Examination of Common Heel and Forefoot Conditions

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70.1 Introduction

Before proceeding with examination, it is vital to obtain a thorough history as this enables examiners to narrow the differential diagnosis. There are key subjective issues within the history that tend to raise clinical suspicion for a particular diagnosis such as increased physical activity and metabolic disorders in stress fractures, and relief of pain when walking barefoot in Morton's neuroma. Foot examination follows the general orthopedic sequence of look, feel, move, and special tests. It is helpful to develop a routine systematic approach to foot examination, which can be either proximal (hindfoot) to distal (forefoot) or medial to lateral to avoid overlooking critical parts of the examination. The first step should include having the patient remove both shoes and socks and lift up pant legs if necessary. Inspection of the foot needs to be done in sitting and standing positions if the patient is able to bear weight. Inspecting the plantar aspect of the foot is equally important. For example, plantar ecchymosis can be the only sign of a subtle Lisfranc injury. Callosities follow areas of increased plantar pressure and provide a clue to altered mechanics such as lateral column overload or failed medial column and transfer metatarsalgia. Palpation follows inspection and should be done firmly to develop a true sense of the level of pain or edema that a patient may be experiencing. Subsequently, range of motion should be observed both passively and actively, again comparing both sides. Additionally, the foot examination is not complete without gait assessment, examination of shoe wear and orthotics if any, and Silfverskiöld test. This chapter provides the reader with knowledge and tips on how to approach the examination of common causes of heel and forefoot pain.

70.2 Plantar Heel Pain

Plantar heel pain is among the most common conditions seen by the orthopedic and sports medicine providers. The heel is an anatomic location that experiences a great deal of force during athletic activities and therefore is surrounded by tissues uniquely designed to withstand greater forces. The plantar heel consists of a thickened skin covering a dense fat pad that overlies the calcaneus bone. At the center of this is the origin of the plantar fascia, a structure which contributes to the windlass mechanism during gait. The branches of the tibial nerve run through the "tarsal tunnel" along the medial aspect of the calcaneus to reach the foot. While many conditions

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can present with heel pain, plantar fasciitis, calcaneal stress fractures, and tarsal tunnel syndrome should be high on the list of differential diagnoses. Since neurogenic pain is covered elsewhere, this section will focus on plantar fasciitis and calcaneal stress fractures.

70.2.1 Plantar Fasciitis

Plantar fasciitis is the most common cause of heel pain in adults, usually between ages 40–60, but may occur in younger ages in athletes with repetitive heel stress, such as runners [1]. Despite its previous characterization as an inflammatory condition, "fasciitis" is now believed to be a misnomer, with the more appropriate term being "plantar fasciosis" to describe the degenerative changes caused by repetitive microtrauma [2, 3].

Due to the nature of the medial longitudinal arch, the insertion of the medial chord is the most common location of degeneration. Patients typically complain of sharp nonradiating plantar heel pain that is commonly but not exclusively medial. They may also report medial arch pain and start-up pain after getting out of bed or after periods of rest that improves with physical activity and stretching [4].

On physical examination, focal tenderness to palpation is usually found over the insertion of the plantar fascia onto the medial calcaneal tuberosity. Patients may have tenderness throughout the plantar fascia. Commonly, a tight Achilles or gastrocnemius may contribute to the pathology, restricting ankle dorsiflexion and exacerbating the trauma to the plantar fascia [4]. In this case, it is critical to perform a Silfverskiöld test to determine which part of the musculotendinous complex is tight. Further, it is important to palpate the length of the plantar fascia to its insertion on the long flexors of the toes, feeling for thickened areas of fibromatosis, or particularly tight regions of the structure. It is key to differentiate between the medial chord of the plantar fascia and the FHL as these structures run close and parallel with one another.

70.2.2 Calcaneal Bone Stress Injuries

Despite the calcaneus bone's important role in weight-bearing, it is largely a cancellous structure which makes it prone to stress fractures, especially after repeated activity, when activity level is rapidly increased or there is a change to footwear or surfaces. It is important to consider biologic/metabolic risk factors as well. Generally, stress fractures are caused by high loads (athletes and military recruits) on normal bones, normal stresses on abnormally weak bones (osteopenia), or high loads on weak bones (female athlete triad). The stress fracture is typically located posteroinferior to the posterior facet of the calcaneus [3]. Patients often complain of pain about the medial and lateral aspects of the tuberosity, diffuse in nature and worse with activity. History frequently includes an identifiable increase in exercise or training regimen leading up to the onset of pain.

On physical examination, patients can often ambulate with an antalgic gait due to pain at heel strike. They may elicit tenderness to palpation medially or laterally along the calcaneal tuberosity. A positive "calcaneal squeeze test," with pain reproduced with compression of medial and lateral calcaneus, is pathognomonic for calcaneal stress fracture [5]. The tenderness is often accompanied by swelling medially, laterally, or both.

70.2.3 Heel Pad Atrophy

The heel pad has a unique structure that allows it to withstand a great degree of repetitive force and loading, enabling the calcaneus to serve as a primary weight-bearing area. The adipose tissue is highly structured and septate, creating an attachment between the heel pad and the periosteum of the calcaneus, preventing the heel pad from shifting or displacing in relation to the skeleton. The most at-risk groups are diabetic patients, and elderly patients that are more prone to loss of water content, collagen structure, and elastic properties of the fat pad [6].

On physical examination, patients typically have focal, nonradiating pain over the plantar, weight-bearing aspect of the calcaneal tuberosity. Unlike other pathologies of the heel, it is not reproduced by palpation along medial and lateral aspects of the calcaneus, calcaneal squeeze test, or passive motion of the ankle or toes [4]. The pain is often not focal as is the case with plantar fasciitis and is often posterior to the plantar fascia insertion.

70.3 Forefoot Pain

70.3.1 Hallux Valgus

Bunions or hallux valgus (HV) is a common condition of the hallux that affects women 15 times as frequent as men [7]. HV describes a deformity of the hallux metatarsophalangeal joint where the first metatarsal is in varus and the proximal phalanx assumes a compensatory valgus position at the MTP joint—Fig. 70.1. There is commonly a pronation deformity due to malrotation of the proximal phalanx caused by adductor hallucis tendon. Patients with hallux valgus can present with various complaints such as difficulty with shoe wear, plantar or dorsal pain due to joint capsule stretching, nerve pain and paresthesia due to stretching of the medial dorsal cutaneous nerve, crossover toes and metatarsalgia of the lesser toes, or undesirable cosmesis. It is crucial to determine the location of pain and underlying cause for successful management. History should include history of inflammatory arthropathy and neuromuscular disorders as well as family history for bunions.

Fig. 70.1 Right hallux valgus. Note the medial deviation of the first metatarsal and lateral (valgus) deviation of the toe at the MTP joint (dashed line). The lesser toes show claw toe deformity with dorsal callosities, more pronounced on the second toe

Physical examination of hallux valgus includes assessment of the components of the deformity, its magnitude, unilateral vs. bilateral, and whether it is passively correctable. Assess for medial eminence protrusion and dorsal osteophytes. Assess the pronation using the toenail as a guide, which should be parallel to the ground while standing. It is extremely important to check for arthritis in the MTP joint. Assess and document the active and passive ranges of motion, especially dorsiflexion. Normal ROM ranges between 70–90° dorsiflexion and 20–30° plantar flexion. MTP grind test, palpation of the sesamoids, and sesamoid grind test provide crucial information, in addition to radiographs, to guide motion-sparing vs. fusion decisions.

Medial column stability assessment should be done in all HV cases. One hand applies dorsiflexing pressure to the lesser metatarsals while stabilizing the lesser TMT joints. Then the other hand attempts to dorsiflex and plantarflex the first ray at the TMT1. The ROM is compared to the other side. Any translation of more than 1 cm is indicative of hypermobility—Fig. 70.2. Generalized ligamentous laxity should also be ruled out. Metatarsalgia and lesser MTP stability are discussed later but should be included in HV evaluation in addition to any forefoot abduction, medial arch collapse, hindfoot deformity, or ankle equinus.

70.3.2 Metatarsalgia

Metatarsalgia is a general term used to describe forefoot pain rather than a specific pathology. Common causes of metatarsalgia include lesser metatarsophalangeal joint disorders such as hammertoes, instability, inflammatory arthropathies, and synovitis. They also include Morton's neuroma, ankle equinus, stress fractures, Freiberg's disease (AVN of second metatarsal head), and

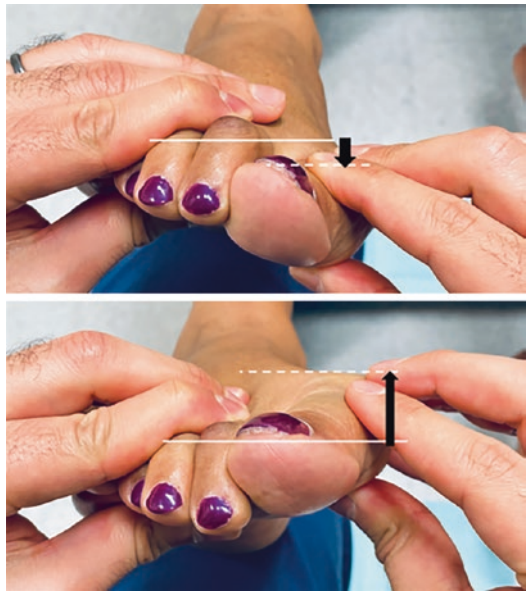

Fig. 70.2 Assessment of medial column stability. Note the plantar (top) and dorsal (bottom) translation of the first metatarsal head (dashed line) relative to the lesser metatarsal heads (solid line)

transfer metatarsalgia. It is important to point out that these conditions are not mutually exclusive.

Detailed history and thorough examination can help to narrow down the list to the most likely etiology and guide successful management. For example, walking barefoot typically causes relief of symptoms in patients with Morton's neuroma but exacerbates metatarsalgia in those with MTPJ pathologies and ankle equinus. Using a cushioned insole or a metatarsal pad offers no to minimal relief to those with Freiberg's disease and stress fractures. The most important clue is the location of the pain whether plantar or dorsal and whether isolated to one metatarsal head or not. Tingling and paresthesia affecting third and fourth toes are typical of Morton's neuroma.

In addition to the examination of the hallux, physical examination includes inspection for lesser toe deformities such as hammertoes, hallux valgus, and scars of previous surgeries. Plantar callosities under the second and occasionally the third metatarsal head often point towards transfer metatarsalgia. Next is palpation of each metatarsal head and MTPJ for tenderness both dorsally and plantarly. Assess the stability of each MTPJ by performing the vertical drawer test by translating the proximal phalanx dorsally while stabilizing the metatarsal. This test has been reported to be 99.8% specific and should be done if any lesser toe deformity is observed [8]. Assess the range of motion of the forefoot joints and the ankle. Toe ROM is typically normal except in lesser toe deformities, which can be partially correctable. In Freiberg's disease, MTPJ degeneration and dorsal osteophytes limit dorsiflexion. Silfverskiöld test should be performed in all forefoot pain patients to rule out gastrocnemius tightness as a causative or contributing pathology. Additionally, neurological and vascular examination should be done. Provocative tests such as Mulder's click, while not highly sensitive, can point out to the presence of a Morton's neuroma. The test is performed by applying alternating plantar and dorsal pressure to the affected web space while compressing the foot at the level of the metatarsal heads. Pain radiating into the affected toes and a click are both required for a positive test. Finally, deep imprints in the shoe insoles point to excessive pressure under the metatarsals in transfer metatarsalgia.

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