra-articular fractures can be more difficult to treat.



(Left) A transverse fracture across the distal femur **(Center)** An intra-articular fracture that extends into the knee joint **(Right)** A comminuted fracture that extends into the knee joint and upwards into the femoral shaft.

Distal femur fractures can be closed — meaning the skin is intact — or can be open. An open fracture is when a bone breaks in such a way that bone fragments stick out through the skin or a wound penetrates down to the broken bone. Open fractures often involve much more damage to the surrounding muscles, tendons, and ligaments. They have a higher risk for complications and take a longer time to heal.

When the distal femur breaks, both the hamstrings and quadriceps muscles tend to contract and shorten. When this happens the bone fragments change position and become difficult to line up with a cast.



Cause

Fractures of the distal femur most commonly occur in two patient types: younger people (under age 50) and the elderly.

- Distal femur fractures in younger patients are usually caused by high energy injuries, such as falls from significant heights or motor vehicle collisions. Because of the forceful nature of these fractures, many patients also have other injuries, often of the head, chest, abdomen, pelvis, spine, and other limbs.
- Elderly people with distal femur fractures typically have poor bone quality. As we age, our bones get thinner. Bones can become very weak and fragile. A lower-force event, such as a fall from standing, can cause a distal femur fracture in an older person who has weak bones. Although these patients do not often have other injuries, they may have concerning medical problems, such as conditions of the heart, lungs, and kidneys, and diabetes.

Symptoms

The most common symptoms of distal femur fracture include:

- Pain with weightbearing
- Swelling and bruising
- Tenderness to touch
- Deformity — the knee may look "out of place" and the leg may appear shorter and crooked

In most cases, these symptoms occur around the knee, but you may also have symptoms in the thigh area.

Doctor Examination

Medical History and Physical Examination

It is important that your doctor knows the circumstances of your injury. For example, if you fell from a tree, how far did you fall? It is just as important for your doctor to know if you sustained any other injuries and if you have any other medical problems, such as diabetes. Your doctor also needs to know if you take any medications.

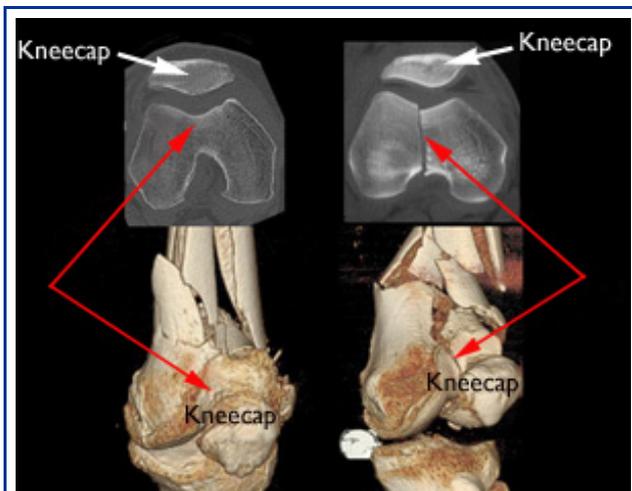
After discussing your symptoms and medical history, your doctor will do a careful examination.

- Your doctor will assess your overall condition to make sure no other body parts have been injured (head, belly, chest, pelvis, spine, and other extremities)
- He or she will examine your skin around the fracture to make sure it is not an open fracture
- Your doctor will also check the blood and nerve supply to your leg

Tests

Other tests that will provide your doctor with more information about your injury include:

- **X-rays.** The most common way to evaluate a fracture is with x-rays, which provide clear images of bone. X-rays can show whether a bone is intact or broken. They can also show the type of fracture and where it is located within the femur. To make sure no other breaks are missed, your hip and ankle joints will also be x-rayed.
- **Computed tomography (CT) scan.** A CT scan shows a cross-sectional image of your limb. It can provide your doctor with valuable information about the severity of the fracture. This scan can show whether the fracture enters the joint surface and, if so, how many pieces of bone there are. A CT scan will help your doctor decide how to fix the break.
- **Other tests.** Your doctor may order other tests that do not involve the broken leg to make sure no other body parts are injured (head, chest, belly, pelvis, spine, arms, and other leg). Sometimes, other studies are done to check the blood supply to your leg.



CT scans provide cross-sectional and 3-D images. In this illustration of two separate fractures, the cross-sectional image has been placed above its corresponding 3-D image. The distal femur fracture on the left has not broken the weightbearing part of the bone. The fracture on the right, however, has broken the joint surface into two pieces.

Treatment

Nonsurgical Treatment

Nonsurgical treatment options for distal femur fractures include:

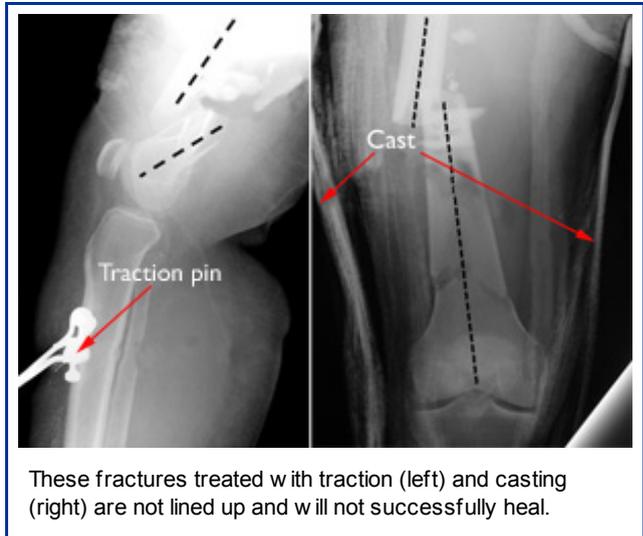
- **Skeletal traction.** Skeletal traction is a pulley system of weights and counterweights that holds the broken pieces of bone together. A pin is placed in a bone to position the leg.
- **Casting and bracing.** Casts and braces hold the bones in place while they heal. In many cases of distal femur fracture, however, a cast or brace cannot correctly line up the bone pieces because shortened muscles pull the pieces out of place. Only fractures that are limited to two parts and are stable and well aligned can be treated with a brace. Casts and braces can also be uncomfortable.

Patients with distal femoral fractures of all ages do best when they can be up and moving soon after treatment (such as moving from a bed to a chair, and walking). Treatment that allows early motion of the knee lessens the risk of knee stiffness, and prevents problems caused by extended bed rest, such as bed sores and blood clots.

Because traction, casting, and bracing do not allow for early knee movement, they are used less often than surgical treatments. Your doctor will talk with you about the best treatment option for you and your injury.

Surgical Treatment

Because of newer techniques and special materials, the results of surgical treatment are good, even in older patients who have poor bone quality.



Timing of surgery. Most distal femur fractures are not operated on right away — unless the skin around the fracture has been broken (open fracture). Open fractures expose the fracture site to the environment. They urgently need to be cleansed and require immediate surgery.

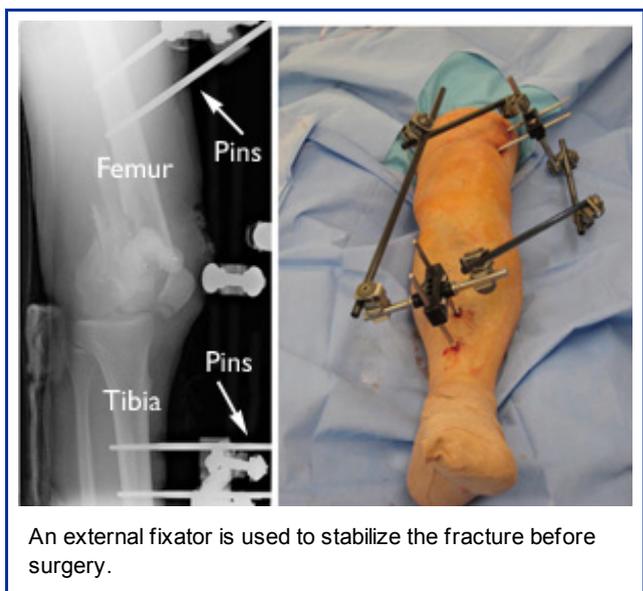
In most cases, surgery is delayed 1 to 3 days to develop a treatment plan and to prepare the patient for surgery. Depending on your age and medical history, your surgeon may recommend that you are evaluated by your primary doctor to make sure that you have no medical problems that need to be addressed before surgery.

External fixation. If the soft tissues (skin and muscle) around your fracture are badly damaged, or if it will take time before you can tolerate a longer surgery because of health reasons, your doctor may apply a temporary external fixator. In this type of operation, metal pins or screws are placed into the middle of the femur and tibia (shinbone). The pins and screws are attached to a bar outside the skin. This device is a stabilizing frame that holds the bones in the proper position until you are ready for surgery.

When you are ready, your surgeon will remove the external fixator and place internal fixation devices on or in the bone under the skin and muscles.

Internal fixation. The internal fixation methods most surgeons use for distal femur fractures include:

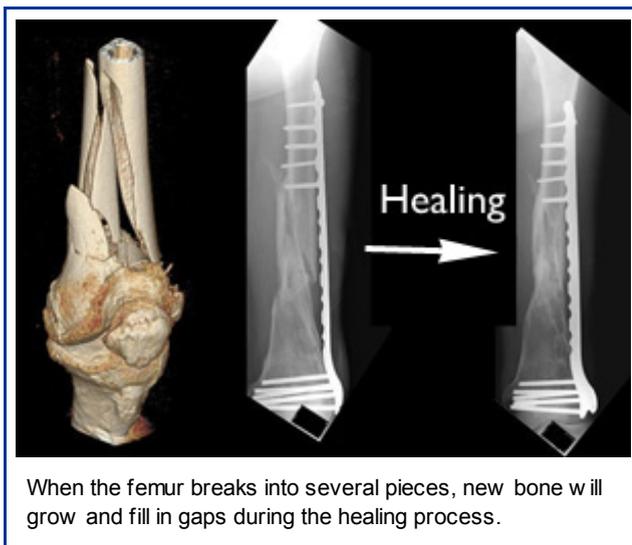
- **Intramedullary nailing.** During this procedure, a specially designed metal rod is inserted into the marrow canal of the femur. The rod passes across the fracture to keep it in position.
- **Plates and screws.** During this operation, the bone fragments are first repositioned (reduced) into their normal alignment. They are held together with special screws and metal plates attached to the outer surface of the bone.



Both of these methods can be done through one large incision or several smaller ones, depending on the type of fracture you have and the device your surgeon uses.



If the fracture is in many small pieces above your knee joint, your surgeon will not try to piece the bone back together like a puzzle. Instead, your surgeon will fix a plate or rod at both ends of the fracture without touching the many small pieces. This will keep the overall shape and length of the bone correct while it heals. The individual pieces will then fill in with new bone, called a callous.



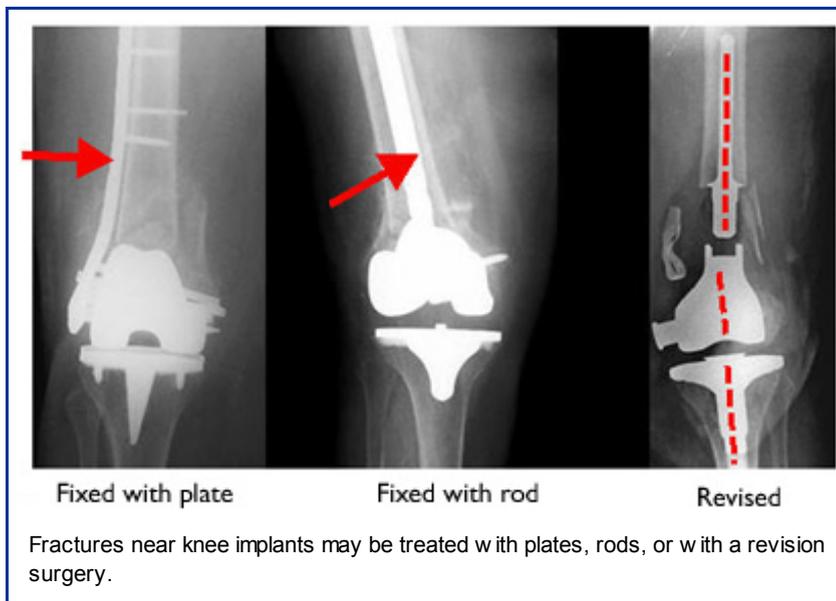
In cases where a fracture may be slow to heal, such as when a patient is elderly with poor bone quality, a bone graft may be used to help the callous develop. Bone grafts may be obtained from the patient (most often taken from the pelvis) or from a tissue bank (cadaver bone). Other options include the use of artificial bone fillers.

In extreme cases, a fracture may be too complicated and the bone quality too poor to fix. These types of fractures are often treated by removing the fragments and replacing the bone with a knee replacement implant.

Fractures and knee replacements. As the population ages and the number of knee replacements rises, an increasing problem has emerged: More distal femur fractures are being seen in seniors who have knee replacements.



Those fractures are typically treated with rods or plates, just like other distal femur fractures. In rare cases, the artificial implant must be removed and replaced with a larger implant. This procedure is called a revision and may be necessary if the implant is loose or not supported by surrounding good bone.



Surgical complications. To prevent infection, you will be given intravenous antibiotics before your procedure. Because blood clots in your leg veins may develop after surgery, your doctor may also give you blood thinners.

There will be blood loss during your surgery. How much blood is lost will depend upon the severity of your fracture and the procedure used to treat it. Your doctor will assess your blood level during the operation and, if low, will determine whether it is in your best interest to have a blood transfusion.

Recovery

A distal femur fracture is a severe injury. Depending on several factors — such as your age, general health, and the type of fracture you have — it may take a year or more of rehabilitation before you are able to return to all everyday activities.

Early Motion

Your doctor will decide when it is best to begin moving your knee in order to prevent stiffness. This depends on how well the soft tissues (skin and muscle) are recovering and how secure the fracture is after having been fixed.

Early motion sometimes starts with passive exercise: a physical therapist will gently move your knee for you, or your knee may be placed in a continuous passive motion machine that cradles and moves your leg.

If your bone was fractured in many pieces or your bone is weak, it may take longer to heal, and it may be a longer time before your doctor recommends motion activities.

Weightbearing

To avoid problems, it is very important to follow your doctor's instructions for putting weight on your injured leg.

Whether your fracture is treated with surgery or not, your doctor will most likely discourage weightbearing until some healing has occurred. This may require as much as 3 months or more of healing before weightbearing can be done safely. During this time, you will need crutches or a walker to move around. You may also wear a knee brace for additional support.

Your doctor will regularly schedule x-rays to monitor how well your fracture is healing. If treated with a brace or cast, these regular x-rays show your doctor whether the fracture is lined up. Once your doctor determines that your fracture is stable enough, you can begin weightbearing activities. Even though you can put weight on your leg, you may still need crutches or a walker at times.

Rehabilitation

When you are allowed to put weight on your leg, it is very normal to feel weak, unsteady, and stiff. Even though this is expected, be sure to share your concerns with your doctor and physical therapist. A rehabilitation plan will be designed to help restore normal muscle strength, joint motion, and flexibility.

Your physical therapist is like a coach guiding you through your rehabilitation. Your commitment to physical therapy and making healthy choices can make a big difference in how well you recover. For example, if you are a smoker, your doctor or therapist may recommend that you quit. Some doctors believe that smoking may prevent bone from healing. Your doctor or therapist may be able to recommend professional services to help you quit smoking.

To help you gauge how well your rehabilitation is going, as you recover ask yourself:

- Is my ability to walk and care for myself improving?
- Are my normal activities of daily living improving?
- Is my pain gone or less, and are my knee motion, stability and strength improving?

The goals of rehabilitation are to get you and your knee back to as normal function as possible. This may take up to a year or more.

Complications

Infection

Newer techniques in treating these difficult fractures have cut the infection rate by more than a half: Currently less than 5% of patients have infections. If you have surgery, your doctor will give you antibiotics to help prevent infection.

Open fractures (those with tears in the skin) and high energy fractures (such as car accidents) are at higher risk for infection. If the infection is deep, it may involve the bone and the device used to fix the bone. A bone infection can require long-term, intravenous antibiotic treatment, as well as several surgeries to clean out the infection.

Stiffness

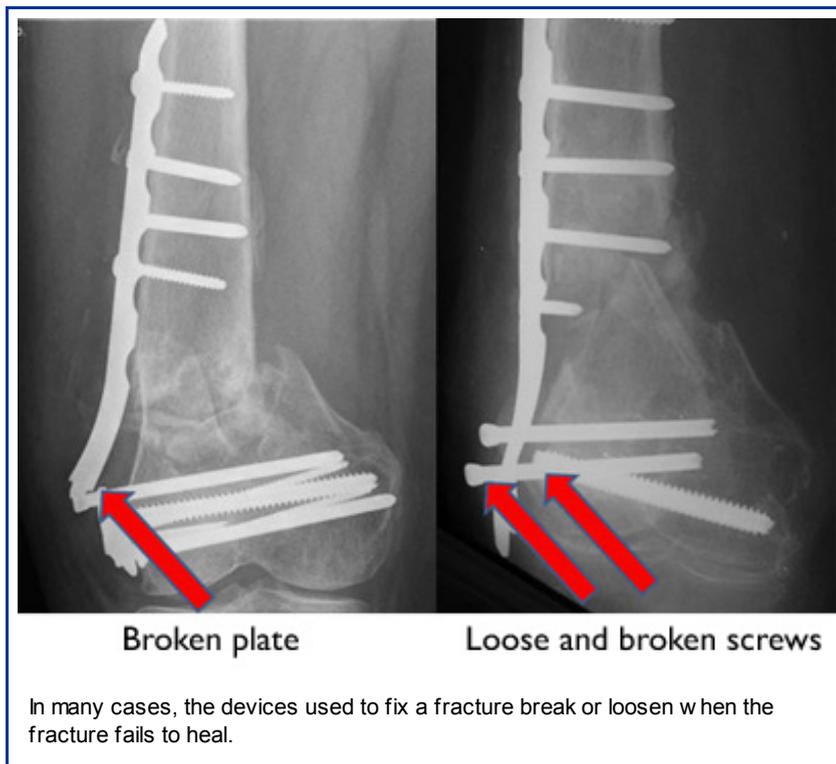
Some knee stiffness is expected after a distal femur fracture. Moving your knee soon after surgery is the best way to prevent stiffness. If you have lost significant knee motion and your fracture is healing, your doctor may suggest an additional operation to break up scar tissue around the kneecap.

Bone Healing Problems

In some cases, bone healing can be slow or not happen at all. If a follow-up x-ray shows rods, plates, and screws breaking or pulling out of the bone, it may be a sign that the bone is not healing. This can happen even if your fracture has been fixed well and you have followed your doctor's guidelines.

Open fractures and high energy fractures are most at risk for not healing. These challenging fractures are also most at risk for infection, and infection can cause bone healing problems.

To help the fracture heal, your doctor may suggest applying a bone graft to the fracture, and changing or adding to how it was fixed (plates, screws, rods).



Knee Arthritis

Distal femur fractures that enter the the knee joint may heal with a defect in the normally smooth surface of the joint. Because the knee is the largest weightbearing joint in the body, any defect can damage the protective articular cartilage and, over time, result in arthritis. In some cases, the joint surface may wear down to bare bone.

Arthritis caused by fracture or injury is called post-traumatic arthritis. It can be treated like other forms of osteoarthritis — with physical therapy, braces, medications, and lifestyle changes.

In cases of severe arthritis that limits activity, a total knee replacement may be the best option to relieve symptoms.

Long-Term Outcomes

It typically takes a year or more for a distal femur fracture to completely heal. Factors that may significantly affect healing and your long-term satisfaction include:

- How severe your injury is. Higher energy fractures may be in more pieces and slower to heal, especially if they are open with more damage to soft tissues.
- Your bone quality. Better quality bone (younger patients) may keep the plates, screws, and rods better in place. Older patients and those with osteoporosis are at high risk for the implants loosening and pulling out of the bone. Newer techniques and implants may help prevent this risk, but cannot eliminate it entirely
- Your commitment to your recovery. Although recovery is a slow process, your commitment to physical therapy and following your doctor's guidelines are an essential part to returning to the activities you enjoy.

Your doctor will regularly check how your recovery is progressing. He or she will assess your pain level (if any), strength, and knee motion, and also how well you are able to perform daily activities.

Your satisfaction with doing normal everyday activities, as well as work and sports activities, is the final assessment of your recovery.

Things to Discuss With Your Orthopaedic Surgeon

- Do I have any specific risks for not doing well?
- Do I have weak bones?
- Will I have a brace?
- What are my specific risks for surgery?
- What will I get to prevent blood clots from forming in my leg?
- Will I need a blood transfusion?
- Will bone graft be necessary? If so where will it come from?
- How much work will I miss?
- When can I start bending my knee?
- When will I be able to put weight on my leg?
- Will I get arthritis?

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- Fractures (Broken Bones) (<http://orthoinfo.aaos.org/topic.cfm?topic=A00139>)
- Open Fractures (<http://orthoinfo.aaos.org/topic.cfm?topic=A00582>)
- Infections After Fracture (<http://orthoinfo.aaos.org/topic.cfm?topic=A00580>)
- Femoral Shaft Fractures (Broken Thighbone) (<http://orthoinfo.aaos.org/topic.cfm?topic=A00521>)
- Internal Fixation for Fractures (<http://orthoinfo.aaos.org/topic.cfm?topic=A00196>)
- Helping Fractures Heal (Orthobiologics) (<http://orthoinfo.aaos.org/topic.cfm?topic=A00525>)
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OrthoInfo

The American Academy of Orthopaedic Surgeons
6300 N. River Road
Rosemont, IL 60018
Phone: 847.823.7186
Email: orthoinfo@aaos.org