Continuing Medical Education

The Top Five Running Injuries Seen in the Office—Part 2

Here's the current evolution in thought, literature, and treatment of these conditions.

BY STEPHEN PRIBUT, DPM

Objectives

1) Describe the features of the top running injuries.

2) Present recent concepts on muscle imbalance and the relationship of core muscles to clinical entities including PFPS and iliotibial band syndrome.

3) Review the significance of tendinopathy and fasciopathy in clinical practice.

4) Review the concept of enthesis and tendinopathy as they pertain to Achilles tendon injuries.

5) Review current theories of the cause of medial tibial stress syndrome.

6) Present current concepts of stress reactions and stress fractures of bone as repetitive stress injuries of bone.

7) Describe an outline of treatment recommendations for Achilles tendonitis, plantar fasciitis, iliotibial band syndrome, patellofemoral pain syndrome, medial tibial stress and stress reactions of bone.

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*Following this article, an answer sheet and full set of instructions are provided (pg. 190).—**Editor***

Stress Fractures and Stress Reactions of Bone: A Chronic Repetitive Stress Injury

Definition

The term stress fracture, while commonly used and easily understood, does not represent the nature and diversity of this frequently found overuse injury. Repetitive stress injury (RSI) of bone, or stress reaction, are both better suited to describe this injury. The majority of injuries that are diagnosed as stress fracture do not demonstrate a fracture line and should not be termed a fracture. More severe stress injuries are similar to what is termed fatigue fractures in other materials. It should be noted that bone has been found to fail more

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frequently in tension than in compression.

In runners, the most frequently injured bones are the tibia, metatarsals, and calcaneus. The available data on the other bones offers varying data, but virtually all lower extremity bones may be affected, including the femur, navicular, fibula, cuboid, and cuneiforms.

Stress fractures were first noted by Briethaupt, a military physician, in 1855, who noted swelling and pain in the feet of Prussian military recruits.[36] In 1897, radiographic examination revealed the nature of the injury and "march fracture" entered the literature as reported by Stewchow.[37] A number of studies have followed which detail this injury in both a military population and within the athletic population. Estimates of the occurrence in the running population is that as many as 10% or more of injuries may be stress reactions in bone.[38]

TABLE 6
Treatment Suggestions for Achilles Tendinopathy

Relative rest, Absolute Rest. Activity must be reduced to prevent continued, repetitive overloading of the injured tissue.

Immobilization vs. Eccentric Stretching—Choose one. Carefully consider the other in the event of failure.

Physical Therapy modalities—including electrotherapy, ultrasound

Ice—symptomatic
Heel lift to reduce strain deformation and loads at the insertion.
Orthotic to reduce torque and rotational strain on the tendon.

Running alterations:
Avoid over cushioned shoes, which will increase the eccentric contraction of the calf muscle.

Avoid uphill running. Avoid incline on treadmill. Avoid over striding which increases the foot to leg angle in dorsiflexion.

Background

Bone is a dynamic structure. As a biological material, it is subject to change as a result of environmental stimuli and in response to genetic predilection. The initial injury might be a biological or biochemical abnormality or failure at the cellular or bone multicellular unit (BMU) level. Bone adapts to many levels of intermittent, repetitive compressive and tension strains by an increase in density. In the presence of abnormally high and repetitive forces, the ability to heal by microdamage repair is not adequate, and more damage than repair occurs.[39] In short, an excessive amount of stress or repetitive stress is occurring without the bone having adequate rest to allow for adaptation to the stress. In essence, the stress that creates these injuries is too much, too soon for the bone.

It is important to keep in mind other contributing factors in the development of RSI of bone. Besides training errors and the biomechanical causes that we usually think of, a variety of systemic conditions can contribute to this injury. These factors include osteopenia, osteoporosis, other metabolic bone disorders, hormonal abnormalities, inadequate nutritional intake, and collagen disorders. In women, amenorrhea or oligomenorrhea may lead to deficient estrogen and low bone mineral density. The female athlete triad includes low bone density by definition, along with disordered eating and amenorrhea.[40] Overtraining may lead to decreased testosterone levels in men resulting in osteopenia. Patients of either gender who have suffered multiple stress fractures should have a bone density (DEXA) scan performed.

Abbreviations

MPFL	medial patellofemoral ligament
VMO	vastus medialis obliquus
PFPS	patellofemoral pain syndrome
ITB	iliotibial band
ITBS	iliotibial band syndrome
MRI	magnetic resonance imaging
RSI	repetitive stress injury
MTSS	medial tibial stress syndrome
VL	vastus lateralis
BMU	bone multicellular unit

Diagnosis

Initial suspicion of a repetitive stress injury of bone (RSIB) or stress reaction often leads to the clinical diagnosis. The patient's history of injury, changing pattern of exercise, physical examination, and imaging studies lead the practitioner to the diagnosis. The classical presentation is in an athlete presenting with sudden onset of pain during or after a run. Usually, there has been a discernable change in training habits. Mileage may have increased, twice a day runs begun, speed work initiated, a new pair of running shoes used, or there has been aging of running shoes along

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with any other contributing factor. Physical examination will usually reveal a discrete area of tenderness. Certain bones are not as accessible to palpation as others are. The pelvic bones, femur, talus, and midtarsal bones are notoriously difficult to palpate and examine clinically. So, a high level of suspicion must be present to reach the diagnosis particularly in the rearfoot and midfoot; and the use of imaging should be considered.[41]

On the tibia, as is mentioned elsewhere in this article, a horizontal line of tenderness is often the differentiating clinical sign from the vertical tenderness of medial tibial stress syndrome. Immobilization in a pneumatic walker for four to six weeks or more is often helpful for tibial stress fractures, and a variety of other stress injuries of bone.[42] Calcaneal stress fractures may be suspected when there is tenderness upon lateral compression of the body, rather than at the medial calcaneal tuberosity or tenderness that is only plantar to the calcaneus.

In a group of military recruits, the majority (56%) of calcaneal stress reactions occurred in the posterior third of the bone and 79% occurred in the upper half of the calcaneus.[43] Earlier reviews noted that the injury occurred primarily in the posterior aspect of the calcaneus, but Sormaala notes the importance of suspecting a stress reaction in the more anterior portion of the bone. Stress fractures of the tarsal navicular should be suspected when there is dorsal tenderness extending proximally to distally. In addition to simple tenderness, tenderness to percussion or to the vibrations of a tuning fork have been used as pathognomonic signs.

Diagnostic imaging includes radiographic evaluation, technetium-99 bone scan, and MRI. Often, an injury is not visible on radiographic examination. Bone scintigraphy is considered sensitive, while MRI is considered to be both sensitive and specific.[41] At early stages, the MRI shows marrow edema as an increased STIR signal and in fat-suppressed T2 images. On T1 sequences, a decreased signal is noted.[44] As the injury progresses to a stage of increasing severity, a low signal fracture line and bone callus may be visible.

A number of conditions may appear similar to stress fracture on certain imaging studies (Table 7). In other cases, asymptomatic bone marrow edema may be visible on MRI.[41]

Treatment

Conservative treatment works well for most RSI of bone. The key is finding the appropriate mechanical treatment to eliminate the pain of weight bearing. With the elimination of pain, the forces should be sufficiently low for healing and remodeling to take place. Weight-bearing exercise should be avoided. Multiple authors have recommended the use of a pneumatic walker for tibial stress fractures.[42,45] This may be used alone or with crutches, as needed. A cam walker, pneumatic walker or low pneumatic walker may alleviate pain faster and is often clinically superior to a post-operative shoe for stress reactions of the metatarsal area, and for other foot stress reactions.

Conservative treatment works well for most RSI of bone. The key is finding the appropriate mechanical treatment to eliminate the pain of weight bearing.

During recovery, one should guide the athlete to appropriate cross-training activity. Swimming, bicycling, and maintenance of upper body strength should be implemented. Lower extremity exercises should be chosen as appropriate, and if deemed to not risk delayed healing or further injury.

A phased return to activity, allowing sufficient time for healing, is the key to a successful return to activity. In clinical practice, the author has found that weaning from the pneumatic walker seems to lessen the time to comfortable exit from the walker and prevent pain from returning and the necessity of returning to the use of the pneumatic walker. Most lower-extremity stress reactions take between 8 and 17 weeks for recovery.[38]

Medial Tibial Stress Syndrome (Shin Splints)

Shin splints, the term that just won't die, is still on the frequent injury list, but now under a different

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TABLE 7
Differential Diagnosis of Lower Extremity Stress Fracture

Conditions that may appear to be a stress fracture

- Patellofemoral pain syndrome
- Osteoid osteoma
- Osteomyelitis
- Osteosarcoma
- Ewing Tumor
- Bone metastases
- Osteochondral fracture
- Accessory Navicular (painful)
- Inflammatory disorders
- Medial Tibial Stress Syndrome

name.. The terms anterior shin splints, posteromedial shin splints, and a host of other terms came into vogue in the 1970's and 1980's. As long ago as 1967, Slocum encouraged the abandonment of the term shin splints from the medical literature.[46] Ten years later, James also supported the efforts to eliminate the term suggesting posterior tibial syndrome as an alternative.[47]

The improved descriptive term medial tibial stress syndrome is now in common use. The term was first applied by R. Drez and popularized by Mubarak in 1982.[48] This term is appropriate to use in the absence of a stress fracture or an exertional compartment syndrome. The older term, shin splints, never made clear what part of the leg was affected. Some have considered the shin to be the front part of the leg below the knee, the front part of the tibia, or the lower leg itself. We will omit consideration of anterior tibial leg pain and review the medial portion of the tibia that the term medial tibial stress syndrome (MTSS) refers to.

Historically included entities within the realm of MTSS include: periostitis, traction periostalgia, tendinopathy, periosteal reaction, and fatigue failure of the connective tissue connecting muscle to bone.[49]

Where is the Pain? Symptoms and Description

By definition, the pain in MTSS occurs at the posteriomedial aspect of the tibia. Edwards has detailed an algorithmic approach to diagnosis and confirmatory tests to differentiate MTSS from nerve injury and compartment syndrome.[50] He suggests that MTSS may occur more often in the distal third of the tibia, and one should consider stress fracture more proximally. While his flow chart is interesting, it is severely flawed. MTSS is considered as a strong possibility with pain at rest in the presence of palpable tenderness. In the absence of pain at rest, but with palpable tenderness, he considers common or superficial nerve entrapment as the likely cause of lower limb pain.

Unfortunately, in the context of treating runners, this makes little sense. He notes elsewhere in his article that the pain in the early stages does fade with rest. Previous observations of overuse injuries and pain-staging better and more accurately define the pain seen with this condition.[51-53] See Table 8 for a staging of pain occurring in overuse injuries. Nerve compression or entrapment syndromes are usually considered when the history includes the description of pain that is burning in nature and may be associated with a subjective or objective observation of numbness. Exertional compartment syndromes, which present with a somewhat different set of symptoms, will not be reviewed within this paper.

Michael and Holder[54] described the clinical characteristics of early MTSS as including:

1) Induced by exercise, relieved by rest;
2) Dull ache to intense pain;
3) Tenderness posterior medial border of tibia;
4) Pronated feet;
5) Normal x-ray films.

Risk Factors

Thacker[49] reviewed the available epidemiological literature and found a general consensus that there were a variety of potential risk factors detailed in the literature. The risk factors most often cited include: younger age, female gender, change in distance, frequency, speed, surface of runs, change of running shoes, excess pronation, and a previous history of injury. As is often the case in the medical literature, contrary studies are often found. Contrary studies are also cited on age, gender, mileage, hill running, running surface, previous activity level and flexibility. In our constant quest for high level studies that are reliable and meet the requirements of evidence-based

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TABLE 8

Pribut Pain Staging of Overuse Injuries in Athletes

Stage 0—No pain is present before, during or after activity. Minor discomfort may be experienced at various times during training or racing.

Stage 1—Pain or stiffness after activity. The pain is usually gone by the next day.

Stage 2—Mild discomfort before activity that goes away soon after exercise is commenced. No pain is present in the latter part of the exercise. Pain returns after the exercise is completed (starting within 1 to 12 hours later and lasts up to 24 hours).

Stage 3—Moderate pain is present before sport. Pain is present during sport activity, but is somewhat decreased. The pain is an annoyance which may alter the manner in which the sport is performed.

Stage 4—Significant pain before, during, and after activity. The pain may disappear after several weeks of rest.

Stage 5—Pain before, during, and after activity. The athlete has stopped their sports participation because of the severity of the pain. The pain does not abate completely even after weeks of inactivity.

medicine, we often find ourselves wandering in the mire of the literature and decide that the evidence is thin for much of what we think we know. We remain with the knowledge of the importance of having a basic understanding of causative factors in the context of carefully assessing an individual patient.

Imaging

While clinical signs and symptoms will lead you to the diagnosis in many cases, it still may be helpful to rule out a stress fracture. Radiographs should be taken in questionable cases, but they are often insufficiently sensitive to show many stress fractures and offer no information that would demonstrate MTSS.

Both triphasic bone scans (diffuse, superficial, linear uptake) and MRI (diffuse linear signal on T2) have been used to demonstrate stress fracture and, in many cases, they may demonstrate linear patterns suggesting MTSS; although negative studies do not preclude the diagnosis of MTSS.

MTSS—Causes

There are a variety of theories of the pathogenesis of MTSS. Periostitis was one widely believed to be the cause of the pain, but histologically inflammation was not found.[55] Periostalgia has been applied to pain at this site in the absence of inflammation. Johnell, et al., found metabolic changes in bone with no inflammation and believed MTSS to be a stress reaction of bone. Other theorists have proposed traction injury at the posterior tibialis and/or soleus muscles.[54]

Bates in 1985 postulated that excessive pronation and eccentric contraction of the soleus and posterior tibial muscles were contributing factors in the development of MTSS.[56] Factors that increase bending moments or traction at these sites include a planus foot type, tarsal coalition, leg length inequality, and muscle imbalance.[57]

The tibialis posterior muscle origin has been noted to be in the upper two thirds of the interosseus membrane, medial fibula, and lateral tibia. It is somewhat proximal to where the bulk of the tenderness is usually noted clinically. Beck and Osternig performed cadaver dissections which demonstrated that the soleus, flexor digitorum longus and deep crural fascia were close to the usual areas in which symptoms were found and the posterior tibialis muscle was found a considerable distance proximally.[58] In spite of the downplaying of the tibialis posterior by its anatomical position, under eccentric contraction, Pribut postulates that it should still substantially increase the strain in the medial tibia.

Bouché and Johnson researched traction resulting upon the tibial fascia when forces are applied to the posterior tibial, soleus, and flexor digitorum longus tendons.[59] In their discussion, they noted that these muscles eccentrically contract during stance to counter midtarsal and subtalar joint pronatory forces, which earlier had been linked to MTSS.[60] Bouché and Johnson's study demonstrated a direct linear relationship between forces applied to those muscles and strain measured at the muscle bone interface, and the conclusion they reached was that "eccentric contraction of the superficial and deep flexor tendons of the leg is the key pathomechanical factor …" in the creation of MTSS.[59] Bouché also noted that exercising on hard floors had been found to increase eccentric contractions of these muscles. The research of Bouché sits well with the concepts earlier espoused by Michael, et al. in their article entitled "The Soleus Syndrome."[54] Michael's suggestion that the soleus could contribute to "shin splints" was based on cadaver, EMG, and muscle stimulation research.

Treatment and Prevention

Thus far, a number of studies have surprisingly failed to show prevention from graded increase in exercise programs. There are a number of possible experimental design measures that might show differences better, but at this point the evidence that would back up common sense is not there. Thacker notes serious "methodological flaws" in the studies he reviewed.[49]

It is important to include rest and relative rest at the top of recommendations. Two to four weeks of rest may alleviate much of the pain in early MTSS. Training alterations prior to the development of MTSS need to be carefully analyzed and recommendations should be made based upon this analysis. A biomechanical analysis of the lower extremity should be performed, and shoe and custom orthotic recommendations are made as needed.[50] Excessive pronation has been found to be a contributing factor.

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NSAIDS, while not directly addressing inflammation, are useful adjuncts to pain control and allow the early resumption of normal motion patterns and strengthening and stretching exercises. Gastrosoleus stretching should be undertaken. Core muscle strengthening is becoming increasingly used for a variety of lower extremity overuse injuries and should be evaluated for strength deficit.

During the rest period, the athlete will need to be given a program of alternative exercise. This may consist of low impact cardiovascular exercises such as swimming, stationary bicycle, or pool running. It may be supplemented with upper body weight training. Gradual return to activity and incrementally building up distance and intensity should assist in a smooth return to normal activity.

Plantar Fasciopathy, Plantar Heel Pain Syndrome

Plantar fasciitis is one of the most

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frequently found foot injuries among runners. As with several other entities, we are discovering that many of the terms we have called this by are likely incorrect. The heel pain we most often see has been called many things including plantar heel pain, heel spur syndrome, and recently plantar heel pain syndrome.[61] In the term fasciitis, the -itis ending denotes an inflammation. Perhaps if we redefined -itis, we could still use fasciitis and tendonitis, but the death of the term plantar fasciitis is rapidly approaching.

Lemont examined specimens and found no inflammation present. Instead, he found changes analogous to that found in tendinosis: myxoid degeneration, collagen degeneration, increased vascularization, and vascular engorgement of the adjacent bone marrow.[62] Evidence of inflammation was not seen. While Lemont indicated that plantar fasciitis should be considered plantar fasciosis, this latter term is probably best termed fasciosis after biopsy, and plantar fasciopathy is a more suitable term.

The term plantar heel pain syndrome can be used to include conditions of pain in this region in both the absence and presence of an inferior calcaneal spur.

The origin of the plantar fascia is an enthesis similar to the Achilles tendon. Fibrocartilage is found at its site of origin. Growing heel spurs appear to take shape deep to the plantar fascia and have been noted to grow within developing cartilage via endochondral and intramembranous ossification, most likely at the site of the enthesis and in close association with the flexor digitorum brevis.[63] Recent thinking is that this is not a traction injury but an enthesophyte formed in the enthesis via stimulation of the bone by stress. Pribut has hypothesized that even in the absence of direct traction injury at the site of origin of the plantar fascia, there will be sufficient strain in the enthesis and in the calcaneus to stimulate bone and cartilage production and sufficient strain to also create other calcaneal stress injuries. Early changes occurring in the enthesis fibrocartilage near the calcaneal surface include the appearance of cartilage cell clusters and longitudinal fissure formation with erosion of subchondral bone.

Most spurs develop deep to the plantar fascia in the flexor digitorum brevis, quadratus plantae and abductor hallucis muscle origins.[63a] It is logical to conclude that the muscles originating in this area, especially the quadratus plantae, may play a significant role in the plantar heel pain syndrome. The other intrinsic muscles are also likely to be involved in this syndrome. Unfortunately, this is not often discussed or considered in articles and lectures on "plantar fasciopathy." Discussion and debate is often limited to "the spur is not in the fascia", "vertical forces might be involved rather than traction" and "does the spur cause the pain"? The real questions are "what is the totality of structures contributing to the pain?", "what role do the intrinsic muscles play both in the development of pain and production of the heel spur?" , "what does it mean that much of the anatomy in this area is a part of an enthesis?", and "what should we do to eliminate the pain,

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TABLE 9

Selected Entities Causing Plantar Heel Pain

Mechanical
- Plantar Fasciopathy
- Plantar enthesopathy
- Muscle strain at origin of quadratus plantae, abductor hallucis, or flexor hallucis brevis

Repetitive Trauma
- Stress fractures
- Rupture of plantar fascia
- Heel pad atrophy

Neurological
- Posterior tibial nerve—tarsal tunnel syndrome
- Medial calcaneal nerve
- Medial plantar nerve
- Lateral plantar nerve
- Peripheral neuropathy
- Discogenic pain
- Central nervous system lesion

Arthritic
- Seronegative Spondyloarthropathies
- Rheumatoid Arthritis
- Fibromyalgia
- Gout
- Enthesopathy

Misc.
- Infection
- Bone cyst or tumor
- Apophysitis

TABLE 10

Outline of Treatment Recommendations for Plantar Heel Pain Syndrome

Relative or Absolute Rest
Calf Stretching
Intrinsic muscle strengthening (towel toe crunches, marble pick-ups, etc.)
Cryotherapy
NSAIDs (for pain, not inflammation)
Night splints
OTC Insert
Custom Foot orthoses
Shoes—with increased torsional & flexion stability
Check Stability of running and walking shoes, replace if necessary
Avoid barefoot walking
Avoid calf raises and stair dips and other forefoot-only contact exercises

improve function, and keep our runners on the road?"

Symptoms

Pain upon arising in the morning is one of the hallmarks of plantar heel pain syndrome. The pain is noted to be on the plantar or plantar medial aspect of the heel. Tenderness is usually found upon palpation of the medial calcaneal tuberosity. It is important to distinguish plantar fasciitis from a tear of the plantar fascia, which most often occurs 2-6 cm anterior to the origin of the plantar fascia and from a calcaneal stress fracture. The tenderness of most calcaneal stress fractures is linear and found on the body of the calcaneus, often on both the medial and lateral sides. Nerve entrapment may also cause pain in this region. Table 9 details some of the clinical entities that can cause plantar heel pain.

Treatment

Entire issues and seminars are devoted to plantar heel pain and its treatment. We will briefly review current therapy. A survey of members of the American Academy of Podiatric Medicine detailed the most common treatments that they employ for plantar heel pain syndrome.[61] Recommendations based on this survey and subsequent observations follow.

For early heel pain of less than six weeks duration, the most frequent recommendations were for avoidance of walking barefoot or walking in flat shoes, over the counter inserts, regular calf stretching, cryotherapy, nonsteroidal, anti-inflammatory drugs (NSAIDs), and strapping of the foot. Toe crunches or marble pickups designed to improve the strength of the intrinsic muscles should be started.

At an intermediate stage, when pain has been present for six weeks to six months, the respondents usually recommended a custom orthotic. Corticosteroid injections were also frequently recommended—although, in view of Lemont's findings, the rationale of such injections needs to be reconsidered.[62] The increased risk of rupture of the plantar fascia following both corticosteroid injection and exercising after these injections should also be taken into consideration. Night splints were also sometimes used.

Additional measures recommended for late stage plantar fasciopathy include immobilization via the use of a cast or pneumatic walker, plantar fasciotomy, and extracorporeal shockwave therapy.

Plantar fascia rupture is not a commonly found running injury. When this occurs it is readily treated with pneumatic cast boot immobilization using pain as a guide as to when weight bearing should be permitted. Generally 6–8 weeks of immobilization followed with an orthotic and rehabilitative exercises works well. This method has been used in our offices for over 25 years. A similar method was detailed in 2004 by Saxena and Fullem with a study of over 18 cases.[62a]

It is important to examine your patient's running shoe to make certain that flexion and torsional stability is present. If the shoe is excessively flexible, more forces will be created within and near the plantar fascia, most likely via the windlass effect. If the pain has been severe enough to cause the patient to miss several weeks' worth of running, a slow and gradual return is important to avoid recurrence of injury or a new overuse injury. Intrinsic muscle strengthening and calf muscle stretching need to be performed by the athlete regularly. An outline of treatment recommendations follows in Table 10.

It is important to examine your patient's running shoe to make certain that flexion and torsional stability is present.

An Unusual Presentation of Heel Pain

Sometimes the very rare and dangerous can masquerade as the ordinary and simple. A middle aged runner presented to my office with a complaint of burning pain in his heel which occurred at random times. No local tenderness was found. No

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Tinel's sign was found nor was referred pain found in examination of the tarsal tunnel area. The burning was taken to be evidence of a neurological problem, possibly at the level of the spinal nerves (although tarsal tunnel syndrome was a lesser consideration). The patient was referred to a neurologist for evaluation. The neurologist felt the ocular examination to be most significant. Upon ocular examination, increased intracranial pressure was suspected. A brain scan revealed a lesion in the cerebral cortex (near the sensory region). The lesion was a well-differentiated glioma. Within the first month following surgery, the symptoms were no better. As recovery proceeded following the surgery, within 3 months the heel pain symptoms abated and have not returned after 5 years. It is unlikely you'll ever see a case like this. But you are likely to see something rare in your practice. Keep your eyes open and your mind ready.

Summary

The study and quest for understanding athletic injuries is a lifelong undertaking. We have tried to give a picture of some of the most common running injuries in this article and to detail the evolution of thought that has occurred over the last few decades on these commonly seen clinical entities. We hope your interest has been piqued to continue learning about these maladies and that you develop a method of assessing the literature to better treat your patients. To enhance your knowledge of sports medicine in a face-to-face setting, I encourage you to attend lectures on these topics. Venues which include information of interest to the podiatric sports medicine physician include the Annual APMA Scientific Seminar featuring a track put on by the AAPSM, regional meetings which feature the AAPSM and a variety of lecture series at the podiatric medical colleges which are jointly put on with the AAPSM. Information on these meetings can be found at the website of the AAPSM (www.aapsm.org). **PM**

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Dr. Pribut is a Clinical Assistant Professor of Surgery at George Washington University Medical School. He serves on the Runner's World Board of Advisors. He is a past president of the American Academy of Podiatric Sports Medicine. Dr. Pribut is in private practice in Washington, DC.

Continuing Medical Education

SEE ANSWER SHEET ON PAGE 191.

1) Stress fractures occurring in the lower extremity in runners are best demonstrated using:
- A) a bone scan
- B) computed tomography
- C) x-ray
- D) tuning fork

2) Diffuse activity along the posteriomedial aspect of the tibia visible on bone scintigraphy probably indicates:
- A) osteogenic sarcoma
- B) stress fracture
- C) medial tibial stress syndrome
- D) osteomyelitis

3) In reference to the impact on the patellofemoral complex, the vastus medialis oblique is:
- A) a static stabilizer
- B) a dynamic stabilizer
- C) a passive stabilizer
- D) a destabilizer

4) The patella has the least amount of medial stability at:
- A) zero degrees of flexion
- B) 20 degrees of flexion
- C) 45 degrees of flexion
- D) 90 degrees of flexion.

5) Factors considered important to the development of patellofemoral pain syndrome include:
- A) abnormal pronation of the foot
- B) patella alta
- C) weak hip abductor muscles
- D) all of the above.

6) Pain that develops after running in the anterior region of a patient's knee is most likely to be what is appropriately termed:
- A) Runner's Knee
- B) Patellofemoral pain syndrome
- C) chondromalacia patellae
- D) terrible triad

7) Evidence in studies has indicated that a large contributing factor to iliotibial band syndrome is:
- A) weak hip abductor muscles
- B) over pronation of the foot
- C) high arches
- D) low blood levels of Vitamin D

8) The pain of iliotibial band syndrome is most often experienced in the region of the:
- A) anterior knee
- B) posterior aspect of the knee
- C) medial aspect of the knee
- D) lateral aspect of the knee.

9) The most frequently occurring Achilles tendon injuries in runners are best termed
- A) Achilles tendonitis
- B) Achilles heel
- C) Achilles bursitis
- D) Achilles tendinopathy

10) All of the following types of footgear could aggravate pain in the Achilles tendon area except:
- A) zero drop, minimalist shoes and a switch to forefoot contact running style
- B) firm heel shoe, flexible at ball, with 1/4" heel lift
- C) well-cushioned shoes
- D) shoes with a stiff and hard-to-bend sole.

11) The insertion of the Achilles tendon and the plantar fascia are similar in that they both:
- A) insert into the talus
- B) are both improved with stiff running shoes
- C) are improved by jumping jacks and running in sand
- D) are entheses

12) The histological findings of tendinosis include:
- A) myxoid degeneration
- B) parakeratosis
- C) inflammatory exudates
- D) copius lymphocytes

13) Stress fractures of the tibia do not usually demonstrate:
- A) horizontal line of tenderness
- B) diffuse linear vertical uptake on scintigraphy
- C) negative findings on x-ray
- D) focal area of concentrated uptake in proximal 1/3 of tibia on scintigraphy

14) In the detection of stress fractures of the lower extremity, the following imaging study is considered sensitive and specific:
- A) Te-99 Bone Scinigraphy
- B) MRI
- C) Ultrasound
- D) X-ray

15) Pain and tenderness at the posteriomedial aspect of the tibia in runners:
- A) is best treated with corticosteroid injections
- B) is most often a stress fracture
- C) is caused by a tight or a weak anterior tibialis muscle
- D) often falls into the category of posterior tibial stress syndrome

16) The following statement about patellofemoral pain disorder is false:
- A) the preferred name of this condition is anterior knee pain

Continued on page 190

B) pronation of the foot has been found in studies to be a risk factor
C) studies indicate weak hip abductors to be associated with PFPS
D) the subchondral bone, extensor retinaculum and infrapatellar fat pad are possible sources of pain in PFPS.

17) All of the following statements about the Achilles tendon insertion are true except:
A) Fibrocartilage is found at the insertion of the Achilles tendon
B) Sesamoidal cartilage is found at the insertion of the Achilles tendon
C) periosteal cartilage is found at the insertion of the Achilles tendon
D) articular cartilage is found at the insertion of the Achilles tendon

18) Surgical treatment of Achilles tendinosis most commonly would likely include any of the following except:
A) stripping of the paratenon
B) excision of non-viable tissue
C) Gastrocnemius recession (e.g., Strayer Procedure)
D) linear tenotomy

19) The tibialis posterior muscle originates from the:
A) distal medial aspect of the tibia
B) the proximal interosseus membrane, medial fibula and lateral tibia
C) proximal 2/3 of the tibia only
D) distal fibula and tibia

20) Although evidence based proof is weak, overuse running injuries are thought to be contributed to by all of the following except:
A) carbohydrate loading
B) overtraining
C) shoes losing shock absorption and wearing down substantially
D) starting marathon training never having run more than 20 minutes at a time

See answer sheet on page 191.

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The Top Five Running Injuries Seen in the Office—Part 2 (Pribut)

Circle:

1.	A	B	C	D	11.	A	B	C	D
2.	A	B	C	D	12.	A	B	C	D
3.	A	B	C	D	13.	A	B	C	D
4.	A	B	C	D	14.	A	B	C	D
5.	A	B	C	D	15.	A	B	C	D
6.	A	B	C	D	16.	A	B	C	D
7.	A	B	C	D	17.	A	B	C	D
8.	A	B	C	D	18.	A	B	C	D
9.	A	B	C	D	19.	A	B	C	D
10.	A	B	C	D	20.	A	B	C	D

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1) This CME lesson was helpful to my practice ____

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