Misdiagnosis is more likely if the patient is not examined specifically for tenderness at the ischial hamstring origin.

Hamstring injury

A hamstring strain or a pulled hamstring as it is sometimes called is a tear in one of the hamstrings muscles (Semitendinosis, Semimembrinosis and Biceps femoris). It often results from an overload of the muscles or trying to move the muscles too fast. If you have taken an impact in the back of the leg it must be treated as a contusion. Otherwise read on.

Strains are common in all sports especially ones where sprinting is involved. They range from a complete rupture of the muscle to small micro tears that the athlete will probably not notice at the time.

Symptoms include:

- A sudden sharp pain at the back of the leg
- Muscles going into spasm
- Swelling and bruising
- If the rupture is very bad you may feel a gap in the muscle

Strains are graded 1, 2 or 3 depending on severity. A grade 1 might consist of small micro tears in the muscle. A grade 2 would be a partial tear in the muscle and grade 3 is a severe or complete rupture of the muscle

Grade 1: What does it feel like?

- Might have tightness in the thigh
- May be able to walk properly
- Probably won't have much swelling
- Lying on front and trying to bend the knee against resistance probably won't produce much pain

What can the athlete do?

- Use a compression bandage or heat retainer until you feel no pain
- See a sports injury professional who can advise on rehabilitation and strengthening

What can a Sports Injury Specialist or Doctor do?

- Use sports massage techniques to speed up recovery (very important)
- Use ultrasound and electrical stimulation
- Prescribe a rehabilitation programme

Grade 2: What does it feel like?

- Probably cannot walk properly

- May get occasional sudden twinges of pain during activity
- May notice swelling
- Pressing in causes pain
- Bending the knee against resistance causes pain
- Might be unable to fully straighten the knee

What can the athlete do?

- Ice, compress, elevate, use crutches for 3 to 5 days
- See a sports injury specialist who can advise on rehabilitation

What can a Sports Injury Specialist or Doctor do?

- Use sports massage techniques to speed up recovery (very important)
- Use ultrasound and electrical stimulation
- Prescribe a rehabilitation programme including stretching and strengthening exercises

Grade 3: What does it feel like?

- Unable to walk properly without the aid of crutches
- In severe pain
- Bad swelling appear immediately
- A static contraction will be painful and might produce a bulge in the muscle
- Expect to be out of competition for 3 to twelve weeks or more

What can the athlete do?

- Seek medical attention immediately
- R.I.C.E. (Rest, Ice, Compress, Elevate.)
- Use crutches
- See a sports injury professional who can advise on rehabilitation and prevention

What can a Sports Injury Specialist or Doctor do?

- Use sports massage techniques to speed up recovery (very important)
- Use ultrasound and electrical stimulation
- Prescribe a rehabilitation programme and monitor it
- Operate if needed

HAMSTRING STRAIN

Mechanism of injury

1. Different nerve supply between short head of biceps femoris (common peroneal nerve) and the rest of the hamstring (tibial nerve) muscles may lead to asynchronous activation.

2. Usually on a direction or speed change

3. Acts as an eccentric brake during kicking

Signs

1. Pain on passive stretch, especially after cooling down

2. Pain on contraction

3. Pain on palpation, may also be able to feel gap in muscle.

Management

1. Immediate RICE

2. Ultrasound

3. Deep frictions

4. Eccentric exercise program

5. Stretching

6. Cycling

ECCENTRIC EXERCISE PROGRAM

1. Warm the area up first (cycling, walking)

2. Stretching 3*20 seconds to the point of discomfort

3. Start with slow kicking in standing, with the hip less than 20 degrees flexed, slowly increase speed. Progress to using a light weight. Prone knee catches, where the knee is allowed to extend and it caught by hamstring muscle action before terminal extension. Can progress with weights. Now, more functional tasks can be begun, such as gentle normal kicking in standing increasing speed and resistance. All exercises should be completed for three sets of 10 repetitions. When this can be completed easily, with no pain, it is time to increase the speed, increase the resistance, or progress the exercise.

4. Stretching 3*20 seconds

Alternate exercise program - Running

1. As with any eccentric program, must ensure that sessions are completed pain free, or with only a slight ache towards the end of a session before progression
2. Begin with non aggravating warm up and stretch as above
3. Begin with power walking - use, for example, a 60m length. Gradually increase speed over the first 20m, sustain the speed over the middle 20, and

gradually slow down over the last 20m. Stress the importance of GRADUAL movement. Begin with 6 sets and progress.

4. Progress to jog. Build up speed over the first 20, then constant speed for the next 20, and then slow down over the final 20m.
5. Progress speed, eventually to sprint, utilizing the same 3 stage (speed up, constant speed, speed down) process.
6. Stretch and cool down following session. Ice and compression as required

Hamstring

Acute injury

An acute hamstring injury can happen in a variety of different ways, with the one common factor that there is a sudden pain in the muscles, which is directly related to a particular movement or incident.

The hamstring muscles or their tendons may tear as a result of an over-stretch injury, for instance if you have to sprint suddenly when you are cold, or when your muscles are tightened because of a previous strain, or fatigue from training hard the previous day. Over-stretching may happen if your foot slips forward when your leg is straight in front of you, for instance as you land during hurdling. A direct blow to the hamstrings while they are contracting can tear the muscles. You may be hit by a hockey ball or a squash racket while you are running fast. Inefficient muscle function can also contribute to sudden tears in the hamstrings.

What you feel is a sudden pain in the hamstrings, which may be no more than a twinge, up to a searing pain. You may see bruising, immediately, or some time after the injury has happened, and the bruising, with perhaps swelling, will tend to track downwards towards the knee. If there is a severe tear, you may see a knot of tissue forming a bump on the thigh, especially if you work the hamstrings by trying to bend your knee. After the initial pain, the torn part feels sore to touch, and gives pain in the same area whenever you contract the hamstrings, either by extending your hip or bending your knee; and when you stretch the muscles, by keeping your leg straight and bending forwards at the hips.

A severe tear, involving a lot of muscle tissue, may need to be stitched together again by a specialist surgeon. However, if the tear is more minor, your doctor may decide that you need no more than a conventional rehabilitation program, which you must follow completely.

A gradual pain in the hamstrings, directly related to a particular movement or activity, is usually termed a hamstring 'pull' or 'strain'. This injury happens for similar reasons to the acute tear. The muscles are tight, fatigued, or weakened, and are then strained by overwork. Over training, especially if this involves repetitive movements, is a common cause of hamstring overuse strains.

By definition, the overuse strain starts with only a very slight pain, which gradually gets worse, as you continue with the activity which caused the problem. Occasionally, the pain is only evident when you work the hamstrings against resistance in their least efficient range, lying on your stomach with your knee held bent to a right angle, and extending your leg backwards at the hip.

The problem with overuse injuries to the hamstring is that they tend to recur. Even if they do not develop to the stage of an acute tear, they limit your ability to run, sprint, hop, and stretch your leg out. Specialist treatment may include injections, and various forms of physiotherapy. But the most important factor in recovery is regaining full flexibility in the muscles, and efficient function. If you try to resume your sport before you have completed the whole recovery process, you are making a recurrence of the problems inevitable.

A mild hamstring injury may recover within ten days to two weeks, but a more severe problem can last for over three months. If your hamstring injury does not improve, despite careful rehabilitation, it may be that there is an underlying problem. Hamstring pain and spasm can be caused by a stress fracture in the thighbone.

Hamstring Strains: Expediting Return to Play

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In Brief: Strains to the hamstring muscle group are prevalent and, unfortunately, often recurrent, with prolonged rehabilitation and persistent disability. Most hamstring injuries are of a single muscle near the muscle-tendon junction. Rarely, the hamstring muscle group may avulse from the ischial tuberosity. The diagnosis can usually be made by history and physical exam, but MRI can be used to help pinpoint the extent and location of the injury. Initial treatment typically consists of rest, ice, compression, elevation, and pain relief. There is no consensus on optimal rehabilitation, but functional exercises with stretching and strengthening have been emphasized.

Hamstring strains are among the most common injuries in sports, and they often frustrate physician and athlete alike with a long recovery and high rate of recurrence. But by diagnosing the extent of the injury accurately and taking appropriate therapeutic steps, clinicians can improve the odds.

Case 1: Acute Hamstring Injury

A 34-year-old male recreational bicyclist and tennis player felt a painful "pop" in his left posterior thigh while playing tennis but continued to play despite pain. Over the next few days, he experienced mild pain in his midposterior thigh when playing tennis. Ten days after the initial injury, he experienced a similar "pop" with his hip flexed and knee extended, but the pain was worse. He was unable to continue play and had difficulty sleeping that night because of pain.

On physical exam the next day, the patient walked with a limp. He had a subcutaneous ecchymosis and palpable tenderness over the left semimembranosus muscle 4 cm distal to the ischial tuberosity. When he performed an isometric contraction with knee flexion, his hamstring muscles were felt to be in continuity. He had full range of motion of both hips. When he touched his fingertips to his ankles while standing, he had moderate tenderness at the left hamstring origin. Strength and sensation were intact except for 4-/5 strength in the left hamstrings. Straight-leg raise was 90° on the right and 75° on the left. Knee and ankle jerk reflexes were symmetric.

The patient was diagnosed as having an acute left hamstring strain and started on a physical therapy program of passive stretching and isometric strengthening. He maintained aerobic conditioning initially with swimming pool and stationary bicycle activities as tolerated. Ice and electrical stimulation were used before and after workouts. Nonsteroidal anti-inflammatory drugs (NSAIDs) were prescribed for pain control.

One week later the patient was walking without a limp and began concentric strengthening and more aggressive hamstring stretching. He began a jogging program when he was able to walk without hamstring discomfort for 20 to 30 minutes. He gradually advanced to sport-specific skills over the next 2 weeks and also started eccentric strengthening. He was discharged from physical therapy about 1 month after

Figure 1: Courtesy of Thomas M. Best, MD, PhD

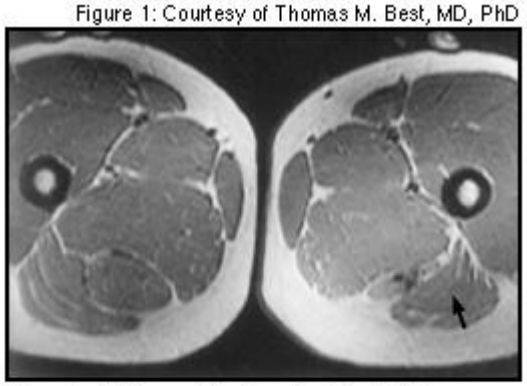

Figure 1. A 23-year-old professional football player experienced left hamstring pain for 5 months that did not respond to conservative therapy. An MRI showed a distal retraction of the hamstring muscle group into the midthigh (arrow) caused by an avulsion from the ischial tuberosity. Such patients typically require operative treatment.

starting rehab and was advised that he could play tennis. The patient has not had further problems, although he notes that the muscle periodically is "a little stiff."

Case 2: Chronic Hamstring Pain

A 23-year-old professional football player was referred for persistent left hamstring pain of 4 months' duration. Four months prior to initial consultation he had injured the hamstring when diving for a loose ball and had felt a pop. He also noticed that he felt painful nervelike sensations down the lateral aspect of his leg. Six weeks after the initial injury he was subjectively better, although he still had a large ecchymosis in the midbelly of his hamstring with occasional pain radiating from the popliteal fossa into the foot. Magnetic resonance imaging (MRI) showed significant changes within the belly of the muscle. Two weeks later, the patient was able to jog lightly but could not sprint and had not returned to play. One month later, repeat MRI was obtained by another consulting physician and showed no interval change. Electromyography (EMG) studies were normal.

On presentation to our clinic 2 months later (4 months after the initial injury), physical exam revealed a well-muscled individual with a normal gait. He had no appreciable quadriceps atrophy. An obvious asymmetry of the hamstring muscles was visible with distal retraction of the muscle belly, and a defect was palpated immediately distal to the ischial tuberosity on the left side. When the patient attempted to contract the muscle, the hamstrings could be felt retracting at the mid and distal thigh. It was easy to feel the ischial tuberosity on the patient's left side, in contrast to the uninjured leg, where the hamstring origin prevented palpation of this bony landmark.

Despite an aggressive 4-month rehabilitation program of eccentric strengthening and stretching, isokinetic testing showed a 50% strength reduction in the left hamstring. The clinical diagnosis at this time was complete avulsion of the hamstring muscle complex from the ischial tuberosity. An MRI confirmed this injury and showed significant distal retraction of the muscle complex into the midthigh (figure 1).

Treatment options at this point included continued rehabilitation or surgical exploration of the avulsed hamstring. Findings at surgery included a complete avulsion of the hamstring complex with a retracted and scarred distal muscle belly. A delayed primary repair was performed with a fractional release of the muscle belly distally. He was back training for football 6 months later but still had symptoms. Other injuries prevented his return to football.

Hamstring Anatomy and Function

The hamstrings consist of three muscles that run from the hip to the knee and assist with hip extension and knee flexion: the semitendinosus, the semimembranosus, and the biceps femoris (figure 2). The semimembranosus muscle forms the bulk of the mass of the muscle group. Both the semimembranosus and semitendinosus are innervated by the tibial portion of the sciatic nerve. The biceps femoris has a dual innervation: The long head is supplied by the tibial part of the sciatic, and the short

head is supplied by the common peroneal part of the sciatic. As with other frequently injured muscles, the hamstrings span two joints and are therefore subject to stretching at more than one point.

Figure 2: Mary Albury-Noyes

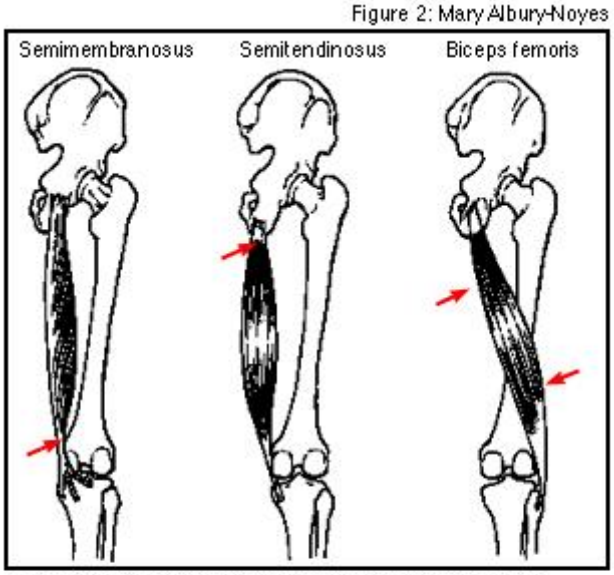

Figure 2. The hamstrings comprise the semimembranosus, semitendinosus, and biceps femoris muscles. In this posterior view, the semitendinosus originates on the ischial tuberosity and inserts on the tibia with the gracilis and the sartorius muscles as the pes anserine muscle group. The semimembranosus also originates on the ischial tuberosity but inserts medial to the semitendinosus on the proximal tibia. The biceps femoris muscle has two heads: a long head that originates on the ischial tuberosity from the semitendinosus tendon, and a short head that originates on the posterolateral femur. Both portions insert on the head of the fibula. Arrows indicate the most common sites of injury.

During walking and running, the hamstrings probably function primarily to decelerate the extending knee prior to foot strike and to assist with hip extension after foot strike (1). In the first half of the swing phase of the running cycle, the hip rapidly flexes. Knee flexion is passive during this period and results from the rapid forward acceleration of the thigh during hip flexion. Midway through the swing phase, however, while hip flexion continues, the knee begins to rapidly extend. During the latter part of the swing phase of gait, or float phase of running, the hamstring muscles decelerate the forward swing of the tibia, thus opposing the activity of the quadriceps.

Efforts have been made to correlate EMG data and time of maximum muscle activity with time of injury during the gait cycle (2). On the basis of conflicting results, it appears that there is probably a complex, poorly understood neuromuscular coordination pattern that may help explain why the hamstrings are injured.

Possible Risk Factors

Hamstring injuries are common in sports that require bursts of speed or rapid acceleration, such as soccer, track and field, football, and rugby. Improper warm-up, fatigue, previous injury, strength imbalance, and poor flexibility have been correlated with injury, but evidence showing a cause-and-effect relationship is sparse. These ideas have largely been based on results from small patient samples. For example, Burkett (3) correctly predicted 4 of 6 hamstring muscle injuries in professional

football players based on strength imbalances between the quadriceps and hamstrings. In each of the injured players, hamstring strength was less than 60% of quadriceps strength. Furthermore, hamstring injuries were more likely to occur if the isometric strength of the right and left knee flexors differed by more than 10%. Despite these data, we are unaware of a published study that identifies athletes at risk because of strength imbalance and attempts to correct the imbalance to determine if this reduces the risk for injury.

Dorman (4) reported on 140 hamstring injuries and found that they usually occurred either quite early or in the latter stages of practices or matches and concluded that improper warm-up and fatigue are risk factors for injury.

What appears clear from the literature is the tendency for hamstring injuries to recur. Ekstrand and Gillquist (5) prospectively studied male Swedish soccer players and found hamstrings to be the muscle group most often injured. Perhaps more important, they noted that minor injuries doubled the risk of having a more severe injury within 2 months. Others (6) have noted a recurrence rate of 25% for hamstring injuries in intercollegiate football players. Despite such observations, it is not well understood why these injuries tend to recur so frequently.

History and Physical Findings

Hamstring strains can usually be diagnosed from history and physical exam findings. The patient will often describe pain in the posterior thigh, particularly during and following activities during which the hamstring is eccentrically activated, like running. On physical examination, tenderness and swelling can exist at the location of the injury, which is most often the muscle-tendon junction.

A careful physical exam can also usually help in detecting an avulsion of the hamstring complex from its bony origin. The patient often has a palpable defect extending from the retracted muscle belly proximally to the ischium.

When Imaging Is Warranted

Imaging studies, including x-rays, are probably not routinely warranted when evaluating hamstring strains. The clinician must always keep in mind, however, the high incidence of bony avulsions in children with open epiphyseal plates and rule this out by x-ray if indicated.

Recently, computed tomography (CT) has been used to accurately define the anatomy of injuries, which may aide in choosing between surgical and conservative measures (7,8). CT scanning of acute hamstring injuries has shown that the site of injury in running athletes is most often the muscle-tendon junction of the long head of the biceps femoris. Images taken 1 to 2 days after injury show areas of hypodensity consistent with inflammation and edema (high-density images suggest hemorrhage). Follow-up scans on patients with chronic injury often show calcifications at the muscle-tendon junction where the injury occurred, but their significance is unknown.

On T2-weighted MRI images, acute lesions appear as increased signal densities because of the increase of free water in traumatized muscle tissue (8,9) Acute

hemorrhage is difficult to detect by MRI; the hemoglobin must become methemoglobin before it shows up.

MRI has shown some promise in predicting recovery following hamstring injuries. In a retrospective study (9) of 14 professional athletes, recovery was delayed in those who had complete muscle transection or had greater than a 50% cross-sectional muscle involvement. We use two possible indications for MRI: a suspected total proximal avulsion of the hamstring muscle complex from the ischial tuberosity, and a suspected complete muscle transection. In both cases, surgical referral may be warranted.

Conservative Treatment vs Surgical Care

As is true of most strains in general, the vast majority of injuries to the hamstrings can be managed without surgery. Initial treatment typically consists of rest, ice, compression, elevation, and pain relief. Compression of the affected area with elastic wrap may help reduce swelling. For pain relief, NSAIDs or acetaminophen can be used for 7 to 10 days. However, no optimal treatment regimen has been developed based on carefully designed clinical trials.

There is likewise no consensus on optimal rehabilitation following initial treatment, but functional rehabilitation that includes stretching and strengthening has been emphasized. A complete rehab program should also address the cardiovascular demands of the patient's sport.

One exception to the general preference for nonsurgical treatment may be avulsion of the hamstring complex at or near the proximal bone-tendon junction. This lesion often leads to chronic pain and functional deficits. Sallay et al (10) reported that it took 12 patients an average of 7 weeks to walk without a limp after sustaining an avulsion-type injury while water skiing. Three of the 12 patients went on to surgery because of persistent functional limitations and chronic pain. Complete rupture of the hamstring muscles may also require surgical repair (10,11).

Based on these small anecdotal patient samples, we believe that surgical referral may be indicated in individuals with total avulsion of the hamstring complex from the ischial tuberosity. The exact timing of surgery is debatable given the infrequent reporting of this injury. Prospective, randomized studies would need to be done to provide clear guidelines and indications for surgical referral. It is our opinion that acute primary repair is preferable so that the risk of scar formation and loss of function is minimized.

Preventive Measures

Most clinicians prescribe warm-up and stretching to help reduce the incidence and severity of muscle strains. The evidence supporting these ideas is sketchy at best and largely based on retrospective studies. For example, following hamstring injury, the affected extremity and muscle group are significantly less flexible than the uninjured side, but there are no differences in isokinetic strength (12) Jonhagen et al (13) found decreased flexibility and lower eccentric hamstring torques in runners who sustained a hamstring strain when compared with uninjured subjects matched for age and speed.

It may well be that stretching and warm-up do more to improve performance than to prevent injury. A recent study (12) showed that hamstring stretching and increased flexibility were effective for improving hamstring muscle performance as measured by peak torque values. The role of stretching and warm-up in injury prevention needs to be better understood so that optimal strategies can be developed.

Emphasizing Nonoperative Steps

Hamstring strains continue to be a challenging and often frustrating problem for professionals who care for athletes. The often long convalescence and high recurrence suggest the need for a better understanding of the mechanism and pathophysiology of these injuries. Fortunately, most patients can be treated nonoperatively. Surgical consultation is probably required for patients with hamstring avulsion from the ischial tuberosity and distal muscle retraction, scarring, and functional limitation. The role of stretching, strengthening, and warm-up in injury prevention is unclear at this time.

What are the hamstrings?

Technically, the hamstrings are the tendons that attach the large muscles at the back of the thigh to bone. The hamstring muscles are the large muscles that pull on these tendons. It has become common in layman's terminology to refer to the long muscles at the back of the thigh as the "hamstrings." Academic anatomists refer to them as the posterior thigh muscles, and more specifically as the semimembranosis, the semitendinosis, and the biceps femoris muscles. These muscles span the thigh, crossing both the hip and the knee. They originate or begin at just below the buttocks, arising from the bone on which we sit (the ischium). They connect by means of their tendons onto the upper parts of the lower leg bones (the tibia and the fibula).

The origin of the word "hamstring" comes from the old English "hamm," meaning thigh. "String" refers to the characteristic appearance and feel of the tendons just above the back of the knee. This article will refer to the "hamstrings" in the commonly used sense as the large muscle group at the back of the thigh.

What is the function of the hamstrings?

The hamstring muscles actively bend (flex) the knee. They also act to straighten or (extend) the hip (as in the motion of moving the thigh backwards). Surprisingly, these large muscles are not very active with normal walking or standing. However, they are extremely important in power activities such as running, jumping, and climbing. Thus, sedentary individuals can get by with quite weak or de-conditioned hamstrings, whereas athletes and very physically active individuals absolutely depend on healthy, well-conditioned hamstrings.

The power advantages of strong hamstrings have been known for a long time. In times past, a sword wielding knight would disable an opponent by a slice across the back of the thigh. Cruel masters were known to have severed the hamstrings of domestic slaves or prisoners in order to make escape less likely. The origin of the term "hamstrung," meaning to have been crippled or held back, is derived from these practices.

How can the hamstrings be injured?

Injuries to the hamstring group of muscles can range from a minor strain to a major rupture. Minor strains are classified as Grade I tears, whereas complete ruptures are classified as Grade III tears. Grade II tears are partial ruptures. Given the function of these muscles, it should not be surprising that Grade III injuries most frequently occur in the athletically active. Grade I injuries tend to be mild in that they tend to heal fully with only minor aggravation to the injured, especially in the sedentary individual. On the other hand, in power athletes, hamstring injuries can be severe and debilitating. Many a promising or successful athletic career has been limited if not ended by such injuries. One such memorable image is that of Yankee baseball star Mickey Mantle sprawled in agony at first base, having sustained a massive Grade III tear while lunging to beat out a throw.

Hamstring injuries usually occur with sudden lunging, running or jumping resulting in muscle injury. Oftentimes a "pop" is heard or felt by the injured athlete. A variable amount of pain is experienced. The athlete is usually unable to continue and oftentimes cannot even stand.

Examination of the individual reveals spasm, tightness, and tenderness. With more severe injury, swelling and a black and blue or bruised appearance will follow. In some cases, a palpable defect (detectable by touching) will be present in the muscle. Tears and strains most often occur at the middle of the back of the thigh where the muscle joins its tendon or at the origin of the hamstring at the base of the buttocks (at the ischium).

How are hamstring injuries treated?

Most hamstring injuries heal without surgery. In rare cases, where there is a complete rupture at the ischium, or where significant piece of ischial bone is jerked away, surgery is necessary. Essentially, all other Grade I to III tears are best treated without surgery.

The goal of treatment is to restore muscle function and prevent scar formation. Initially, treatment consists of rest, ice, compression, and elevation (R.I.C.E.). Rest refers to avoidance of offending activities and oftentimes includes immobilization. In severe cases, crutches or splinting may be necessary. Ice, compression, and elevation all assist in controlling pain and swelling. A short course of nonsteroidal anti-inflammatory medication such as aspirin, ibuprofen , or naproxen may be helpful.

As soon as pain permits, it is important to begin a program of stretching and range of motion exercises. Prolonged immobilization and inactivity results in muscle shrinkage (atrophy) and scar tissue (fibrosis). Excessive scar tissue is incompatible with healthy muscle function. It is best avoided by a program of motion and stretching implemented early in the rehabilitative process.

It should be emphasized that an early rehabilitation program does NOT mean a premature return to the desired usual activity. Given the type of individual that usually sustains a significant hamstring injury, it is usually a battle keeping these patients off the playing field. Re-injury is extremely common and is often due to avoidable premature return to sport. Re-injury not only prolongs recovery, it also increases the risk of permanent damage.

After pain and swelling have been controlled, and acceptable range of motion and flexibility have been attained, a gradual strengthening program should follow. After adequate strength has returned, then a gradual return to the desired activity is attempted. Full return is usually possible only after maximal flexibility and optimal strength have been obtained. Depending on the severity of injury, the entire rehabilitative process may take several months. Physical therapists can assist in guiding the exercise program.

Can hamstring injuries be prevented?

There is no foolproof way to completely avoid hamstring injuries. However, the risks can be minimized by paying attention to the principles of muscle strength and flexibility.

Individual flexibility should be maximized by a regular stretching program as well as a period of warm-up and stretching before the intended athletic activity.

Optimal individual hamstring strength is 50% to 65% of the strength of the quadriceps muscle (muscle of the front of the thigh). Also, there should be minimal imbalance in strength between right and left legs. If necessary, a weight training program should be instituted to achieve these goals.

A well-balanced diet and appropriate fluid intake are essential to avoid electrolyte imbalance and dehydration . Dehydration can lead to muscle cramping, thereby increasing the chance of muscle injury. Excessive body weight increases the risk of muscle injuries in the lower extremities. Some experts have also advocated the use of nutritional supplements, such as antioxidants. Unfortunately, despite the best efforts at prevention and treatment, hamstring injuries will continue to be a common bane of the high performance athlete as well as the "weekend warrior."

Hamstring Injuries At A Glance

- Hamstrings are tendons of the muscles of the back of the thigh.
- Hamstring muscles bend the knee and straighten the hip.
- Hamstring muscle injury is a common athletic injury.
- Most hamstring muscle and tendon injuries heal without surgery.
- The risk of hamstring injury can be reduced with exercises.

RICE stands for Rest / Restricted Activity
Ice
Compression
Elevation

Rest / Restricted activity - it is important that the injured area is exercised at a pain-free level. Pain in the area due to activity is one of the body's warning signs that the injury is getting worse.

Ice - helps control inflammation that may arise when exercising an injured area thereby minimising the extent of the injury and decreasing pain.

Compression and Elevation - are not as important when dealing with an overuse injury.

Ice - should be applied to the injury in something wet or damp, like a damp towel. This helps prevent the skin from freezing, which can cause an ice burn.