

Hamstring Muscle Injury

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One would never think that late in life, we can't become a victim of a hamstring injury. This is an injury that I tried to avoid during my active life as an accomplished athlete. I became conditioned over the years, allowing me to keep such group of muscles healthy to improve my performance. This group of muscles called "Hamstring" is a complex structure composed of three individual muscles able to enhance your athletic capabilities. It plays a critical role in human activities ranging from standing to sprinting or jumping and even walking.

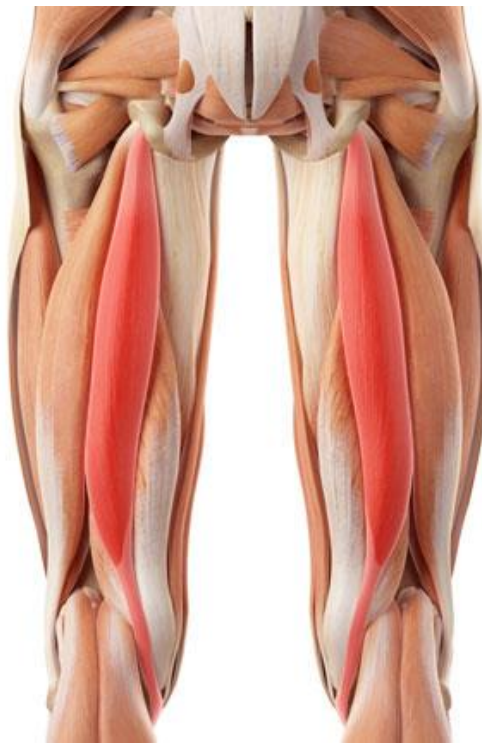
It may appear to be a common injury, but I managed all my life to avoid being a victim of such devastating insult, but it took me recently just a little moment of distraction mixed with enthusiasm while exploring the beauty of a beach area, on a day where the sea was agitated, and the waves were very active. I stepped in the water and tried to resist to the fury of an agitated sea. My feet were planted solidly on the sand to resist the assault, and I felt an instant pull and tear mixed with a sharp pain along the posterior aspect of the right thigh. I experienced instant numbness to the right foot with the inability to bear weight on a crampy lower extremity. At first, I did not realize the extend of the injury, but I was conscious of my inability to be functional on the extremity. I was unable to stand and my decision to fight the successive waves, was to dive in deeper water and swim.

I tried to swim to avoid placing any weight on the lower extremity, but the pain and the spasms became so unbearable that I found the urgent need to return ashore and join a friend who was willing to help me. I understood well that I had a massive avulsion or a tear of my right hamstring and it appears that the tear was proximally at least and perhaps also distally located. My friend did not understand but realized that I was in pain. I was asking to myself how I would manage to get out of the water because the waves did not lose any of their aggressivity. I try to step on the limb, but I was propelled by a gigantic wave, not once but twice and maybe three times, until I got help to stand and get out of turmoil. I received the best care to get out of trouble and soon I was under the shower to remove an extensive amount of sand all over the body and I needed a cane to ambulate. Days later, I was also using a pillow or a cushion to sit down and a compressive device to control the torn hamstring (biceps).

Such injury affecting the hamstring is common in the elite athlete and can be seen also among the amateur player in different sports activities requiring sprint

and jumping. Often a football (soccer) player or a track and field competitor would become an unhappy victim because the time of recuperation for such injury can vary from an individual to another one. Treatment of such injury range from a conservative management to an operative fixation but frequently, we may use such tendons for a reconstruction of ligaments as a free autograft somewhere else in the body especially the knee.

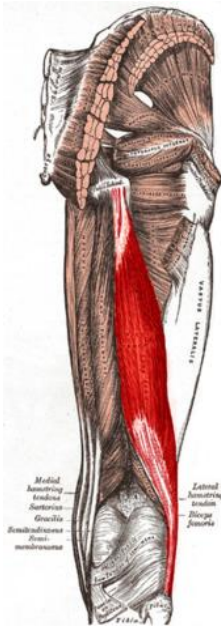
Let us review the structure of the Hamstring with its 3 muscles: Semitendinosus, Biceps Femoris, and Semimembranosus.



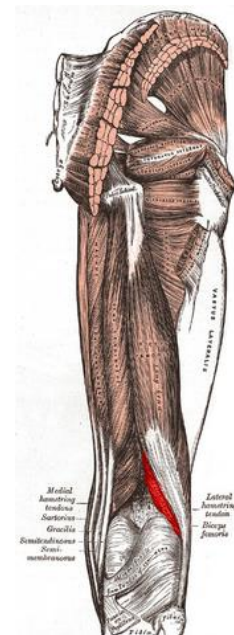
Hamstring muscle

- 1- The Biceps Femoris has a “short head” originating on the lateral lip of the Linea Aspera and insert distally on the fibular head and the lateral tibial condyle. This short head induces flexion of the knee as well as lateral rotation of the tibia. The fibular portion of the common peroneal nerve, provide the innervation of the short head. About vascularization

of this segment of the hamstring, the deep femoral artery provides some perforating branches and the lateral tibial condyle.



Biceps Femoris (Long Head)

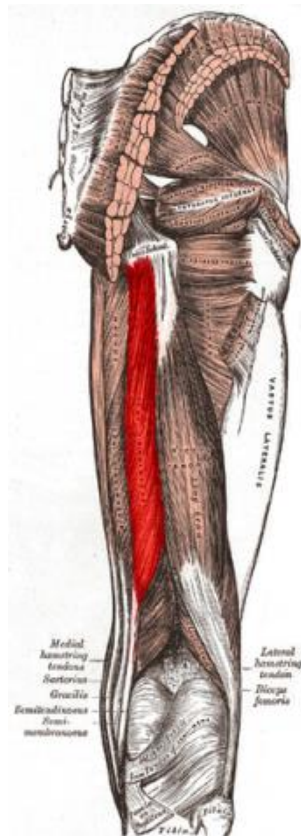


Biceps Femoris (Short Head)

- 2- The Biceps Femoris has also a “long head” which originates from the Ischial tuberosity and insert also to the fibular head and the lateral condyle of the tibia. The log-head also induces the flexion of the knee, the lateral rotation of the tibia and the hip extension. The long-head

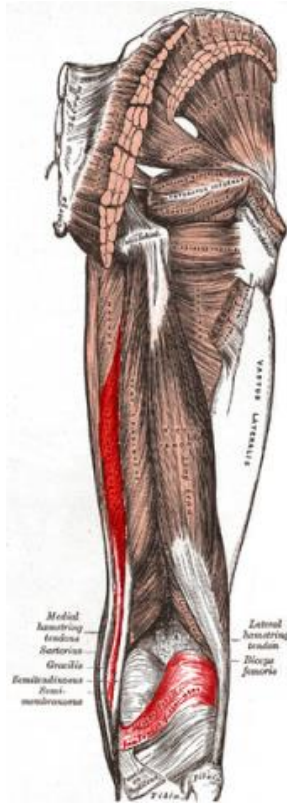
portion of the Biceps Femoris is innervated by the tibial nerve. The deep femoral artery provides also perforating branches for vascularization.

- 3- The Semitendinosus originates at the lower and medial aspect of the ischial tuberosity with an insertion over the medial aspect of the tibia, often called at this area the Pes Anserinus because of the insertion of 3 muscles (Semitendinosus, Gracilis and the Sartorius). This muscle is responsible of the knee flexion. Hip extension and medial rotation of the tibia. The tibial nerve provides the innervation while the perforating branches of the deep femoral arteries supply the vascularization.



Semitendinosus Muscle, part of the Hamstring

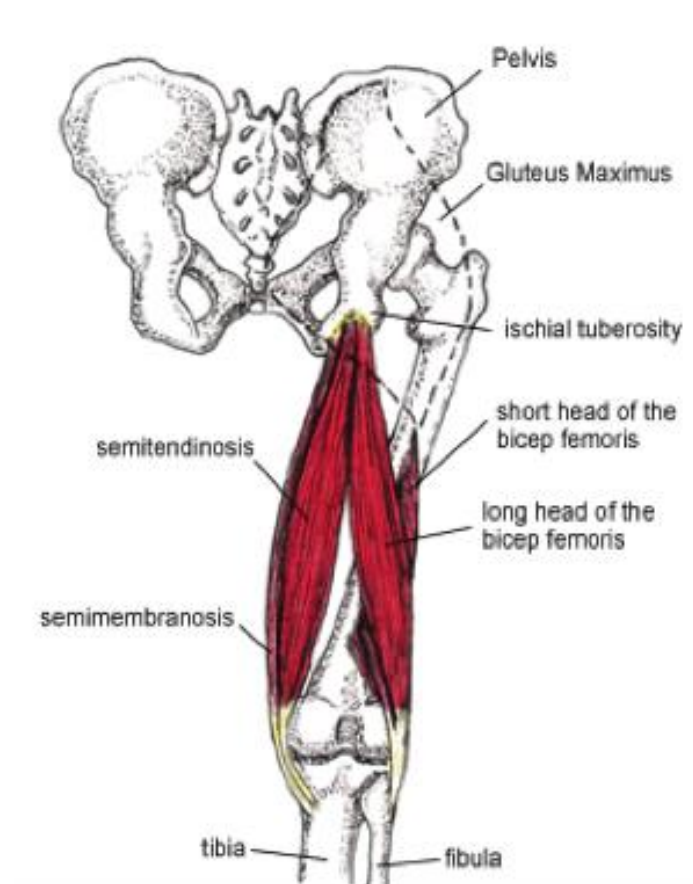
- 4- The Semimembranosus originates from the ischial tuberosity and inserts over the medial tibial condyle with the specific function of bending the knee, extending the hip while providing a medial rotation of the tibia while it being flexed. The tibial nerve also innervates this muscle while the perforating branches of the deep femoral artery assume the vascularization.



Semi-membranous muscle, part of the Hamstring

Most of the hamstring muscles originate from the pelvis and run posteriorly along the length of the femur to cross the femoro-acetabular and tibio-femoral joints except for the short head of the biceps muscle. This is the reason why some anatomists will argue that the short head of the Biceps should not be considered as part of the hamstring group. More, all the Hamstring muscles originate from the ischial tuberosity except for the short head of the biceps. The long head of the biceps femoris and the semitendinosus are linked proximally to the aponeurosis extending 7cms

from the ischial tuberosity. The gastrocnemius forms the inferior border of the popliteal fossa.



Hamstring muscle

The Hamstring muscles have an important role in hip extension and in knee flexion. It activates the final motion at the swing phase of the ambulation to generate an extension moment at the hip while resisting knee extension. They are dynamic stabilizers of the knee joint operating in tandem with the Anterior Cruciate Ligament while they are resisting to anterior translation of the tibia at heel strike, during the gait cycle. The Semitendinosus is the longer muscle (44.3 cm) followed by the long head of the biceps (42.0 cm), Semimembranosus 38.7 cm and Short Head of Biceps (29.7 cm).

Remember that such injury occurs when you strain or pull on your hamstring muscle, a group of three muscles, which run along the back of the thigh. These injuries are very painful and common in all sports requiring jumping and sprinting like Football (Soccer), basketball, baseball. You may find that any sport requiring sudden stops and starts may encourage such injury.

It may be interesting to review a little the development of the lower extremity during the embryogenesis from 4 to 8 weeks of fetal life as well as the vasculature and the innervation. This muscle come from the embryonic mesoderm after the initial limb bud originates from the lateral plate mesoderm. The mesodermal cells differentiate into myoblast which duplicate and coalesce to form the functional muscle tissue under the influence of the fibroblast growth factors. We have already seen how the hamstring complex receives vascular supply from the perforating branches of the deep femoral artery (Profunda femoris). The demarcation between the external iliac artery and the femoral artery is the inguinal ligament. The deep veins of the thigh share the same name and the femoral vein is responsible for significant venous drainage of the thigh. Like for the femoral artery, the femoral vein transitions for the external iliac vein at the level of the inguinal ligament. The lymphatic drainage of the thigh also mirrors the arterial and lymphatic drainage through the cisterna chyli.

The hamstring muscles receives its innervation from the lumbar and sacral plexuses. These plexuses give rise to the sciatic nerve (L4-S3) which bifurcates into tibial and common peroneal (fibular) nerves at the level of the knee joint. The tibial nerve innervates the Semimembranosus, Semitendinosus, and the long head of the Biceps Femoris muscle. The common peroneal branch of the sciatic nerve innervates the short head of the Biceps Femoris.

Surgeons may become aware of anatomical variation of the Hamstring muscle. The Hamstring muscle originates through a conjoined tendon from the ischial tuberosity. It has been reported that occasionally different tendinous origins for the semitendinosus and the long head of the biceps can be observed. Other surgeons have mentioned a third head of the Biceps tendon insertion with an abnormal insertion to the semimembranosus. Others have reported absent semimembranosus muscles seen on MRI studies after injury. This can be significant if a Hamstring reconstruction of an ACL is contemplated. Common peroneal nerve entrapment is generally seen at the

level of the fibular head and neck, but it was reported also at the level the short head of the biceps Femoris tendon, close to the gastrocnemius.

Most hamstring injuries are manageable non-operatively but hamstring tendon avulsions, often require surgical fixation. They can be treated endoscopically with fixation of the torn segment. Chronic injury may also require treatment especially with Achilles tendon augmentation auto-grafting procedure. Ischial apophyseal avulsion although extremely rare (less than 4%), may require surgical exploration and fixation especially if the fragment is displaced more than one centimeter. Patients with an avulsion fracture of the ischium or apophyseal fracture may also be candidate for surgical fixation especially if the fragment is displaced more than 1 cm or they may be at risk of developing a nonunion. The earlier an intervention is contemplated, less chance for developing an impingement at the ischiofemoral level.

The hamstring muscle is used as a graft for the reconstruction of the ACL (Anterior Cruciate Ligament) of the knee and if someone has sustained a hamstring injury, it is important to mention it to the operating orthopedic to avoid any surprise on the operating theater while contemplating a reconstruction of the ligaments. A “quadruple hamstring” autograft is also used as option in an ACL reconstruction in using a combination of the semitendinosus and the gracilis and providing a strong grafting repair. Most of those grafts may offer a loss of 5 degrees of extension mixed with patellar crepitation in the post operative period and even kneeling pain but generally, although reliable, it is believed that there is an associated risk of laxity and weakness of the remaining portion of the hamstring. There is no conclusive evidence suggesting that any graft material produces better results and outcome.

In conclusion, Hamstring strains is commonly seen in elite and recreational athlete and are generally slow to heal and tend to recur. One-third of athletes are known to re-injure the Hamstring within one year after returning to sport activity especially in sprinting. The biceps femoris is the most frequently re-injured, followed by the semimembranosus and the semitendinosus.

If hamstring injuries are classified by pain over the posterior aspect of the thigh exacerbated by knee flexion and hip extension, some patients may report a “popping” and tearing sound. This is a little why we believe that an injury classification may become useful where a Grade I can be judged mild

with minimal pain and functional impairment, or a Grade II with partial thickness tear with pain and loss of strength or a Grade III with severe pain, hematoma and full thickness tear of muscle or tendon. I would always suggest an orthopedic consultation especially when other differential diagnostic may need to be kept in mind like Lumbosacral radiculopathy, Adductor strain or even a femoral stress fracture.

I would always like to enforce that hamstring injuries are initially treated with rest, Iced compresses, elevation, weight protection on the extremity and elastic compression devices. Anti-inflammatory medication can be of help in a short duration to help in controlling swelling and pain. PRP (platelet-rich-plasma) agents have been used with no conclusive evidence. After healing of such lesions, it may also be recommended to get involved in a rehabilitation program focusing on eccentric contraction. This may avoid re-injury.

I hope that my recent thigh injury and the review of the pathology has allowed me, once again, to expose our orthopedic residents back home and in the states, to a practical approach the injured athletes.

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