Dynamic Chiropractic

SPORTS / EXERCISE / FITNESS

Lower Leg Pain: Part II

Last month, we discussed some of the causes of lower leg pain. Specifically, we addressed shin splints. This month the focus will be on two conditions that are fairly exclusive to the athletic population: tibial stress fractures and compartment syndrome. The difficulty with differentiating shin splints and stress fracture is that they often represent a continuum of bone reaction to stress. Initially, pull of muscle on the periosteal attachment leads to shin splints (or sometimes referred to as either periostitis or tibial stress syndrome). Progression to a stress fracture is then possible. The difficulty with differentiating compartment syndrome from the other tibial pain entities is that initially the patient's complaint of pain related to exertion is quite similar.

Tibial Stress Fractures

Tibial stress fractures occur more often than other stress fractures, accounting for half of all stress fractures in athletes.[1] Normally there is a balance between bone resorption and remodeling. When there is inadequate time for healing, resorption dominates. Tibial stress fractures are due to repetitive loading or stress from muscle pull. Factors that increase an individual's predisposition include performance of repetitive activity on hard surfaces, weak supportive musculature, sudden change in training routine, hyperpronation, and poor bone status. The training factors are easily determined through a qualification of how much the person performs an activity, on what surface, what type of shoe is worn, whether orthotics are used, and whether any pre-training exercise is performed.

Other clues are the type of activity. Middle and distal third tibial stress fractures are more common in runners; proximal tibial fractures with military recruits, and middle tibial fractures with dancers.[1] Bone status is less clear from the history, however, in females; delayed menarche or amenorrhea are suggestive of poor bone quality. Certainly, questions regarding dietary intake of calcium through food or supplementation may add important information when providing preventive recommendations.

Classically, the athlete will report pain with activity that is relieved with rest. Soon, though, the pain is persistent occurring anytime the athlete bears weight. Although the pain is sometimes diffuse over several inches, palpation often reveals a discrete site of tenderness on the tibia. Attempts at increasing pain with a tuning fork or percussion at a site proximal or distal to the suspected site on occasion may work, however, results are variable. Radiographs may demonstrate a thin radiolucent line early in the process, or reveal calcific healing after a few weeks. It is recommended to include standard anterior to posterior, lateral, and oblique films of the area to better catch the "angle" of the fracture. One study indicated that radiographs were sensitive to only 10% of stress fractures (confirmed with bone scan).[1] If radiographs are negative, however, and the stress fracture is suspected, it is recommended to order a bone scan. For those females with stress fractures, a dual photon absorptiometry scan may be helpful in determining bone status and help in recommendations regarding diet or exercise.

A triple phase bone scan may help differentiate among shin splints, stress fracture, and compartment syndrome.[2] The initial phase represents intravascular perfusion. The second phase demonstrates the

extravascular "blood pool" phase of radionuclide uptake. The third phase demonstrates the amount of radionuclide found in the hydra shell of bone, referred to as the "delayed" or "bone scan" phase. It is important to remember that the radiation exposure with these studies is low, representing between 0.1 to 0.5 rads (gonadal dose 0.2 to 0.5 rads), which is comparable to a standard lumbar spine x-ray. The three phases also differentiate acute from chronic stress fracture with all three phases positive in the acute phase (2-4 weeks). The second and third phases become progressively normal as healing occurs.

Generally stated, the uptake pattern differs with each condition as follows:

- shin splints -- linear, mild uptake of radionuclide
- stress fractures -- "hot spot" of increased uptake (round or fusiform)
- compartment syndrome -- "hourglass" appearance (increased uptake above and below the involved compartment)

Management of stress fractures is determined by the compliance of the athlete to recommendations, the need for maintenance of cardiovascular fitness, the bone status, and the athlete's ability to bear weight without pain. Generally, bed rest or casting is unnecessary. Recommendations to avoid impact loading for several weeks, yet allow everyday walking, is usually sufficient. However, if the athlete is noncompliant it may be necessary to jail them in a short leg fiberglass cast for several weeks. For those who cannot bear weight without pain, crutches for a week or two may be needed, allowing mild toe contact progressing to heel contact for proprioceptive maintenance.

One exception to the above is when a large radiolucent line is discovered radiographically in a dancer. This is referred to as the "dreaded black line."[3] This type of fracture has a reputation for poor healing and often progresses to full fracture. These individuals must have immobilization imposed to better guarantee healing. Obviously, calcium supplementation should be emphasized with a minimum of 1.5 grams per day for several weeks during healing and one gram daily as a preventive measure. Cardiovascular fitness can be maintained with non-weightbearing activities, such as bicycle riding or pool running using a water vest. Although there has been some discussion of electromagnetic healing of fractures, there is little evidence to support this approach. Yet, many feel it is worth an attempt to incorporate microamperange stimulation in hopes to affect cell metabolism in the area.

Compartment Syndrome

To understand compartment syndrome, it is necessary to visualize the fascial compartments of the lower leg and their contents. Generally, four compartments are recognized (although there is some disagreement about the posterior division). Within each compartment are muscles, nerves, and vasculature:

1. anterior -- tibialis anterior, toe extensors, tibial artery and vein, and the deep peroneal nerve;
2. lateral -- peroneal muscles and superficial peroneal nerve;
3. superficial posterior -- soleus, gastrocnemius, and plantaris; and
4. deep posterior -- posterior tibialis, toe flexors, and posterior tibial artery and vein.F

When pressure inside the compartment rises, it usually is not sufficient enough to cause compression of the contents; however, in an acute injury such as fracture, swelling within the compartment may be dramatic enough to compress and eventually destroy its contents if persistent. In a more insidious manner, overuse may lead to transient increases in pressure that produce activity related complaints,

namely pain, swelling, and possibly numbness/tingling, or weakness.

With runners, symptoms seem to occur at a consistent time often between 10-30 minutes after starting to run. For a given individual, the onset is often consistent enough to be anticipated at every run. Pain usually subsides, however, varying from minutes to hours. In between occurrences, the athlete is often asymptomatic. The examination is also unrevealing unless the athlete provokes the symptoms with a run prior to the appointment. Interestingly, pulses are often normal. There are some sensory changes evident in many athletes. Tenderness and swelling in the compartment are more evident when compared with the opposite "well-leg." Fascial defects may allow muscle herniation that is palpable in 40% of patients following provocation of symptoms. The definitive tool is slit-catheter measurement. Without detailing out the variations, generally it can be said that normal pressure at rest is 4+/-4mm Hg and will rise to between 30 to 50mm Hg following exercise. With compartment syndrome, resting pressure is greater than 15mm Hg that may rise to 80mm Hg or higher during exercise. Levels that remain elevated for 15 to 30 minutes after activity indicate compartment syndrome, especially when elevated above 40mm Hg.

If misdiagnosed, management may include taping or an ace bandage. This will obviously increase pressure and therefore pain. It is also true that myofascial work may aggravate symptoms in the acute phase. No studies have been performed to determine the effect of myofascial work on increasing the compliance of the fascial compartment, yet it theoretically may be of benefit with exertional compartment syndrome (a good research project for one of the readers). Management for chronic compartment syndrome is simply a period of rest from the inciting activity for 4-8 weeks. If recurrent, surgical release using a fasciotomy has a relatively good success rate.

References

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2. BenEliyahu DJ. Radionuclide bone scan imaging of periostitis and stress fractures commonly seen in athletic injuries. Top Clin Chiro 1997:4(1):50-57.
3. Green NE, Rogers RA, Lipscomb AB. Nonunion of stress fractures of the tibia. Am J Sports Med 1985;13:171-176.

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SEPTEMBER 1997