Pediatric Ankle Fractures: Case Report and Review

by Jennifer Michael¹, DPM, Gary Most², DPM

Ankle fractures are a common pediatric problem that requires accurate diagnosis and treatment for optimal outcomes. The anatomy of the pediatric patient lends itself to more ankle fractures compared to sprains, due to the strong ligaments compared to the adjacent physis. Disruption of the physeal growth can occur, and can consequentially cause angular deformity or limb-length discrepancy. Given the potential complications associated with misdiagnosis and mistreatment, pediatric ankle fractures are an important subject for students, residents, and clinicians alike. In this case report we use percutaneous K-wire fixation for a Salter-Harris IV tibial fracture and Salter-Harris III fibular fracture in a 12-year-old boy.

Key words: pediatrics, ankle fracture, Salter-Harris IV, tibial fracture, fibular fracture, percutaneous fixation

Accepted: January, 2015 Published: January, 2015

Ankle fractures are the most common acute injuries of the lower extremity in children. According to Peterson, physeal injuries of the distal tibia and fibula account for 25% of all physeal fractures [1]. About 60% of physeal ankle fractures occur during sports activities and are more common in boys than girls [2,3].

The majority of the ankle’s stability comes from the deltoid ligament and the lateral ligamentous complex. These ligaments arise directly from the tibial and fibular epiphyses and account for the high percentage of physeal injuries about the ankle [4,5]. Ligamentous injuries in the growing child are unusual. Due to the fact that ligaments are generally stronger than open physis, low energy trauma (such as an inversion injury) that might result in a ligamentous injury in an adult often results in a physeal fracture in a skeletally immature individual [6].

The distal physis contributes about 3-4 mm of limb growth per year and 15-20% of final leg length [6]. It begins to close at around 12 years in girls and 14 years in boys [4]. Closure begins centrally, extends medially, and then laterally over the course of 18 months [4,6]. This pattern of closure lends itself to the types of tibial fractures seen in late adolescence. Closure of the distal fibular physis occurs approximately one to two years after the closure of the distal tibial physis. Distal fibular physeal fractures are the most common types of pediatric ankle fracture and are associated...
with a relatively low risk for long-term complications [3]. In contrast, distal tibial physeal fractures are associated with a higher risk for long-term complications [4].

A physeal growth arrest with consecutive bone bridge can occur occasionally after an injury of the distal tibial physis. Angular deformity or leg-length discrepancy can be consequences [7]. Permanent damage to the growth plate can be produced due to the trauma itself or by inadequate treatment [1]. The Salter-Harris classification system is the most commonly used method of describing pediatric ankle fractures [6]. This system grades physeal fractures as types I through V based on anatomic location. Salter-Harris I and II ankle fractures are at lower risk for growth arrest and angular deformity than those that are Salter III or higher. Higher grades of Salter-Harris often require operative repair [6].

The following is a case report of a pediatric patient found to have a Salter Harris IV fracture of the tibia and a Salter Harris III fracture of the fibula that underwent surgical intervention.

**Case Report**

We report on a 12-year-old male who presented to clinic with a 1 day old injury to his left ankle. Past medical history was not significant. The patient stated he was playing on a Ripstick™ with his brother and they collided and he fell. He was unsure of the exact mechanism of injury. Patient was immediately unable to bear weight. He complained of an aching pain and swelling to his entire ankle. No treatments had been tried.

On physical examination, pedal pulses were palpable. Protective sensation was intact. Moderate edema and ecchymosis were noted to left ankle and foot. Tenderness to palpation was noted to the lateral malleolus and medial malleolus. Range of motion exam revealed pain on dorsiflexion, eversion and inversion of the left foot. Instability was noted to the ankle against anterior drawer. The foot appeared in a slightly inverted position compared to the right (Figure 1). There were no lacerations, tenting of skin, or blistering. Gait exam revealed an antalgic gait with an inability to bear weight to his left foot. The remainder of the neurovascular and musculoskeletal examination was unremarkable.

![Figure 1: Clinical photograph of lower extremities showing the increased edema of the left ankle and foot. Also note that the left foot is inverted on the leg compared to right.](image1)

Radiographic evaluation revealed a fracture line extending proximally into the metaphysis from the physis and widening of the lateral aspect of the fibular physis. Soft tissue edema noted around the lateral ankle (Figure 2). Radiographs of the right limb were also obtained to compare the width of the physes (Figure 3).

![Figure 2. 3 views left ankle. Fracture noted at the tibial medial metaphysis extending from the physis and widening of the lateral fibular physis.](image2)
Computed Tomography (CT) imaging was obtained. There is a 16 mm crescentic slender fragment arising from the anterior distal fibular epiphysis that likely extended into the physes and was most consistent with a Salter III fracture. There was approximately 3 mm of anterior displacement of the fragment. The fracture plane likely extended into the distal tibiofibular joint, which was likely associated with a high ankle sprain (Figure 4). The medial one-third of the tibia demonstrated a fracture line extending from the epiphysis through the physis and into the metaphysis consistent with a Salter IV fracture. (Figure 5).

The decision was made for operative management of the fractures via percutaneous K-wires. The patient was taken to surgery 3 days after the initial injury. A popliteal sciatic nerve block catheter was placed to manage intra-operative and post-operative pain. Pre-operative antibiotic of 1g of Ancef was administered. The surgery was performed under monitored anesthesia care with a supplemental saphenous block.

After anesthesia was administered the ankle was stressed and instability was noted at the syndesmotic ligament. The procedure was done using fluoroscopy to make sure the fragments were in the correct anatomical position. The first K-wire was driven from medial to lateral, transversely through the tibial epiphysis. Next, two K-wires were driven into the medial malleolus from distal medial to proximal lateral, crossing the physis and catching the proximal fragment. The fibular K-wire was thrown from anterior distal to posterior proximal. Finally, two K-wires were used to stabilize the syndesmotic ligament thrown from lateral to medial. Good anatomical alignment was achieved (Figure 6). After the procedure, the patient was placed into a soft dressing and instructed to remain non-weight bearing to left lower extremity.

The patient was seen in office 8 days post-operatively. He denied any constitutional symptoms of infection or pain. The dressing was dry and intact. The surgical sites were clean and there were no signs of infection. Minimal swelling and ecchymosis were noted to the surgical site. The ankle joint was without crepitation or instability with stressed range of motion. The patient was to return in 3 weeks for radiographs and possible removal of K-wire fixation. Post-operative course will be closely followed to minimize risk of post-operative complications.
Figure 6. Intraoperative image of percutaneous fixation.

Discussion

Treatment of ankle fractures requires two important goals in children: achieving a satisfactory reduction and avoiding physeal arrest to reduce the risks of angular deformity, early arthrosis, leg-length discrepancy, and joint stiffness. The amount of damage to the physis upon injury is out of the physician’s control, but care should be taken to minimize any further damage [6].

Salter Harris IV fractures traverse the metaphysis, physis, and epiphysis to enter the ankle joint, and account for as many as 25% of distal tibial fractures [8,9]. Patients with nondisplaced fractures should be treated in a non-weight-bearing cast for 4 weeks, which may be followed by a walking cast for another 2 weeks [6]. If there is more than 2 mm of residual displacement, treatment is usually open reduction and internal fixation to minimize articular incongruity and the risk of physeal bar formation [6]. In a series by King et al, growth disturbance developed in only 1 of 20 patients with Salter-Harris III or IV fractures treated with open reduction and internal fixation, but 5 of 9 patients with such fractures who were treated with casting subsequently had radiographic evidence of a bone bridge crossing the physis [8].

In our case, we found percutaneous K-wire fixation to be an acceptable form of fixation, using fluoroscopy intra-operatively to verify adequate reduction. Due to the ankle’s instability and risk of physeal disruption we did not believe casting would be sufficient.

The advantages of percutaneous fracture fixation include smaller incisions, reduced trauma to the tissues, reduced disruption of the blood supply to the bone, and less postoperative pain. The major disadvantage of percutaneous fixation is the potential for less than optimal reduction due to the lack of direct visualization of the osseous injury. [10] It is important to note that screws or threaded wires should never be placed across an open physis. Smooth pins may cross a physis if necessary for fracture fixation. Pins traversing physes should be removed when the fracture becomes stable, generally within several weeks [6].

In conclusion, ankle fractures are a common pediatric problem that requires accurate diagnosis and treatment for optimal outcomes. Radiographs are not always adequate for diagnosing the extent of the injury and CT imaging may be required, especially for surgical planning.

Adequate reduction and stabilization is required to prevent complications to the patient when they become an adult. We used percutaneous fixation and will have to follow the patient into adulthood to determine if it was able to prevent any of these complications. A Pub-Med search for pediatric ankle fractures fixated percutaneously demonstrated that there is insufficient data. A well-controlled trial needs to be conducted comparing percutaneous and open techniques for pediatric ankle fractures.

References


