

Plantar Fasciitis:

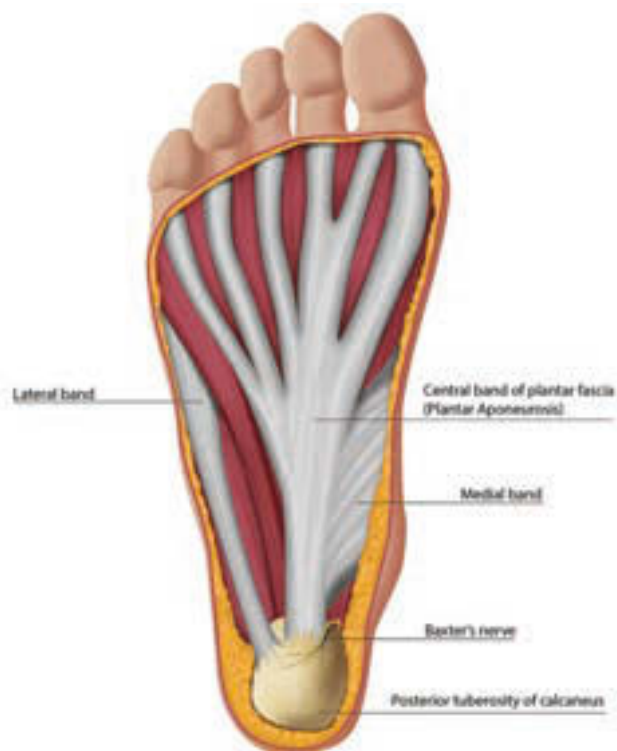
Radiological Findings and Evidence-Based Treatment Approaches



INTRODUCTION

The plantar fascia is a fibrous aponeurosis superficial to the intrinsic muscles of the foot, originating from the medial calcaneal tuberosity, and is integral to supporting the longitudinal arch. Anterior to the calcaneus, it extends forward and separates into medial, central, and lateral portions, and at the mid-sole level, it then splits into five bands which ultimately insert onto the bases of all five proximal phalanges as the plantar plates, respectively (Figure 1).^{1,2}

Figure 1. Anatomy of the plantar fascia.
Source: Latt D, Jaffe DE, Tang Y, et al. 2020.³



Plantar fasciitis, more accurately termed insertional plantar fasciopathy, is the most common cause of chronic plantar heel pain in adults, with a lifetime prevalence of 7-10%. It is primarily an overuse injury with repetitive strain causing microtears of the plantar fascia. Predisposing factors include prolonged standing or jumping, obesity, gastrocnemius-soleus tightness, pes planus and pes cavus, and limited ankle dorsiflexion. Most cases are self-limiting and resolve within 6-12 months, yet symptoms can be prolonged and functionally limiting.⁴

Despite this name suggesting inflammation, histological studies reveal that the condition is primarily characterized by degenerative changes rather than active inflammation, with findings including myxoid degeneration, collagen fragmentation, and vascular ectasia at the fascial attachment site to the calcaneus (angiofibroblastic hyperplasia). This distinction is clinically significant as this shifts the therapeutic approach from purely antigravity and anti-inflammatory strategies to those promoting tissue healing and remodelling.^{5,6}

Plantar fasciitis is predominantly a clinical diagnosis, with imaging reserved for specific circumstances. Patients typically present with medial calcaneal tubercle tenderness, particularly during the first steps in the morning or after periods of rest, which improves with continued ambulation. A thorough history should explore recent increases in weight-bearing activities, changes in footwear, or occupational demands that might contribute to the condition. Key findings during clinical examination include tenderness to palpation of the proximal plantar fascial insertion on the anteromedial calcaneus, rather than directly under the heel.⁵

RADIOLOGICAL FINDINGS

WHEN TO CONSIDER IMAGING

- Atypical clinical presentation (e.g. pain not localized to the medial calcaneal tuberosity).
- Pain persists despite 6-12 weeks of appropriate conservative management.
- Systemic symptoms suggest inflammatory arthropathy (classically a seronegative arthropathy, with bilateral involvement).
- Suspicion of an alternative diagnosis (e.g. calcaneal stress fracture, fat pad atrophy or referred pain from the lumbar spine).⁷

X-RAY FINDINGS

Conventional radiography remains an accessible first-line imaging modality when indicated. X-rays may reveal plantar calcaneal spurs (Figure 2). However, it is important to understand that plantar calcaneal spurs have also been observed in up to 25% of asymptomatic patients, so these may not be clinically predictive. Plain radiographs are primarily valuable for excluding other conditions such as calcaneal fractures, osteomyelitis or significant degenerative joint disease.^{7,8}

Figure 2. Lateral ankle radiograph demonstrating a plantar calcaneal spur (arrow).



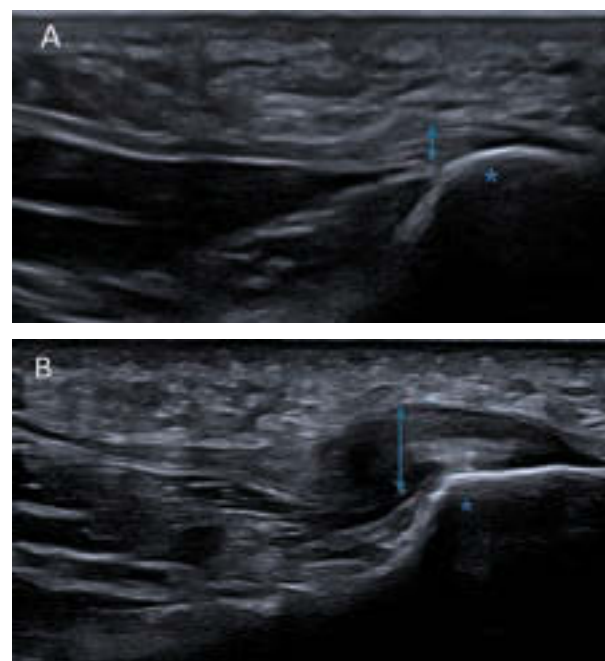
ULTRASOUND FINDINGS

Musculoskeletal ultrasound is a valuable tool for evaluating plantar fasciitis, offering real-time, dynamic assessment without radiation exposure. Key ultrasound findings include:

- Plantar fascia thickness greater than 4mm at the calcaneal insertion.
- Hypoechogenicity of the fascia, indicating structural disorganization.
- Perifascial fluid/oedema (less consistently present).
- Neovascularization on Doppler imaging (less consistently present).⁹

Figure 3 demonstrates the normal plantar fascia and the common sonographic findings noted in plantar fasciitis.

Figure 3. Longitudinal sonographic views of the plantar aspect of the foot demonstrating (A) the normal thickness (<4mm) shown by the two-headed arrow and echogenicity of the plantar fascia and (B) an abnormally thickened (>4mm) hypoechogenic plantar fascia. The Calcaneal tuberosity is marked by *.



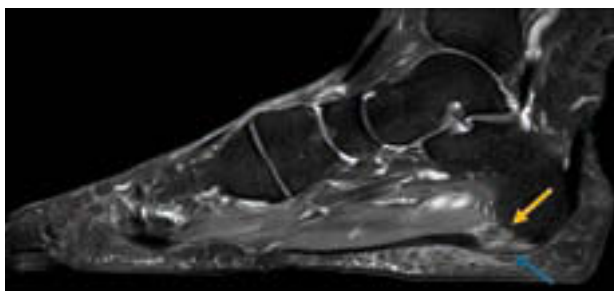
MRI FINDINGS

Magnetic resonance imaging offers the most comprehensive evaluation of plantar fasciitis and surrounding structures, though it is typically reserved for complex or refractory cases due to cost and availability considerations. Characteristic MRI findings in plantar fasciitis include (Figure 4):

- Plantar fascia thickness greater than 4mm at the calcaneal insertion.
- Increased signal intensity on fluid-sensitive sequences at the calcaneal insertion, indicating oedema and degeneration.
- Perifascial soft tissue oedema.
- Bone marrow oedema in the calcaneus in severe or chronic cases.

MR imaging is particularly valuable for differentiating plantar fasciitis from other causes of heel pain, such as plantar fascial tears, Baxter neuropathy, plantar fibroma, calcaneal stress fractures or tarsal tunnel syndrome.^{9,10}

Figure 4. Sagittal fluid-sensitive fat-saturated sequence demonstrating a thickened oedematous plantar fascia at the calcaneal origin (blue arrow), together with calcaneal bone marrow oedema and a small plantar calcaneal spur (yellow arrow).



TREATMENT

A structured conservative approach should be adopted for at least 6-12 weeks. If pain remains moderate to severe and functionally limiting after optimizing conservative treatment, escalation to procedures supported by imaging should be considered, which occurs in approximately 5-10% of cases.

CONSERVATIVE TREATMENT APPROACHES

Plantar fascia-specific stretching represents the most evidence-based initial intervention. The most effective technique involves seated towel stretches, where the patient pulls the toes towards the shin with the knee extended, targeting the plantar fascia directly. Foot orthoses with emphasis on proper arch support and cushioning, and night splints maintaining the ankle in dorsiflexion have also been shown to provide moderate short-term pain relief.¹¹ Non-steroidal anti-inflammatory drugs may provide short-term symptomatic relief but have limited evidence for long-term benefit, and their use should be time-limited and balanced against potential gastrointestinal and cardiovascular risks, particularly in older patients.⁴

ADVANCED TREATMENTS - IMAGE-GUIDED AND DEVICE-BASED INTERVENTIONS

CORTICOSTEROID INJECTIONS

Corticosteroid injections can provide significant short-term pain relief (4-12 weeks), however should be limited to 1-2 per site, ideally with ultrasound guidance to ensure accurate needle placement and to minimize complications such as plantar fat pad dystrophy and plantar fascia rupture. A small volume of steroid is deposited around, not within, the fascia origin (Figure 5).⁴ This may be combined with same-visit dry needling.

PLATELET-RICH PLASMA INJECTIONS

Ultrasound-guided platelet-rich plasma (PRP) injection represents a promising regenerative approach, delivering concentrated growth factors to stimulate tissue healing. This may provide superior long-term outcomes compared to corticosteroid injections, with a more favourable risk-benefit profile, particularly for patients with chronic symptoms. Percutaneous needle tenotomy or dry needling to produce microtears in the affected fascia to stimulate healing is often combined with PRP (Figure 6).¹²

Figure 5. (A) Short-axis in-plane technique for steroid infiltration of the plantar fascia with corresponding ultrasound image (B) demonstrating the needle path for superficial (blue arrow) and deep placement (yellow arrow) of the steroid.

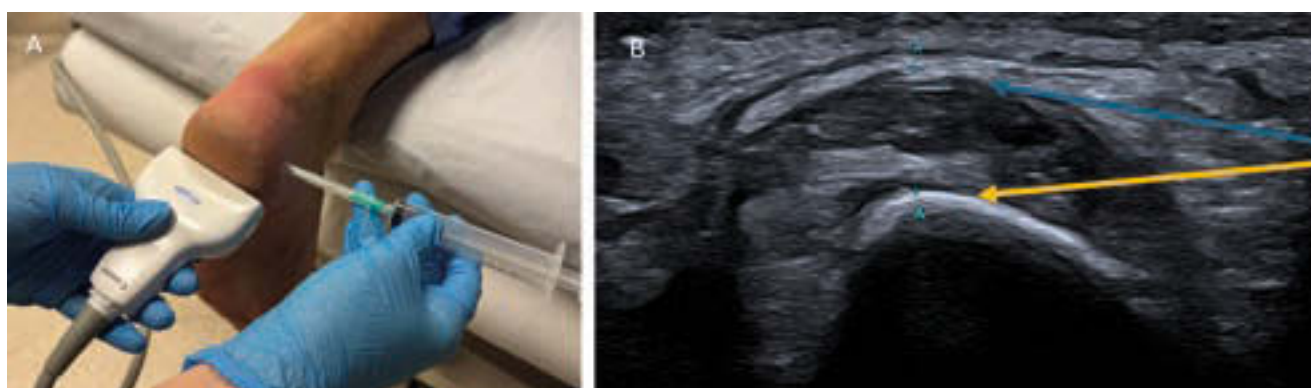
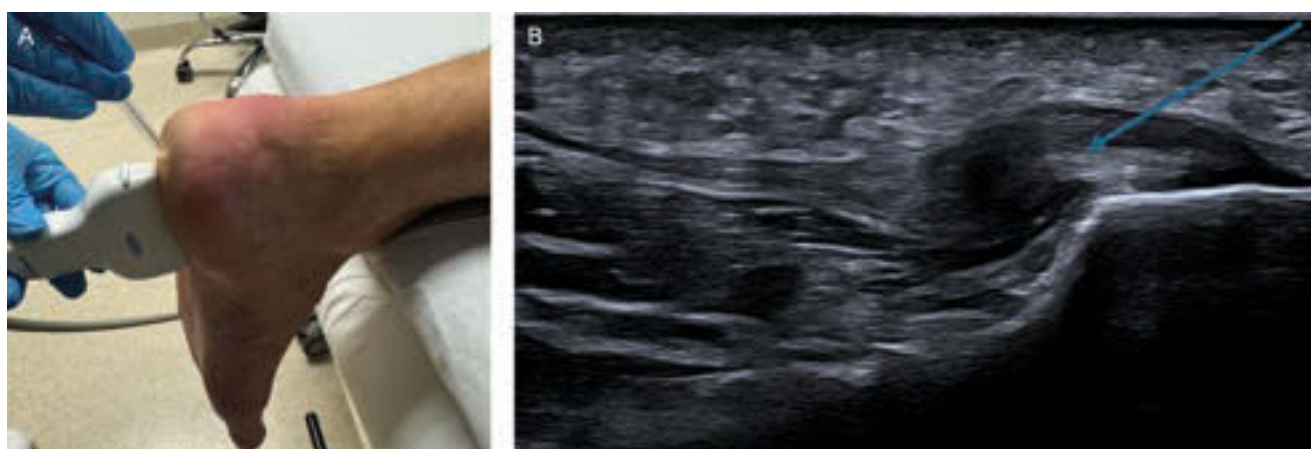


Figure 6. (A) Long axis in plane technique for injecting PRP into the plantar fascia with corresponding ultrasound image (B) with the blue arrow demonstrating the needle placement within the plantar fascia.



WHILE CLINICAL DIAGNOSIS FORMS THE FOUNDATION OF MANAGEMENT, UNDERSTANDING APPROPRIATE IMAGING INDICATIONS AND FINDINGS IS ESSENTIAL WHEN INITIAL TREATMENT FAILS OR DIAGNOSTIC UNCERTAINTY EXISTS

HYALURONIC ACID

Hyaluronic acid, a polysaccharide found in the extracellular matrix of soft connective tissues and synovial fluid, has been recently explored as a treatment for plantar fasciitis due to its viscoelastic properties, which may support extracellular matrix integrity and aid in modulating inflammatory mediators. Hyaluronic acid infiltration into the plantar fascia has been shown to provide short to medium-term pain relief and functional improvement, particularly in patients who do not respond to standard conservative therapies.¹³

EXTRACORPOREAL SHOCKWAVE THERAPY

Extracorporeal shockwave therapy delivers acoustic waves to the affected area, providing neovascularization and tissue healing. This is particularly effective for recalcitrant plantar fasciitis, with success rates of 60-80% after 3-4 months. While generally safe, minor side effects such as bruising or transient pain may occur.¹⁴

SURGERY

Surgery is reserved for the small minority of patients with disabling symptoms persisting beyond 6-12 months despite comprehensive non-operative care, and includes both open and endoscopic partial plantar fasciotomy.¹⁵

CONCLUSION

Plantar fasciitis remains a common and often challenging condition encountered in primary care. While clinical diagnosis forms the foundation of management, understanding appropriate imaging indications and findings is essential when initial treatment fails or diagnostic uncertainty exists. Conservative therapies, particularly plantar fascia-specific

stretching, should form the cornerstone of initial management. Advanced treatments should be reserved for recalcitrant cases, with ultrasound guidance offering a safe and accurate approach for both corticosteroid and PRP treatments. By adopting an evidence-based stepwise approach and maintaining realistic patient expectations, most cases can be effectively managed in the primary care setting whilst always considering the need to seek specialist input for more complex presentations.

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