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Anatomy, Bony Pelvis and Lower Limb, Foot Fascia

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Introduction

The fascia in the foot is composed of fibrous connective tissue that serves to separate, support, and attach muscles. It can be divided into the superficial fascia and the deep fascia. The superficial fascia is located just beneath the skin and varies in strength depending on where it is in the foot. On the dorsal side of the foot, the superficial fascia is thin and mobile. In contrast, the superficial fascia of the plantar side is thick and has multiple septations that contain fat to provide a cushion for the foot. It also has thick connections with the underlying deep fascia. [1]

The deep fascia is stronger than the superficial fascia. On the dorsal side of the foot, the deep fascia is thin and connected to the inferior extensor retinaculum. It continues laterally and posteriorly to connect with the plantar fascia, which is the name of the deep fascia on the plantar side. Similar to the superficial fascia, the deep fascia is much thicker on the plantar side. The central part of the plantar fascia forms the plantar aponeurosis, which starts proximally at the calcaneus and extends distally into five separate bands that become the digital sheaths. It is supported inferiorly by the superficial transverse metatarsal ligament. [2]

The fascia acts as a border for the five anatomic compartments of the foot, which include the medial compartment, the central compartment, the lateral compartment, the dorsal compartment, and the interosseous compartment. The medial compartment is bordered inferiorly by the medial plantar fascia, the central compartment is bordered inferiorly by the plantar aponeurosis, and the lateral compartment is bordered inferiorly by the lateral plantar fascia. The plantar aponeurosis also has intermuscular septa that extend superiorly through the foot to divide the medial, central, and lateral compartments. The interosseous compartment is bordered by the plantar and dorsal interosseous fascia. The dorsal compartment is bordered by the dorsal fascia superiorly and by the tarsal bones and dorsal interosseous fascia inferiorly.

Structure and Function

The fascia has multiple important roles in the foot. It stabilizes the foot by separating and holding muscles in place, it holds shock-absorbing fat in place on the plantar side of the foot to provide a cushion, and it maintains the longitudinal arches of the foot.

Embryology

Like all fascia in the body, the fascia in the foot is derived from the mesoderm. Some anatomists believe the plantar fascia shares its origin with the Achilles tendon. A connection that they believe diminishes with age. [3][4]

Blood Supply and Lymphatics

The blood supply to the fascia in the foot is supplied by smaller vessels that branch off the dorsalis pedis artery and the posterior tibial artery. The dorsalis pedis artery supplies the fascia on the dorsal aspect of the foot, and the posterior tibial artery supplies the fascia on the plantar aspect of the foot.

There are both superficial and deep lymphatic vessels in the foot that travel through the fascia. The superficial lymphatic vessels are more prominent medially. They converge next to the great saphenous vein and eventually drain into the superficial inguinal lymph nodes while the lateral lymphatic vessels converge next to the small saphenous vein and eventually drain into the popliteal lymph nodes. The deep lymphatic vessels follow the major blood vessels in the foot and drain into the popliteal lymph nodes.

Nerves

The nerves that supply the fascia of the foot can be classified regionally. The dorsal fascia is supplied by the superficial fibular nerve, the lateral fascia is supplied by the sural nerve, the medial fascia is supplied by the saphenous nerve, and the plantar fascia is supplied by the lateral and medial plantar nerves.

Muscles

The fascia plays a key role in dividing and attaching muscles in the foot. The relationship of the fascia with the muscles can be further described by the compartment they are in.

- Medial compartment: The medial plantar fascia overlies the abductor hallucis, flexor hallucis brevis, and the flexor hallucis longus tendon.
- Central compartment: The central plantar fascia overlies the flexor digitorum brevis, the tendon of the flexor hallucis longus, the tendons and musculature of the flexor digitorum longus, the quadratus plantae, the lumbricals, and the adductor hallucis.
- Lateral compartment: The lateral plantar fascia overlies the abductor and flexor digiti minimi brevis.
- Interosseous compartment: The plantar and dorsal interosseous fascias border the interosseous muscles.
- Dorsal compartment: The dorsal fascia overlies the extensors hallucis brevis and extensor digitorum brevis.

Surgical Considerations

If conservative treatment has failed, plantar fasciotomy can be considered. This technique is performed by using minimally invasive and endoscopic approaches to cut the plantar fascia and relieve tension. [5][6]

Clinical Significance

Plantar Fasciitis

Plantar fasciitis presents as sharp, unilateral pain at the proximal, plantar aspect of the foot. The pain is often most severe after long periods of rest. While the pathophysiology is not completely understood, recent evidence suggests that plantar fasciitis is due to a disruption in normal biomechanics that results in repetitive small tears in the plantar fascia. It is most common in obese individuals who have to stand or walk on hard surfaces. Plantar fasciitis can be diagnosed clinically by reproducing tenderness with palpation of the inner heel. A lateral radiograph of the foot may also show calcaneal spurring where the plantar fascia attaches proximally to the calcaneus. Treatment of plantar fasciitis generally involves rest, ice, massage, and calf-strengthening exercises [5][7][8].

Plantar Fascial Tear

Plantar fascial tears can occur acutely or chronically. If acute, it will present with a sudden popping sensation on the plantar aspect of the foot that is associated with acute pain, ecchymosis, and edema. If chronic, it will present with ecchymosis and edema in a patient with underlying plantar fasciitis. Plantar fascial tears can be diagnosed clinically by palpating a painful lump on the sole. Imaging with diagnostic ultrasound can aid in the diagnosis. Treatment is usually conservative and begins by immobilizing the foot with a boot initially, including the use of pre-fabricated shoe and cushioned heel inserts. The literature supports the utilization of a non-weight bearing plantar fascia-specific

stretching program as opposed to a weight-bearing Achilles tendon stretching program. The former yields the highest patient satisfaction scores at 8-week follow-up [9][10][11].

Plantar Fibromatosis

Plantar fibromatosis is a non-malignant disorder that causes nodular thickening of the plantar fascia. It presents as a painless lump on the medial border of the plantar surface of the foot. While the cause is not well understood, there is believed to be a genetic component to the disorder. Clinical assessment and imaging with MRI or diagnostic ultrasound are used to make the diagnosis. Treatment is unnecessary if there are no symptoms. If symptomatic, insoles can be used to redistribute weight off of the area of thickening. Further intervention includes radiotherapy and even surgery if necessary [12].

Questions

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Figures



Lateral radiograph of the heel showing a large heel spur. This finding is present in approximately 50% on patients presenting with plantar fasciitis. Contributed by Scott Dulebohn, MD

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