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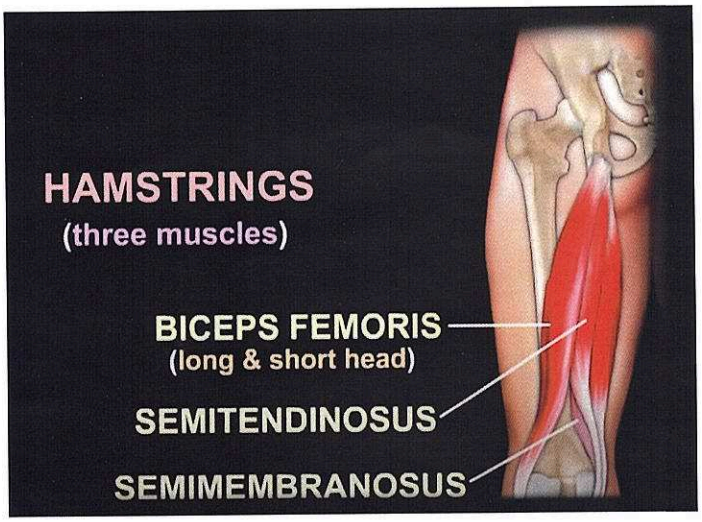
Hamstring Injuries

The hamstrings are a group of muscles located on the back of the thigh. The muscles of the hamstrings are the biceps femoris (long and short head), semitendinosus, and semimembranosus. The proximal end of the hamstring muscle originates from the ischial tuberosity of the pelvis. The semitendinosus and the long head of the biceps femoris share a common origin from the ischial tuberosity in this medial location. The semimembranosus has its own separate origin which is lateral on the ischium. The hamstrings origin on the ischial tuberosity is approximately 6cm proximal to the inferior border of the gluteus maximus. The gluteus maximus muscle is covering the hamstring tendon proximally. All muscles of the hamstrings are innervated by the tibial (medial part) of the sciatic nerve except for the short head of the biceps which is innervated by the common peroneal nerve. The short head of the biceps femoris is innervated by the common peroneal nerve. The hamstring muscles are a major flexor of the knee, and they also aid in hip extension. The hamstring muscles are inserted on the proximal part of the leg. The biceps femoris splits from the semitendinosus and moves laterally to take a lateral direction and be inserted into the posterior aspect of the fibular head. The biceps femoris is the most posterior structure inserted into the fibular head and posterior to the biceps femoris tendon lies the common peroneal nerve. Another muscle appears to help the long head of the biceps femoris laterally, and this is the short head of the biceps femoris muscles. The short head of the biceps femoris does not originate from the ischium, but it has a common insertion with the long head of the biceps femoris. The semimembranosus and semitendinosus are inserted into the proximal part of the medial tibial condyle. There is a balance between the hamstring muscles on the lateral aspect and on the medial aspect. Proximally, the sciatic nerve is very close to the hamstring muscles, and it is about 1.2cm lateral to the hamstring muscles. The hamstring muscles cover the sciatic nerve. The sciatic nerve lies anterior to the hamstring muscles in the proximal and middle third of the thigh. Injury to the hamstring muscles primarily occur proximally and are a common source of chronic pain and injury in athletes. Hamstring injury is often referred to as a hurdler's injury. Athletes who attempt to clear hurdles are prone to injury due to excessive hamstring tension. Injury to the hamstrings muscles also may occur in running athletes and in soccer/football players due to sudden hip flexion and knee extension which is opposite to the function of the hamstring muscles. Risk factors include previous hamstring injury that may cause healing by a weak scar that is susceptible to another injury, tighter hamstrings in the shorter leg in leg length discrepancy, decreased hip extension, severe imbalance between the quadriceps and hamstring strength, or inadequate warmup. With hip flexion and knee extension, there is an eccentric forceful contraction and lengthening of the muscle which causes injury to that tendon. Hamstring strains are classified into three grades: minor tear within the muscle, partial tear within the muscle, or complete tear of the muscle or the tendon. Most hamstring injuries in adults will occur at the musculocutaneous junction, but injury may also occur at the insertion into the ischial tuberosity. Avulsion injuries can also occur where there is a severe hamstring injury, and the tendon tears away with a fragment of bone. These avulsion fracture injuries are not common and are typically seen in patients who are younger and skeletally immature athletes. After a sprain or partial tear, the satellite cells respond to the injury and is responsible to make new muscle. On clinical examination, the patient will complain of sharp pain in the back of the thigh, popping or tearing of the muscle, ecchymosis of the posterior thigh, and a palpable mass in the middle of the thigh.



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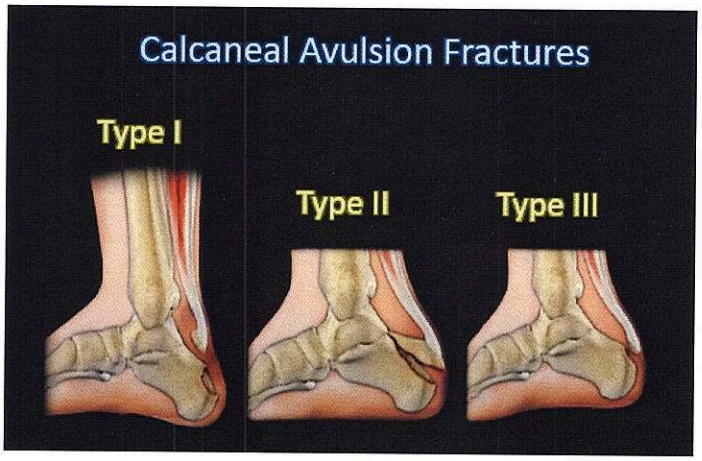
This injury is usually diagnosed by an MRI. A sprained or pulled hamstring can occur due to insufficient warm up time before activity. Conservative treatment includes rest, ice, compression bandage, elevation, protected weight-bearing for four weeks, and physical therapy. Surgery is done when there is a complete injury of the tendon with muscle retraction. The surgery is usually done early, make the incision, find the retracted muscle/tendon, and protect the nerve. The patient will be prone, and the tendon is approached by a transverse incision over the gluteal crease. The tendon is repaired with the knee flexed. Use anchors in the ischium to repair the tendon to the ischial tuberosity. In case of bony avulsion, screws may be used in selected cases to fix the bony fragment to the ischium. Post-operatively, the patient will be partial weight-bearing for about six weeks with the knee flexed to forty degrees. By six months, 80% of the patients return to the preinjury level of activity, function and sports. Avoid a situation where there is a severely retracted tear with scarring of the muscle, and the muscle is scarred to the sciatic nerve.

Clinical Evaluation of the Hamstring Muscles

The hamstring muscles predominantly flex the knee and assist in extension of the hips. To examine the hamstring function, put the patient prone so that the hips and the lower extremities can hang freely from the edge of the table (dangle). Assess if the patient is able to flex the knees and if the patient can do that against gravity and against resistance. Palpate on the medial side to see if there is contraction or activity of the semimembranosus and semitendinosus. Palpate laterally to see if there is any activity of the biceps femoris muscle. There are three hamstring muscles: biceps femoris (long and short head), semitendinosus, and semimembranosus. The long head of the biceps femoris muscle arises from the ischium and is inserted into the fibular head. The short head of the biceps femoris arises from the femur and is inserted with the long head of the biceps laterally on the fibula. The semitendinosus has a common origin with the biceps femoris muscle, then it is separated from the biceps femoris as it descends medially, and as the long head of the biceps femoris descends laterally. The semimembranosus has its own origin from the ischial tuberosity. It goes medially to be inserted on the proximal tibia medially, next to the insertion of the semitendinosus muscle. All hamstring muscles are supplied by the tibial division of the sciatic nerve except the short head of the biceps femoris muscle which is supplied by the common peroneal division of the sciatic nerve. Hamstring muscle function could be affected and should be assessed if there is an injury to the hamstring muscle/tendon itself (such as injury to the hamstring origin) or if the sciatic nerve is affected (tibial or common peroneal division).

Calcaneal Avulsion Fractures

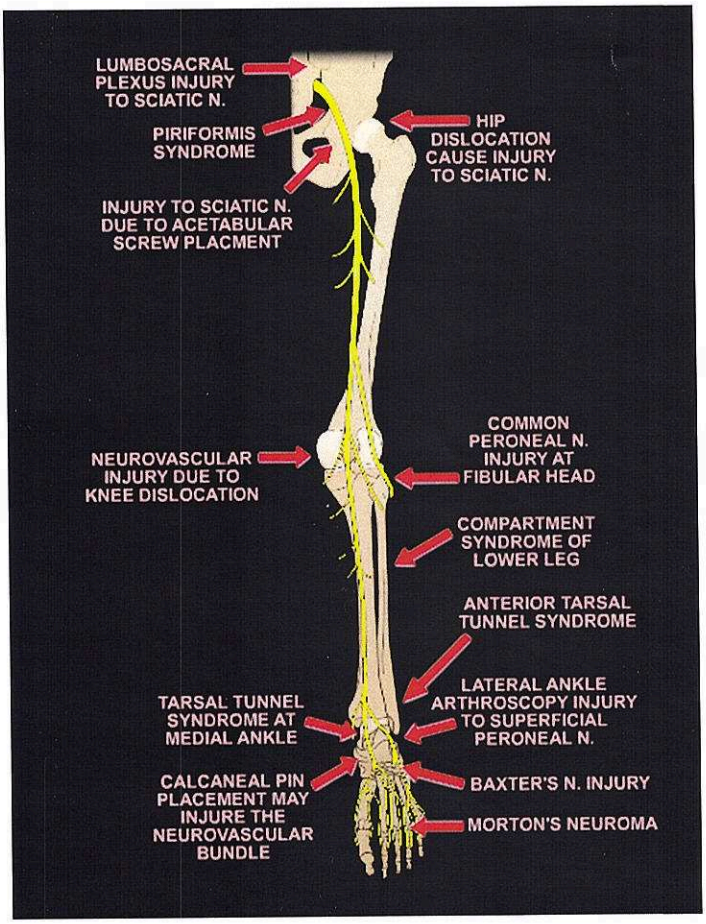
The calcaneus is the largest of the tarsal bones. An avulsion fracture of the calcaneus can occur at the point of insertion of the Achilles tendon. Injury is usually due to sudden dorsiflexion of the gastrocnemius and soleus muscles which pulls the Achilles tendon upward causing an avulsion fracture of the calcaneus. In addition to forced dorsiflexion of the ankle which causes this fracture; other causes of avulsion fracture of the calcaneus are fall, blunt trauma, sprinting, diabetes, and osteoporosis (more common among elderly females). There are three types of published avulsion fractures of the calcaneus: type I, type II, and type III. Type I is the "sleeve" type tuberosity fracture. Type II is the "beak" type avulsion fracture. Type III is rare; it is an infrabursal avulsion fracture. The fragment may cause skin complication and an open wound with exposed bone. In type I, the fragment is usually displaced and rotated which compresses the skin at the back of the heel. This pressure will create skin necrosis and significant soft tissue complication. The skin is usually very bruised because of the pressure of the bone on the skin. In type II, the piece of bone is bigger than in Type I fracture. This fracture usually causes skin complication, and the fragment may cause skin necrosis and an open wound with exposed bone unless there is an urgent treatment for this condition. In type III, a very small piece of the calcaneus is attached to the Achilles tendon. In



general, most calcaneal fractures are closed injuries that can be treated nonoperatively and when surgery is necessary, the surgery is delayed until the soft tissue condition improves. On the other hand, avulsion fractures of the calcaneus are rare and are different. They require urgent care for reduction and fixation of the avulsed fragment. This will eliminate the risk of skin complication and restore the function of the Achilles tendon.

Lesions of the Sciatic Nerve & Its Branches

The sciatic nerve is the largest nerve in the body. The sciatic nerve starts from the nerve roots in the lower back, and these nerve roots join each other to form the sciatic nerve. The sciatic nerve arises from L4, L5, S1, S2, and S3. The sciatic nerve has two main components: common peroneal nerve and tibial nerve. The sciatic nerve runs through the buttock and the lower limb. The level of the division of the sciatic nerve is variable, but it usually occurs at the middle or the lower third of the thigh. In about 10% of patients, the division of the sciatic nerve can occur at the greater sciatic foramen. Lumbosacral plexus injury can occur from a pelvic fracture with displacement of the sacroiliac joint. As the sciatic nerve enters the pelvis through the greater sciatic notch, the nerve passes underneath the piriformis muscle. There are some uncommon variations in the relationship between the sciatic nerve and the piriformis muscle; however, the normal relationship with the sciatic nerve passes underneath or anterior to the piriformis muscle. Entrapment of the sciatic nerve at the piriformis level is called piriformis syndrome. Piriformis syndrome is a condition of leg pain or sciatica due to compression of the sciatic nerve at the hip. From the gluteal region where the sciatic nerve is covered by the gluteus maximus, the sciatic nerve runs downwards to the back of the thigh. The sciatic nerve lies between the greater trochanter and the ischium and as it descends anterior to the piriformis muscle, it crosses posterior to the tendon of the gemelli muscles, the obturator internus muscle, and the quadratus femoris muscle. The sciatic nerve is anterior to the piriformis but posterior to the obturator internus. The sciatic nerve is close to the acetabulum, and this is why it can be injured easily as the hip dislocates. The common peroneal division of the sciatic nerve is the one that is most commonly injured during dislocation or fracture dislocation of the hip. Injury to the sciatic nerve will cause foot drop. The sciatic nerve can be injured due to posterior surgical approach due to errors in placement of the retractors because of lengthening of the femur or from total hip acetabular screw placement. If you insert acetabular screws in the posterior inferior quadrant and the screws are long, you can injure the sciatic nerve. High in the thigh before the nerve divides, the sciatic nerve supplies the hamstring muscles, which are the long head of the biceps femoris, the semimembranosus, the semitendinosus, in addition to the ischial part of the adductor magnus muscle. All these branches to the muscles come from the medial side of the sciatic nerve. The short head of the biceps femoris is innervated by the common peroneal nerve. In the back of the thigh and just above the knee, the sciatic nerve divides into two nerves (tibial nerve and common peroneal nerve) which innervates different parts of the lower leg. The tibial nerve is medial and descends down vertically towards the tibia. The common peroneal nerve is lateral (fibular). The common peroneal nerve then travels anteriorly around the fibular neck and divides into superficial and deep peroneal nerves. If you have an injury to the common peroneal nerve, this will cause problems for both the superficial and deep peroneal nerves. In cases of knee dislocation, it is important to check for common peroneal nerve function and to



rule out popliteal artery injury. The superficial peroneal nerve supplies the muscles of the lateral aspect of the leg. In the ankle, the superficial peroneal nerve divides into intermediate dorsal cutaneous and medial dorsal cutaneous branches that supply the skin of the dorsum of the foot. The superficial peroneal nerve may become injured during fasciotomy of the lateral compartment of the leg. The superficial peroneal nerve can also be injured during anterolateral extensile approach that is used for the treatment of pilon fractures. The superficial peroneal nerve can be injured during ankle arthroscopy. The deep peroneal nerve pierces the intramuscular septum and supplies the muscles of the anterior compartment of the leg. The deep peroneal nerve gives a sensory branch to the first web space between the first and the second toes. Injury to the deep peroneal nerve will cause foot drop. Anterior tarsal tunnel syndrome is a compression neuropathy involving the deep peroneal nerve. The tibial nerve passes into the foot, running posterior to the medial malleolus and beneath the flexor retinaculum. At this level, the posterior tibial nerve divides into medial and lateral plantar branches, and a medial calcaneal branch. The tibial nerve lies between the posterior tibial artery and the flexor hallucis longus.

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Lesions of the Sciatic Nerve & Its Branches continued

Tarsal tunnel syndrome is a compression neuropathy caused by compression of the posterior tibial nerve within the tarsal tunnel. Tarsal tunnel syndrome is the most common compression neuropathy in the ankle and foot. Thickening of the flexor retinaculum may cause compression of the posterior tibial nerve. The Baxter's nerve is the first branch of the lateral plantar nerve. The Baxter's nerve contributes to 20% of all heel pain cases, and this nerve provides motor innervation to the abductor digiti minimi muscle. There are two sites of entrapment typical with Baxter's nerve impingement. The first site located between the fascia of the abductor hallucis and quadratus plantae muscles. The second site is where the nerve passes along the anterior aspect of the medial calcaneal tuberosity. A calcaneal pin may cause injury to the posterior tibial nerve. The area around the calcaneus is surrounded by an important neurovascular bundle and several tendons. Error in placement or the direction of the calcaneal pin can interfere with the neurovascular bundle. Morton's neuroma is a compressive neuropathy of the interdigital nerve. It occurs most commonly in the third interdigital space. Perineural fibrosis and entrapment of the interdigital nerve may be the cause of this problem.

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