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Plantar Fasciitis

- Author: Craig C Young, MD; Chief Editor: Craig C Young, MD [more...](#)

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Background

Plantar fasciitis is the pain caused by inflammation of the insertion of the plantar fascia on the medial process of the calcaneal tuberosity. The pain may be substantial, resulting in the alteration of daily activities. Various terms have been used to describe plantar fasciitis, including jogger's heel, tennis heel, policeman's heel, and even gonorrheal heel. Although a misnomer, this condition is sometimes referred to as heel spurs by the general public.

There are many diagnoses within the differential of heel pain; however, plantar fasciitis is the most common cause of heel pain for which professional care is sought. Approximately 10% of the United States population experiences bouts of heel pain, which results in 1 million visits per year to medical professionals for treatment of plantar fasciitis.^[1] The annual cost of treatments for plantar fasciitis is estimated to be between \$192 and \$376 million dollars.^[2] The etiology of this condition is multifactorial, and the condition can occur traumatically; however, most cases are from overuse stresses.

The typical presentation is sharp pain localized at the anterior aspect of the calcaneus. Plantar fasciitis is often associated with a heel spur (exostosis); however, many asymptomatic individuals have bony heel spurs, whereas many patients with plantar fasciitis do not have a spur.^[3]

Plantar fasciitis can be a difficult problem to treat, with no panacea available. Fortunately, most patients with this condition eventually have satisfactory outcomes with nonsurgical treatment.^[4] Therefore, management of patient expectations minimizes frustration for both the patient and the provider.

Anatomy

The plantar fascia is a thickened fibrous aponeurosis that originates from the medial tubercle of the calcaneus, runs forward to insert into the deep, short transverse ligaments of the metatarsal heads, dividing into 5 digital bands at the metatarsophalangeal joints^[5] and continuing forward to form the fibrous flexor sheathes on the plantar aspect of the toes. Small plantar nerves are invested in and around the plantar fascia, acting to register and mediate pain.

The plantar fascia is made up of 3 distinct parts: the medial, central, and lateral bands. The central plantar fascia is the thickest and strongest section, and this segment is also the most likely to be involved with plantar fasciitis. In normal circumstances, the plantar fascia acts like a windlass mechanism to provide tension and support through the arch.^[6] It functions as a tension bridge in the foot, providing both static support and dynamic shock absorption.^[7]

Pathophysiology

Biomechanical dysfunction of the foot is the most common etiology of plantar fasciitis; however, infectious, neoplastic, arthritic, neurologic, traumatic, and other systemic conditions can prove causative. The pathology is traditionally believed to be secondary to the development of microtrauma (microtears), with resulting damage at the calcaneal-fascial interface secondary to repetitive stressing of the arch with weight bearing.^[8, 9, 10]

Excessive stretching of the plantar fascia can result in microtrauma of this structure either along its course or where it inserts onto the medial calcaneal tuberosity. This microtrauma, if repetitive, can result in chronic degeneration of the plantar fascia fibers. The loading of the degenerative and healing tissue at the plantar fascia may cause significant plantar pain, particularly with the first few steps after sleep or other periods of inactivity.

The term fasciitis may, in fact, be something of a misnomer, because the disease is actually a degenerative process that occurs with or without inflammatory changes, which may include fibroblastic proliferation. This has been proven from biopsies of fascia from people undergoing surgery for plantar fascia release.

Studies have introduced the etiologic concept of fasciosis as the inciting pathology. Fasciosis, like tendinosis, is defined as a chronic degenerative condition that is characterized histologically by fibroblastic hypertrophy, absence of inflammatory cells, disorganized collagen, and chaotic vascular hyperplasia with zones of avascularity.^[11, 12, 13, 14]

These changes suggest a noninflammatory condition and dysfunctional vasculature. With reduced vascularity and a compromise in nutritional blood flow through the impaired fascia, it becomes difficult for cells to synthesize the extracellular matrix necessary for repairing and remodeling.^[15]

Biomechanics of running

During running, the vertical forces in the foot at foot strike may reach 2-3 times an individual's body weight.^[16] The plantar fascia and longitudinal arch are also part of the foot's shock absorption mechanism. During the heel-off phase of gait, tension increases on the plantar fascia, which acts as a storage of potential energy. During toe-off, the plantar fascia passively contracts, converting the potential energy into kinetic energy and imparting greater foot acceleration.

Etiology

The cause of plantar fasciitis is often unclear and may be multifactorial. Because of the high incidence in runners, it is best postulated to be caused by repetitive microtrauma. Possible risk factors include obesity, occupations requiring prolonged standing and weight-bearing, and heel spurs.^[17] Other risk factors may be broadly classified as either extrinsic (training errors and equipment) or intrinsic (functional, structural, or degenerative).

Extrinsic risk factors

Training errors are among the major causes of plantar fasciitis. Athletes usually have a history of an increase in distance, intensity, or duration of activity. The addition of speed workouts, plyometrics, and hill workouts are particularly high-risk behaviors for the development of plantar fasciitis. Running indoors on poorly cushioned surfaces is also a risk factor.

Appropriate equipment is important. Athletes and others who spend prolonged time on their feet should wear an appropriate shoe type for their foot type and activity (see Treatment).^[18] Athletic shoes rapidly lose cushioning properties.^[19] Athletes who use shoe-sole repair materials are especially at risk if they do not change shoes often. Athletes who train in lightweight and minimally cushioned shoes (instead of heavier training flats) are also at higher risk of developing plantar fasciitis.

Intrinsic risk factors

Structural risk factors include pes planus, overpronation, pes cavus, leg-length discrepancy, excessive lateral tibial torsion, and excessive femoral anteversion.^[18, 20]

Athletes with pes planus (low-arched) or pes cavus (high-arched) feet have increased stress placed on the plantar fascia with foot strike.^[19] Pronation is a normal motion during walking and running, providing foot-to-ground surface accommodation and impact absorption by allowing the foot to unlock and become a flexible structure. Overpronation, on the other hand, can lead to increased tension on the plantar fascia.

Leg-length discrepancy, excessive lateral tibial torsion, and excessive femoral anteversion can lead to an

alteration of running biomechanics, which may increase plantar fascia stress.

As regards functional risk factors, tightness in the gastrocnemius and soleus muscles and the Achilles tendon is considered a risk factor for plantar fasciitis. Reduced dorsiflexion has been shown to be an important risk factor for this condition.^[17] Weakness of the gastrocnemius, soleus, and intrinsic foot muscles is also considered a risk factor for plantar fasciitis.

Aging and heel fat pad atrophy are 2 degenerative risk factors for plantar fasciitis.

Epidemiology

A survey of US professional football, baseball, and basketball team physicians and trainers found that plantar fasciitis was among the 5 most common foot and ankle injuries observed in professional athletes.^[21] It is estimated that approximately 1 million patient visits per year are due to plantar fasciitis.^[17] Plantar fasciitis accounts for about 10% of runner-related injuries and 11-15% of all foot symptoms requiring professional care. It is thought to occur in 10% of the general population as well. It may present bilaterally in a third of cases.

Age-, sex-, and race-related demographics

The exact incidence and prevalence by age of plantar fasciitis is unknown, but the condition is seen in adults essentially of all ages. A peak incidence may occur in women aged 40-60 years. An increased incidence exists in patients with certain spondyloarthropathies (eg, ankylosing spondylitis), which often present in patients aged 20-40 years.

Women are affected by plantar fasciitis twice as often as men. In young people, the condition occurs equally in both sexes. Race and ethnicity play no role in the incidence of plantar fasciitis.

Prognosis

About 80% of plantar fasciitis cases resolve spontaneously by 12 months; 5% of patients end up undergoing surgery for plantar fascia release because all conservative measures have failed.

For athletes in particular, the slow resolution of plantar fasciitis can be a highly frustrating problem. These individuals should be cautioned not to expect overnight resolution, especially if they have more chronic pain or if they continue their activities.^[22] Generally, the pain resolves with conservative treatment.^[22, 23]

Although no mortality is associated with this condition, significant morbidity may occur. Patients may experience progressive plantar pain, leading to limping (antalgic gait) and restriction of activities such as walking and running. In addition, changes in weight-bearing patterns resulting from the foot pain may lead to associated secondary injury to the hip and knee joints.

Patient Education

Patients should be informed that improvement often takes many weeks or months and requires considerable effort to maintain a heel-cord stretching program or to wear a night splint. They should also be taught proper performance of a home exercise program involving stretching the plantar fascia.

The following recommendations are appropriate:

- Wear shoes with adequate arch support and cushioned heels; discard old running shoes and wear new ones; rotate work shoes daily
- Avoid long periods of standing
- Lose weight
- Stretch the plantar fascia and warm up the lower extremity before participating in exercise
- For increased flexibility, stretch the plantar fascia and the calf after exercise
- Do not exercise on hard surfaces
- Avoid walking barefooted on hard surfaces
- Avoid high-impact sports that require a great deal of jumping (eg, aerobics and volleyball)
- Apply ice for 20 minutes after repetitive impact-loading activities and at the end of the day
- Limit repetitive impact-loading activities such as running to every other day, and consider rest or cross-training for nonrunning days

Contributor Information and Disclosures

Author

Craig C Young, MD Professor, Departments of Orthopedic Surgery and Community and Family Medicine, Medical Director of Sports Medicine, Director of Primary Care Sports Medicine Fellowship, Medical College of Wisconsin

Craig C Young, MD is a member of the following medical societies: [American Academy of Family Physicians](#), [American College of Sports Medicine](#), [American Medical Society for Sports Medicine](#), and [Phi Beta Kappa](#)

Disclosure: Nothing to disclose.

Chief Editor

Craig C Young, MD Professor, Departments of Orthopedic Surgery and Community and Family Medicine, Medical Director of Sports Medicine, Director of Primary Care Sports Medicine Fellowship, Medical College of Wisconsin

Craig C Young, MD is a member of the following medical societies: [American Academy of Family Physicians](#), [American College of Sports Medicine](#), [American Medical Society for Sports Medicine](#), and [Phi Beta Kappa](#)

Disclosure: Nothing to disclose.

Additional Contributors

Gregory C Berlet, MD, FRCS(C) Clinical Assistant Professor of Orthopedics, Chief of Foot and Ankle Surgery, Department of Orthopedic Surgery, Ohio State University College of Medicine and Public Health

Gregory C Berlet, MD, FRCS(C) is a member of the following medical societies: [American Medical Association](#), [American Orthopaedic Foot and Ankle Society](#), [Canadian Medical Association](#), [Canadian Orthopaedic Association](#), [College of Physicians and Surgeons of Ontario](#), [Ontario Medical Association](#), and [Royal College of Physicians and Surgeons of Canada](#)

Disclosure: Nothing to disclose.

Jason H Calhoun, MD, FACS Frank J Kloenne Chair in Orthopedic Surgery, Professor and Chair, Department of Orthopedics, The Ohio State University Medical Center

Jason H Calhoun, MD, FACS is a member of the following medical societies: [American Academy of Orthopaedic Surgeons](#), [American College of Surgeons](#), [American Diabetes Association](#), [American Medical Association](#), [American Orthopaedic Association](#), [American Orthopaedic Foot and Ankle Society](#), [Missouri State Medical Association](#), [Musculoskeletal Infection Society](#), [Southern Medical Association](#), [Southern Orthopaedic Association](#), [Texas Medical Association](#), and [Texas Orthopaedic Association](#)

Disclosure: Nothing to disclose.

William T DeCarbo, DPM Foot and Ankle Surgeon, Orthopedic Foot and Ankle Center

William T DeCarbo, DPM is a member of the following medical societies: [American College of Foot and Ankle Surgeons](#) and [American Podiatric Medical Association](#)

Disclosure: Nothing to disclose.

James K DeOrio, MD Director of Foot and Ankle Fellowship Program, Assistant Professor of Orthopedic Surgery, Orthopedic Surgery, St Lukes Hospital, Jacksonville, Florida

James K DeOrio, MD is a member of the following medical societies: [American Academy of Orthopaedic Surgeons](#), [American Orthopaedic Foot and Ankle Society](#), [Florida Medical Association](#), and [German Society of Neurology](#)

Disclosure: Nothing to disclose.

Miguel C Fernandez, MD, FAAEM, FACEP, FACMT, FACCT Associate Clinical Professor; Medical and Managing Director, South Texas Poison Center, Department of Surgery/Emergency Medicine and Toxicology, University of Texas Health Science Center at San Antonio

Miguel C Fernandez, MD, FAAEM, FACEP, FACMT, FACCT is a member of the following medical societies: [American Academy of Emergency Medicine](#), [American College of Clinical Toxicologists](#), [American College of Emergency Physicians](#), [American College of Medical Toxicology](#), [American College of Occupational and Environmental Medicine](#), [Society for Academic Emergency Medicine](#), and [Texas Medical Association](#)

Disclosure: Nothing to disclose.

Joseph P Garry, MD, FACSM, FAAFP Associate Professor, Sports Medicine Faculty, Department of Family & Community Medicine, University of Minnesota Medical School

Joseph P Garry, MD, FACSM, FAAFP is a member of the following medical societies: [American Academy of Family Physicians](#), [American College of Sports Medicine](#), [American Heart Association](#), [American Medical Society for Sports Medicine](#), and [North American Primary Care Research Group](#)

Disclosure: Nothing to disclose.

Shepard R Hurwitz, MD Executive Director, American Board of Orthopaedic Surgery

Shepard R Hurwitz, MD is a member of the following medical societies: [American Academy of Orthopaedic Surgeons](#), [American Association for the Advancement of Science](#), [American College of Rheumatology](#), [American College of Sports Medicine](#), [American College of Surgeons](#), [American Diabetes Association](#), [American Orthopaedic Association](#), [American Orthopaedic Foot and Ankle Society](#), [Association for the Advancement of Automotive Medicine](#), [Eastern Orthopaedic Association](#), [Orthopaedic Research Society](#), [Orthopaedic Trauma Association](#), and [Southern Orthopaedic Association](#)

Disclosure: Nothing to disclose.

Christopher F Hyer, DPM, FACFAS Foot and Ankle Surgeon, Director, Advanced Foot and Ankle Surgery Fellowship, Orthopedic Foot and Ankle Center

Christopher F Hyer, DPM, FACFAS is a member of the following medical societies: [American College of Foot and Ankle Surgeons](#) and [American Podiatric Medical Association](#)

Disclosure: Wright Medical Technology Consulting fee Consulting; Wright Medical Technology Royalty Consulting; Orthopaedic Research and Education Foundation Grant/research funds Co-Investigator

Rick Kulkarni, MD

Rick Kulkarni, MD is a member of the following medical societies: [Alpha Omega Alpha](#), [American Academy of Emergency Medicine](#), [American College of Emergency Physicians](#), [American Medical Association](#), [American Medical Informatics Association](#), [Phi Beta Kappa](#), and [Society for Academic Emergency Medicine](#)

Disclosure: WebMD Salary Employment

Eric L Legome, MD Chief, Department of Emergency Medicine, Kings County Hospital Center; Associate Professor, Department of Emergency Medicine, New York Medical College

Eric L Legome, MD is a member of the following medical societies: [Alpha Omega Alpha](#), [American Academy of Emergency Medicine](#), [American College of Emergency Physicians](#), [Council of Emergency Medicine Residency Directors](#), and [Society for Academic Emergency Medicine](#)

Disclosure: Nothing to disclose.

Leslie Milne, MD Assistant Clinical Instructor, Department of Emergency Medicine, Harvard University School of Medicine

Leslie Milne, MD is a member of the following medical societies: [American College of Sports Medicine](#)

Disclosure: Nothing to disclose.

Dinesh Patel, MD, FACS Associate Clinical Professor of Orthopedic Surgery, Harvard Medical School; Chief of Arthroscopic Surgery, Department of Orthopedic Surgery, Massachusetts General Hospital

Dinesh Patel, MD, FACS is a member of the following medical societies: [American Academy of Orthopaedic Surgeons](#)

Disclosure: Nothing to disclose.

Mark A Silverberg, MD, FACEP, MMB Assistant Professor, Assistant Residency Director, Department of Emergency Medicine, State University of New York Downstate College of Medicine; Consulting Staff, Department of Emergency Medicine, Staten Island University Hospital, Kings County Hospital, University Hospital, State University of New York Downstate at Brooklyn

Mark A Silverberg, MD, FACEP, MMB is a member of the following medical societies: [American College of Emergency Physicians](#), [American Medical Association](#), [Council of Emergency Medicine Residency Directors](#), and [Society for Academic Emergency Medicine](#)

Disclosure: Nothing to disclose.

Deepika Singh, MD Staff Physician, Department of Emergency Medicine, Lawrence and Memorial Hospital, New London, CT

Deepika Singh, MD is a member of the following medical societies: [American College of Emergency Physicians](#), [American Medical Association](#), [American Nurses Association](#), [Emergency Medicine Residents Association](#), and [Sigma Theta Tau International](#)

Disclosure: Nothing to disclose.

Matthew D Sorensen, DPM Foot and Ankle Surgeon, Summit Orthopedics

Matthew D Sorensen, DPM is a member of the following medical societies: [American College of Foot and Ankle Surgeons](#)

Disclosure: Nothing to disclose.

Francisco Talavera, PharmD, PhD Senior Pharmacy Editor, eMedicine

Disclosure: eMedicine Salary Employment

Russell D White, MD Professor of Medicine, Director of Sports Medicine Fellowship Program, Medical Director, Sports Medicine Center, Head Team Physician, University of Missouri-Kansas City Intercollegiate Athletic Program, Department of Community and Family Medicine, University of Missouri-Kansas City School of Medicine, Truman Medical Center Lakewood

Russell D White, MD is a member of the following medical societies: [Alpha Omega Alpha](#), [American Academy of Family Physicians](#), [American Association of Clinical Endocrinologists](#), [American College of Sports Medicine](#), [American Diabetes Association](#), and [American Medical Society for Sports Medicine](#)

Disclosure: Nothing to disclose.

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