



ACSM Sports Medicine Basics

EXERCISE-INDUCED LEG PAIN



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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. In the modern day, the pursuit of athletic excellence has reached such phenomenal extremes, the human body is often subjected to degrees of physical work it is not able to tolerate. While most body tissues have the capacity to adapt and strengthen in response to increased loading, overuse injuries result when loading increases occur too quickly for adequate 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 those conditions, use of the term “shin splints” is 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 fiber damage
- **How does it occur?** Over-stretching a muscle
- **Region most affected:** Tibialis anterior muscle (front of the leg, beside the shin bone) often following chronic downhill running.
- **Signs and symptoms:** Acute, focal (site of the tear) pain within the muscle 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?** Micro-tears 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 loading (muscle contracting while being forced to lengthen). 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 micro-tears.
- **Signs and symptoms:** Pain, swelling and palpable crepitation (crunchy feeling) along the tendon during muscle contraction and stretch. For tibialis posterior tendinopathy, this can be mainly felt behind the medial malleolus (inside ankle bone.) Pain is likely to occur primarily at the start of and following exercise.
- **Prevention:** Gradual increases in training. Leg (tibialis posterior and tibialis anterior) and foot muscle strengthening to support the arch of the foot when not injured. Orthotic inserts in the shoes to reduce chronic per planus (flat foot) or hyperpronation during exercise, 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 associated with the tendon.

MEDIAL TIBIAL STRESS SYNDROME -MTSS (APERIOSTITIS)

- **What is it?** Over-stimulation or inflammation of the medial tibial periosteum (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, micro-damage occurs and the region becomes inflamed and painful. The injury may be compounded by simultaneous, repetitive muscle or fascial pull on the periosteum.
- **Region most affected:** Inside border of the distal half to third of the tibia (shin bone), in the region of the narrowest cross section.
- **Signs and symptoms:** Pain during weight bearing (particularly running and jumping). Tenderness on palpation. Sometimes swelling, redness and warmth.
- **Prevention:** Gradual training increases (<10 percent per week). Attaining good dorsiflexion flexibility (moving the top of the foot toward the shin) and leg muscle strength pre-season, wearing appropriate footwear, varying the training surface and consuming 1000 mg/day dietary calcium.
- **Treatment:** Rest (7 to 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 a small proportion of people, orthotics prevent injury and/or reduce symptoms.

TIBIAL STRESS FRACTURE

- **What is it?** An incomplete crack or cracks in the tibia following repetitive impact loading.
- **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 likely preceded by a greater degree of bone remodelling (bone resorption followed in due course by formation) than MTSS, with resultant temporary bone porosity and weakness.
- **Region most affected:** As for MTSS. Less commonly, below the knee, medially.
- **Signs and symptoms:** Profound, localized pain during running and jumping. In severe cases, pain may occur when walking and nonweight bearing at night. Focal tenderness and swelling on palpation. A triple-phase 99mTc bone scan may be



positive within 48 hours of injury. Edema is visible on MRI.

- **Prevention:** Gradual increases in training intensity. Same as for MTSS.
- **Treatment:** A period of complete rest (15 days minimum) from painful weight-bearing activity is vital. Although uncommon, spontaneous complete fractures may occur at the site of the stress fracture with continued loading. Typical tibial stress fractures will heal within four to eight weeks with modified rest. An important exception is stress fractures on the anterior (foremost) border of the tibia that can take many months to heal and may require extrinsic stimulation (pulsed electromagnetic field or low-intensity pulsed ultrasound) or surgery. 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. A diet, hormone and bone density evaluation is recommended to rule out underlying factors that may be predisposing the individual to stress fracture.

CHRONIC COMPARTMENT SYNDROME

- **What is it?** A condition of leg muscle ischemia (lack of blood) induced by 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 percent. 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. Nerves and arteries passing through the compartment will be impinged.
- **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 percent 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 to 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 and leg elevation. Fasciotomy (a minimally invasive 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-inflammatories and stretching are ineffective treatments. Exercises that increase muscle bulk will compound the problem.

CONCLUSION

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

About the Author

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