CHAPTER **57**

RUNNING INJURIES OF THE LOWER EXTREMITY

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Injuries to the running athlete occur for a variety of reasons and can present a challenging and rewarding opportunity for the podiatric physician. The podiatric physician who devotes a portion of his or her practice to the care of the injured runner has learned to understand the mind set of the running patient (i.e. the desire to continue to pursue this activity despite injury, yet the willingness to accept advice from the competent physician regarding rest and recovery) and has developed an appreciation of the various etiologies of these injures.

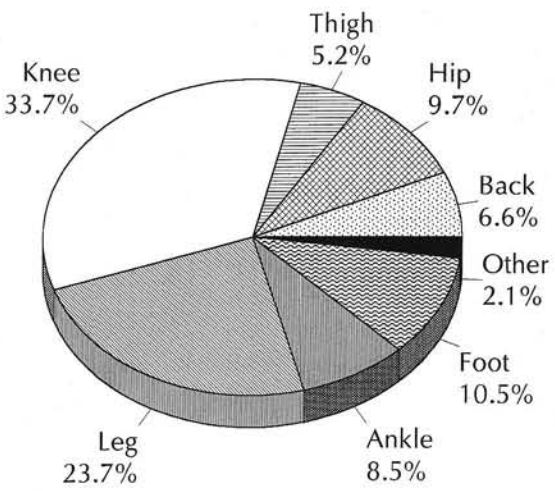
Fixx related that "Running or jogging has become not just a habit but an indispensable way of life to millions of Americans, and their numbers are increasing at a startling rate."[1] Due to this fact, the number of injuries related to running have steadily increased, with studies showing that 35% to 65% of runners are injured on a yearly basis.[2] Bovens[3] indicated an injury rate of 85% in an 18-month follow-up study. While these numbers are quite high, the true number of running injuries may be much higher, because many runners treat themselves and understand the causes of injuries and how to adjust their methods to maintain their activity. Elite runners may present to the podiatrist's office with an entire arsenal of running shoes and orthotic devices and a page full of treatments that they have already attempted without success, desiring a treatment plan that will not alter their current level of fitness.

Running injuries range from subungal hematomas to ulnar and radial fractures secondary to falls, or car versus runner accidents, and the entire spectrum in between. Garrick reported that the majority of all sports injuries (55% to 90%) involve the lower extremity, with the knee, ankle, and foot acknowledged as the most commonly injured parts.[4] In an overview of the rates of foot and ankle injuries by sport, running accounted for the largest percentage, approximately 27%.[4] Epidemiological studies of running injuries indicate the knee sustains the highest rate of injury (24% to 41.7%)[2,5,6,7] with injuries of the knee and distal accounting for 70% to 91% of all running-related injuries (Table 1).[5,6] Brody reported that approximately 70% of runners will sustain an injury, preventing running for 7 to 10 days with only 5% seeking any medical intervention.[8]

With these considerations in mind, the authors will attempt to provide an insight into the etiologies of injuries, including running mechanics, types of running-related injuries and how to best serve these patients through a proper treatment and rehabilitation plan.

Table 1

Distribution of Running Injuries



ETIOLOGY OF RUNNING INJURIES

Running injuries are caused by a combination of underlying etiologies which can be divided into intrinsic (structural and running biomechanics) and extrinsic (running surface, shoe wear, amount and level of running) and an understanding of both is essential in the evaluation and development of a

treatment plan. The occurrence of injury has been directly correlated with high weekly mileage (>40 miles),[2,5,7,9,10] with a history of a prior running injury[5,9] also playing a role in future injuries. Other factors including hill running, running surfaces, excessive running shoe wear, and increased speed have also been identified. Runners have been classified based on their level of activity and speed with various injuries more common in the different classes of runners (Table 2).[8] The injuries which occur in lower level runners are often not seen in higher level runners, as they would have limited this group's ability to achieve that level. The severity of injury and the relative decrease in activity have been described and are helpful in determining the prognosis of rehabilitation potential (Table 3).[11]

The many factors associated with running injuries are essential in the diagnosis of the injury as well as determining the types of treatment and rehabilitation activities in which the patient may participate. Running injuries can be either acute or overuse in nature, with both having different etiologies and treatments. This paper will focus on the overuse syndromes sustained by runners.

Overuse injuries result from repetitive forces applied to the body over a time period without the ability for the body to recover or adapt.[12] The

Table 2

CLASSIFICATION OF RUNNERS

LEVEL	TYPE	DISTANCE(MILES/WEEK)	PACE (MINUTES/MILE)
1	Jogger	2-20	10 - 20
2	Sports Runner	20-40	8 - 10:30
3	Competitive Long Distance Runner	40-60	6 - 9
4	Elite or National Class	>60	5 - 6:30

Adapted from Brody DM: Techniques in the Evaluation and Treatment of the Injured Runner. *Ortho Clin North America* 13(3):541-558, 1982.

Table 3

CLASSIFICATION OF INJURY, BASED ON SEVERITY AND DISABILITY

Level	Modification of Running Activity	Description
I	No change, maintain training	Injury/pain does not affect athletic activity.
II	Decrease duration/intensity	Injury/pain restricts normal athletic activity. Daily runs must be shortened and run at slower pace
III	Eliminate part of training	Injury limits ability to perform activity daily. Alternative fitness activities recommended for alternate days
IV	Eliminate all training	Injury requires cessation of running and interferes with daily life activities. Patient may require non-weight bearing for protection

Adapted from Requa RK, DeAvilla LN, Garrick JG: Injuries in recreational adult fitness activities. *Am J Sports Med* 21(3):461-467, 1993.

following questions can help clue the practitioner to the severity and type of injury:

> When does it begin to hurt, at the start, middle and/or end of your run?
>
> Was the onset quick or gradual?
>
> Does it hurt in your non-running activities (athletic and daily)?
>
> Does it hurt with all types of shoes?
>
> How many miles do you have on this pair of shoes? (300-500 miles are considered normal wear)
>
> How much do you run on an average day, in an average week?
>
> Have you recently increased your mileage or your speed?
>
> Are you running more hills or on a different surface?
>
> Did you have any injuries to the region prior to beginning running or have you had any prior injuries in that region? Have you attempted any treatment modalities, and have they helped?

The physical examination of the injured runner or athlete is much different than the standard podiatric examination, because the etiology of their symptoms is directly related to their activity. The examination centers not only on the patient's chief area of complaint, but also on the structures that may be contributing to the pathology, including a thorough evaluation of the runner's shoes. Runners should be instructed to bring appropriate running attire (shorts, shoes, orthotic devices) so that a complete examination can be performed on the initial visit. The standard evaluation including biomechanical evaluation in weight bearing and non-weight bearing positions can provide clues to the underlying etiology.

The examination consists of evaluation of the hip, knee, foot and ankle for any range of motion variations, as well as joint stress testing in an attempt at reproducing the presenting pain. Structural variations, such as leg length discrepancies, muscle weakness, etc. must be evaluated for their contribution to the patient's pathologic compensation. Joints must be evaluated for effusions and pain at the insertions of muscular groups surrounding those joints. An evaluation for a leg length discrepancy must be performed, as this may lead to pathomechanical compensation. If the injured runner presents with non-traumatic complaints centered about the knee, the patella is examined for abnormal tracking or position, and the Q (quadriceps) angle is measured (Fig. 1). Measurements for tibial varum and the usual range of motion examination of the foot and ankle are then performed with the identification of the foot's neutral position.

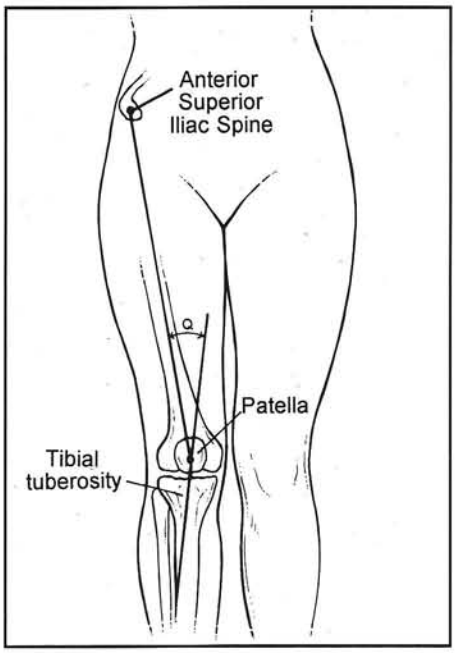


Figure 1. The Q (quadriceps) angle is the measurement of angulation between lines drawn from the center of the patella to the ASIS and the tibial tuberosity with the quadriceps contracted. Normal values are < 10 degrees in males and <15 degrees in females.

The patient is then evaluated in stance, initially evaluating the back for spinal abnormalities with symmetry of the lower extremities observed. Flexibility is tested including toe touches for evaluation of hamstrings, calves and lower spine. Leg length examination is again evaluated by observing the anterior superior iliac spines. The evaluation for tibial varum and foot compensatory mechanisms are then evaluated. Navicular drop[13] attempts to quantify the amount of pronation by comparing the height of the navicular with the foot in subtalar joint neutral and in resting stance. Normal is measured as 10 mm, with > 15 mm indicative of abnormal pronation. The combination

of non-weight bearing and stance measurements give the practitioner a limited picture of the patient's pathology, with observation in running gait then indicated for more specific evaluation.

The patient's gait examination should consist of the patient in both walking and running gait. It is important for the practitioner to acknowledge and have an appreciation of the differences including the airborne or swing phase, and the support or stance phase (Fig. 2).[13] Running gait has a double float phase where both feet are off the ground, increasing force on foot contact as compared to the double support phase of walking gait. Gait is evaluated for symmetry of motion of all aspects of the body with the patient requiring an adequate runway to allow normal running form. The use of a treadmill and video equipment are often helpful to allow the patient to achieve a gait rhythm which will allow pathologic compensations to become evident. The initial contact site on the foot varies with the different levels of running as does the amount of time spent in the stance phase. Pink described the time spent in stance and swing in recreational runners with the fast pace group (6.8 minutes/mile) spending 6% less time in stance as compared to the slow pace group (9.1 minutes/mile).[13] The peak vertical force during running gait was also noted to occur during midstance, with many authors describing toe-off as a more passive motion due to the rotation of the torso in running. Brody[14] described that the feet impact the ground 50 to 70 times per minute with 2 to 4 times the force of body weight. This causes minor biomechanical abnormalities that go unnoticed with walking gait to become pronounced in running.

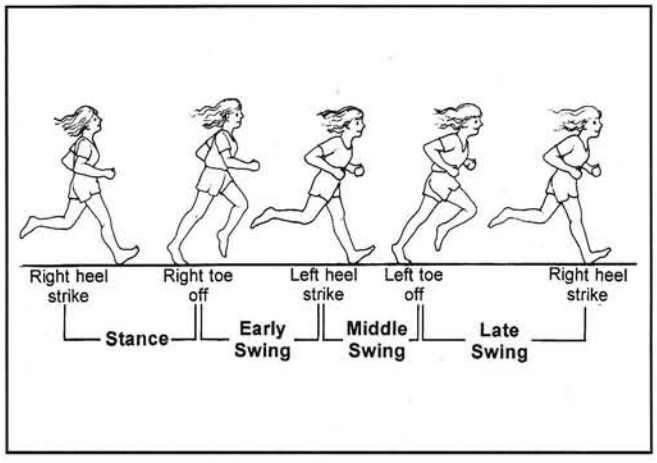


Figure 2. Running gait.

A complete history and physical examination can be an excellent indicator of the type of injury sustained, but the progression of some injuries and multiple diagnosis with similar presentation require the use of diagnostic testing to provide the additional information necessary for accurate diagnosis. The use of radiographic studies including plain film x-rays, computed axial tomography scans, magnetic resonance imaging, and bone scans and the ability to measure compartment pressures allow more accurate diagnosis and increase the ability to provide an appropriate prognosis and therapeutic plan.

TYPES OF RUNNING INJURIES

The types of injuries sustained in runners are too numerous to count and with the possibility of both acute and chronic or overuse injuries, the discussion of all running injuries is endless. The following will focus on the more common presentation of running injuries, the overuse injuries that are often exclusive to distance runners.

Patellofemoral Syndrome (Chondromalacia, Runner's Knee)

Patellofemoral pain syndrome is the most common running injury (16% to 25.8%)[7,6] resulting in 30% to 53%[10] of running-related knee injuries. It is commonly caused by an abnormal lateral tracking of the patella on its femoral articular surface, secondary to muscle imbalance (weaker vastus medialus or tight vastus lateralus), deficient lateral femoral condyle, increased femoral anteversion, structural articular abnormalities, ligamentous pull, or increased Q angle secondary to pronatory adaptations in the lower extremity. The commonly used term chondromalacia is incorrect, as the symptoms are not due to cartilage damage (usually from prior traumatic injury), but rather due to pressure of the articular surfaces of the patella and femoral articular surface secondary to the abnormal patellar tracking (Fig. 3).

Pain usually presents insidiously, with pain first noticed at the end of the run especially with increased amounts of hill running and stair climbing. As the symptoms progress, the pain may occur with the initiation of running and then resolve during the run, with eventual return at the end of the run. Pain with prolonged compression of the patella on the femoral articulation while

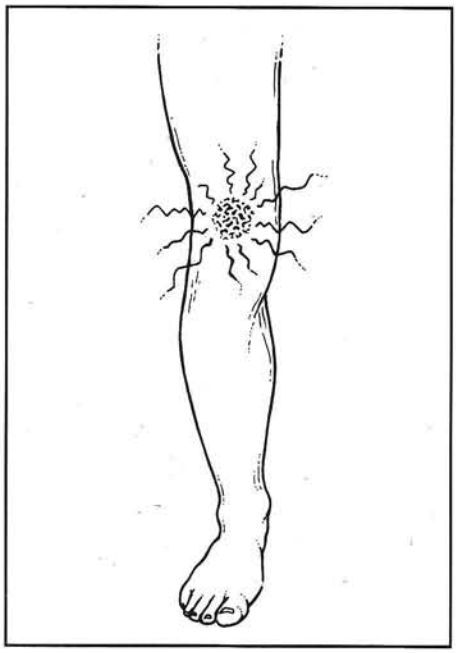


Figure 3. Pain is located at, and inferior to the patella in patellofemoral syndrome.

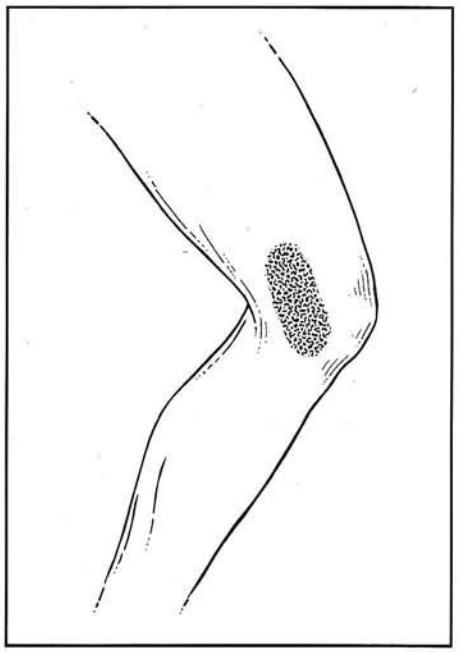


Figure 4. Diffuse pain in Iliotibial band syndrome.

sitting for long periods of time, termed the "theater sign",[15] is a non-activity related complaint. Examination of the knee reveals pain with direct patellar palpation and compression (Clar's sign) as well as shifting the patella laterally (the "apprehension sign") on the femoral articulation. Resisted extension of the knee from 30 degrees of flexion reproduces the symptoms. Radiographic examination of the knee using a tangential or sunrise view reveals a "jockey cap" shaped patella with lateral deviation on the lateral femoral condyle.

Treatment involves decreasing running and using methods to decrease the inflammatory process, including nonsteroidal anti-inflammatory drugs (NSAIDs) and ice application. Other activities which increase articular pressure including stair climbing, prolonged sitting, and knee bending should be decreased or eliminated. Stretching of the hamstrings and strengthening of the quadriceps, focusing on the vastus medialus, are important in the rehabilitation process as is a gradual return to running on flat surfaces. The use of orthotic devices to limit pronation, with its resultant transverse plane rotation at the knee, is appropriate, as are various patellar straps and braces to assist with normal tracking of the patella. Examination of shoes for breakdown which may be allowing abnormal pronation should be considered prior to orthotic management, as shoe collapse can allow for severe collapse through the midstance period. Proper support and strengthening allows for early return and prevention of recurrence in the runners with patellofemoral syndrome.

Iliotibial Band Syndrome

Iliotibial band syndrome comprises between 10.6%[6] and 17%[10] of running-related knee injuries and approximately 4% of overall running injuries.[6] The iliotibial band is a thickening of the fascia lata originating from the iliac spine and coursing to its insertion on the anterolateral tibial condyle (Gerdy's tubercle). Iliotibial band syndrome occurs secondary to the iliotibial band becoming irritated over the lateral femoral epicondyle with repetitive flexion and extension of the knee. Injury is commonly the result in increased intensity or mileage with pronatory forces causing increased and rapid internal tibial rotation during foot strike and mid-support. Conversely, the patient with tibial varum and supinated foot is very prone to this injury due to increased tethering of the band against the femoral condyle.

Running on hills, especially downhill, increases stress on the iliotibial band and can also play an important role (Fig. 4). Patients commonly complain of pain at the lateral femoral epicondyle, with occasional pain radiating to the tibia, which is

pronounced with walking, running, or stair climbing or descent. Pain is most evident when the patient enters the stance phase of the cycle and relief is only achieved with straight leg walking to decrease the irritation. The diagnosis can be made by performing either the Noble or Rinne test. The Noble test identifies iliotibial band syndrome with the patient in a supine position and the knee flexed at 90 degrees with the examiner extending the knee while palpating the lateral femoral condyle. A positive Noble test reproduces the pain when the knee extends to 30 degrees of flexion. The Rinne test is performed with the patient standing on the injured extremity and bending at the knee with pain reproduced when flexed to approximately 30 degrees.

A three-step process[16] for the treatment of iliotibial band syndrome was proposed by Linenger with Stage I consisting initially of resting and decreasing activity, stretching, ice, and NSAIDs. Stage II progresses with steroid injections with compensatory biomechanical support. The final intervention, which is rarely warranted, consists of surgical release of tight posterior fibers in Stage III. The return to activity is dependent on decreased symptoms and the patient maintaining a thorough stretching regimen which involves isolating the iliotibial band, by crossing the affected leg with adduction across the non-involved extremity. Combining this with biomechanical support will decrease the irritation at the iliotibial band and allow the patient to gradually return to pre-injury activity levels.

Popliteal Tendinitis

Popliteal tendinitis occurs commonly with a lot of downhill running, as the popliteus acts to resist anterior subluxation of the femur on the tibia (Fig. 5). The popliteus originates at the posteromedial aspect of the tibia and courses proximally to insert onto the lateral femoral epicondyle. Pain may be due to stretch on the popliteus, with internal rotation of the knee in pronation. The pain is isolated with palpation anterior to the lateral collateral ligament of the knee at the insertion of the popliteus tendon. The pain is increased with any motions that resemble the causes, including internal rotation and posterior displacement of the tibia on the femur in a non-weight bearing position.

Treatment involves elimination of any hill-running and attempts to decrease pronation including orthotics in coordination with ice therapy and NSAIDs. Stretching prior to running, and a gradual return on flat surfaces are essential in returning to pre-injury running levels.

Medial Tibial Stress Syndrome

Medial Tibial Stress Syndrome composes a variety of entities that involve the medial aspect of the tibia. It has been noted to afflict from 6%[9] to 19.5%[17] of injured runners, and is common in patients whose activities involve large amounts of jumping and forefoot gait.

The commonly used term of "shin splints" was described by the American Medical Association as pain and discomfort in the leg from repetitive running on hard surfaces or forcible, excessive use of the foot dorsiflexors.[18] This definition was used to exclude fractures and ischemic disorders such as exercise-induced compartment syndrome. Many authors have varied opinions on the exact components of shin splints, and therefore more specific terms including medial tibial stress syndrome, stress fractures, soleus myositis, posterior tibial tendonitis, and exertional compartment syndrome are more appropriately used. Pain localized to the anterior aspect of the

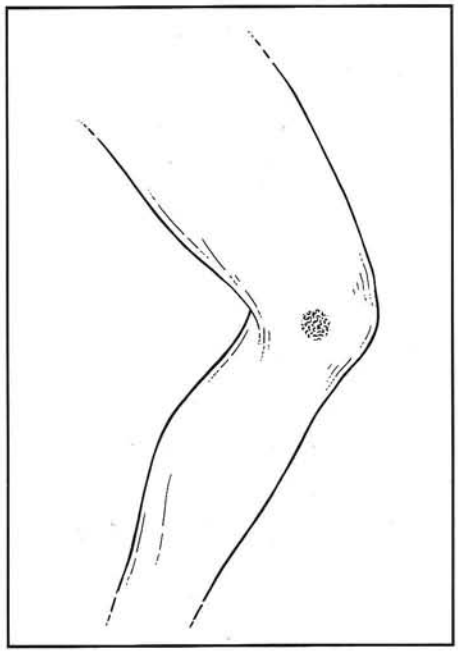


Figure 5. Pinpoint tenderness localized with popliteal tendinitis.

tibia is more common of a stress fracture, chronic anterior compartment syndrome or anterior tibial myositis/tendonitis, while the medial pain has been described on a continuum of processes producing the symptoms (Fig. 6).

Authors have different opinions as to the pathologic continuum, with Fredrickson using a combination of bone scans and MRI to identify the progression of the tibial stress reaction with various grades of periostitis noted (Table 4)[19] Patients complain of a dull ache progressing to sharp pain at the posteromedial border of the tibia at the junction of the middle and distal thirds of the leg. Pain is reproduced with deep palpation in this region, or with testing of the deep posterior muscle group. These injuries can present in the same fashion as deep posterior compartment syndrome, therefore it may be necessary to perform compartment pressure measurements if symptoms arise in the middle to end of activity. As with most overuse injuries, the symptoms usually arise at the beginning of the work out, with alleviation during activity, and returning following the run. Progression of the syndrome results in pain throughout the workout and affecting daily activity. Medial tibial stress syndrome is common in runners and jumping athletes who rapidly increase their levels of training, run on canted surfaces, and have hyperpronatory-type gaits.

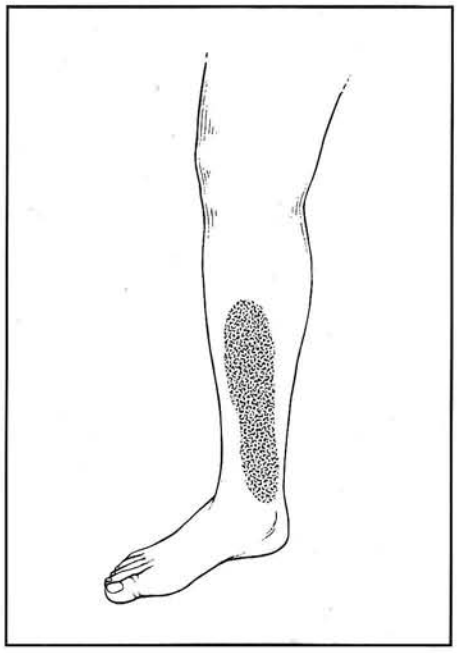


Figure 6. Medial tibial stress syndrome

Table 4

DESCRIPTION OF BONE SCAN AND MRI RESULT FOR CONTINUUM OF MEDIAL TIBIAL STRESS SYNDROME

		MRI		
GRADE	**BONE SCAN**	**PERIOSTEAL EDEMA**	**MARROW EDEMA**	**FRACTURE**
1	Mild diffuse increased activity	Mild-Moderate on T2	normal	No
2	Moderate increased activity more localized to cortex	Moderate-Severe on T2	T2	No
3	Severely increased activity at corticomedullary region	Moderate-Severe on T2	T1 and T2	No
4	Intense activity in transcortical region	Moderate-Severe on T2	T1 and T2	Yes

Adapted from Fredrickson M, Bergman AG, Hoffman KL, Dillingham MS: Tibial Stress Reaction in Runners: correlation of clinical symptoms and scintigraphy with a new magnetic resonance grading system. *Am J Sports Med* 23(4):472-481, 1995.

Table 5

COMPARISON OF PRESSURE MEASUREMENTS BETWEEN NORMAL AND EXERTIONAL COMPARTMENT SYNDROME

Time of Measurement	Normal	Exertional Compartment Syndrome
Resting Pressure	9.5	> 15
One Minute after Exercise	13	> 30
Five Minutes after Exercise	10.75	> 20

Adapted from Pedowitz RA, Hargens AR, Mubarak SJ, Gershuni DH: Modified criteria for the objective diagnosis of chronic compartment syndrome of the leg. *Am J Sports Med* 18(1):35-40, 1990.

posterior compartment involved a vertical incision made posterior to the tibia at the medial junction of the middle and distal thirds of the leg, deepened to the superficial posterior compartment followed by identification and a longitudinal incision of the fascia overlying the deep posterior compartment. Symptoms persisted for 16 months prior to surgical intervention. Excellent results were seen in 65% of the procedures, and poor results in 15%.

In both groups, postoperative care consisted of weight bearing as tolerated, with progression to stretching exercises and jogging (6 weeks) and full running activity (8 to 12 weeks). Biopsy was not performed of the periosteum or muscle interface, therefore it is not known if all of these cases were compartment syndrome or medial tibial stress syndrome. This indicates that pain at the postero-medial tibial is likely multi-factorial in nature. Exertional compartment syndrome is an entity that most practitioners have not treated or diagnosed, but one that must be considered with runners and other athletes who exercise for prolonged periods of time increasing blood flow to the lower extremity.

Stress Fractures

Stress fractures are often correlated with running and repetitive jumping athletes. Many athletes will present to the office after having seen several physicians for their chronic foot, ankle or leg pain. They have been given a host of diagnoses, however nothing has appeared to resolve their symptoms. It is important for the podiatric physician to have a high index of suspicion for stress fractures when treating the athletic patient.

The incidence of stress fractures in runners ranges from 4.8%[6] in a retrospective survey of runners to 37% in female collegiate cross-country runners.[24] Stress fractures in general are attributed to one of two causes, abnormal bone with normal stresses, or normal bone with abnormal stresses. Running can combine the two, as runners greatly increase the load put on the foot with 2 to 4 times body weight in gait with an increase in the number of times the foot hits the ground per minute. The increased loading sustained by the lower extremity accentuates any abnormal structures or compensations the body makes, therefore increasing the chances of injury. McBryde described the injury as "a partial or incomplete fracture of a bone due to its inability to withstand nonviolent stress that is applied in a rhythmic, repeated subthreshold manner" (Fig. 8).[25]

Figure 8. The classic "Runner's Fracture" of the distal fibula due to hyperpronation with repetitive loading of the lower extremity.

Stress fractures arise from errors in training in 60% to 75%[25] of runners sustaining these types of injuries. The nonviolent stress comes from both direct weight bearing loading or rotational forces. Stress fractures sustained by runners have been reported in areas ranging from the sesamoids to the spine with the greatest incidence (34%) occurring in the tibia.[25] Various structural components can also predispose patients to stress fractures, including a hypermobile or short first ray and frontal plane tibial pathology.

The patient will describe the pain as being most severe with running and eventually walking, which is relieved by rest. The pain will eventually dissipate after decreasing activity. Runners will complain of pain in a diffuse anatomic region with pinpoint tenderness often localized with palpation. Tenderness can often be elicited in the surrounding muscle and soft tissue which makes the diagnosis difficult in more proximal bones as is evidenced with medial tibial stress syndrome. Reproduction of pain by placing a vibrating tuning fork on any segment of the bone or with the use of ultrasound, can help differentiate osseous pathology versus contiguous soft tissue pain.

Radiographic plain films are often misleading and it is important to take follow-up films to identify callus if the pathology is indeed a stress fracture. Positive films may not be evident for at least two weeks, with radiographic changes often failing to appear for 4 to 6 weeks. The use of scintigraphy or bone scans with increased uptake at a localized segment is beneficial in diagnosing and following patients, as the scan can be positive 1 to 2 days after fracture and remain hot at least one year while remodeling occurs with continued decrease in signal intensity. The use of CT and MRI may also be of benefit in the diagnosis and can establish other diagnosis.

Once the diagnosis of stress fractures is identified, the treatment plan consists of activities and support that prevent the pathologic stress with attempts made to maintain fitness through alternative activities. Patients may need to be non-weight bearing or use protective measures to decrease the stress, especially at sites that are at high risk for complete fracture. Surgical management is sometimes indicated if the patient and physician feel that an earlier return to range of motion and activity is desired. In general, treatment consists of decreasing running to an asymptomatic level, and restricting the return to full activity until the patient is completely pain-free. As with all running injuries, a gradual increase in activity with attempted correction of the pathologic forces is indicated.

Achilles Tendinitis

Injuries to the Achilles tendon in sports range in severity as well as anatomic location. The variety of injuries sustained by the Achilles tendon complex make the management and exact diagnosis essential in determining the patient's prognosis and eventual return to activity. Injuries to the Achilles tendon range from acute rupture which is rare in running, to the common Achilles tendinitis or retrocalcaneal bursitis with injuries to the complex occurring in 2.7% to 20.3% of patients.[26] Schepsis[27] described paratendonitis (29%) and retrocalcaneal bursitis (30%) as the two most common injuries related to overuse running injuries. With the exception of the acute rupture, the onset is usually insidious in nature, with pain occurring at the beginning of the run and the patient being able to continue activities as it gradually decreases. Progression of the symptoms occurs with the patient eventually having discomfort throughout the run and into everyday activities. The symptoms can be secondary to intrinsic causes including Haglund's deformity, gastrocnemius or gastrocsoleal equinus, or extrinsic causes (increased mileage, increased speed, increased hill running, tight shoes) with pain localized over the center of the irritation (Fig. 9).

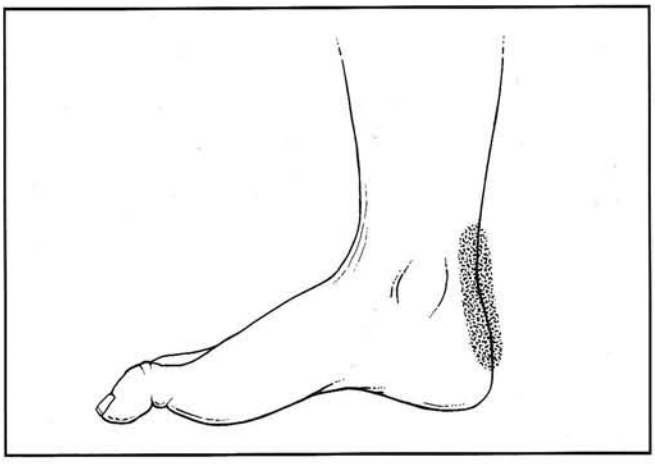


Figure 9. Localized tenderness over the Achilles tendon and related structures.

Treatment options range from the conservative including decreasing activity, NSAIDs, shoe changes, biomechanical support (heel lifts, orthosis), and ice, to surgical options including spur or calcification excision. It is important to determine the etiology of the symptoms prior to treatment, and direct the therapy correspondingly. Steroid injections are usually avoided due to the potential for rupture. Stretching exercises include leaning against a wall with the knee of the affected leg extended and stretching the Achilles tendon with the foot in a neutral to slightly internal position. The return to activity varies with treatment, but must be graduated with small increases in activity. Emphasis should be placed on stretching and maintaining mechanical support.

Plantar Fasciitis

Plantar fasciitis is the most common running-related injury to the foot accounting for approximately 26% of foot complaints[6] with an aggressive approach taken in runners. The classical symptoms of first step pain are frequently evident with pain occurring at the beginning of the run, and symptoms resolving and then returning at the end of the run. As symptoms continue, there is no longer relief in the middle of the run, and symptoms are noted to be increased with hill running or any running on very soft surfaces including sand and gravel. The true etiology of plantar fasciitis is still in debate, but many running factors including increased pronation due to a variety of causes lead to an increased stretch in the plantar structures resulting in pain with palpation at the medial calcaneal tubercle. Radiographs should be taken in long-standing cases to rule-out calcaneal stress fractures and rarer etiologies.

Many of the standard treatment modalities including ice, rest, stretching of the Achilles and plantar fascia, heel cups, and NSAIDs, will have probably been attempted when the runner presents to the office. Additional treatments include low-Dye strapping, orthotic management, and steroid injection, with surgery being considered in cases recalcitrant to conservative treatment. As with all running injuries, providing the athlete with alternative exercise is essential in allowing the patient to maintain their fitness and to maintain a positive psychological attitude during their absence from the normal running routine.

Some common running injuries have been described, but many others should be considered including sesamoiditis, bunion pain, retrocalcaneal exostosis, sciatica, ischial and greater trochanteric bursitis, multiple muscle strains and other overuse syndromes. Acute injuries including isolated muscle strains, tendon ruptures, ankle sprains and fractures can occur in all athletes with many instances reported in runners. Injuries can also be sustained due to environmental conditions, including cold injuries and sunburn which can greatly affect a person's ability to continue running. Evaluation of the region of chief complaint, and an understanding of the why and what of running will greatly assist the physician in determining why your patient has a specific complaint.

TREATMENT OF THE INJURED RUNNER

The treatment of any athlete at any level is a difficult problem as most are in some type of progression of their training, whether it is to lose 10 pounds, run a local 5K race or to compete in an ultra marathon. They consider any decrease in training defeat. It is important for the physician to understand both the runner's desire to reach a pain free level for activity, and need to get there without continued setbacks and injuries during the rehabilitation and training period. Treatment should consist of 3 steps, RICE, protective maintenance, and prevention and progression.

The initial step in the rehabilitation process is to decrease the inflammatory response responsible for the symptoms and this involves the four components of the RICE principle (Rest, Ice, Compression, and Elevation). Resting the injured site by eliminating the etiologic factor is the first step, with ice compression and elevation used in combination with anti-inflammatory medications. The use of a frozen paper cup of water in ice massage in the initial phase helps with both stretching and decreasing inflammation.

Protective maintenance occurs in numerous fashions based on the severity of injury, and can range from decreasing activity to complete non-weight-bearing support. The runner's first question is often "When can I start training again?" This is followed by "What did I injure?" This makes it difficult for the physician who wants to have the patient eliminate all activity. Attempts are made to

allow the patient to continue with running by decreasing mileage, decreasing speed, encouraging level running surfaces, changing shoes, and encouraging a thorough warm-up and cool down. The use of moist heat and stretching prior to runs combined with more stretching and ice massage after activity are beneficial in maintaining activity while allowing the body to repair itself. Decreasing running is sometimes inadequate for treatment, and instructing a runner to stop activity and follow-up in one week will have them turn to someone else for treatment. It is important to provide runners with alternative methods of activity including cycling, rowing or skiing machines, and swimming. The use of "water-jogging" has been shown to provide equal cardiovascular training with a decrease in the repetitive stress applied in running (Fig. 10).

The third component of treating running injuries is to prevent the recurrence of injury while allowing the patient to progress to the training level they desire. Prevention necessitates identifying the etiology of the injury and eliminating it through education, biomechanical support (proper shoes, orthosis) and proper coaching. This includes informing and educating the patient that the rehabilitation may be a long process. By supplementing their running routine with alternative training methods they can maintain a high level of fitness while gradually increasing their running to pre-injury levels.

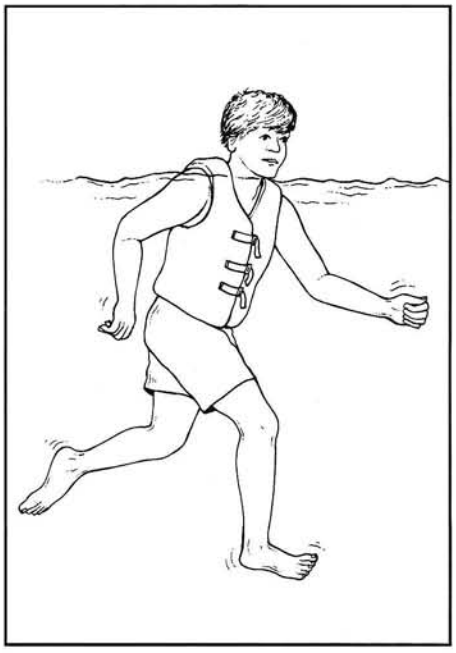


Figure 10. Jogging in a pool with the use of a life-vest imitates running without the stress on the injured extremity.

CONCLUSION

Runners can be very difficult patients to manage. The stress they place on their body greatly increases the likelihood of injury. Their desire to continue the activity makes treatment plans very complicated. It is important for the physician to completely evaluate the patient during the activity that causes discomfort to identify the abnormal compensation or training regimen that is contributing to their complaints. Attempts must be made to protect and rehabilitate the injured runner, while providing alternative activities for them to maintain their fitness. Education of runners as to improper techniques and ways to strengthen their extremities are the key to successfully treating the injured runner, and will help to provide proper care for the running community.

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