INTRODUCTION
Your child has a fracture of the femur, which is the main thigh bone. This is a fairly common injury. Treatment usually requires surgery to allow the fracture to be aligned and to hold it in place with a cast and/or other device. The femur has excellent blood supply from the surrounding muscles and the fracture usually heals well. Most children heal this fracture in 4-8 weeks without long term problems.

BACKGROUND
A femur fracture is the result of a forceful impact to the leg as in a fall or car accident. For younger children, the injury it is not uncommonly a result of child abuse. The femur is one of the strongest bones in the body and it takes a lot of force to break it. There may also be other serious injuries.

DIAGNOSIS
After an injury resulting in a femur fracture, the child has significant pain and is usually transported directly to the emergency department by the parents or ambulance. The doctor will ask for details on exactly how the injury occurred and will carefully examine the leg including the hip and knee. It is important to check the integrity of the skin and the status of the nerves and blood vessels. X-rays are done to see the pattern of the fracture. The fracture is classified as...

  - closed (skin intact) or open (piercing the skin, sometimes called "compound")...
  - non-displaced (aligned) or displaced (out of alignment)...
  - transverse (horizontal), oblique (diagonal), spiral (twisting), or comminuted (multiple pieces)

TREATMENT
Treatment is based on age, fracture pattern and location, risk for infection, and treatment of any associated injuries. In general, young patients can be treated with cast. Older patients generally do better with surgical treatment. Open fractures undergo surgery to clean the wound and stabilize the fracture to minimize the risk of infection.
CAST TREATMENT: For infants and small children, a spica (full body) cast can be applied immediately or within 24 hours of the injury. The cast does not hold the fracture rigidly, but the fracture heals reliably and a young child’s rapid growth will remodel and correct small amounts of shortening and angulation which naturally occur in the cast.

TRACTION AND CASTING: Older children and fractures without good stability can be treated very effectively with traction for several weeks, followed by spica casting. This is a very effective treatment with few risks, but it is very inconvenient. In certain circumstances, it is the treatment of choice to avoid problems related to other treatment options. Your child stays in a special bed the hospital for several weeks with the leg suspended with ropes and weights. Once early fracture healing provides some stability to the fracture, a spica cast can be applied to immobilize the leg in the correct position until fracture healing has progressed and the cast can be removed.

OPEN REDUCTION AND INTERNAL FIXATION: Open reduction and internal fixation or ORIF is the phrase used to describe surgical options for treating a fracture that use pins, plates and screws, or rods to hold the fracture in place while healing progresses. There are many types of implants that are used. It is important to realize the children are different than adults. Children have smaller bones, growth plates at both ends of the bone, and blood vessel differences. Any surgical treatment needs to avoid causing problems with these differences. For adults, the most common means of treating a femoral shaft fracture is to use a rigid intramedullary rod with interlocking screws at the top and the bottom. This is usually inserted from the hip down, but can be inserted from the knee up. This treatment is very effective, but it is not typically done in children because of the growth plates and risk for damaging blood supply to the hip. The other issues for operative treatment include risk for anesthesia, the incisional scar, the risk of infection, and usually a second surgery to remove the pins, plates and screws, or rods.

FLEXIBLE INTRAMEDULLARY RODS: For children from age 4 to 12, depending on weight, the most commonly used treatment currently is flexible intramedullary rods. In the operating room, the fracture can be realigned with a special traction table. In this position, 2 incisions can be made on either side of the knee and 2 thin metal rods can be
inserted into the bone above the growth plate and passed upward inside the bone to cross the fracture site. The rods are thin and flexible to allow for placement and the combination of 2 rods with opposite curvatures, provide enough stability to hold the fracture in place.

RIGID INTRAMEDULAR ROD WITH INTERLOCKING SCREWS: For children approaching maturity (over 12 for girls and over 14 for boys) can be treated with a modified version of a rigid intramedullary nail. A thinner nail can be inserted from the hip with a more lateral (trochanteric starting point). This reduces the risk of damage to the blood supply to the hip. Because the rod is stiffer and stronger, it provides good stability for bigger children and avoids problems with the flexible nails.

OTHER OPTIONS: There are occasions when the common treatments described above can be used. If there are other injuries to the knee or hip, there are times when a long incision is made and a stiff metal plate can be applied to the fracture site and stabilized with crossing screws. If there is a large contaminated wound associated with the fracture, the risk of infection is very high, especially if metal rods and screws are used. To minimize the risk of infection, an external fixator is used to hold the fracture with pins placed above and below the wound site and held in place with an external frame of bars and clamps. This allows the wound to be treated, while the fracture is held by the external fixator.

ADDITIONAL TREATMENT: If pins, plates and screws, or rods are used to fix a fracture in a young child, it is usually necessary to remove the implants after 4 to 6 months. This requires a second surgery, usually done as an outpatient, with associated time out of school for recovery.

HOSPITAL CARE
Following the initial treatment by cast or surgery with internal fixation, the child is typically admitted to the hospital for pain management and additional care. The child usually goes home the day after the injury, once the child has recovered from anesthesia/sedation, the pain is adequately managed, and the family is prepared to manage at home.

PAIN MANAGEMENT
Fractures hurt and appropriate pain management is important. With good pain management, children will eat better, sleep better, heal better, and have less apprehension as they continue treatment. Ibuprofen and Tylenol codeine, when given together, work well and provide good pain relief for most children. It is worth while to set an alarm (even in the middle of the night) to
stick to the schedule. It takes a few minutes to wake up and take the medicine, as opposed to letting pain build up and spending hours trying to get it under control.

Ibuprofen is a non-steroidal anti-inflammatory medication, which has few side effects and low risk, but is usually not strong enough for the first few days. For best effect, it should be given every 8 hours for at least 5 days and as long as needed after that.

Tylenol codeine is a mild narcotic medication, which will provide better pain relief, but also has more side effects, which often include sleepiness, nausea, constipation, etc. Pain relief is best and side effects are minimized if dosing is adjusted based on the pain severity. Start by giving a full dose every 4 hours. If pain relief is good, continue at the same dose or decrease the dose by half. If pain relief is not adequate, increase the dose. You can use 4 dosing steps, which are a full dose, a half dose, a quarter dose, or nothing. It is best to not skip a dose and to not skip a step.

In summary, give ibuprofen every 8 hours for 5 days and on top of the ibuprofen, give the tylenol codeine every 4, adjusting the dose based on the level of pain. Most kids are off the tylenol codeine within 2-3 days and off the ibuprofen by 5-7 days. Children usually do very well are usually pain free within 5-10 days.

**CRUTCHES AND WEIGHTBEARING**

Getting out of bed and moving around will be limited by pain. Moving around is important for getting around, avoiding bed sores and to promote good circulation and healing. This means that pain management is important and specifically, it is important to be comfortable enough to move around. Children will often not want to take the pain medicine and often are not too uncomfortable if they don't move much. However, since moving is important, pain should be assessed and treated while the child is moving. If the pain is well managed, it will be difficult but possible to stand on the opposite leg and to sit in a chair. A knee immobilizer will be used to hold the leg initially. Quite often, the quadriceps muscle will not function well for a week or so following the injury. The knee immobilizer will keep the knee from giving way if weight is applied to the leg. Putting weight on the leg is encouraged to the level tolerated by pain. Putting more and more weight on the leg as pain improves will help the fracture heal. The knee immobilizer can be removed or loosened while sitting and it is okay to remove it for bathing and sleeping. The knee immobilizer is discontinued after 7-10 days.

As the fracture heals and pain improves, progressive activities are encouraged. Early on the child will not want to put weight on the leg and may hold it up in the air while using crutches. After the
first few days, the child should be encouraged to put the foot down with each step and gradually put more and more weight on the leg. Once full weight can be applied, crutches can be discontinued. This usually takes 3-4 weeks. Due to the fracture, the child will not move normally, and will get stiff and the hip and knee. As the pain improves, it is also important to start moving the hip and knee to recover normal joint motion. It usually takes several weeks for the pain to reach a point, where movement and motion exercises can be started. Children will usually recover motion with gentle stretching at home. If weightbearing or motion does not recover pretty well by 6 weeks, physical therapy is started to work through these problems.

WOUND CARE AND ACTIVITY
If your child had surgery, a sterile dressing is applied in the operating room. This should be kept clean and dry and left in place for 3 days. After 3 days the outer dressing can be removed. It is okay to get the leg wet with a wash cloth or with a short shower, but it should not be immersed in a bathtub or pool. There will steristrips across the incision to protect it. These should be left in place as long as possible. The steristrips control stretch and help to minimize the scar. After 7 days, the wound will be sealed enough that bathtubs and clean pools are okay. Once the steristrips are loose, they can be removed. There may be a fine clear suture string visible holding the incision together. This suture will dissolve and fall off or can be removed by the doctor at the follow up appointment.

For the first 48 hours, the leg should be elevated to minimize swelling and pain. It is possible for the swelling to increase to the point that the skin may get too tight. This is a serious problem. The first and most reliable sign of trouble is that the pain is not well controlled. If pain is severe and increasing dramatically over 2-4 hours despite elevation and appropriate pain medicine, it is very important to return to the hospital.

Walking and light duty activity should be encouraged and gradually increased. Most children return to school after 4-5 days, once the worst of the pain has improved and the child no longer requires the stronger narcotic pain medicine. It is important to make arrangements with the school and to work with their policies on pain medications, transportation, use of crutches, etc.

Strenuous activities should be restricted for at least 6 weeks and until x-rays demonstrate progressive healing. The cast or internal fixation will protect the fracture, but they are not strong enough for strenuous activities. There should be no running, jumping, climbing, and definitely no falling. This includes staying off bikes, skates, skateboards, scooters, trampolines, monkey bars, slides, swings, etc. A general rule of thumb is to keep 2 feet on the ground at all times. Return to running and jumping and sports is allowed once x-rays show the fracture has healed and quadriceps strength has returned to within normal limits. If needed, physical therapy is initiated to facilitate recovery of full strength and flexibility.
EXPECTED OUTCOMES
For children, femoral shaft fractures are common and almost always heal reliably and without problems. Arterial and nerve injuries occur rarely. It is uncommon, but possible for growth to be stimulated by the healing process. Overgrowth can be up to an inch (1-2 cm) over the year following the injury. This is most common with cast treatment (less stable) and often the fracture is left short in the cast in anticipation of this overgrowth process. A significant leg length discrepancy following a femur fracture is relatively uncommon and if present rarely leads to future problems.

MORE INFORMATION
Further information can be obtained on the internet. Your local public library can help you explore these sources if you are interested. Two good sites for expert and peer reviewed information are the American Academy of Orthopedic Surgeons at www.aaos.org and www.emedicine.com.

FEEDBACK
If you have questions or comments, please contact the office or submit them to the web site at www.pedortho.com.