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Getting injured runners back on track

With more people running—and incurring lower extremity injuries—than ever before, you’ll have many occasions to use this handy diagnostic and treatment guide.

PRACTICE RECOMMENDATIONS

- Advise patients with metatarsalgia to use metatarsal pads, consider orthotics, use contrast baths, and avoid high heels and pointy-toed shoes. **C**
- Recommend that runners with stress fractures of the foot have at least 4 weeks of rest before a gradual return to activity. **C**
- Consider short-term physical therapy for patients with plantar fasciitis to enable them to learn proper stretching and strengthening techniques. **C**

Strength of recommendation (SOR)

- A** Good-quality patient-oriented evidence
- B** Inconsistent or limited-quality patient-oriented evidence
- C** Consensus, usual practice, opinion, disease-oriented evidence, case series

CASE ▶ Jim F, 40 years old and overweight (BMI=28 kg/m²), has come to see you because of foot pain that began shortly after he took up running. Jim tells you that turning 40 was “an eye opener” that prompted him to “get healthy.” He says that while he was a competitive athlete in high school, he never ran regularly—until he embarked on a running program 3 months ago.

Jim denies acute injury, bruising, swelling, redness, fever, or chills, but states that the pain, which he describes as dull and achy, is gradually getting worse. It hurts the most when he stands for long periods of time. He says that he occasionally takes ibuprofen for the foot pain, but has not tried icing or stretching. When you ask him what kind of sneakers he wears during his runs, Jim reports that his running shoes—purchased at a discount store—are about 5 years old.

Participation in running has grown by more than 40% in the United States in the past decade.¹ As a result, patients like Jim are bound to have their share of aches, pains, and injuries that prompt them to visit their family physician. And that’s where this review can help. This rundown of the most common foot pain diagnoses, as well as the at-a-glance summaries of the differential diagnosis (**TABLE 1**)²⁻⁵ and treatment options (**TABLE 2**),^{3,6-25} can help you quickly get patients the relief they need to return to running.

Metatarsalgia: Pain on the plantar surface

Typically associated with a recent increase in activity or change in footwear, metatarsalgia is defined by pain on the plantar surface of the forefoot in the area of the metatarsal heads. The second, third, and fourth metatarsals are the most common offenders, and the pain may or may not be accompanied by swelling, bruising, or deformity.

Mechanical irregularities in the foot are thought to con-

tribute to the development of metatarsalgia, which is typically inflammatory in nature. Physical exam often reveals tenderness at the affected metatarsal heads, with or without pain in the corresponding metatarsophalangeal joint, and occasionally, with overlying edema or hyperkeratosis.

■ **Tuning fork test.** Commonly used but weakly supported, this diagnostic test is performed by applying a vibrating tuning fork to a site of possible fracture. If the maneuver produces focal pain, the test is positive and may be helpful in ruling in metatarsal stress fractures.²⁶

■ **Treatment: Change shoes, consider NSAIDs.** Treatment for metatarsalgia begins conservatively, with a change in footwear. High heels or pointy-toed shoes should be avoided, and metatarsal pads (FIGURE 1) can be placed inside the shoes to help off-load the metatarsal head.⁶ The pads come prefabricated or can be custom made, and are typically placed by physical therapists to ensure proper placement. Orthotics should also be considered, as they can help normalize abnormal foot mechanics that may contribute to metatarsalgia.^{7,8} (See “A word about runners’ footwear” on page 649.^{9,27-31})

Metatarsalgia is believed to be an inflammatory process, and NSAIDs may be helpful. Contrast baths—alternately submerging the affected foot in a basin of hot (but not scalding) water for 1 to 2 minutes, then immersing it in cold water for 30 to 60 seconds and repeating the process for about 20 minutes once or twice daily—may be helpful. Magnetic insoles are not recommended, as they have been found to be no better than sham insoles.³² Rarely, surgical repair of underlying mechanical abnormalities is indicated for treatment of refractory metatarsalgia.

CASE ► On examination, Jim F has no swelling, but some hyperkeratosis overlying the second and third metatarsal heads. He has tenderness to palpation at these heads as well as the corresponding metatarsophalangeal joints, and a negative tuning fork test.

You advise Jim that he has metatarsalgia, educate him about the pathophysiology of this condition, and give him a prescription for a nonsteroidal anti-inflammatory drug. You

FIGURE 1

Treatment for metatarsalgia is conservative



In addition to changing to more comfortable footwear, patients with metatarsalgia can place metatarsal pads like the one shown here in their shoes to ease the metatarsal load.

suggest he use contrast baths—and explain how this is done—once or twice a day and refer him to physical therapy for proper placement of metatarsal pads in his shoes, and schedule an appointment for a 6-week follow-up.

■ **Return to running.** There is no firm recommendation regarding abstaining from running with metatarsalgia. Advise patients to use pain as a guide in determining the intensity and duration of activity.

Stress fracture: Tenderness and pain of insidious onset

Stress fractures of the foot (SFF)—overuse injuries also known as fatigue fractures—are common in recreational runners. They are thought to result from microtraumas, which alone are not sufficient to break bone but together overwhelm the bone’s natural ability to remodel and recover over time. SFF are characterized by tenderness and pain of insidious onset, and typically occur when more than one training variable (eg, frequency, duration, and intensity) is changed simultaneously. SFF can also result from a change in exercise mechanics, such as foot strike.

Stress fractures can occur in any bone in the foot, but are most common in the metatarsal bones, specifically the mid or distal portion

➤ Overuse injuries, such as stress fractures of the foot, often occur when more than one training variable—frequency, duration, or intensity—changes simultaneously.

FIGURE 2
Severe pain with first steps of the day



The pain of plantar fasciitis—often most severe first thing in the morning—may localize to the insertion of the plantar fascia on the medial calcaneal tubercle, as shown above.

of the second or third metatarsal, or the tarsal navicular.^{2,33} On examination, the patient will have tenderness to palpation, often well localized. A positive tuning fork test (see page 647) is highly suggestive of a stress fracture.

In female runners, stress fractures may be associated with the female athlete triad—osteoporosis or osteopenia, disordered eating (specifically caloric deficiency and low BMI), and amenorrhea. In addition to the major long-term health problems that may result from even one component of the triad, SFF may be a short-term consequence.³⁴

Although SFF is a clinical diagnosis, x-rays—including 3-view plain films of the foot, with the area of concern clearly noted on the order—are recommended. Magnetic resonance imaging may be used for secondary imaging if doubt about the source of the pain remains.³⁵

Of note: Occasionally, a metatarsal stress

fracture progresses to a frank fracture, specifically of the metaphyseal-diaphyseal junction of the fifth metatarsal—known as a Jones fracture. This type of fracture has a high rate of malunion or nonunion.³⁶ If there is any suspicion of a fracture in this area, consider a referral to a sports medicine specialist or orthopedic surgeon.

■ **Treatment: Icing, analgesics, and a boot.** Standard treatment for SFF includes icing for 15 to 20 minutes up to 3 times a day for a minimum of 72 hours after injury, but may be continued throughout the healing period. Analgesics such as acetaminophen and a walking boot for 3 to 4 weeks, with follow-up at 3 weeks, should also be implemented. Recent evidence suggests that NSAIDs may hinder the bone healing process, and their use in treating SFF is controversial.¹⁰⁻¹²

■ **Weaning from the boot** can begin when the patient is pain free with the boot on, usually by 3 to 4 weeks. Patients often progress quickly from wearing the boot at all times to wearing it only outside of the house, to not wearing it at all. Advise patients who need to walk long distances for a good portion of the day to keep the boot nearby and to put it on if the pain returns.

Once weaning from the boot begins, physical therapy (PT) should be considered to help the patient regain foot and ankle range of motion (ROM), proprioception, and strength. Once he or she learns the exercises, rehabilitation can be accomplished with a home exercise program. Foot deformities, such as pes planus or pes cavus, may indicate a need for orthotics. A well-structured athletic shoe may help to prevent future injury.^{7,8}

■ **Return to running.** Once adequate ROM and strength in the foot and ankle are recovered, the patient can begin to resume activity, starting with a low-impact cross-training exercise, such as a stationary bike or elliptical, for a week or 2. A patient who remains pain free can progress from cross-training to running on a treadmill for another week or 2, then gradually switch to outdoor running.

Plantar fasciitis: Heel pain with an insidious onset

Plantar fasciitis is one of the most common causes of heel pain in athletes (primarily run-

A word about runners' footwear

The proper footwear for runners is subject to considerable debate, with arguments supported by contradictory evidence. What is known, however, is that running shoes should:

- be a comfortable fit with cushioning chosen to accommodate arch type
- be replaced after running 300 to 500 miles or every 12 months, whichever comes first^{27,28}
- be purchased from a sporting goods or running store, rather than at a discount retailer. That's because the shoes sold at discount stores are often older, and breakdown of the protective cushioning is more likely to have occurred prior to purchase.²⁸

The most expensive shoe is not automatically the best choice for the runner, however. Some studies have found no benefit in foot strike pressures with expensive cushioned running shoes compared with low- or medium-cost brands.²⁹ Shoes should be selected based on comfort, although the patient's arch type should also be considered when selecting running footwear.³⁰

Barefoot running shoes, designed to simulate barefoot running, are also an option. As with cushioned running shoes, evidence regarding barefoot running is contradictory. Some studies suggest that running mechanics are improved with barefoot running or barefoot running shoes; others have had unfavorable or inconsistent results, indicating a need for further research.^{9,31}



Some studies suggest that barefoot running or barefoot running shoes improve running mechanics; other studies have had unfavorable or inconsistent results.



ners) and nonathletes alike. Plantar fasciitis may be associated with acute trauma, but is more commonly insidious in onset. The diagnosis is clinical and rarely requires imaging.

Pain associated with plantar fasciitis may be described as sharp and stabbing or dull and aching. It is on the plantar surface of the heel, sometimes radiating to the arch, and may localize to the insertion of the plantar fascia on the medial calcaneal tubercle (FIGURE 2). The pain is typically most severe with the first few steps in the morning or after other periods of prolonged rest. It usually improves after a few steps, but may return later in the day. Plantar fasciitis does not cause paresthesias or other neurologic symptoms, so their presence is suggestive of a different diagnosis, such as nerve entrapment, compartment syndrome, or tarsal tunnel syndrome.^{3,5}

■ Treatment: It's multifactorial. NSAIDs are commonly used. Relative rest is recommended, but cross training may be considered to maintain fitness.³⁷ Short-term PT is also recommended to teach the patient proper stretching and strengthening techniques in the form of a home exercise plan. Modalities such as iontophoresis (a system of transdermal delivery of medication with the use of electrical currents), Graston (a form of instrument-assisted soft tissue mobilization), and

taping may be incorporated into PT, as well.¹³

Night splinting may also be used to keep the foot in a dorsiflexed position. A splint can be purchased without a prescription and prevents the plantar fascia from shortening overnight by providing a continuous passive stretch, thus reducing pain with first steps.¹⁴

Orthotics may also help to reduce symptom severity and duration, and studies have found no difference in outcomes with prefabricated vs custom-made devices.¹⁵ Another treatment to consider, particularly for recalcitrant cases of plantar fasciitis, is extracorporeal shock wave therapy, which has been studied for more than a decade with conflicting results.¹⁶ Corticosteroid injection may also be used for treatment-refractory plantar fasciitis, but caution is required, as the injection may increase the risk of rupture of the plantar fascia.^{17,18}

■ Return to running. There are no set guidelines for when an athlete with plantar fasciitis can return to running. Typically, after 2 to 4 weeks of relative rest and other treatments, the runner can begin to transition from cross-training to treadmill running.

Achilles tendinopathy: An overuse injury

Achilles tendinopathy (AT) is typically an

TABLE 1
Differential diagnosis for runners' foot pain²⁻⁵

Symptom	Differential diagnosis
Foot pain	<ul style="list-style-type: none"> • Compartment syndrome • Metatarsalgia* • Nerve entrapment • Neuroma (Morton's neuroma) • Plantar fasciitis* • Stress fracture of the foot* • Tarsal tunnel syndrome
Heel pain	<ul style="list-style-type: none"> • Achilles rupture • Achilles tendinopathy* • Calcaneal stress fracture • Fat pad atrophy • Haglund deformity • Plantar fasciitis* • Retrocalcaneal bursitis • Tarsal tunnel syndrome

*Represents a more common diagnosis.

overuse injury incurred by athletes, although it is sometimes seen in patients who are sedentary and overweight. With a prevalence among runners of approximately 11%, AT is sometimes called the “runners' disease.”⁴

Tendinopathy is a more accurate description than tendonitis, as histologic studies of affected Achilles tendons suggest that AT is a degenerative, rather than an inflammatory, condition.³⁸ A diagnosis of AT can be further classified as midportion or insertional.

■ **Midportion Achilles tendinopathy (MAT)**, characterized by pain that occurs in the body of the Achilles tendon and worsens with activity, is often a clinical diagnosis. Physical findings suggestive of MAT are tenderness to palpation of the midportion of the Achilles tendon, with thickening of the tendon, warmth, crepitus, or palpable nodules in the tendon body. Onset is insidious and is commonly associated with an increase in activity.

■ **Treatment: Orthotics or a heel lift.** Like that of plantar fasciitis, treatment of midportion Achilles tendinopathy is primarily conservative. The use of orthotics, or a heel lift, is one of the most cost-effective interventions, and they are widely used, despite limited evidence of efficacy.³⁹ Custom orthotics are costly, and patients

often benefit from trying prefabricated orthotics first to determine whether they will help.

■ **Eccentric exercises.** One of the most studied interventions for MAT is eccentric exercise training. Studies of eccentric exercises have been very favorable, and the exercises can be taught during routine PT sessions.¹⁹⁻²² Modalities such as ultrasound therapy and extracorporeal shock wave therapy (ESWT) have also been studied. But because results have been inconsistent, they are generally reserved for treatment-refractory cases.²³

In patients with no contraindications, NSAIDs may be a good choice for pain management with relatively favorable results in the literature.²⁴ Corticosteroid injections should not be used, as they have been directly linked to rupture of the Achilles tendon.²³

Other interventions, such as plasma-rich protein injections and prolotherapy—a technique in which an irritant is injected into the tendon in an attempt to create an inflammatory reaction, thus increasing local blood flow and healing—are being studied for the treatment of AT, but are not routinely used or covered by insurance for this purpose. Surgical intervention may be considered for patients whose symptoms last for more than 3 to 6 months despite conservative treatment.

■ **Insertional Achilles tendinopathy (IAT)** can be clinically differentiated from MAT by the location of symptoms and tenderness to palpation at the insertion site of the Achilles into the calcaneus. Like MAT, IAT is exacerbated by activity. Other conditions that may contribute to, or be mistaken for, IAT are a Haglund deformity and retrocalcaneal bursitis.

■ **Treatment: Footwear modification.** Treatment of IAT, like that of MAT, is primarily conservative. Orthotics or heel lifts are commonly used. However, there is greater emphasis on footwear modification due to the mechanical irritation and resultant posterior heel swelling often associated with IAT. While eccentric exercises play a role in IAT treatment, the benefits are limited.²⁵

As with MAT, corticosteroid injections are contraindicated due to the risk of tendon rupture. Modalities such as ultrasound, ESWT, plasma-rich protein, and prolotherapy lack sufficient evidence to be widely recommended.

TABLE 2
Diagnosing and treating common runners' injuries

Diagnosis	History	Physical exam	Interventions
Metatarsalgia	Plantar foot pain, insidious onset; occasional swelling, bruising, or deformity	Tenderness of MT heads; possible edema or hyperkeratosis; negative tuning fork test	Footwear: cushioning, wide toe box, MT pads; consider orthotics. Contrast baths; NSAIDs ⁶⁻⁹
Stress fracture	Pain, insidious onset, increasing in intensity and duration	Localized TTP; possible swelling or bruising; positive tuning fork test; X-rays/MRI may be helpful	Boot for minimum of 3-4 weeks, followed by PT for foot/ankle ROM, strength, proprioception Ice, acetaminophen (NSAIDs controversial) ¹⁰⁻¹² Progressive return to running*
Plantar fasciitis	Plantar foot/heel pain, worse with first steps in AM and after prolonged weight-bearing	TTP at medial calcaneal tubercle	Relative rest, NSAIDs, PT for HEP, Graston technique, taping; possible night splinting ¹³⁻¹⁵ Consider ESWT, corticosteroid injection for refractory cases ¹⁶⁻¹⁸
MAT	Posterior heel/Achilles pain in midportion; insidious onset, increasing in intensity, worse with activity	Tenderness midportion Achilles; possible tendon thickening; warmth, crepitus, nodules	Relative rest; PT for eccentric exercises; heel lift, with or without orthotics ¹⁹⁻²² Consider PRP, prolotherapy, ESWT, or ultrasound in refractory cases ^{23,24} Surgical intervention rarely indicated ³
IAT	Posterior heel/Achilles pain in insertion of Achilles; insidious onset, increasing in intensity; swelling possible; worse with activity	Tenderness with or without swelling; deformity at Achilles insertion	Relative rest; footwear modification (heel lift, possibly with orthotics); PT for eccentric exercises, though less valuable than for MAT ^{1,25}

*Starting with cross-training exercise, progressing to running on a treadmill, then to running outdoors.

[†]Corticosteroid injection contraindicated.

ESWT, extracorporeal shock wave therapy; HEP, home exercise program; IAT, insertional Achilles tendinopathy; MAT, midportion Achilles tendinopathy; MRI, magnetic resonance imaging; MT, metatarsal; NSAIDs, nonsteroidal anti-inflammatory drugs; PRP, plasma-rich protein; PT, physical therapy; ROM, range of motion; TTP, tenderness to palpation.

For refractory cases of IAT, surgical intervention often relieves the pain.

Return to running. After an initial rest of 2 to 4 weeks, patients may return to running while completing therapy. It's not necessary to wait until the patient is completely pain free, but pain should be used to guide decisions about intensity and duration of activity.

CASE ▶ When Jim returns 6 weeks later, he reports that he took 3 weeks off from running because of the pain. Initially, he used contrast baths daily, Jim says, but now he uses them only when he is symptomatic, and he discontinued the NSAID a few weeks ago. Jim tells

you he went to the local running store for a new pair of running shoes and that he is now able to run at his previous pace while remaining relatively pain free. **JFP**

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▶
Eccentric exercises, which focus on stretching and strengthening the muscles, have been found to be a highly effective treatment for Achilles tendinopathy.

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