AMERICAN COLLEGE of SPORTS MEDICINE

American College of Sports Medicine • Current Comment • March 2002

"EXERCISE-INDUCED LEG PAIN"

Introduction

Anatomically speaking, the "leg" is the region between the knee and the ankle. Repetitive weight-bearing exercise commonly causes painful injuries in this region. The sources of leg pain are varied, but the cause is often the same. The pursuit of athletic excellence has now reached such phenomenal extremes the human body is often subjected to degrees of physical work it is not designed to tolerate. While most body tissues have the capacity to adapt and strengthen in response to increased loading, overuse injuries result when the increased loading occurs too quickly for the adaptation to take place.

Types of Leg Pain

"Shin splints" is a lay term that has been associated with a large number of fundamentally different exercise-induced leg injuries. Initially, "shin splints" was thought to be caused by tibialis posterior tendon injury. Later, other conditions associated with chronic exercise-- including compartment syndrome, tibialis anterior strain, tibial periostitis and tibial stress fracture--were indiscriminately referred to as shin splints. Given the very different pathologies of these conditions, use of the term "shin splints" is now clearly inappropriate for the purposes of diagnosing and managing exercise-induced leg pain. Instead, specific conditions must be identified and addressed. The most common forms of exercise-induced leg pain are described below.

Muscle Strain

What is it?	Muscle fibre damage
How does it occur?	Over-stretching
Region most affected:	Tibialis anterior muscle (front of the leg, beside the shin bone), often following chronic downhill running.
Signs and symptoms:	Acute, focal pain within the muscle (at the site of the tear) during contraction and stretch. May be swollen and warm.
Prevention:	Attain good muscle flexibility, warm up, introduce training modifications gradually, vary training.
Treatment:	After the swelling has subsided, stretch and strengthen the affected muscle within the limits of pain.

Tendinopathy

What is it?	Microtears in tendon that may cause inflammation in the surrounding tissue. Often incorrectly referred to as tendinitis.
How does it occur?	Over-training in repetitive movements, particularly over-stretching and eccentric (muscle contracting while lengthening) loading. There may be a relationship between repetitive hyperpronation (excessive flattening of the arch of the foot during locomotion) and tibialis posterior tendinopathy.
Region most affected:	Tibialis posterior. However, tibialis anterior, Achilles and peroneal tendinopathy can also occur following exercise overuse.
Signs and symptoms:	Pain, swelling and palpable crepitance (crunchy feeling) along the tendon during muscle contraction and stretch. Pain may occur mainly at the start of and following exercise.
Prevention:	Gradual increases in training, orthotic inserts in the shoes to reduce hyperpronation, if necessary.

Treatment:	Initially, take anti-inflammatory medication and minimize painful activities. Complete rest is not advised, as tendon heals better when given mild, normal loading. Once inflammation and pain has subsided, stretch and strengthen the muscle of the tendon.

Medial Tibial Stress Syndrome -MTSS (periostitis)

What is it?	Over stimulation or inflammation of the periosteum (the membrane surrounding bone) - the most common leg injury.
How does it occur?	Bone bending is a natural consequence of weight bearing. Wider bones resist bending better than narrower ones and are therefore less prone to injury. Chronic repetitive bending stimulates a long bone to widen its cross section by activating bone cells in its periosteum to lay down new bone. If increases in training intensity continue to occur during this process of adaptation, the bone cells cannot keep up and the region becomes inflamed. The injury may be compounded by simultaneous repetitive muscle pull on the periosteum.
Region most affected:	Mid-to-distal (further from the knee) medial (inner) border of the tibia (shin bone), in the region of the narrowest tibial cross section.
Signs and symptoms:	Pain during weight bearing (particularly running). Tenderness on palpation. Sometimes swelling, redness and warmth.
Prevention:	Gradual training increases (<10% per week). Attaining good dorsi flexion (moving the top of the foot toward the shin), flexibility **preseason**, wearing appropriate footwear (and replacing every 500-700 miles), varying the training surface, and consuming 1000 mg/day calcium.
Treatment:	Rest (7-10 days minimum) from painful activities. Pool run and cycle to maintain aerobic fitness. Return to training **very** gradually. Do not stretch or strengthen muscles while symptomatic. While there is little scientific evidence that lower extremity alignment anomalies (e.g. flat feet or hyperpronation) cause MTSS, for some, orthotics prevent injury and/or reduce symptoms.

Tibial stress fracture

What is it?	An incomplete crack or cracks in the tibia where repetitive loading has overcome the ability of the bone to resist it.
How does it occur?	May follow MTSS if training is continued at, or higher than, the intensity at which periostitis occurred. Stress fractures, however, are preceded by a greater degree of bone remodeling (bone resorption followed by formation) than MTSS, with resultant temporary bone porosity and weakness.
Region most affected:	Same as for MTSS. Occasionally below the knee, medially.
Signs and symptoms:	Profound, localized pain when running or hopping. If exercise is continued, pain may occur when walking and at night. Focal tenderness and swelling on palpation. A triple-phase ^{99m}Tc bone scan may be positive within 48 hours of injury.
Prevention:	Gradual training increases. Same as for MTSS.
Treatment:	A period of complete rest (15 days minimum) from painful weight-bearing activity is **crucial**. Although uncommon, spontaneous complete fractures may occur if the advice to rest is ignored. Typical tibial stress fractures will heal within four to eight weeks. An important exception are stress fractures on the anterior (foremost) border of the tibia that can take many months to heal and may require electric stimulation or grafting. It is not uncommon for tibial stress fractures to recur. If so, further rest is necessary and the return to training must be at a much slower rate than previously. In addition, a diet, hormone and bone density evaluation should be considered to rule out underlying factors that may be predisposing the athlete to stress fracture.

Chronic compartment syndrome

What is it?	A condition of leg muscle ischemia (lack of blood) occurring during exercise. It is relatively rare
How does it occur?	Normally during exercise, an elevated demand for oxygen induces increased flow of blood to the muscles, causing them to swell about 20%. If the sheaths of connective tissue (fascia) surrounding the muscles are unusually inelastic, this expansion is limited, and the increase in blood flow is prevented. Muscles starved of oxygen produce cramping pain.
Region most affected:	The anterior compartment. However, the deep posterior and peroneal compartments may also be affected. The condition occurs in both legs in 90% of cases.
Signs and symptoms:	Deep, diffuse, aching, cramping leg pain, swelling and tightness, leg muscle weakness, numbness in the leg and/or foot, reduced pulse at the front of the ankle, occasional muscle herniations through fascial defects. Initially pain develops around 30 minutes into a moderate exercise bout, but, with time, pain occurs earlier. If the activity is promptly ceased, pain resolves within 10-15 minutes. The diagnosis may be confirmed by compartment pressure testing during or immediately following exercise. Unlike muscle strain, tendinopathy, MTSS or stress fracture, symptoms are absent between exercise bouts.
Prevention:	Nothing known to be effective.
Treatment:	Acutely, immediate rest, leg elevation and icing. Fasciotomy (a surgical procedure involving the cutting of fascia in the leg to release the compartments) is the only effective long term solution if a patient is to remain active. Rest, anti-inflammatory drugs and stretching are ineffective treatments. Exercises that increase muscle bulk will compound the problem.

Conclusion

Clearly for most exercise-induced painful leg conditions, prevention is the most effective form of management. A recurring preventive theme is gradual increases in training intensity. Such gradation is necessary in order to avoid overloading the body's adaptive mechanisms.

Written for the American College of Sports Medicine
by
Belinda R. Beck, Ph.D. FACSM