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Persistent foot pain

Background

Persistent foot pain can present difficulties in both diagnosis and management.

Objective

This article aims to describe an approach to diagnosis and management based on the location of the pain, the patient's age, and the type of activity being undertaken.

Discussion

Accurate diagnosis is important for persistent foot pain, as the investigation and management varies significantly between conditions. As a background to understanding common conditions encountered, this article reviews the age related changes in foot structure, foot loading and pathologies. A more detailed discussion of commonly encountered conditions follows.

■ **Persistent foot pain can present significant diagnostic challenges. Even if a diagnosis has been made, relevant pathology can be difficult to settle. As an approach to likely diagnoses, the discussion in this article will be in terms of location (rear foot, midfoot, forefoot) with allowances for medial and lateral pain in each region. Likely diagnoses will also vary depending on the patient's age and activity level.**

Management options vary with circumstances such as geographic factors and access to imaging and further opinion. While plain X-ray is critical in presentations where there is doubt as to a diagnosis, mention will be made of preferred further imaging if appropriate.

This article aims to describe an approach to management of conditions presenting in primary care, rather than a definitive review of management. As such, content will be in significant part based on observations and opinions of current management trends in clinical practice by the authors.

Age related structural changes and pathology

Childhood to adolescence

Major changes occur in foot posture as skeletal maturation occurs through childhood and adolescence.

Posture

The foot progressively matures from a flat platform with increasing mobility through a significant pronation phase to a more mature posture after 7 years of age. Postural support or correction (orthoses/wedging) for the feet and legs is rarely required before this age. Supportive footwear is always important.

Skeletal maturity

Bone stress in this age group occurs at immature ossification sites, particularly traction at apophyses (tendon growth plate insertions), rather than the bone overload occurring in older age groups.

Rear foot

The calcaneal apophysis is present at 8 years of age. Symptoms of calcaneal traction apophysitis (Sever disease/osteochondrosis) may



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start at around 9–10 years of age. Apophyseal closure at around 12 years of age fully resolves this activity related heel pain.

Tarsal coalition

Occasionally tarsal bones develop interosseous cartilaginous and ultimately ossified bands, most commonly at the calcaneonavicular and talocalcaneal sites. The condition usually presents in late childhood or early adolescence as rear foot or ankle pain, or is clinically noted as limited inversion. On clinical assessment there is a markedly reduced subtalar (inversion and eversion) and midfoot motion compared to the normal hypermobile adolescent. Diagnosis can be made on X-ray or computerised tomography (CT), however, orthopaedic referral is important as management options range from observation to surgery.

Midfoot

The navicular generally has one primary ossification site. At times there is a secondary epiphysis for the medial tubercle arising in adolescence. Subsequent malunion of the tubercle ossification centre can lead to an 'accessory navicular' with prominent lump and activity related pain in the medial midfoot arising from stress at the synostosis between body and accessory navicular. Treatment involves offloading the area with supportive footwear and taping. Further options include orthosis, anti-inflammatory medication, ultrasound guided injection with cortisone to the synostosis, and occasionally, excision.

Similar pathology is encountered at the base of the fifth metatarsal with similar management options. Navicular osteochondrosis (Kohler disease) is uncommon.

Forefoot

Freiberg disease/osteochondrosis arises in the metatarsal head (generally the second), which leads to flattening of the metatarsal head and maldevelopment of the metatarso-phalangeal joint. Plain X-ray may be diagnostic, however in early presentations X-ray may be normal and magnetic resonance imaging (MRI) is necessary for diagnosis. Treatment involves reducing stress on the metatarsal by podiatry review and offloading padding, and possibly surgery.

Teens to mid 30s

Bones

This period of bone maturation corresponds to the phase of life where there is increased activity loads due to multiple sporting activities being undertaken. Bone regeneration capacity may lag behind bone loading and result in bone stress.

Investigations

- X-ray is essential for each and every foot presentation where bone stress is a possible diagnosis (although X-ray may be normal)
- Bone scan has been the subsequent imaging modality for bone and joint pathology. However, MRI, with its more refined localising ability between bone and joint, especially in the midfoot, and ability to provide additional soft tissue information, is being increasingly utilised
- CT scan may be necessary to further assess fracture severity following a MRI or bone scan.

Important stress fractures occurring in this age group are covered in *Table 1*. Stress fractures of the talus, calcaneus, cuboid, phalanges and base of second metatarsal ('dance fracture') are less common. These present with local pain and tenderness with running activities. Plain X-ray is often normal, therefore a bone scan or MRI may be necessary to aid diagnosis. Management involves offloading, and referral to an orthopaedic surgeon or sports physician is advisable.

Joints

Osteoarthritis within the foot will generally present after the fourth decade. However, high running and jumping loads can lead to early joint degeneration, particularly of the first tarsometatarsal joint (TMTJ) and first metatarso-phalangeal joint (MTPJ), even in those aged in their early 20s. This results in transferring increased load onto the other metatarsal heads and first metatarsal sesamoids, and increases stress through the plantar fascia and Achilles tendon ('windlass mechanism').¹

Tendons and fascia

Achilles tendinopathy is a challenge to manage because of its tendency to persistence. Ultrasound and X-ray are essential if pain is felt low in the tendon, due to possible tendon deep surface impingement and fraying from prominent superior process of calcaneus (Haglund syndrome), as this will impact on physiotherapy exercise prescription. Early referral to a physiotherapist is critical to provide guidance for load modification and an individualised strengthening regimen, and podiatry review.

While a definitive discussion is beyond the scope of this article, some observations as a guide to management are:

- strengthening is the mainstay of intervention. While initial strengthening guidelines were provided by a Swedish group in the 1990s and early this century,^{2,3} there has been significant review of regimens.⁴ The important feature is that the regimen adopted by the physiotherapist needs to be tailored specifically to each patient, responding to patient feedback on regimen tolerance and progress
- medical management may include anti-inflammatory therapy (short course of 4–6 weeks), particularly if the patient has early morning pain or pain early in activity that eases suggesting an inflammatory pattern.⁵ A 'polypill' of ibuprofen and doxycycline has been suggested.⁶ Cortisone injections are generally avoided.⁵



Table 1. Important stress fractures seen in the teens to mid 30s

Fracture	Location	History	Investigation	Referral	Treatment
Second to fourth metatarsal	Metatarsal neck	Running athlete or walker with recent increased load. Local tenderness or palpable bony lump may be present	<ul style="list-style-type: none"> • Plain X-ray (periosteal new bone formation may be diagnostic) • Bone scan or MRI 	Sports physician or physiotherapist and podiatrist	<ul style="list-style-type: none"> • Offload 4–6 weeks and low impact activity • Walking as pain allows with period in Cam walker if needed
Base of fifth metatarsal ('Jones') fracture	Junction of base and proximal shaft laterally	Running, ball sports	Plain X-ray often diagnostic (incomplete fracture line may be apparent on X-ray)	Sports physician or orthopaedic referral	<ul style="list-style-type: none"> • Referral is important as condition is prone to delayed healing • Internal fixation if fracture line is present
Navicular	Dorsal proximal midnavicular	Running athlete, dorsal rear foot pain	MRI or bone scan. If confirmatory, then CT is critical to assess severity	Sports physician or foot and ankle surgeon	<ul style="list-style-type: none"> • Offload in nonweight bear cast or Cam walker • Internal fixation if significant fracture
Sesamoid	Medial or lateral sesamoid	Increasing plantar forefoot pain, running sport	Foot X-ray with sesamoid views +/- bone scan/CT or MRI	Sports physician, foot and ankle surgeon, podiatry referral	Challenging – refer. It is not adequate to make a diagnosis of 'sesamoiditis' and inject steroid

A commercially available sock that maintains the foot in dorsiflexion overnight can lessen early morning pain and stiffness (as used in plantar fasciitis).

For more recalcitrant cases, in addition to strengthening, second line medical interventions such as topical glyceryl trinitrate, lithotripsy shock wave therapy, sclerotherapy⁷ or autologous blood injection^{8,9} can be considered. Surgical assessment is appropriate if other measures do not provide adequate resumption of function, especially for calcific insertional Achilles tendinopathy.

Nerve

While less common than carpal tunnel syndrome, the tibial nerve can be compressed under medial ankle flexor retinaculum as the nerve passes with posteromedial ankle tendons producing tarsal tunnel syndrome with neural symptoms of aching, burning, numbness and tingling along the plantar foot. Podiatry review, offloading medial ankle, nerve conduction studies and cortisone injection and surgery may be indicated.

40s and beyond

Postural

Rear foot

In people over 40 years of age, long standing pronation will progressively overload the medial ankle supports (tibialis posterior tendon, medial ankle 'deltoid' ligament and the 'spring' ligament [talo-calcaneo-navicular]) leading to a cascade of pronation, tissue failure and eventual rear foot subluxation and degenerative disease.¹⁰

Midfoot

The medial arch will be flattened with increasing rear foot pronation, leading to osteoarthritis of the tarsal joints.

Forefoot

There is progressive clawing of the second to fourth toes and metatarsal plantar flexion. This increases load onto metatarsal heads (forefoot plantar pain). The clawing causes the proximal phalanges to sublux dorsally leading to synovitis of second to fourth MTP joints and joint line tenderness dorsally. There are no osteoarthritic changes on X-ray. The MTP plantar plates are attenuated and may eventually tear. Friction and pressure lead to dorsal callous over proximal interphalangeal joint.

The first MTPJ undergoes:

- degenerate change, with pain felt deep in the joint or dorsally from impinging dorsal osteophytes
- increasing valgus posture of proximal phalanx and varus posture of first metatarsal (producing hallux valgus deformity) with pain felt medially over the site of medial bunion pressure.

The site of pain and tenderness is an important guide when forming a management plan (bunion deformity correction or joint intervention). Medial tenderness suggests bunion friction is a concern, while dorsal tenderness implies joint disease (tenderness at dorsal osteophytes). Tenderness at both sites suggests concurrent disease.

The fifth MTPJ undergoes increasing deformity leading to bunionette. These deformities lead to compression of the



intermetatarsal region (second to fourth web spaces) and intermetatarsal 'bursitis' (friction causing fibrosis and neural irritation and eventual possible neuroma) (Figure 1).

Early podiatry referral and intervention may slow progression of the deformity and enhance comfort.

Tissues

- Fat pads: subcalcaneal and forefoot fat pads tend to atrophy with loss of impact attenuation
- Joints: osteoarthritis at first MTP and first TMT joints is common, although it does occur at other TMT joints and within the midfoot (talo-navicular)
- Tendons: tibialis posterior tenosynovitis and tendon failure is more common in the sixth and seventh decades, and presents with inflammatory pattern posteromedial ankle pain and increasing medial rear foot collapse. Plantar fasciitis (PF) is common and distressing, and occurs across all ages from 20 years onward.

Age related load changes and pathology

Childhood to adolescence

Activity load levels up to the age of 10 years do not generally exceed the body's ability to adapt and manage these loads (except calcaneus apophysis). As adolescents undertake a range of sporting activities, loads can markedly increase. Loads may need to be reduced with prioritising sport and training to what is essential.

Late teens to 30s

Activity levels tend to be more restricted to single sports for the higher level athlete and mixed (eg. netball + walk + gym) for the recreational athlete. In the former group, it may be necessary to cross train with nonimpact loading, while the latter may be able to continue lower level weightbearing activity.

Middle age to older

While running, cycling, and swimming provide aerobic activity for some people, walking, with its low impact load, remains a popular activity. As such it is important in general health maintenance, particularly if cardiovascular risks are present, to adequately and aggressively manage foot conditions. The treating practitioner may manage metabolic lifestyle morbidities, while early referral of foot conditions will ensure these do not lessen exercise critical for the management of cardiovascular risk.

Specific conditions

Emphasis is on discussion of conditions commonly encountered in primary care, including imaging guidelines and referral options.

Rear foot

Sever disease is the likely diagnosis in the presentation of an active youngster, despite the wide variation in the site of rear foot and ankle pain. It always eventually settles fully. Management requires activity levels being curtailed to levels where discomfort is manageable, and podiatry review. X-ray need rarely be performed.

Plantar fasciitis is more often diagnosed by eliciting a history of inflammatory pain, as palpation can be frustrating. Functional tests, such as heel walking and hopping on the forefoot (Figure 2a, b), can assist if there is doubt as to whether the diagnosis is PF or subcalcaneal fat

Figure 1. Age related changes with deviation at first and fifth MTPJ and crowding and clawing of phalanges



Figure 2a, b. Assessment for plantar fascia-heel loading producing pain is suggestive and forefoot loading producing rear foot pain is strongly suggestive





pad contusion. (This is uncommon and has a more mechanical history without pain hopping on forefoot.) If uncertainty remains, it is prudent to treat as PF as this is a likely diagnosis. Diagnostic ultrasound and X-ray can be of assistance.

Management strategies are shown in *Table 2*.

Plantar fascia preferred injection techniques vary. It may be easier to conceptualise landmarks using plantar approach, with tarsal tunnel block minimising plantar injection pain. The authors' preferred approach is outlined in *Table 3*. Surgery has generally been regarded as a last resort. However, it needs to be considered earlier if the patient has severe and persisting pain (especially with the increased availability of endoscopic release).

Table 2 summarises the common rear foot conditions.

Forefoot

Metatarso-phalangeal joint management is outlined in *Table 4*.

Conclusion

An approach to formulating a likely diagnosis in patients presenting with persistent foot pain is presented in this article based on the changes in structure and load for the foot in each age phase. Simple imaging is highly recommended unless diagnosis is clinically straightforward. Management as outlined is an attempt to describe current trends in management of common conditions encountered and is based on these age related changes, and while opinions for the practices as outlined are not necessarily evidence based, they are presented as a guide to reasonable and accepted current clinical practice.

Table 2. Common rear foot conditions

Age	Condition	Presentation	Examination	Investigation	Management
Young (<14 years of age)	Sever disease	<ul style="list-style-type: none"> Active 9–12 years of age Multiple sports Activity related heel pain Inflammatory symptoms (pain present after activity and in the morning) 	<ul style="list-style-type: none"> Tender posterior heel and low Achilles region Pain on heel walking 	Plain X-ray for more severe pain (limping, night pain) or patient over 12 years of age to confirm apophysis is still present	<ul style="list-style-type: none"> Explanation Advice to balance loads with pain Ice Analgesia Podiatry assessment Always settles fully
Older (20–60+ years of age)	Plantar fasciitis	<ul style="list-style-type: none"> Plantar heel pain Pain present when 'first put foot to floor' or after sitting during the day ('gel pain') 	<ul style="list-style-type: none"> 'Tiptoe' bouncing (traction effect on the plantar fascia origin), or walking on heels will reproduce pain Palpation can be frustrating and unrewarding 	<ul style="list-style-type: none"> Imaging if atypical or not settling X-ray demonstrating 'heel spur' is of diagnostic significance in presence of symptoms If atypical pain, ultrasound (also to assist injection) or bone scan or MRI may be indicated 	<ul style="list-style-type: none"> NSAIDs¹¹ Physiotherapy to coordinate ice massage, stretching,¹² 'golf ball' massage, taping and strengthening of intrinsic muscles Podiatry referral for footwear and arch supports^{13,14} Corticosteroid injection Lithotripsy shock wave therapy if not settling Surgery

Table 3. Plantar fasciitis injection technique

Cortisone injection is the second line intervention for ongoing severe pain. It can be exquisitely painful, so prior injection into the tarsal tunnel – injecting 3 mL of 2% lignocaine about the posterior tibial artery posteromedial to the ankle and waiting 5–7 minutes – can be effective in minimising injection pain. (You can use the waiting time to write notes and explain ice massage and stretching techniques) Injection of 1 mL steroid with 4 mL* of 1% lignocaine with adrenaline using a 23 gauge 1 inch long needle into the region of the anterior (anteromedial) process of the calcaneus is performed with the patient prone and entering at 90 degrees to the skin. The tip of the needle may touch bone to clarify landmarks and there may be a 'gristly' sensation as the tip of the needle penetrates fascia, with resistance to injecting fluid as an indicator that the needle is within the fascia

* The authors' preference is to use a larger volume of fluid as it enables the fluid to be spread over a wider area than would be used in, for example, epicondylitis, and enables fascia to be multiply pricked with needle



Table 4. Metatarso-phalangeal joint management

Joint	Condition	Investigation	Conservative management	Surgical intervention
First MTPJ (fifth MTP 'buniette')	Hallux valgus	<ul style="list-style-type: none"> • X-ray 	<ul style="list-style-type: none"> • Footwear advice • Podiatry assessment and mechanical support to slow progression 	<ul style="list-style-type: none"> • Debulking of medial bony prominence and corrective osteotomy (metatarsal and proximal phalanx)
	Hallux rigidus	<ul style="list-style-type: none"> • X-ray 	<ul style="list-style-type: none"> • Joint mobilisation • Intermittent NSAIDs or intra-articular injections • Orthosis padding to offload joint 	<ul style="list-style-type: none"> • Surgery for: <ul style="list-style-type: none"> – dorsal pain cheilectomy – established osteoarthritis – fusion
Second to fourth joints	Claw toe deformity (attenuation or rupture MTP plantar plate, MTPJ synovitis)	<ul style="list-style-type: none"> • X-ray is important although generally normal appearance • Ultrasound of joints and intermetatarsal region, MRI 	<ul style="list-style-type: none"> • Podiatry review (orthoses, padding and footwear advice) for plantar pain • Ultrasound guided injection if dorsal tenderness is present at MTPJ 	<ul style="list-style-type: none"> • Correction of claw deformity
Second to fourth web space	Inter-metatarsal 'bursitis'	<ul style="list-style-type: none"> • X-ray • Ultrasound¹⁵ +/- MRI 	<ul style="list-style-type: none"> • Mechanical support padding/footwear • Cortisone injections* 	
Morton neuroma	Second, third, fourth web space (sharp, shooting pain)	<ul style="list-style-type: none"> • Compression of the metatarsals tenderness intermetatarsal space • X-ray • Ultrasound¹⁵ • MRI 	<ul style="list-style-type: none"> • Dome padding (separate the metatarsals) • Footwear advice (width) 	<ul style="list-style-type: none"> • Radio frequency denervation or excision neuroma

* The authors inject by palpation of web space at level of metatarsal heads and using 1 mL steroid and 1 mL local anaesthetic OR ultrasound guided injection into intermetatarsal inflammatory tissue (intermetatarsal 'bursitis') and around neuroma if present

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