After reading this newsletter the learner will be able to:

1. Describe population-specific influences increasing the risk of lower extremity fractures in childhood.
2. Discuss common pediatric fractures of the lower extremities, including assessment findings and management.

Fractures are the most common musculoskeletal injury in children. Approximately 50% of children, more boys than girls, will suffer a fracture during childhood. 1 out of 5 children seen in the Emergency Department with injuries has a fracture. In children, fractures occur more often in the upper extremities, such as the clavicle, radius and humerus, which were discussed in a previous newsletter. Fractures of the long bones in the lower extremities, the femur, tibia and fibula, in children also frequently occur.

This newsletter will describe population-specific influences increasing the risk of lower extremity fractures in childhood. Fractures of the shafts of the three long leg bones, tibia, fibula and femur will be discussed, including assessment findings and management.

Population-specific influences
Causes of femoral, tibial and fibial fractures are often age dependent. At any age, being a passenger in a motor vehicle that crashes, can cause multiple injuries, including fractures.

Newborns and Infants: Although not as common as upper extremity fractures, lower extremity fractures, particularly of the femur during breech deliveries, occasionally occur, but birth trauma isn’t a major cause of lower extremity fractures. During birth, the incidence of fracture is much higher in the upper extremities, such as a clavicle fracture that results from the birth of a large baby, a breech presentation and or a prolonged labor. Instead, in newborns and infants, motor vehicle accidents, falls and child abuse are the primary causes of lower extremity fractures. Many studies have shown the leading cause of lower extremity fractures for children less than 1 year of age, or children not yet walking, is non-accidental. Up to one half of infants and young children who sustain lower extremity fractures are victims of child abuse.

The location of the fracture and the age of the child should be considered, however. For example, a spiral femur fracture in a 6-month-old infant is likely intentionally inflicted and caused by purposely twisting the child’s leg. However, a spiral fracture or the tibia may occur in a 3-year-old child secondary to a twisting fall, which is likely accidental.

A specific type of fracture, a complete distal femur metaphyseal fracture, a complete break of the thigh bone, is often seen in infants who have been abused. Spiral fractures of long bones and fractures that extend into the growth plates are also suspicious for abuse.

Toddler: Tibia or “toddler” fracture (spiral fracture of the tibia) is most common in children aged 9 months to 3 years. A toddler can fracture the shinbone when he or she trips over a toy or falls down a stair while learning to walk. An unsteady toddler may have fallen with a twist, or the child may have gotten his/her foot caught and fallen, twisting it while trying to free his/her foot.

Preschooler: Most children who are hit by an automobile are between 4 and 7 years of age. Because the child’s femur is at the level of the bumper, this is a common mechanism of femur fractures, as well as multiple traumas.

School-age Children: Lower extremity fractures in school-age children are often the result of a bicycle-automobile collision. Fractures often occur during play, as well as during organized and non-organized sports. Fractures are a common injury from accidents occurring while jumping on a trampoline, as well as skiing. In older children, a lower extremity fracture is most commonly caused by a sporting injuries, especially skiing and football injuries. School-agers are at particular risk for falling from high heights, such as from trees or roofs. The influence of friends, their curiosity and lack of understanding of potential dangers, puts this age-group at particular risk. Playground falls, such as from the top of a slide, are most common in children between 5 and 9 years of age.

Common Causes of Lower Extremity Fractures in Children

- Falling while playing on playground equipment
- Falling or twisting leg while learning to walk
- Being a passenger in a motor vehicle accident
- Being struck by a car as a pedestrian or while riding bicycle, skateboard
- Contact sports, such as football – receiving a direct blow to the thigh and/or calf
- Child abuse – an intentional direct blow to the lower limb or twisting or shaking the child’s lower limb
TIBIA AND FIBULA SHAFT FRACTURES

Lower leg fractures include fractures of the tibia and fibula. Of these two bones, the tibia is the only weight-bearing bone. In 75% to 85% of patients where the cause of fracture of the tibia is a direct impact, such as from a motor vehicle accident, the fibula (the thin bone at the outer side of the lower leg) is fractured as well—a tib-fib fracture. The fibula is smaller, running parallel to the tibia on the outside of the lower leg, so the impact is commonly transmitted along the interosseous membrane to the fibula. Fibula fractures can occur alone, such as if there is an extreme sideways bend at the ankle or knee or a direct blow to the outside of the lower leg, such as from a soccer ball.

Tibial shaft fractures are the third most common fracture in children, after fractures of the femur and forearm, and account for 15% of pediatric fractures. Most tibial shaft fractures are short oblique or transverse fractures of the middle or distal third of the shaft. Tibia fractures can be caused by a indirect trauma (rotational stress) or direct (impact). The mechanism of injury varies depending on the age of the patient. A general principle to remember is that a more significant trauma is necessary to fracture the tibia in older children. Indirect trauma, twisting injuries, referred to as a toddler’s fracture, are a common cause of tibia fractures in children from one to 3-4 years of age. A toddler’s fracture of the tibia is often seen from a simple trip over a toy. As the child falls, a torsional force (twisting) occurs when the body rotates with the foot in a fixed position. In older children, the tibia is commonly fractured following a direct, high energy force, such as caused by motor vehicle accidents and sports-related injuries.

Toddlers and very young children with nondisplaced tibia fractures (Toddler’s fracture) may present with sudden guarding and a limp or an inability to bear weight, but will often lack the extensive swelling and noticeable deformity seen with displaced fractures. These fractures usually do not break the skin, and the bone stays fairly well-aligned. The child with a high energy tibia fracture will usually have acute pain, an inability to bear weight on the affected limb, as well as extensive swelling and ecchymosis, causing a significant risk for compartment syndrome.

Of all the body’s long bones, the tibia is the most likely to break through the skin when it fractures from a direct force. This greatly increases the risk of bacterial contamination and infection at the fracture site. It also may prevent normal healing. The sharp ends of a broken tibia can cut into nearby nerves and blood vessels and cause serious damage to soft tissues inside the lower leg. Thus, special attention should be paid to neurovascular status in the first 24 hours following such injuries.

A fracture of the tibia is often difficult to detect by X-ray. A bone scan may be necessary to verify the diagnosis. Pediatric tibial (and fibular) shaft fractures are usually uncomplicated and can be treated with simple closed reduction/manipulation and a short leg weight-bearing cast.

Displaced fractures are often reduced in the operating room under conscious sedation/general anesthesia.

FEMORAL SHAFT FRACTURES

Femoral shaft fractures are one of the most common fractures in children. The frequent site for a femoral fracture is in the middle one-third of the shaft. Femoral shaft fractures are also the most common cause of fractures requiring hospitalization.

The causes of femoral shaft fractures are often age dependent, although motor vehicle accidents are a frequent cause regardless of the child’s age. A common mechanism of injury for femur fractures in children is falls, such as from a fall from the top of a playground slide, tree or roof. A high-energy injury, such as pedestrian-motor vehicle crash, is also a common cause. The most common cause of femur fractures in infants under 1 year old is child abuse, which accounts for approximately 70% of the fractures in this age group. It is often obvious when a child has a fractured femur. Most children with a femur fracture are unable to walk and are in extreme pain. The thigh is often noticeably deformed and there is a limited range of motion of the hip or knee because of the pain. However, the diagnosis might be more difficult in patients suffering a concurrent head injury or multiple traumas.

Treatment for femur fractures depends upon the fracture location, whether the fracture is open or closed, as well as the age and weight of the child. In general, for closed fractures, newborns and infants (up to 6 months of age) with a femur fracture can often be treated successfully in a Pavlik harness. Children between the age of approximately 6 months to 5 - 8 years (under 80 lbs) are usually treated with spica cast immobilization. In older children, intramedullary nailing is often required.

Femur fractures have the potential to cause dangerous, sometimes life-threatening complications, such as a blood clot to form within the large veins of the thigh and significant bleeding inside the thigh. The child’s hematocrit should be monitored. It is important to note isolated closed fractures of the femur should not cause an acute drop in the patient’s hematocrit. Healthcare providers must search for other sources of blood loss when the hematocrit level is declining or if it is less than 30%.

Children are significantly affected by immobilization, pain, fear, and lack of independence brought on during the care and healing of a lower extremity fracture. Femur fractures in particular can require long periods of immobility until sufficient callus formation has occurred to allow for ambulation with or without assistive devices. Family members are faced with a significantly increased caregiver burden, as well. Healthcare providers are in a key role in providing anticipatory guidance, education and support to the family and child.
1. Lower extremity fractures do NOT include which of the following bones?
   a. Tibia
   b. Ulna
   c. Femur
   d. Fibula

2. In children, femoral shaft fractures:
   a. typically occur after a fall from a bicycle.
   b. are one of the most common fractures.
   c. rarely produce complications.
   d. can result from minor twisting forces.

3. Assessment findings for a fractured femur include all of the following EXCEPT:
   a. an inability to walk.
   b. severe pain.
   c. noticeably deformed affected thigh.
   d. full range of motion of both extremities.

4. Between the ages of 4 and 7 years, a common cause of femoral shaft fracture is:
   a. tripping.
   b. child abuse.
   c. motor vehicle-pedestrian accidents.
   d. skiing.

5. Child abuse is a primary cause of lower extremity fractures in newborns and infants.
   a. True
   b. False
6. An 8 year old boy was hit with a baseball on the outside of his calf on his lower right leg. While sliding into home base his right leg bent under him significantly at the ankle. There is a high risk that he fractured his:

a. tibia.
b. fibula.
c. radius.
d. femur.

7. “Toddler’s fracture” involves the:

a. fibula.
b. femur.
c. tibia.
d. tibia and femur.

8. With a “toddler fracture”, the young child most often presents with:

a. extensive swelling.
b. severe bruising.
c. noticeable limping.
d. considerable deformity.

9. Which of the following will most likely result in a “toddler fracture”? When the child:

a. suffers abuse.
b. trips over a toy.
c. runs.
d. falls down a flight of stairs.

10. When a tibia fracture occurs due to a direct impact, it is one of the body’s long bones most likely to break through the skin.

a. True
b. False