Plantar Heel Pain

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KEYWORDS

- Plantar heel pain • Plantar fascia • Plantar fasciitis • Windlass mechanism
- Heel spur • Baxter nerve • First branch lateral plantar nerve
- Extracorporeal shock-wave therapy

KEY POINTS

- Approximately 1 in 10 people are predicted to develop such heel pain during their lifetime.
- Plantar fasciitis is the most common cause of plantar heel pain and is responsible for 80% of the cases.
- Plantar heel pain is usually responsive to conservative interventions, including home stretches, nonsteroidal antiinflammatory drugs, orthoses, night splints, and, at times, corticosteroid injections and extracorporeal shock-wave therapy.
- If conservative measures do not provide pain relief, surgery can be considered.

INTRODUCTION

Plantar heel pain is a very common complaint that can cause significant discomfort and disability. Approximately 1 in 10 people are predicted to develop such heel pain during their lifetime, with more than 2 million individuals undergoing treatment of it annually in the United States.[1,2] Although 1% of all visits to orthopedic surgeons are attributed to heel pain, it is also commonly treated by internists and family practitioners.[3] The annual cost of the evaluation and treatment of plantar heel pain by these providers is estimated at approximately $284 million.[4]

The cause, diagnosis, and effective management of plantar heel pain have challenged practitioners since the early 1800s, when Wood first described plantar fasciitis, citing an infectious origin.[5] In the 1930s, gonorrhea, syphilis, tuberculosis, and streptococcal infections were thought to be responsible.[6] The focus then shifted to plantar fat pad impingement by heel spurs.[7] A plethora of conditions are now acknowledged as causes of plantar heel pain.

A thorough history and physical examination are crucial to the diagnosis of plantar heel disorders. Although plantar fasciitis is the most common culprit, accounting for

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80% of patients with inferior heel pain, the clinician's differential must always include other causes. Mechanical, rheumatologic, and neurologic conditions can all manifest as plantar heel pain. This article reviews the relevant anatomy and biomechanics of the plantar hindfoot, the cause of plantar heel pain, pertinent components of the physical examination, useful diagnostic adjuncts, as well as both conservative and operative treatment modalities.

ANATOMY OF THE PLANTAR FASCIA AND HINDFOOT

The plantar fascia is a broad fibrous aponeurosis that spans the plantar surface of the foot (**Fig. 1**). It originates from the medial and anterior aspects of the calcaneus and helps to divide the intrinsic plantar musculature of the foot into 3 distinct compartments: medial, central, and lateral. Distally, the plantar fascia forms 5 digital bands at the metatarsophalangeal joints. Each digital band then divides to pass on either side of the flexor tendons, inserting into the periosteum at the base of the proximal phalanges.

The plantar fascia has a continuous connection with the Achilles tendon, leading to tightening of the plantar fascia when tensile loads are applied to the tendon. For this reason, Achilles tendon stretching and night splinting have become effective conservative treatments for plantar fasciitis.

The heel's fat pad, first described by Teitze in 1921, is also an integral component of the plantar hindfoot.[8] It is anchored to both the calcaneus and skin, acting as a shock absorber for the hindfoot. It helps to dissipate impact forces caused by heel strike during ambulation, which generates forces up to 110% of one's body weight when walking and 250% of body weight when running.[9] However, after 40 years of age, it begins to degenerate, losing some of its overall thickness and height. With this deterioration, softening and thinning of the fat pad occur, which leads to diminished protection of the heel.[10]

BIOMECHANICS OF THE PLANTAR FASCIA AND HINDFOOT

The foot and its ligaments can be thought of as a truss, with the calcaneus, midtarsal joint, and metatarsals forming the truss's medial longitudinal arch.[11] The plantar fascia acts as a tie-rod, preventing arch collapse via its great tensile strength, particularly during weight bearing. Preservation of the medial longitudinal arch is crucial for ambulation in a systematic and efficient manner. With arch collapse, the appropriate timing of pronation and supination during the gait cycle is altered, leading to inefficient foot function.

The *windlass mechanism* is a term used to describe the role of the plantar fascia in dynamic function during gait; a windlass is the tightening of a rope or cable.[12] As one's toes are dorsiflexed, the plantar fascia tightens, shortening the distance between the calcaneus and metatarsals and elevating the medial longitudinal arch (**Fig. 2**).[13] In the high-arched position, less tension on the truss is required for arch support, as opposed to a low-arched position. In other words, in a high-arched position, there is less tension on the plantar fascia.

CAUSE OF PLANTAR HEEL PAIN

A multitude of mechanical, neurologic, and rheumatologic conditions can manifest as plantar heel pain (**Box 1**). The mechanical causes include derangements of the plantar fascia, calcaneal stress fractures, and heel pad disorders. Although heel spurs are intimately associated with these conditions, they do not directly cause plantar heel