Heel pain: a practical approach

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Background

Heel pain is a common presentation in primary care and the risk of developing pain is higher with increasing body mass index and age.[1] This is troubling given the increasing prevalence of obesity and an ageing population.

Objective

This article aims to assist with differential diagnosis of heel pain, which is critical as there are many structures in the heel area that can cause pain, and each requires a tailored treatment.

Discussion

Structures affected by pain vary with age, although the more common diagnoses such as Achilles insertional tendinopathy and plantar fascia pain can occur at any age. The use of diagnostic imaging must be considered in the context of clinical presentation as asymptomatic pathology occurs in many tissues. Evidence-based treatment for common causes of heel pain are limited. As with all presentations to clinicians, the potential for non-musculoskeletal, more sinister causes of pain and systemic disease must be considered.

Keywords

heel; pain; diagnosis; therapeutics

Heel pain is a vague term describing pain surrounding the calcaneus, most commonly felt posteriorly or inferiorly. Anatomically, the heel refers to the fatty tissue that forms a pad under and around the calcaneus to protect structures of the foot during weight-bearing activity.[2] However, patients consider a more broad area as their heel. This review, therefore, will consider the structures that may cause pain from the calcaneus, extending to both lateral and medial perimalleolar regions, the Achilles enthesis and proximal plantar fascia attachment. Most pain arises from pathology in soft tissue structures (tendons, fascia and nerves); apophyses and other sources of bony pain are less common. As with other soft tissue structures, pathology on imaging is not always correlated with pain and a good clinical examination is required to reveal the painful structure. Palpation pain is a poor diagnostic test in isolation, as many structures are painful on palpation without being the cause of symptoms. The history and further clinical examination remain important.

Sources of pain by structure

Tendons

The key tendons that may be involved in heel pain are the Achilles tendon at its insertion, flexor hallucis longus (FHL), tibialis posterior and the peroneal tendons (*Figure 1*). The medial and lateral tendons are surrounded by tenosynovial sheaths that can be irritated by friction or compression at the malleolus. Tibilais posterior pain (tendon and/or sheath) is most commonly seen in older women.[3,4] FHL tenosynovitis is seen in younger people, especially dancers because of the repetitive movement of the ankle and foot between extremes of plantarflexion and dorsiflexion.[5]

The Achilles insertion is a complex structure that includes the retrocalcaneal bursa.[6] All insertional pain should be treated

Table 1. Possible structures and sites of pain

Site/type of pain	Common sources of pain	Less common sources of pain
Posterior	• Achilles tendon insertion • Superficial calcaneal bursa • Posterior impingement of soft-tissues/os trigonum in active people • Calcaneal apophysis in adolescents	• Sural nerve
Inferior	• Plantar fascia • Calcaneal fat pad	• Medial or lateral calcaneal nerve, especially as they split from the tibial branch
Medial	• Tibialis posterior tendon and sheath • Tibialis posterior insertion and apophysis in adolescents	• FHL and sheath • Abductor hallucis • Deltoid and spring ligaments • Posterior tibial nerve in tarsal tunnel (is associated with neural symptoms such as tingling) • Bone: medial malleolus
Lateral	• Lateral ligaments of the ankle • Sinus tarsi	• Peroneal tendinopathy or tenosynovitis associated with subluxation • Cubometatarsal joint • Peroneus brevis insertion/apophysis of base of 5th metatarsal in adolescents or after ankle sprain
Deep, vague pain	• Subtalar joint	• Bone pain: calcaneus, talus, navicular

FHL, flexor hallucis longus

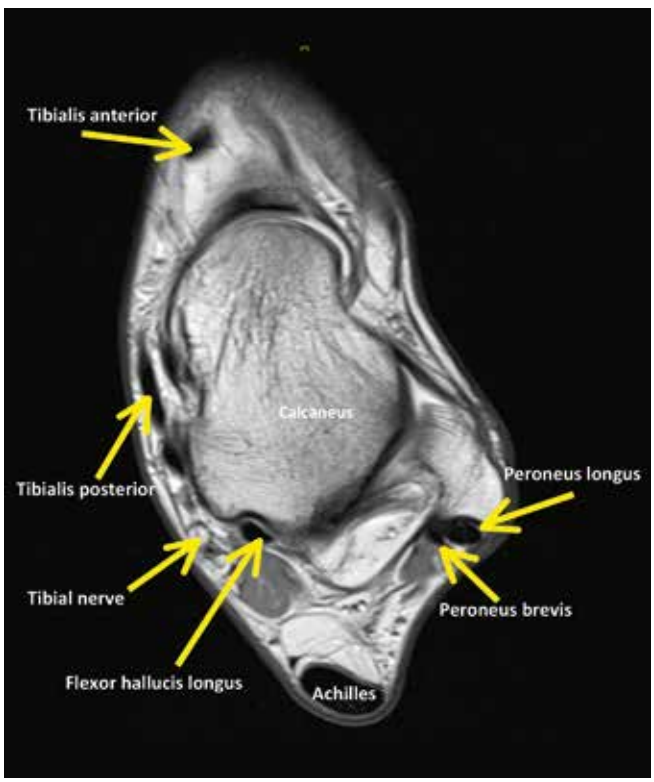

Figure 1. Relationship of the calcaneus to neural structures and tendons (transverse view)

holistically as a tendinopathy, as the bursa is rarely affected in isolation.[7] The mid-substance and insertional Achilles tendon undergo similar histopathological change.[8] Excess compression of the tendon against the superior calcaneus in dorsiflexion is the provocative load; however, a Haglund morphology (a square superior prominence of the calcaneus) is common and complete resolution of symptoms can occur despite the anatomy.[9]

Peroneal tendinopathy is less common and is seen after acute ankle sprain or provoked by an insufficient retinaculum at the lateral malleolus, again increasing compression and friction loads. The plantar fascia, histologically indistinguishable from a tendon, is also a common source of pain, especially in older women who are more obese.[10]

Neural sources of heel pain: entrapment and referred pain

Pain from a neural source can mimic soft tissue pain. Neural sources of heel pain may include an entrapment that can occur proximally, for example, in the lower lumbar spine and gluteal region, or distally at the ankle retinacula. The posterior tibial nerve ends deep to the flexor retinaculum, then divides into the medial and lateral plantar (also termed calcaneal) nerves, where it is especially vulnerable. Pain from this source can mimic plantar heel pain.[11] Tarsal tunnel syndrome is an entrapment of the posterior tibial nerve under the flexor retinaculum. Rarely, sural nerve symptoms can be related to Achilles tendinopathy, resulting in posterior heel neural signs.

Bone and joints

Calcaneal bone injury is rare in adults but can cause heel pain following either a traumatic fall from a height (fracture) or excessive weight-bearing such as running or marching (bone stress reaction or stress fracture).[12,13] Talar and navicular stress fractures are infrequent but considered high risk because of their propensity to progress to full fracture or result in non-union or delayed union,[14] which require lengthy periods of non-weight bearing or surgical management. The subtalar joint or the transverse tarsal joint may cause pain due to acute injury or arthritis.

Sources of pain by site

Differential diagnosis is complex, as there may be pain from more than one structure. The site of pain may be a guide to the structures involved (*Table 1*) and there are several key clinical history questions that will guide the clinician to the likely source of pain (*Table 2*). The most important questions to ask are 'Where is your pain? When did it start and what were you doing when it started?' Mechanical causes of heel pain are often brought on by a change in activity or a change in shoes. A specific incident or trauma to the region will guide further questioning around the forces and potential sources of pain.

Table 2. Subjective assessment questions to direct clinical reasoning

Question	Common responses	Diagnoses to consider
Age	Young	Common: Sever's disease (calcaneal apophysitis) Uncommon: calcaneal stress or tumour
	Middle-aged	Common: Achilles insertion tendinopathy, plantar fascia pain
	Older	Common: tibialis posterior tendinopathy and lengthening
What aggravates the pain?	Mechanical causes (eg walking, running)	Insertional Achilles tendinopathy (note, a warm-up phenomenon with activity is reported) Pain that increases with activity may indicate: • involvement of sheath (paratendinitis) • bone (stress reaction or stress fracture) • sinus tarsi or neural sources (including tarsal tunnel); prolonged standing can irritate tarsal tunnel.
	Non-mechanical	Pain at rest should be questioned further in terms of positioning and neural symptoms Tendon pain at rest is uncommon but pain on rising after sitting is a hallmark sign of tendinopathy
Was the onset of pain associated with an incident?	Yes: change to weight-bearing load (eg running or footwear)	Achilles tendinopathy Calcaneal bone stress
	No	Consider arthritic causes
Pain behaviour	Morning pain and stiffness	Achilles tendinopathy, FHL tenosynovitis, plantar fascia pain Long time to warm up (>60 minutes): consider rheumatological cause
	Night pain	Bone stress (eg calcaneal stress or more sinister causes)
General health questions and red flags	Night pain Other flags such as loss of weight, night sweats, joint pain and swelling	Tumour Consider non-musculoskeletal cause and include rheumatoid arthritis, gout, spondyarthopathies, infection
	Past injury	Repeated ankle sprains can commonly cause posterior impingement and sinus tarsi syndromes
Other	Cramping (calf and feet)	Vascular claudication Can be an early indicator of bone stress
	Neural symptoms	Sharp pain, burning, 'pins and needles' or numbness indicate neural involvement (eg tarsal tunnel syndrome (posterior tibial nerve and branches) present with symptoms in posteromedial ankle and heel and may extend to distal sole and toes)

Figure 2. Simmonds' calf squeeze

With the foot relaxed squeezing the calf should elicit plantar flexion of the foot with an intact Achilles tendon

Figure 3. Posterior impingement test

Firm and slow compression of the calcaneus into the tibia will cause symptoms

Figure 4. FHL test

Active or resisted plantarflexion of the great toe in full ankle plantarflexion will provoke crepitus and possible pain

Table 3. Objective assessment

Site/type of pain	Common sources of pain
Observation	Skin – colour, bruising, swelling, abrasions, rashes, Achilles tendon swelling / thickening or obvious deformity, muscle wasting
Functional – walking	Limping, avoiding joint movement or loading
Calf raise – double or single	Should be capable of lifting body weight on each leg at least 10 times. Inability to do this consider Achilles tendon rupture or tibialis posterior tear
Palpation	The sural nerve can be easily palpated lateral to the Achilles tendon with the ankle in dorsiflexion Sinus tarsi pain can indicate local and subtalar joint synovitis Plantar fascia attachment on the medial process of the calcaneal tuberosity Tibialis posterior and FHL tendons posteromedial to medial malleolus Apophyses such as calcaneal, navicular, base of 5th metatarsal • Note the Achilles tendon squeeze can be painful when the tendon is not the source of heel pain and is a poor diagnostic test Sites of bone stress: calcaneal squeeze for calcaneus, dorsal navicular and talar neck
Muscle strength	Resisted inversion in plantarflexion for tibialis posterior Resisted eversion for peroneals. Observe peroneal tendon does not sublux around lateral malleolus
Other – special tests	Specific tests such as the Simmonds' calf squeeze test for suspected Achilles tendon rupture (*Figure 2*) Posterior impingement test (*Figure 3*) and FHL testing (*Figure 4*) should reproduce symptoms Crepitus and clicking not always associated with symptoms Gentle palpation of the Achilles during active plantarflexion and dorsiflexion may demonstrate crepitus consistent with Achilles paratendinitis (sheath inflammation) Tinel's sign is well described and involves 4–6 taps over the nerve (such as sural or tibial) and should elicit 'pins and needles' or tingling
Neural testing	Straight leg raise with bias for peroneal nerve (add adduction, ankle plantar flexion and inversion) or tibial nerve (add dorsiflexion and eversion) Commonly – this may not reproduce the pain but an asymmetry can be noted Seated slump with lumbar kyphosis or lordosis

Following a thorough history taking, the potential sources of pain are identified and further objective assessment conducted to confirm the diagnosis (*Table 3*). Although some diagnoses are uncommon, they are important to recognise. Examples of these diagnoses include Achilles tendon rupture, which can be recent or chronic and presents with pain due to blood pooling distal to rupture, progressive tibialis posterior lengthening, seronegative arthropathies presenting as Achilles insertional tendinopathy, stress fractures, osteoid osteoma and tarsal coalition.

Bony presentations may require imaging when there is a high index of suspicion. Tarsal coalition may present with flat foot and pain, and requires imaging to confirm it, especially if the patient has a family history of the condition. Osteoid osteoma should be considered when night pain is reported.

The role of diagnostic imaging in heel pain

Clinical assessment remains the most important diagnostic tool as imaging identifies pathology and structural abnormality.

Table 4. Evidence-based and clinical opinion for management by cause

Cause of pain	Recommendations	No evidence or not advised
Achilles tendon insertion pain or retrocalcaneal bursitis	Heel raises in shoes or added externally to shoes (to reduce compression at the Haglund prominence)	Avoid stretching and the eccentric heel drop program (due to compression). May be completed to plantargrade
	Graded strength rehabilitation from flat ground into plantar flexion	Intra-tendinous injections
	Other: polypill (ibuprofen, epigallocatechin gallate and doxycycline)[18]	Rest/ice/anti-inflammatory medications have limited efficacy: there is no evidence of inflammation in chronic tendinopathy
Posterior impingement syndrome	Calf strengthening – single leg heel raises, 25+ repetitions in a painfree range of motion in younger people Manual techniques that involve sub-talar joint distraction	Compressive positions or forced ankle joint plantar flexion
FHL (usually tenosynovitis)	Calf strengthening – single leg heel raises, 25+ repetitions in a pain-free range of movement in younger people Hirrudoid/diclofenac gel wrap – good clinical results with physiological justification (heparin based treatments block the formation of fibrin associated with crepitus[17]	Eccentric exercises and stretches in full dorsiflexion or heel off step
Neural – entrapment (including tarsal tunnel)	Neural mobilisation	Neural tension exercise
	Check for direct compression (eg footware)	
	Treat underlying pathology of FHL	
Plantar fascia pain	Taping and orthotics may offer relief Strengthening of the foot intrinsics, calf and kinetic chain Low height isometric heel raise sustained hold	
Tibialis posterior tendinopathy (may be tenosynovitis)	Taping and orthotics Heel raise Strengthening in good ankle alignment	Eccentric exercise often increases the friction around the medial malleolus and exacerbates symptoms
Calcaneal bone stress **Talar stress fracture** **Navicular stress fracture**	Reduction in load and may require non-weight bearing	
Apophysitis	Reduction in load May benefit from a heel cup with heel raise in shoes to reduce traction of the apophysis Taping and orthotics Graded strengthening program Improving muscle compliance of the gastrocnemius, soleus and tibialis posterior	Though stretching is regularly recommended, initially it is painful especially if felt at the insertion

FHL, flexor hallucis longus

However, tendon and joint pathology can be present without pain. Therefore, pathology on imaging can mislead the clinician into thinking that imaging has confirmed the source of pain. Common examples include the presence of an os trigonum and heel spurs at the attachment of the plantar fascia and peroneal tendon pathology, seen as an increased signal on magnetic resonance imaging (MRI), which is common following an ankle inversion injury. Posterior ankle impingement syndrome and subtalar joint synovitis following an ankle sprain is a more likely source of pain (*Figure 3*). Similarly, pathology in the retrocalcaneal bursa and Achilles tendon, together with a Haglund morphology can be present in people who are pain-free.[15]

Treatment of heel pain

An overview of the available evidence and expert clinical opinion for the conservative treatment of common causes of heel pain is not intended to be comprehensive or prescriptive (*Table 4*). Clinical experience, for example neural mobilisation techniques,[16] has been included as there is a lack of published evidence for efficacious treatment. Furthermore, the decision to include analgesia or anti-inflammatory medication is discussed only where its use has been shown to be detrimental or to have an off-label effect (eg heparin-based treatments for paratendinitis[17] and the polypill).[18] Consideration of the kinetic chain is vital for the successful rehabilitation of many conditions and is outside the scope of this paper. Referral to allied health professionals such as physiotherapists or podiatrists may be necessary.

Conclusion

Heel pain is usually of mechanical origin and the most valuable approach for the clinician is to use the site of pain to narrow potential diagnoses. Imaging can assist, however should not replace clinician assessment. Treatments vary with presentation and require thoughtful prescription.

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