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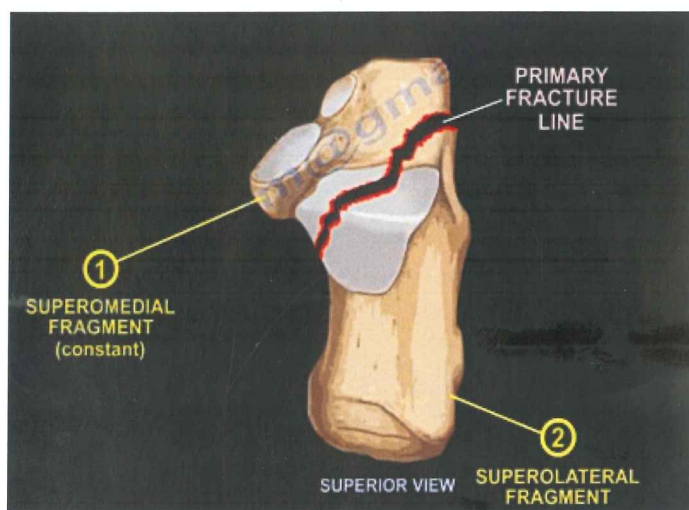
Fractures of the Calcaneus

Calcaneus fractures are classified into two different categories, tongue-type and joint depression. Tongue-type fractures have the posterior facet attached to the tuberosity, and joint depression fractures are classified by the posterior facet not being attached to the tuberosity.

In Tongue Type fractures, the primary fracture line exits anterolaterally and posteromedially. The secondary fracture line appears beneath the posterior facet and exits posteriorly through the tuberosity. The superolateral fragment and posterior facet are attached to the tuberosity. The tongue-type fracture could be treated with a closed reduction and screw fixation. In joint depression calcaneus fractures, the primary fracture line splits the calcaneus obliquely through the posterior facet and exits anterolaterally and posteromedially. The secondary fracture line exits superiorly just behind the posterior facet. The posterior facet is a free fragment. The lateral portion of the posterior facet is usually involved and depressed.

The Sander's classification is used to guide treatment and predict the outcome of calcaneus fractures. This classification is based on the number of fracture fragments of the posterior facet as seen on a coronal CT scan. Type I fractures are nondisplaced and do not require operative treatment; Type II fractures are a two-part fracture of the posterior facet; and Type III fractures have a three-part fracture of the posterior facet. Sander's Type II and Type III calcaneal fractures will benefit from surgery of reduction and fixation. Type III fractures are more prone to arthritis because they have more fracture fragments and may require a fusion. Type IV fractures are highly comminuted and may need a primary subtalar arthrodesis.

Calcaneal avulsion fractures are an important topic due to the fact that these are emergencies. Calcaneal avulsion fractures require an urgent reduction and internal fixation to prevent skin complications. In joint depression fractures, the surgeon will need to wait for the swelling to go down prior to performing surgery. Avulsion fractures of the calcaneus are emergencies and the surgeon should not wait to perform surgery—surgery should be performed immediately. Open reduction and internal fixation of the calcaneus is generally delayed for 1-2 weeks to allow for improvement of the soft tissue swelling, except with fractures of the posterior tuberosity (avulsion fracture)



which can cause skin tenting and URGENT reduction is recommended.

Associated conditions include: spine fractures (10%), Compartment Syndrome of the foot (10%), calcaneocuboid joint fractures (60%), and peroneal tendon subluxation. Peroneal tendon subluxation may be detected on an axial CT scan and may be seen as an avulsion fracture of the fibula on x-rays. Compartment Syndrome of the foot, if neglected will lead to claw toes due to contracture of the intrinsic flexor muscles.

The complication rate of calcaneus fractures is high. Factors associated with poor outcomes are: age (older than 50 years), smoking, early surgery, history of a fall, heavy manual labor, obesity, males, bilateral injury, workman's compensation, and peripheral vascular disease. Men tend to have a more difficult time recovering with calcaneal fractures than women.

The Bohler Angle will need to be examined in imaging. The normal angle is between 20-40 degrees and should be measured on lateral x-rays. The Bohler Angle is formed by a line drawn from the highest point of the anterior process of the calcaneus to the highest point of the posterior facet and a line drawn tangential to the superior edge of the tuberosity.

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Fractures of the Calcaneus continued

A decrease in this angle indicates the collapse of the posterior facet. The Harris and Axial views additionally allow the physician to see if the calcaneus is shortened and/or widened with varus. An axial cut CT scan will show the calcaneocuboid joint and the peroneal tendon subluxation. The sagittal view will show the subtalar joint and its depression. The coronal view will show the posterior facet displacement.

A CT scan will also show the number of the joint fracture fragments as seen on the coronal CT scan. The surgical outcome of calcaneal fractures correlate with the number of joint fracture fragments and the quality of the reduction. An MRI will show stress fractures of the calcaneus and the integrity of the peroneal tendons.

A stress fracture of the calcaneus may be misdiagnosed as plantar fasciitis. These stress fractures typically occur in female runners and symptoms will usually include swelling, as well as tenderness with medial and lateral compression of the hind foot. A positive squeeze test could mean that there is a stress fracture of the calcaneus. The physician should order an MRI if the x-ray is negative. The MRI should show a fracture in T1 as a linear streak, or a band of low signal intensity in the posterior calcaneal tuberosity. T2 will find an increased signal.

Wound related complications are the most common types of complications which occur approximately 20% of the time. These complications occur more in smokers, diabetics, and in patients with open fractures. With Grade I and II open fractures with a medial

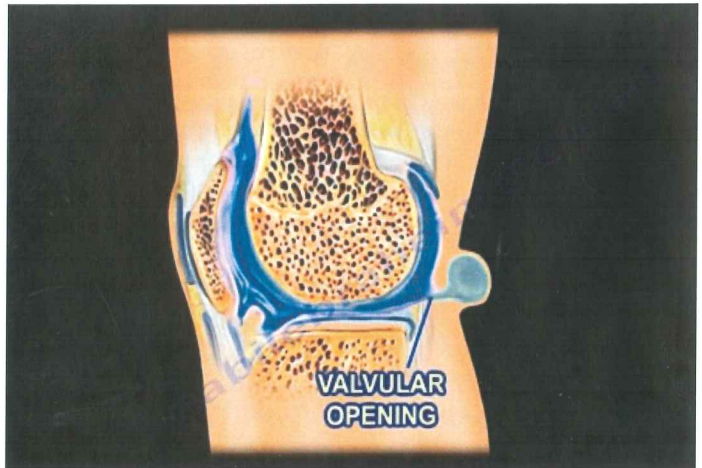
wound, lateral incisions may be done. But, the surgeon should not perform an open reduction and internal fixation (ORIF) in Grade III medial wounds and in most lateral wounds. Open fractures of the calcaneus may lead to amputation as there is a high risk of infection. Another complication of calcaneus fractures is the malunion of the calcaneus. In malunions, there is a widening of the heel, varus deformity, and loss of height which causes the talus to become dorsiflexed, limiting the dorsiflexion of the ankle. Peroneal tendon irritation and impingement from the lateral is another common complication of calcaneus fractures. Surgery will decrease the risk of post-traumatic arthritis. Tongue type fractures may benefit from a closed reduction and percutaneous fixation or an open reduction and internal fixation. Joint depression type fractures will usually require an open reduction. Some surgeons advocate for conservative treatment of the calcaneus (nonoperative treatment). Subtalar distraction arthrodesis plus insertion of a bony clock and rigid internal fixation is a great operation that is usually done for calcaneal fractures that are associated with a loss of height and limited dorsiflexion of the ankle. This operation improves talar inclination and decreases anterior ankle impingement. This will take care of the arthritis in the subtalar joint. In regards to the extensile lateral approach, the lateral calcaneal artery provides blood supply to the lateral flap associated with the calcaneal extensile approach. It is important for the surgeon to note that the Sural nerve is in the vicinity of the surgical area. The extensile approach has delayed wound healing in about 20% of cases.

Baker's Cysts

A Baker's cyst is sometimes called a "popliteal cyst" and is a benign swelling found behind the knee. The Baker's cyst lies posterior to the medial femoral condyle. The cyst is connected to the knee joint through a valvular opening. Knee effusion or swelling from intra-articular pathology allows the fluid to go through the valve to the cyst in one direction (usually behind the knee). Sometimes, the patient will complain about swelling behind the knee which will alert the clinician to the possibility of having a problem inside the knee itself. The cyst is located between the semimembranosus and the medial gastrocnemius muscles. The cyst is usually located at or below the joint line.

The patient will usually have swelling behind the knee with pain, fullness, and tenderness. Knee effusion, or excessive fluid inside the knee, creates fluid pressure that allows a unidirectional passage of the fluid from the knee joint, through the valve, and into the cyst. A Baker's cyst is easier to see with the knee fully extended. A diagnosis can usually be confirmed with an MRI showing the associated intra-articular pathology. Ultrasounds are additionally helpful, especially if the cyst is found to be outside of its typical normal position.

Baker's Cysts are commonly caused by knee arthritis and meniscal tears (especially the medial meniscus). Tears of the posterior horn of the meniscus that extend to the capsule, may cause a defect, or one-way valve to develop between the knee joint and the bursa that lies between the gastrocnemius and semimembranosus muscles. If the



cyst is present in an atypical location, the physician should consider a tumor as a part of the differential diagnosis. A Baker's cyst is a fluid filled cyst and not a solid tumor. The cyst should transilluminate.

Treatment of painful, large, cysts may include: Ice, compression wrap, anti-inflammatory medication, strengthening exercises, and an aspiration of the cyst. Aspirations of the cyst may be done blindly or with ultrasound guidance. Recurrence of Baker's cysts is common if the intra-articular pathology continues. The best treatment is arthroscopy and debridement of the intra-articular pathology.

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Recurrence of the cyst is common following its removal, therefore, the main treatment of Baker's cysts should be directed towards treating the intra-articular pathology (usually meniscal tear or arthritis). The cyst may burst, causing calf pain and swelling. It is important for the physician to rule out deep vein thrombosis (DVT) or thrombophlebitis.

Popliteal Cysts in children are a common soft tissue mass at the back of the knee. These cysts occur more in boys, are asymptomatic,

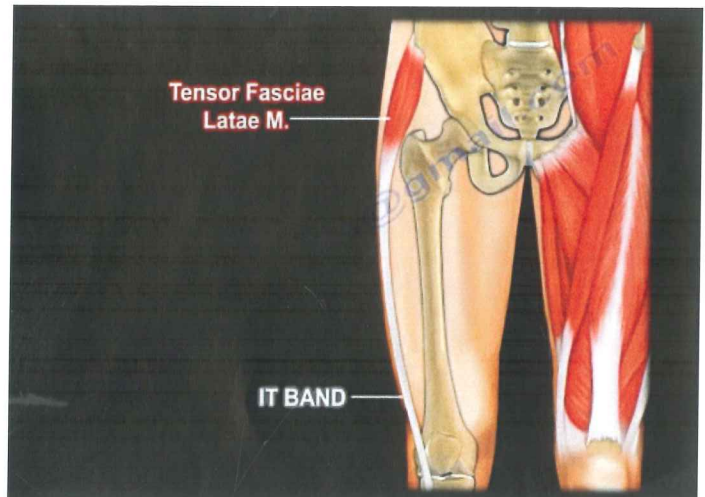
transilluminates, and are not tumors. The cyst may not be intra-articular and may not have a connection to the knee joint. Popliteal cysts in children are usually not associated with a meniscal tear. Surgery is rarely indicated and the cyst is usually treated by observation. Spontaneous resolution of the cyst can occur in 10-20 months. In difficult cases, an aspiration of the cyst may be indicated. The cyst may respond to aspiration and steroid injection because it is not connected to the knee joint.

Iliotibial Band Syndrome of the Knee

Inflammation and thickening of the iliotibial band results from excessive friction as the iliotibial band slides over the lateral femoral condyle. The iliotibial band is a thick band of fascia that extends along the lateral thigh from the iliac crest to the knee. It inserts into the Gerdy's tubercle of the tibia. The iliotibial band is a continuation of the tensor fasciae latae muscle. The tensor fasciae latae muscle arises from the outer surface of the anterior iliac crest, between the tubercle of the iliac spine and inserts into the iliotibial tract. The gluteus maximus also inserts into the iliotibial band.

The iliotibial band extends, abducts, and laterally rotates the hip. Additionally, it contributes to lateral knee stabilization. In iliotibial band syndrome, the IT band is repeatedly shifted forward and backwards across the lateral femoral condyle. Impingement usually occurs around 30 degrees of knee flexion. There may be swelling, tenderness, and crepitus over the lateral femoral condyle. The condition of ITBS around the knee most commonly occurs in runners, cyclists, and other athletes undergoing exercises with repetitive knee flexion and extension. The IT band inserts into the Gerdy's tubercle and the pain is proximal to the Gerdy's tubercle. Pain may be reproduced by doing a single leg squat.

Predisposing factors include: foot and knee malalignment (foot pronation and varus knee), a prominent lateral condyle, a tight IT band, leg length discrepancy, weak abductors of the hip, poor shoe wear, and/or training errors. The Ober's test is a provocative clinical examination that is used to assess tightness of the iliotibial band. The patient should lay on the side with the affected leg up. The examiner will slowly abduct the leg with the knee in flexion and the hip in full extension. When the IT band is tight, adduction of the leg will be limited as the leg will not touch the other knee and the test will be considered positive. During the Noble Test, the examiner will place the knee into flexion and place the thumb over the IT band



prior to its insertion into the Gerdy's tubercle of the lateral tibia. With pressure placed onto the IT band, then the leg will be extended. If pain is felt at the lateral femoral condyle with extension of the leg, then this is a positive Noble test. In regards to imaging, x-rays will not be helpful and an MRI may show edema in the area of the ITB.

Nonoperative Treatment will be considered first and consists of rest and ice. Physical therapy is very important as the stretching, proprioception, and improvement in neuromuscular coordination is beneficial. Training modification, better shoe wear, and injections (may be helpful) are additional conservative treatment methods. A majority of patients will get better within 4-8 weeks when using nonoperative treatment methods. A surgical excision of the scarred, inflamed part of the iliotibial band is done as a last resort. Sometimes, there may be an excision of a cyst or bursa. A Z plasty is rarely done.

Capitulum Fractures

In regards to capitulum fractures, it is important for the physician to be aware of the coronal shear fracture of the capitulum that includes the capitulum and part of the trochlea. The coronal shear fracture involves the capitulum and extends medially to include part of the trochlea. In these cases, the physician will see a double arc on the lateral x-rays. One arc represents the capitulum and the other arc is the lateral ridge of the trochlea. Fractures of the capitulum in general

can be missed on the lateral view x-ray if the fragment is too small. There are four types of capitellar fractures. Type I fractures constitutes a large fragment of bone and articular cartilage. Type II fractures are characterized by a small shell of bone and articular cartilage. Type III fractures are comminuted fractures of the capitulum.

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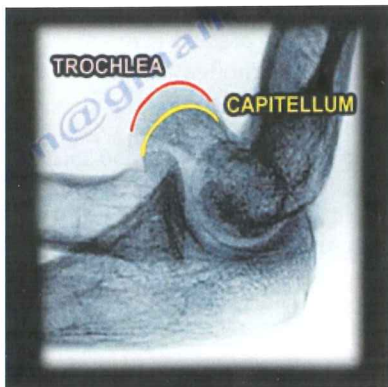
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Capitellum Fractures continued

Type IV fractures are verticle shear type fractures which extend medially to include the capitellum and trochlea. In Type IV fractures, the physician will see a “double bubble” or double arc on the lateral x-rays. A fracture of the capitellum may be associated with other injuries to the ligaments or to the bones. Fractures may also block movement of the elbow or cause elbow instability. Rarely a CT scan is needed, unless the fracture is a part of a complex injury to the elbow.

Treatment usually consists of an open reduction and internal fixation. The most common outcome with this treatment method is elbow stiffness. The patient may need more surgery in the future in order to release the elbow contractures. Type I fractures are treated with fixation, Type II fractures are treated by excision and occasionally fixation, Type III fractures are treated by excision and Type IV fractures are treated with an open reduction and internal fixation. Fixation of some of these fractures may require headless screws.



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